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Kogrukluk River Salmon Studies, 2006

by

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May 2008

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

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Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

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

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TABLE OF CONTENTS

Page

LIST OF TABLES.....iv
LIST OF FIGURES.....iv
LIST OF APPENDICES.....v
ABSTRACT.....1
INTRODUCTION.....1
Background.....3
Regional.....3
Kogrukluk River Escapement Monitoring.....3
Objectives.....4
METHODS.....5
Study Area.....5
Weir Construction and Maintenance.....6
Construction.....6
Maintenance.....7
Escapement Monitoring.....7
Passage Counts.....7
Estimating Missed Passage.....8
Single Day Method.....8
Linear Method.....8
Proportion Method.....9
Estimates Required in 2006.....9
Carcasses.....10
Age, Sex, and Length Composition.....10
Sample Collection.....10
Estimating Age, Sex, and Length Composition.....11
Weather and Stream Observations.....12
Related Fisheries Projects.....12
Inriver Abundance of Chinook Salmon in the Kuskokwim River.....12
Kuskokwim River Sockeye Salmon Investigations.....13
Kuskokwim River Salmon Mark–Recapture Project.....14
Other Related Projects.....14
RESULTS.....15
Escapement Monitoring.....15
Chinook Salmon.....15
Chum Salmon.....15
Sockeye Salmon.....15
Coho Salmon.....16
Pink Salmon.....16

TABLE OF CONTENTS (Continued)

Page

Other Species 16
Carcasses 16
Age, Sex, and Length Composition 17
Chinook Salmon 17
Chum Salmon 17
Sockeye Salmon 18
Coho Salmon 18
Weather and Stream Observations 19
Related Fisheries Projects 19
Inriver Abundance of Chinook Salmon in the Kuskokwim River Project 19
Kuskokwim River Sockeye Salmon Investigations 20
Kuskokwim River Salmon Mark–Recapture Project 20
Chinook Salmon 20
Sockeye Salmon 21
Other Related Projects 21
DISCUSSION 21
Escapement Monitoring 21
Chinook Salmon 23
Abundance 23
Run-timing at Weir 25
Chum Salmon 25
Abundance 25
Sockeye Salmon 27
Abundance 27
Run-timing at Weir 27
Coho Salmon 28
Abundance 28
Run-timing at Weir 29
Pink Salmon 29
Carcasses 30
Age, Sex, and Length Composition 31
Chinook Salmon 31
Chum Salmon 34
Sockeye Salmon 36
Coho Salmon 37
Weather and Stream Observations 38
Related Fisheries Projects 39
Inriver Abundance of Chinook Salmon in the Kuskokwim River Project 39
Kuskokwim River Sockeye Salmon Investigations 39
Kuskokwim River Salmon Mark–Recapture Project 40

TABLE OF CONTENTS (Continued)

Page

Chinook Salmon 40
Sockeye Salmon 41

CONCLUSIONS 42

Escapement Monitoring 42
Age, Sex, and Length Composition 42
Weather and Stream Observations 43

RECOMMENDATIONS 43

Weir Operations 43
Fish Passage 44
Salmon Age, Sex, and Length Composition 45
Climatological Monitoring 45
Spawner-Recruit Analysis 46

ACKNOWLEDGMENTS 47

REFERENCES CITED 48

TABLES AND FIGURES 53

APPENDIX A. SALMON PASSAGE AT THE KOGRUKLUK RIVER WEIR, 2006 103

APPENDIX B. DAILY CARCASS COUNTS AT THE KOGRUKLUK RIVER WEIR, 2006 107

APPENDIX C. CLIMATE INFORMATION FOR THE KOGRUKLUK RIVER WEIR, 2006 109

APPENDIX D. DAILY STREAM TEMPERATURE FROM DATALOGGER AT THE KOGRUKLUK RIVER WEIR, 2006 115

APPENDIX E. HISTORICAL PASSAGE OF CHINOOK SALMON AT THE KOGRUKLUK RIVER WEIR 117

APPENDIX F. HISTORICAL SALMON ESCAPEMENT ESTIMATES AT THE KOGRUKLUK RIVER WEIR 125

APPENDIX G. HISTORICAL PASSAGE OF CHUM SALMON AT THE KOGRUKLUK RIVER WEIR 127

APPENDIX H. HISTORICAL PASSAGE OF SOCKEYE SALMON AT THE KOGRUKLUK RIVER WEIR 135

APPENDIX I. HISTORICAL PASSAGE OF COHO SALMON AT THE KOGRUKLUK RIVER WEIR 143

APPENDIX J. HISTORICAL CUMULATIVE CARCASS COUNTS AT THE KOGRUKLUK RIVER WEIR 151

LIST OF TABLES

1. Actual daily and estimated counts of Chinook, chum, sockeye and coho salmon at the Kogrukluk River weir, 2006. 54
2. Age and sex composition of Chinook salmon at the Kogrukluk River weir based on escapement samples collected with a live trap, 2006. 56
3. Mean length (mm) of Chinook salmon at the Kogrukluk River weir based on escapement samples collected with a live trap, 2006. 57
4. Age and sex composition of chum salmon at the Kogrukluk River weir based on escapement samples collected with a live trap, 2006. 58
5. Mean length (mm) of chum salmon at the Kogrukluk River weir based on escapement samples collected with a live trap, 2006. 59

LIST OF FIGURES

1. Kuskokwim Area salmon management districts and escapement monitoring projects with emphasis on the Kogrukluk River. 66
2. Kogrukluk River study area and location of historical escapement monitoring projects. 67
3. Profile of the Holitna River and major tributaries, Alaska (Collazzi 1989). 68
4. Percentage of females per strata as determined by ASL sampling and visual identification at Kogrukluk River weir, 2006. 69
5. Daily Chinook, chum, sockeye, and coho salmon passage at Kogrukluk River weir relative to daily morning water level, 2006. 70
6. Daily Chinook, chum, sockeye, and coho salmon passage at Kogrukluk River weir relative to daily average water temperature derived from hourly data logger readings, 2006. 71
7. Run timing of Chinook and sockeye salmon captured at the Kalaskag tagging site, compared to run timing of salmon recovered at Kogrukluk River weir by date tagged, 2006. 72
8. Daily and cumulative percent passage of overall Chinook passage compared to tagged Chinook salmon passage at Kogrukluk River weir in 2006. 73
9. Daily and cumulative percent passage of overall sockeye passage compared to tagged sockeye passage at Kogrukluk River weir in 2006. 74
10. Dates when individual Chinook salmon stocks pass through the Kalaskag tagging sites (rkm 271) based on anchor- and radio-tagging studies. 75
11. Dates when individual sockeye salmon stocks pass through the Kalaskag tagging site (rkm 271) based on anchor- and radio-tagging studies. 76
12. Historical operational dates for Kogrukluk River wier. 77
13. Historical Chinook and chum salmon escapement with pre-2004 minimum escapement goal and current escapement goal range at Kogrukluk River weir. 78
14. Historical Chinook salmon escapement into six Kuskokwim River tributaries, and the Kuskokwim River Chinook salmon escapement indices, 1991–2006. 79
15. Historical annual run timing of Chinook salmon based on cumulative percent passage at Kogrukluk River weir, 1976–2006. 80
16. Historical chum salmon escapement into 7 Kuskokwim River tributaries, 1991-2006. 81
17. Historical annual run timing of chum salmon based on cumulative percent passage at Kogrukluk River weir, 1976–2006. 82
18. Historical sockeye and coho salmon escapement with the pre-2004 minimum escapement goal and the current escapement goal range. 83
19. Historical Sockeye salmon escapement into 6 Kuskokwim River tributaries, 1991–2006. 84
20. Historical annual run timing of sockeye salmon based on cumulative percent passage at Kogrukluk River weir, 1976–2006. 85
21. ASL Historical coho salmon escapement into 6 Kuskokwim River tributaries, 1991–2006. 86

LIST OF FIGURES (Continued)

Figure **Page**

22. Historical annual run timing of coho salmon based on cumulative percent passage at Kogrukluk River weir, 1976–2006. 87
23. Historical Chinook and chum salmon age distribution at Kogrukluk River weir. 88
24. Daily Historical age composition of Chinook, chum, and coho salmon at the Kogrukluk River weir, 1996–2006. 89
25. Chinook historical age composition by date for Chinook salmon at Kogrukluk River weir. 90
26. Historical annual percentage of female salmon as determined by weighted ASL sampling and visual identification at Kogrukluk River weir. 91
27. Historical percentage of female Chinook, chum, and coho salmon by date at Kogrukluk River weir. 92
28. Historical intra-annual mean length at age of Chinook salmon by date at Kogrukluk River weir. 93
29. Historical average annual length of Chinook salmon at Kogrukluk River weir with 95% confidence intervals. 94
30. ASL composition of the 2006 Kuskokwim River Chinook salmon commercial and subsistence harvests and total monitored escapement and Kogrukluk River weir with +/- 95% confidence interval. 95
31. Historical age composition by date for chum salmon at Kogrukluk river weir. 96
32. Historical intra-annual mean length at age of chum salmon by date at Kogrukluk River weir. 97
33. Historical average annual length of chum salmon at Kogrukluk River weir with 95% confidence intervals. 98
34. Length frequency histograms for chum salmon at Kogrukluk River weir for 2002–2006. 99
35. Historical age composition by date for coho salmon at Kogrukluk river weir. 100
36. Historical intra-annual mean length at age of coho salmon by date at Kogrukluk River weir. 101
37. Historical age average annual length for coho salmon with 95% confidence intervals at Kogrukluk River weir. 102

LIST OF APPENDICES

A1. Daily, cumulative, and percent passage for Chinook, chum, coho, sockeye, and pink salmon at Kogrukluk River weir, 2006. 104
B2. Daily salmon carcass counts at the Kogrukluk River weir, 2006. 108
C1. Daily climate and water level data collected at the Kogrukluk River weir site. 110
D1. Daily stream temperature summary from Hobo data logger at Kogrukluk River weir, 2006 116
E1. Historical daily Chinook salmon passage at the Kogrukluk weir, 1996–2006. 118
E2. Historical daily cumulative Chinook salmon passage at the Kogrukluk River weir, 1996–2006 120
E3. Historical cumulative percent passage of Chinook salmon at the Kogrukluk River weir, 1996–2006. 122
F1. Historical factor table for salmon escapement estimates, Kogrukluk River 1976–2006. 126
G1. Historical daily chum salmon passage at the Kogrukluk River weir, 1996–2006. 128
G2. Historical daily cumulative chum salmon passage at the Kogrukluk River weir, 1996–2006. 130
G3. Historical cumulative percent passage of chum salmon at the Kogrukluk River weir, 1996–2006 132
H1. Historical daily sockeye salmon passage at the Kogrukluk River weir, 1996–2006. 136
H2. Historical daily cumulative sockeye salmon passage at the Kogrukluk River weir, 1996–2006. 138
H3. Historical cumulative percent passage of sockeye salmon at the Kogrukluk River weir, 1996–2006. 140
I1. Historical daily coho salmon passage at the Kogrukluk River weir, 1996–2006. 144
I2. Historical daily cumulative coho salmon passage at the Kogrukluk River weir, 1996–2006. 146
I3. Historical cumulative percent passage of coho salmon at the Kogrukluk River weir, 1996–2006 148
J1. Historical cumulative carcass counts and percent carcasses return at the Kogrukluk River weir. 152

ABSTRACT

The Kogrukluk River produces Chinook salmon *Oncorhynchus tshawytscha*, chum salmon *O. keta*, sockeye salmon *O. nerka,* and coho salmon *O. kisutch* that contribute to intensive subsistence and commercial salmon fisheries downstream. Located in the upper Holitna River basin, a major tributary of the Kuskokwim River, the Kogrukluk River weir is one of several projects operated in the Kuskokwim Area that form an integrated geographic array of escapement monitoring projects. Collectively, and in accordance with the State of Alaska's Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222), this array of projects provides the means to assess escapement trends, which should be monitored consistently and considered in harvest management decisions. Towards this end, Kogrukluk River weir has been operated annually since 1976 to determine daily and total salmon escapements of returning salmon species; to estimate age, sex, and length compositions of Chinook, chum, and coho salmon escapement; to monitor environmental variables that influence salmon productivity; and to contribute to an integrated platform in support of other Kuskokwim Area fisheries projects.

In 2006, a fixed-picket weir was operated on the Kogrukluk River from 29 June through 14 September, with a total of 13 inoperable days. The total annual Chinook salmon escapement of 19,414 fish was above the sustainable escapement goal (SEG) range of 5,300 to 14,000 fish. Total annual chum salmon escapement of 180,594 was above the SEG range of 15,000 to 49,000 fish. Total annual sockeye salmon escapement of 60,807 was above the recent 10-year average of 12,067 fish. The total annual coho salmon escapement of 17,011 was within the SEG range of 13,000 to 28,000 fish. Age, sex, and length (ASL) samples were taken from 3.7% of the Chinook escapement, 0.7% of the chum escapement, and 2.5% of the coho escapement. The Chinook sample composition included 0.5% age-1.1 fish, 34.9% age-1.2 fish, 30.9% age-1.3 fish, 29.4% age-1.4 fish, 4.3% age-1.5 fish, and 33.4% females. The chum salmon escapement was comprised of 1.6% age-0.2 fish, 62.2% age-0.3 fish, 36.0% age-0.4 fish, 0.3% age-0.5 fish, and 38.2% females. The coho salmon escapement was comprised of 10.6% age-1.1 fish, 86.5% age-2.1 fish, 2.8% age-3.1 fish, and 55.0% females. Chinook, chum, and coho salmon all showed length partitioning by sex and age class. In addition to enumerating escapement and estimating ASL composition, the weir served as a platform for several other projects including: *Inriver Abundance of Chinook Salmon in the Kuskokwim River*, *Kuskokwim River Chinook Salmon Run Reconstruction, Kuskokwim River Sockeye Salmon Investigations*, *Kuskokwim River Salmon Mark–Recapture Project*, and collection of pink salmon *O. gorbuscha* and Dolly Varden *Salvelinus malma* genetic tissue. The objectives relating to these projects were fully achieved in 2006.

Key words: Chinook salmon, *Oncorhynchus tshawytscha*, chum salmon, *O. keta*, coho salmon, *O. kisutch*, longnose suckers, *Catostomus catostomus*, escapement, age-sex-length, Kogrukluk River, Kuskokwim River, resistance board weir, radiotelemetry, mark–recapture, genetic stock identification, stock-specific run-timing, sockeye salmon, *O. nerka*, pink salmon, *O. gorbuscha*, Dolly Varden, *Salvelinus malma.*

INTRODUCTION

The Kuskokwim River is the second largest river in Alaska, draining an area approximately 130,000 km^2, 11% of the total area of Alaska (Figure 1; Brown 1983). Each year mature Pacific salmon *Oncorhynchus spp.* return to the river and its tributaries to spawn, supporting an annual average subsistence and a commercial harvest of nearly one million salmon (Whitmore et al. 2005). The subsistence salmon fishery in the Kuskokwim Area is one of the largest in the state, and remains a fundamental component of local culture (ADF&G 2004; Coffing 1991, *Unpublished* a, b; Coffing et al. 2000; Whitmore et al. 2005). The commercial salmon fishery, though modest in value compared to other areas of Alaska, has been an important component of the market economy of lower Kuskokwim River communities (Buklis 1999; Whitmore et al. 2005). Salmon that contribute to these fisheries spawn and rear in nearly every tributary of the Kuskokwim River basin.

The goal of salmon management in the Kuskokwim River is to provide for long-term sustainable fisheries by ensuring adequate numbers of salmon escape to the spawning grounds each year. Since 1960, management of Kuskokwim River subsistence, commercial, and sport fisheries has been the responsibility of the Alaska Department of Fish and Game (ADF&G). Management authority for the subsistence fishery was broadened in October 1999 to include the federal government under Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA). The U.S. Fish and Wildlife Service (USFWS) is the federal agency most involved within the Kuskokwim Area. In addition, numerous tribal groups are charged by their constituency to actively promote a healthy and sustainable subsistence salmon fishery. Over the years, these and other groups have combined their resources to better achieve the common goal of providing for long-term sustainability of salmon fisheries in the Kuskokwim River.

The successful management of a long-term sustainable salmon fishery requires an array of escapement monitoring projects that reliably measure the adequacy of annual escapement to key spawning systems and track temporal and spatial patterns in abundance. However, few spawning streams have received rigorous salmon escapement monitoring. Consequently, critical long-term salmon escapement data is lacking for much of the Kuskokwim drainage which has limited the ability of managers to assess the adequacy of escapements and the effects of management decisions. Historically, only 2 long-term ground based projects have operated in the Kuskokwim River drainage: the Aniak River sonar and the Kogrukluk River weir (Whitmore et al. 2005). The need for long-term escapement information prompted the establishment of several weirs throughout the late 1990s. Currently, 8 ground-based escapement monitoring projects, consisting of 7 weirs and 1 sonar project, are operated cooperatively by a variety of state, federal, and tribal organizations. These ground-based projects combined with aerial stream surveys are used to represent the diversity of salmon populations that contribute to subsistence, commercial, and sport harvests while taking into account the overall ecosystem function in the watershed.

Each of the escapement monitoring projects conducted throughout the Kuskokwim River drainage provides invaluable information leading to the successful management of a sustainable salmon fishery. However, the utility of each of these projects is variable. For instance, aerial surveys serve only as abundance indices because they are flown only once each season, are subject to a high degree of variability, and are geographically skewed towards lower Kuskokwim River tributaries. Each weir project provides invaluable information pertaining to stock-specific annual escapement, though most lack long-term data sets required to track historical trends and set sustainable escapement goals which assess the adequacy of annual escapements.

The need for long-term escapement monitoring projects became more evident in September 2000, when the Alaska Board of Fisheries (BOF) classified both Kuskokwim River Chinook (*O. tshawytscha*) and chum salmon (*O. keta*) as “stocks of yield concerns” (5 AAC 39.222, 2001) (Burkey et al. 2000a, b). This designation was upheld during the 2004 BOF meeting (Bergstrom and Whitmore 2004) but was rescinded during the 2007 BOF meeting at the recommendation of ADF&G following several years of expected harvest levels and relatively strong escapements. The value of long-term data sets to sustainable management promotes the need for continued escapement monitoring at established ground-based projects throughout the drainage with insufficient historical data sets, and highlights the importance of long-term projects such as the Kogrukluk River weir.

Management of sustainable salmon fisheries requires more than just adequately monitoring escapement. Escapement projects throughout the Kuskokwim drainage commonly serve as platforms for collecting other types of information useful for management and research. For example, collection of age, sex, and length (ASL) data are typically included in most escapement monitoring projects (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008), and the Kogrukluk River weir is no exception. Knowledge of ASL composition can provide insights into understanding fluctuations in salmon abundance and is essential in developing spawner-recruit relationships used in formulating escapement goals (DuBois and Molyneaux 2000). Weir projects also serve as platforms for collecting baseline information on habitat variables such as water temperature and stream discharge (level), that may be important for establishing future water reservations and standards. Furthermore, weir projects, singly and in concert, provide support for various collaborative watershed scale research projects aimed at narrowing knowledge gaps in the biology and ecology of Kuskokwim River salmon, ultimately improving the effectiveness of management decisions. Without the current infrastructure of ground based escapement monitoring projects located throughout the watershed, such essential research would be financially and logistically impractical.

BACKGROUND

Regional

In the dialect of the upper Kuskokwim River Yup'ik people, Kogrukluk means "middle fork" (Evan Ignatti, elder, Kashegelok; personal communication). In the early 1800s, the Holitna River was an important route for the Russian fur-trading link to Bristol Bay and the Kuskokwim River (Oswalt 1990). Twice yearly, Russian explorers and traders traveled north and south along the Holitna and Nushagak Rivers, making a 5-day portage between Shotgun Creek and the Chichitnok River to complete the passage (Brown 1983; Oswalt 1990). Until 1845, this served as the primary supply route to the first Russian station on the Kuskokwim River, which was located at the mouth of the Holitna River. To service this trade route, a number of communities were established along the Holitna River including Kashegelok, Nogamut, and Itulilik. Residents of Holitna River communities made their living from subsistence hunting and fishing, relying heavily on the abundant Holitna River salmon runs and supplementing their livelihoods through the fur trade (Brown 1983; Oswalt 1990; Evan Ignatti, elder, Kashegelok; personal communication). In the 1930s the Red Devil mercury mine opened, creating jobs and luring Holitna villagers into the communities of Red Devil and Sleetmute. As the fur trade declined and other opportunities arose, the Holitna River villages were slowly abandoned. Sometime between 1940 and 1960, the Holitna River below the confluence of the Kogrukluk and the Chukowan rivers shifted to the east, effectively destroying the village of Kashegelok (Evan Ignatti, elder, Kashegelok; personal communication). During the spring flood of 2003, the Chukowan River cut a second mouth at its confluence with the Holitna River, building a gravel bar across the channel in an area traditionally favored as a floatplane landing site. The last 2 residents (Evan Ignatti and Ignatti Ignatti) of the village of Kashegelok relocated to Red Devil in 2003. Today, there are a number of lodges and homesteads mostly on the lower Holitna River. The Holitna River drainage continues to draw users from throughout the Kuskokwim River drainage and beyond, and remains an important area for subsistence fishing, sport fishing, and hunting.

Kogrukluk River Escapement Monitoring

The Kogrukluk River weir (also known as the Ignatti weir or Holitna River weir) has the longest operational history of any ground-based escapement monitoring project in the Kuskokwim Area. The importance of the Holitna River and its tributaries as a key salmon spawning system in the Kuskokwim River drainage has been recognized by state managers since at least 1961 when the first aerial survey was flown (Burkey 1994; Schneiderhan *Unpublished*). In 1969, a salmon counting tower project was initiated on the Kogrukluk River upstream of the confluence of Shotgun Creek (Figure 2; Yanagawa 1972). The tower was relocated twice between 1970 and 1978 because of shifting river channels, but always remained upstream of the mouth of Shotgun Creek. In order to more accurately assess salmon escapements, installation of a counting weir was attempted in 1971 near the counting tower site, but the weir was destroyed by high water early in the season (Yanagawa 1973). Both tower and weir operations in this section of the Kogrukluk River were hindered by log jams and shifting channels. Inadequacies of the existing tower sites and the absence of more suitable locations resulted in a transition from a counting tower to a weir between 1976 and 1978 (Baxter 1979). Because the weir was located below the confluence of Shotgun Creek, both tower and weir projects were operated concurrently from 1976 to 1978 to compare escapement estimates between projects. Since its inception in 1976, the Kogrukluk River weir has operated annually to monitor Chinook, chum, and sockeye (*O. nerka*) salmon escapement to this system. Beginning in 1981, the weir operations were extended to include coho salmon (*O. kisutch*; Baxter 1982). Since the BOF stocks of yield concern designation in 2000, several mainstem and regional projects have depended on the Kogrukluk River weir as a platform for studies to determine stock-specific run-timing through tag recoveries (Kerkvliet 2003, Kerkvliet 2004, Pawluk, Kerkvliet et al. 2006, Pawluk, Baumer et al. 2006, Schaberg et al. *In prep*), to determine marked-to-unmarked ratios for abundance estimates (Wuttig and Evenson 2002; Chythlook and Evenson 2003; Stuby 2003-2007; Stroka and Brase 2004; and Stroka and Reed 2005), and to collect stock-specific baseline samples for genetic stock identification studies (Crane et al. 2004; Templin et al. *In prep*), among others.

Kogrukluk River salmon escapements are a relatively small percentage of overall salmon escapements in the Kuskokwim River drainage; however, this tributary appears to support an above average number of spawning Chinook, chum, sockeye, and coho salmon when compared to other Kuskokwim River tributaries of similar size (Burkey et al. 1999). The Kogrukluk River weir is 1 of only 2 ground-based projects in the Kuskokwim River drainage with a formal escapement goal for Chinook salmon, 1 of only 2 projects with a formal escapement goal for chum salmon, and the only project with a formal escapement goal for coho salmon (Figure 1; Linderman and Bergstrom 2006).

OBJECTIVES

The objectives of the Kogrukluk River escapement monitoring project in 2006 were to:

1. Determine the daily and total annual escapement of male and female Chinook, chum, sockeye, and coho salmon to the Kogrukluk River;
2. Estimate the age, sex, and length (ASL) composition of total annual Chinook, chum, and coho salmon escapements from a minimum of 3 pulse samples, 1 collected from each third of the run, such that 95% simultaneous confidence intervals for the age composition in each pulse are no wider than 0.20 (α = 0.05 and d = 0.10);
3. Monitor habitat variables and determine possible effects of water level and water temperature on salmon migration past the weir; and
4. Provide for collaborative, efficient research in the Kuskokwim River system by:
    a. Serving as a monitoring location for Chinook salmon equipped with radio transmitters deployed as part of *Inriver Abundance of Chinook Salmon in the Kuskokwim River*;

b. Serving as a monitoring location for sockeye salmon equipped with radio transmitters deployed as part of *Kuskokwim River Sockeye Salmon Investigation*;

c. Serving as a recovery location for anchor-tagged Chinook and sockeye salmon as part of the *Kuskokwim River Salmon Mark–Recapture* project;

d. Serve as a collection site for Dolly Varden (*Salvelinus malma*) genetic tissue as part of the *Baseline development for Dolly Varden in southwestern Alaska* project; and

e. Serve as a collection site for pink salmon genetic tissue.

The primary goal of this report is to summarize and present the results for the 2006 field season at the Kogrukluk River weir. Secondary to this, we intend to provide a more holistic perspective of Kuskokwim Area fisheries by placing the 2006 findings into the broader spatial and temporal context. To do this we draw heavily on data from past years at this project to highlight between year trends, and we draw on data from other escapement monitoring projects, related research projects, and the commercial and subsistence fishery in order to highlight spatial trends. These goals are intended to enhance the utility of this report beyond simply archiving data. It is important to note that some of the data used to make these broader comparisons are preliminary. Effort was made to ensure that all preliminary data was reported as such. In addition, many of the referenced documents are currently being developed. Consequently, most of the reported trends for other projects were determined by the authors of this report based on finalized data sets generously provided by other researchers. At the time of publication of this document all reported estimates and trends are as accurate as possible. However, the final results and conclusions for "*In prep*" documents may change. This highlights the importance for readers to consult the original documents prior to referencing results from other projects. Furthermore, unless stated, the statistical significance of the trends discussed for this and other escapement monitoring projects have not been determined. Many of these trends are subjective and based on low sample sizes with high variance. It is important to remember that sampling methodologies often differ across projects and over time leading to difficulty in comparisons. Throughout this document every effort was made to ensure sound comparisons. However, the reader should be aware of these potential issues and receive broader spatial and temporal trends with caution.

METHODS

STUDY AREA

The Kogrukluk River drains a watershed of about 2,073 km^2 formed by surface runoff from the north side of a low plateau dividing the Tikchik Lakes and Nushagak River basins from the Holitna and Kuskokwim River basins. From its headwaters near Nishlik Lake, the Kogrukluk River flows northerly for approximately 80 river kilometers (rkm). The Kogrukluk River joins Shotgun Creek upstream of the weir site and the Chukowan River below the weir site, near the abandoned village site of Kashegelok, to form the headwaters of the Holitna River (Figure 2). The Holitna River joins the Kuskokwim River at rkm 491, and the Kogrukluk River is an additional 218 rkm upstream of the confluence (Sheldon et al. 2005).

Over its course, the Kogrukluk River descends approximately 250 m with an average drop of 3.2 m per km across a 1–5 km wide flood plain (Figure 3; Collazzi 1989). The flood plain is poorly drained and is composed of soft sediments that erode easily. The substrate is composed of predominately gravels and cobbles. At normal flow, the Kogrukluk River has a nominal load of suspended materials, making the water clear except at periods of high flow when it may be stained due to organic leaching. During periods of high flow, the river can change course quickly forming oxbows, sloughs, and large log jams creating a complex mosaic of reproductive habitat suitable for Chinook, chum, sockeye, and coho salmon (Baxter *Unpublished* b; Healy 1991). Riparian areas consist of low-lying mixed spruce (*Picea spp.*), cottonwood (*Populus sp.*) forests, willows (*Salix spp.*), and alders (*Alnus spp.*) on banks and gravel bars, interspersed with wet tundra. Uplands are typically rolling spruce-hardwood forest, with alpine tundra above 200 m. White spruce (*P. glauca*), birch (*Betula spp.*), and aspen (*P. trenuloides*) are common on moderate south-facing slopes and black spruce (*P. mariana*) are common on north-facing slopes, poorly drained areas, and pockets of permafrost. The understory consists of spongy moss and low brush on cool moist slopes, grasses on dry slopes, and willows, alders, and dwarf birch (*B. nana*) near timberline.

The Kogrukluk River weir is located approximately 220 rkm from the village of Sleetmute and 212 km by air from the city of Bethel. This project is the most remote ground-based escapement project in the Kuskokwim Area (Figure 1). Personnel and supplies are transported to and from the weir by floatplane.

The weir site in 2006 was the same location used in previous years, which is approximately 710 rkm from the mouth of the Kuskokwim River, about 1 rkm upstream from the confluence with the Chukowan River, and about 3 rkm downstream of the Shotgun Creek confluence (Figure 2). The weir has been at this location since 1976 (Baxter *Unpublished* a). Areas further downstream were considered unsuitable due to excessive water depth, channel width, and morphology.

At the weir site, the Kogrukluk River is approximately 70 m wide and 3–4 m deep at full capacity. During normal summer operations, river depth is about 1.3 m in the deepest section. The weir is positioned in the center of a 2 km stretch of relatively straight channel. Banks are composed of soft sediment and bottom material is primarily composed of gravels and cobbles. The weir site is at the base of a southwest-facing hillside.

WEIR CONSTRUCTION AND MAINTENANCE

Construction

The Kogrukluk River weir is a fixed picket design. The design and materials used to construct the Kogrukluk River weir in 2006 were the same as those described by Baxter (1981), with the exception of an improved fish trap and a tighter picket spacing. The use of the new fish trap and picket spacing began in 2005. The fish trap, which was 1.5 by 2.5 m and included an entrance gate, holding box, and exit gate, was modeled after the trap used at the George River since 2001 (Linderman et al. 2002). The picket spacing was narrowed after investigators observed small chum salmon passing through the pickets in 2004, a year that was characterized by an unusually high abundance of small, age-3 chum salmon. Picket intervals were reduced from 76.2 mm to 63.5 mm, which narrowed the gap from 49.0 to 36.5 mm. As in past years, the weir spanned a 70-m channel, with a fish trap located 30–50 m from the east bank. A boardwalk was constructed above the weir from the east bank to the fish trap to facilitate access to the trap. The weir design does not allow boats to pass without partially dismantling the weir. Boat traffic at the weir was rare, but when necessary, boats were passed by removing weir pickets and pulling the boat through the opening (Baxter 1981). The use of a floating resistance board weir was considered for this site to better accommodate periodic high flows, heavy debris loads, and boat traffic. However, extensive site surveys indicated that the weir location lacked the necessary homogenous river-bed profile and substrate stability for proper installation and operation of a floating weir.

Maintenance

The weir was cleaned and inspected daily. Small debris that accumulated around the weir pickets, such as sticks, leaves, fibrous root mats, algae, and fish carcasses, were removed and passed downstream. Large debris such as logs and root wads were typically removed using chainsaws, axes, and ropes, and sometimes required partial dismantling of the weir.

The daily cleaning routine included a visual inspection of the weir for signs of substrate scouring, damaged pickets, or other conditions that could compromise operations. Periodically the crew conducted a more thorough inspection by snorkeling along the leading edge of the weir. Problems were addressed immediately. Areas showing signs of substrate scouring were addressed with sandbags or comparable means.

ESCAPEMENT MONITORING

The Kogrukluk River weir differs from other weir projects throughout the Kuskokwim River drainage in that no target operational period has been defined. Annually, the weir is installed in early June prior to the onset of the Chinook and chum salmon runs and is operated into late September or early October in order to encompass much of the coho salmon run. However, the annual operational period for the weir varies. No attempt is made to estimate missed passage prior to installation and/or after removal of the weir. In years when there are inoperable days during the operational period, estimates of daily salmon passage are made for compromised days in order to provide more consistent comparisons of escapements among years. Total annual escapement was determined from the total observed and estimated fish passage.

Passage Counts

Passage counts were conducted in 4 to 8 one-hour shifts per day between 0730 and 2400 hours. This schedule was adjusted as needed to accommodate variation in fish behavior and abundance. Delays in fish passage occurred only at night or during ASL sampling. Crew members visually identified the species and sex of each fish observed passing upstream of the weir and recorded them on a tally counter. Following each shift, crew members recorded total counts in a designated logbook and zeroed the tally counter. At the end of each day, total daily and cumulative seasonal counts were recorded in a designated logbook. These counts were reported each morning to ADF&G staff in Bethel via single side band radio or satellite phone.

The live trap was used as the primary means of upstream fish passage. An observer positioned on the trap viewed fish entering from downstream through a clear-bottom viewing box that reduced glare and water turbulence. In addition to improving fish identification, this allowed observers to anticipate and effectively trap fish tagged in the mainstem Kuskokwim River. When salmon were reluctant to enter the fish trap, such as during periods of extreme low water, it was necessary to employ an alternative counting method in which the observer removed a few weir pickets and counted fish while positioned on the boardwalk above the weir. A “flash-panel” composed of light colored material, such as an aluminum weir panel or a painted board, was used to increase contrast and visibility. On occasion, fish that had previously passed upstream of the weir would move back downstream through this temporary gap. Such fish were subtracted from daily counts unless it was obvious that the fish had already spawned.

Visual determination of sex was possible due to advanced sexual dimorphism of each species. For example, females were obviously swollen and round behind the pectoral fins, had blunt, bullet-shaped heads, and swam with steady, wide strokes. Males exhibited an exaggerated elongation of the kype, were streamlined and muscular in appearance, and swam with short, powerful strokes. Though some variation exists, these differences were applicable to all salmon species observed. The abovementioned viewing box greatly improved identification, although the presence of a flash-panel on the river bottom was usually sufficient for making these determinations.

During the rare occasions that boats were passed through the weir, crew members were positioned to observe fish that may pass upstream during this process. These fish were counted and added to the daily totals. If fish that had previously passed upstream of the weir moved back downstream through this temporary gap, the fish were subtracted from daily counts unless it was obvious that the fish had already spawned.

No effort was made to enumerate very small fish (salmon or resident species) that passed through the weir pickets. Since picket spacing was reduced in 2005, the occurrence of this type of passage has been considered negligible for all salmon species except pink salmon. Complete enumeration of pink salmon is not possible because most pink salmon can pass upstream through the spacing between weir pickets. Consequently, reported pink salmon abundance reflects only the number of fish observed passing the weir through the counting location during normal enumeration routines. Similarly, estimated pink salmon escapement (see Methods: Estimating Missed Passage) reflects the number of fish passing the weir during inoperable periods that would have been observed through the counting location during normal enumeration routines.

Estimating Missed Passage

To better assess annual run size of each species of salmon and to facilitate comparison among years, upstream salmon passage was estimated for days when the weir was inoperable. Estimates were assumed to be zero if passage was considered negligible based on historical data and run-timing indicators. Otherwise, daily passage was estimated using 1 of 3 methods; the method used depends on the duration and timing of the inoperable periods.

Single Day Method

For a single inoperable day, daily passage is calculated as the average of the observed passage for 2 days before and 2 days after the inoperable period. On the occasions where a partial day count was conducted or a hole was identified in the weir, estimates of missed passage are generated using the single day method minus any observed passage from the compromised day.

Linear Method

When adequate data exist before and after a relatively short inoperable period, estimates are calculated from a linear interpolation of the average observed passage for 2 days before and after the inoperable period using the following formula:

$$\hat{n}_{d_i} = \alpha + (\beta \cdot i) \qquad (1)$$

where

$$\alpha = \frac{n_{d_1-1} + n_{d_1-2}}{2},$$

$$\beta = \frac{\left(n_{d_I+1} + n_{d_I+2}\right) - \left(n_{d_1-1} + n_{d_1-2}\right)}{2(I+1)},$$

for (1, 2, …, *i*, …*I*)

where

$\hat{n}_{d_i}$ = passage estimate for the i^{th} day (1, 2, …, *i*, …*I*) of a multiple day breach event;

n_{d_I+1} = observed passage the first day after the inoperable period (d_I);

n_{d_I+2} = observed passage the second day after the inoperable period (d_I);

n_{d_1-1} = observed passage 1 day before the inoperable period;

n_{d_1-2} = observed passage 2 days before the inoperable period;

I = number of days the inoperable period lasted.

Proportion Method

When adequate data before or after an inoperable period do not exist, or the inoperable period is relatively long, estimates of daily passage are derived from a model data set. The model data set is chosen for fish passage characteristics similar to Kogrukluk River. The model data set used could be from a different year at Kogrukluk River weir, or from a neighboring project. In either case, daily passage is based on a model data set's daily passage proportions, and is calculated using the formula:

$$n_{d_i} = \left(\frac{\left(n_{2d_i} \times n_{1t_1}\right)}{n_{2t_1}}\right) - n_{o_i} \qquad (2)$$

where

n_{d_i} = passage estimate for a given day (*i*) of the inoperable period;

n_{2d_i} = passage for the i^{th} day in the model data set 2;

n_{1t_1} = known cumulative passage for the operational time period (t_1) from the estimated data set 1;

n_{2t_1} = known cumulative passage for the corresponding time period (t_1) from the model data set 2; and

n_{o_i} = observed passage (if any) from the given day (*i*) being estimated.

Estimates Required in 2006

In 2006, the "linear method" was used to estimate missed Chinook, chum, sockeye, coho, and pink salmon passage when the weir was not operational between 12 and 25 August. This method was also used in 2003, 2004, and 2005 but varied from previous years. Clark and Salomone (2002) described details about past practices for estimating missed daily passages.

Carcasses

Spawned out and/or dead salmon (hereafter referred to as carcasses) that accumulated on the weir were counted by species before being passed downstream. The daily carcass count was tallied by species and recorded in a designated logbook. In some past years, sex of all carcasses had been determined at this project, as it is done at several other Kuskokwim River escapement projects. However, this was not done in 2006 do to the high volume of carcasses and the extensive processing time. In addition it is believed that carcass recovery from the weir is biased toward males and accurate sex determination is difficult due to decay.

AGE, SEX, AND LENGTH COMPOSITION

ASL composition of the total annual Chinook, chum, and coho salmon escapements were estimated by sampling a portion of the fish passage and applying the sample ASL composition to the total escapement as described by DuBois and Molyneaux (2000).

Sample Collection

The crew at the Kogrukluk River weir employed standard ASL sampling techniques as described by DuBois and Molyneaux (2000). For chum and coho salmon, a pulse sampling design was used, in which moderate sampling was conducted for 3 days followed by a few days without sampling. The goal of each pulse was to collect samples from 200 chum and 170 coho salmon. The pulse sample design was more loosely followed with Chinook salmon such that the goal to sample a minimum of 210 fish from each third of the run preceded the goal to sample in pulses. This method results in near daily Chinook salmon sample collection throughout most of the run. Sample sizes were selected so that the simultaneous 95% confidence interval estimates of age and sex composition proportions would be no wider than 0.20 ($\alpha = 0.05$ and $d = 0.10$) (Bromaghin 1993) per pulse for Chinook salmon assuming 10 age/sex categories, for chum salmon assuming 8 age/sex categories, and for coho salmon assuming 6 age/sex categories. Samples sizes were increased by about 10% from that recommended by Bromaghin (1993) to account for scales that could not be aged. The minimum acceptable number of sample periods for Chinook, chum and coho salmon was 3 per species, 1 sample period representing each third of the run, to account for temporal dynamics in the ASL composition.

ASL sampling consisted of capturing salmon with the fish trap by opening the entrance gate while the exit gate remained closed, allowing fish to accumulate inside the holding box. The holding box was allowed to fill with fish until a reasonable number was inside. Crew members used a dip net to remove fish from the holding box. Fish were removed from the dip net and placed into a partially submerged fish cradle. Three scales were taken from the preferred area as described in standard procedures and transferred to numbered gum cards (DuBois and Molyneaux 2000). Sex was determined through visual examination of the external morphology, as previously described. Length was measured to the nearest millimeter from mideye to tail fork (MEF) using a straight-edged meter stick. Sex and length data was recorded on standardized numbered data sheets that correspond with numbers on the gum cards used for scale preservation. After sampling, each fish was released upstream of the weir. The procedure was repeated until the holding box was emptied.

Additional Chinook and coho salmon samples were collected through active sampling. Active sampling required that a crew member be positioned above the downstream end of the trap to observe fish passing upstream. Both the entrance and exit gates remained open, which allowed most species to pass unimpeded and increased current flow through the structure. Fish were more likely to enter the trap with both gates open. When a Chinook or coho salmon entered the trap, the crew member would immediately close both the entrance and exit gates, thereby actively trapping the fish for sampling. This method was useful in isolating the relatively few Chinook salmon from larger volumes of chum and sockeye passing at the same time and improved ASL sampling success.

After sampling was completed, relevant information such as sex, length, sampling date, and sampling location was copied to computer mark-sense forms that correspond to numbered gum cards. The completed gum cards and mark-sense forms were sent to the Bethel or Anchorage ADF&G offices for processing. The original ASL gum cards, acetates, and mark-sense forms were archived at the ADF&G office in Anchorage. The computer files were archived by ADF&G in the Anchorage and Bethel offices. Data were also loaded into the Arctic-Yukon-Kuskokwim (AYK) salmon database management system (Brannian et al. 2005).

Estimating Age, Sex, and Length Composition

ADF&G staff in Bethel and Anchorage aged scales, processed the ASL data, and generated data summaries as described by DuBois and Molyneaux (2000). These procedures generated 2 types of summary tables for each species: 1 described the age and sex composition and the other described length statistics. These summaries accounted for changes in the ASL composition throughout the season by first partitioning the season into temporal strata based on pulse sample dates and/or sample size requirements, and then applying the ASL composition of individual temporal samples to the corresponding temporal stratum, and finally summing the strata to generate the estimated ASL composition for the season. This procedure ensured that the ASL composition of the total annual escapement was weighted by the abundance of fish in the escapement rather than the abundance of fish in the samples. For example, if samples of chum salmon were collected in 6 pulses, then the season would be partitioned into 6 temporal strata with 1 pulse sample occurring in each stratum. Using this method, a sample of 200 chum salmon collected from 3 to 4 July would be used to estimate the ASL composition of the hypothetical escapement of 2,000 chum salmon that passed the weir during the temporal stratum that might extended from 1 to 7 July. This procedure would be repeated for each temporal stratum, and the estimated age and sex composition for the total annual escapement would be calculated as the sum of chum salmon in each stratum. In similar fashion, the estimated mean length composition for the total annual escapement would be calculated by weighting the mean lengths in each temporal stratum by the escapement of chum salmon that passed the weir during that stratum. Confidence intervals were constructed for the estimated mean lengths according to Thompson (1992).

The practice of collecting complete ASL data from sockeye salmon was discontinued at Kogrukluk River weir in 1995 because widespread scale absorption confounds reliable aging (Burkey 1995; Cappiello and Burkey 1997). However, crews continue to visually estimate sex composition during daily enumeration routines. Annual sex composition was determined by comparing the total annual escapement of males to the total annual escapement of females. In 2006 intra-annual variation in sex composition was assessed by stratifying the total annual escapement into weekly strata.

Throughout this document fish ages are reported using European notation and total age. European notation is composed of 2 numerals separated by a decimal. The first numeral indicates the number of winters the juvenile has spent in freshwater and the second numeral indicates the number of winters spent in the ocean (Groot and Margolis 1991). Total age of a fish is equal to the sum of these 2 numerals, plus 1 year to account for the winter when the egg was incubating in gravel. For example, a Chinook salmon described as age-1.4 was actually 6 years of age. European notation will be used throughout this document to represent specific age classes (fish with a particular life history strategy). Total age will be used when discussing brood size because broods often consist of same age fish with different life history strategies. For example a brood of age-6 Chinook salmon may consist of age-1.4 and age-2.3 fish.

Weather and Stream Observations

The Kogrukluk River is influenced by both coastal and interior weather systems which results in a local climate that is often different from the rest of the Kuskokwim Basin. Heavy thundershowers often occur between mid-July and mid-August. Heavy rain tends to wash out large quantities of debris and sediment, causing the Kogrukluk River to become stained and murky, though reduced water clarity usually improves quickly. These differences are only revealed through active weather monitoring.

Water and air temperatures were manually measured each day at approximately 0730 and 1700 hours. Water temperature was determined by submerging a calibrated thermometer below the water surface until the temperature reading stabilized. Air temperature was obtained from a thermometer attached to an outside wall of the cabin in a shaded location. Temperature readings were recorded in a designated logbook, along with notations about wind direction, estimated wind speed, cloud cover, and precipitation. Daily precipitation was measured using a rain gauge calibrated in millimeters. These manual techniques are consistent with past years at this project. In 2006, water temperature was also measured with a remote temperature logger located at mid water column just upstream of the weir. The data logger was programmed to record temperature every hour during the operational period. Records were retrieved at the end of the season and compared to temperatures measured manually using a thermometer.

Daily operations included monitoring river depth with a standardized staff gauge. The staff gauge consisted of a metal rod driven into the stream channel with a meter stick attached. The height of the water surface, as measured from the meter stick, represented the “stage” of the river in millimeters above an established datum plane. The staff gauge was calibrated to the datum plane by a semi-permanent benchmark to provide for consistent stage measurements between years. The benchmark consisted of a nail driven into the second step of a wooden staircase leading from the riverbank to the utility shed, which represents a measurement of 5 m above baseline and corresponds to the highest water level observed at the Kogrukluk River weir. Water stage was measured at approximately 0730 and 1700 hours.

Related Fisheries Projects

Inriver Abundance of Chinook Salmon in the Kuskokwim River

The Kogrukluk River weir was used as a platform for the project entitled *Inriver Abundance of Chinook Salmon in the Kuskokwim River*. This study was designed to develop estimates of the total Chinook salmon abundance upstream of Kalskag. This goal was addressed by conducting a 2-sample mark–recapture study within the upper Kuskokwim River drainage above Kalskag.

Radio transmitters were inserted into Chinook salmon caught near Kalskag, and fixed radio receiver stations located throughout the upper Kuskokwim River drainage monitored the movement of tagged Chinook salmon. The known Chinook salmon passage at weir projects located throughout the upper drainage, coupled with data collected from receiver stations, was used to develop estimates of total Chinook salmon abundance. Complete methodology is provided by Stuby 2007. Results of this study will be a critical component of a related project entitled *Kuskokwim River Chinook Salmon Run Reconstruction*, which entails a 2-part approach to develop a statistical model that will use fragments of historical information to estimate a time series of annual Chinook salmon abundance in the Kuskokwim River from the 1970s through 2007.

The Kogrukluk River weir and crew facilitated this project by monitoring a receiver station located upstream of the weir, recapturing radio-tagged Chinook salmon passing upstream of the weir, and enumerating total passage of Chinook salmon upstream of the weir. The receiver station was downloaded nearly weekly by the weir crew and data was sent to researchers as often as possible throughout the season. For each recaptured fish, the crew recorded date of recapture, tag number, tag color, and the general condition of the fish.

Kuskokwim River Sockeye Salmon Investigations

The Kogrukluk River weir was used as a platform for the project entitled *Kuskokwim River Sockeye Salmon Investigations*. This project was designed to address critical knowledge gaps in the biology and ecology of Kuskokwim River sockeye salmon. Specifically, this project aimed to describe the location and relative abundance of sockeye salmon spawning aggregates, estimate stock-specific run-timing in the mainstem, describe and compare habitat use and seasonal migration patterns of river-type and lake-type juveniles, and describe and compare smolt size and growth among tributaries and habitat types. These goals were addressed by conducting a radiotelemetry study within the upper Kuskokwim River drainage above Kalskag, conducting juvenile seining within various habitat types throughout the Holitna drainage, and collecting scales from returning adult sockeye salmon.

Similar to the Chinook project, radio transmitters were inserted into sockeye salmon caught near Kalskag. Fixed radio receiver stations located throughout the upper Kuskokwim River drainage and aerial surveys were used to monitor the movement of tagged fish. Juvenile salmon were sampled from various habitat types throughout the Holitna drainage and in Telaquana Lake using standard beach seining techniques. Scales were collected from adult sockeye salmon following standard protocol (Dubois and Molyneaux 2000). The known sockeye salmon passage at weir projects located throughout the upper drainage, coupled with data collected from tracking efforts, was used to address distribution, relative abundance, and run-timing of spawning aggregates. Data from seining efforts was used to address habitat use and outmigration timing of juveniles. Variation in size and growth of juvenile sockeye salmon was determined by back-calculating from scales collected from adults (S.E. Gilk, ADF&G, Anchorage; personal communication).

The Kogrukluk River weir and crew facilitated this effort by monitoring a receiver station located upstream of the weir, recapturing radio-tagged sockeye salmon passing upstream of the weir, enumerating total passage of sockeye salmon upstream of the weir, conducting juvenile sampling, and collecting scales from adult sockeye salmon. The receiver station was downloaded nearly weekly by the weir crew and data was sent to researchers as often as possible throughout the season. For each recaptured fish, the crew recorded date of recapture, tag number, tag color, and the general condition of the fish. Juvenile sampling was conducted nearly bi-weekly throughout the season. The crew collected a total of 12 samples during each sampling period, 3 samples from each of the 4 dominant habitat types (main channel, side channel, side slough, and spring slough). Sampled fish were identified to species and counted. A sub-sample of each salmon species from each habitat type was measured for total length and preserved for aging. Scale samples were collected from approximately 75 adult sockeye salmon.

Kuskokwim River Salmon Mark–Recapture Project

The Kogrukluk River weir was used as a platform for the project entitled *Kuskokwim River Salmon Mark–Recapture Project*. In 2006 this project was designed to investigate stock-specific run-timing and travel speed of Kuskokwim River Chinook and sockeye salmon. These goals were addressed by conducting a tagging study within the upper Kuskokwim River drainage above Kalskag. Uniquely numbered anchor tags were attached to Chinook and sockeye salmon caught near Kalskag. Weir crews at projects located throughout the upper Kuskokwim River drainage recaptured observed tagged fish in the weir trap. Known recapture dates and tag number from the weirs coupled with known deployment dates of recaptured tags from the Kalskag tagging site was used to develop estimates of stock-specific run-timing and travel speed. For the purpose of estimating stock-specific run-timing and speed for each species, fish radio-tagged as part of concurrent research efforts were pooled with anchor-tagged fish to increase sample size. This was considered appropriate since similar gear types were used for capture, and the objectives of both projects were considered in the tag deployment schedule. The pooling of both samples likely resulted in a better estimate of stock-specific run-timing than either considered independently because the radio tag to anchor tag ratio varied from day to day when radio tags were deployed according to a rigid pre-determined schedule and anchor tags were affixed to the remaining catch. Complete methodology is presented by Schaberg et al. (*In prep*).

The Kogrukluk River weir and crew facilitated this effort by recapturing observed anchor-tagged Chinook and sockeye salmon. For each recaptured fish, the crew recorded date of recapture, tag number, tag color, and the general condition of the fish. In addition, crews randomly examined Chinook and sockeye salmon for the presence of a severed adipose fin that served as a secondary mark indicating tag loss.

Other Related Projects

In 2006, the Kogrukluk River weir was used as a platform to collect genetic tissue from pink salmon and Dolly Varden. The collection of pink salmon genetic tissue was not in conjunction with any specific research project. Pink salmon samples were sent to the ADF&G genetics lab in Anchorage for storage and processing. The collection of Dolly Varden genetic tissue was in support of a USFWS project entitled *Baseline development for Dolly Varden in southwestern Alaska*. Dolly Varden samples were sent to the USFWS conservation genetics lab in Anchorage for storage and processing.

The Kogrukluk River weir and crew facilitated these efforts by capturing pink salmon and Dolly Varden, collecting and preserving the appropriate genetic tissue for each species, and visually determining sex and measuring total length of Dolly Varden. Samples were sent to ADF&G and USFWS at the end of the season. Sampling efforts were conducted on an opportunistic basis.

RESULTS

ESCAPEMENT MONITORING

The operational period for the 2006 Kogrukluk River weir field season was 28 June through 14 September. Installation of the weir began on 18 June. The weir was operational at 2000 hours on 28 June. A partial day count was conducted on 28 June; total escapement was not estimated for this partial day. Daily escapement monitoring was conducted successfully until water levels and debris loads increased so rapidly in mid August that the weir structure itself was in jeopardy. When this occurred, the crew dismantled parts of the weir to preserve the overall structure. This inoperable period began at 0700 hours on 12 August, lasted 13 days, and ended at 1030 hours on 25 August. Passage was estimated during this inoperable period using the linear method (see Methods). Following this inoperable period, daily operations resumed successfully until a second high water event began at 1000 hours on 15 September and rendered the weir inoperable for the remainder of the season. No escapement estimate was made for the morning of 15 September. The last full day of escapement monitoring was 14 September. The weir was removed on 23 September.

Chinook Salmon

Total annual Chinook salmon escapement upstream of the Kogrukluk River weir in 2006 was 19,414 fish, which includes an estimated 230 fish (1.2% of the total run) that passed during inoperable periods (Table 1). Chinook salmon were observed passing the weir from 29 June to 13 September. Passage increased steadily following weir installation, peaked in mid July, decreased gradually through late August, and decreased to about 2 Chinook salmon per day for the remainder of the season (Table 1). Peak daily passage of 1,233 fish and the median passage date occurred on 16 July. The central 50% of the passage occurred between 9 and 23 July (Appendix A1).

Chum Salmon

Total annual chum salmon escapement upstream of the Kogrukluk River weir in 2006 was 180,594 fish, which includes an estimated 4,086 fish (2.3% of the total run) that passed during inoperable periods (Table 1). Chum salmon were observed passing upstream of the weir from 28 June to 14 September. Passage increased rapidly following weir installation, peaked in mid July, decreased gradually through late August, and decreased to about 5 fish per day for the remainder of the season (Table 1). Peak daily passage of 7,720 fish occurred on 6 July and the median passage date was 16 July. The central 50% of the passage occurred between 9 and 24 July (Appendix A1).

Sockeye Salmon

Total annual sockeye salmon escapement upstream of the Kogrukluk River weir in 2006 was 60,807 fish, which includes an estimated 1,034 fish (1.7% of the total run) that passed during inoperable periods (Table 1). Sockeye salmon were observed passing upstream of the weir from 28 June to 14 September. Passage increased rapidly following weir installation, peaked in mid July, decreased gradually through mid August, and decreased to about 3 fish per day for the remainder of the season (Table 1). Peak daily passage of 4,664 fish occurred on 20 July and the median passage date was 18 July. The central 50% of the passage occurred between 12 and 23 July (Appendix A1).

Coho Salmon

Total annual coho salmon escapement upstream of the Kogrukluk River weir in 2006 was 17,011 fish, which includes an estimated 4,200 fish (24.7% of the total run) that passed during inoperable periods (Table 1). Coho salmon were observed passing upstream of the weir from 23 July to 14 September. Passage increased gradually from late July through 12 August when high water prompted the crew to dismantle parts of the weir. Coho salmon escapement was estimated for a 13 day period, and enumeration resumed on 25 August. Passage increased thereafter and peaked in early September before decreasing gradually until a second high water event on 15 September ended operations for the remainder of the season (Table 1). Peak daily passage of 922 fish occurred on 8 September and the median passage date was 31 August. The central 50% of the passage occurred between 23 August and 6 September (Appendix A1).

Pink Salmon

Observed pink salmon escapement upstream of the Kogrukluk River weir in 2006 was 1,676, which includes an estimated 743 fish (44.3% of the observed run) that passed during inoperable periods (Appendix A1). Pink salmon were observed passing upstream of the weir from 5 July to 12 September. Daily observed pink salmon passage remained low throughout much of July before increasing rapidly in early August, just prior to a high water event that prompted the crew to dismantle parts of the weir. Observed pink salmon escapement was estimated for a 13 day period. Enumeration resumed on 25 August, after which daily observed pink salmon passage was reduced to a few fish sporadically observed over the remainder of the season (Appendix A1). The peak daily observed passage of 117 fish and the median observed passage occurred on 11 August. The central 50% of the observed passage occurred between 6 and 15 August (Appendix A1).

Other Species

Several other species are routinely observed passing upstream and downstream of the weir by crew members during normal salmon enumeration routines. Other species observed passing upstream of the Kogrukluk River weir during the 2006 field season include 1,882 char (*Salvelinus spp.*) and 22 whitefish (*Coregonus sp.*). Arctic grayling (*Thymallus arcticus*) and northern pike (*Esox lucius*) were also observed but total counts were not recorded. For a complete listing of fish species in the area, see Baxter (*Unpublished* c).

Carcasses

A total of 33,633 salmon carcasses were recovered from the Kogrukluk River weir (Appendix B1), or 12% of the observed escapement of all Pacific salmon species. A total of 1,864 Chinook salmon carcasses were recovered (10% of the observed annual escapement) from 17 June through 11 September. A total of 29,403 chum salmon carcasses were recovered (17% of the observed annual escapement) from 28 June through 14 September. A total of 2,046 sockeye salmon carcasses were recovered (3% of the observed annual escapement) from 8 June through 14 September. A total of 23 coho salmon carcasses were recovered (0.2% of the observed annual escapement) from 26 August through 14 September. A total of 297 pink salmon carcasses were recovered (32% of the observed annual escapement) from 11 June through 10 September. Other fish species recovered from the weir include Arctic grayling, char, northern pike, and whitefish. In addition, 1 beaver (*Castor canadensis*) was recovered from the weir.

AGE, SEX, AND LENGTH COMPOSITION

Chinook Salmon

Chinook salmon ASL sampling at the Kogrukluk River weir consisted of daily effort from 4 July to 11 August resulting in a total sample of 801 fish. Age, sex, and length were successfully determined for 711 fish (88.7% of the total sample) or 3.7% of the total annual escapement (Tables 2 and 3). The total annual escapement was partitioned into 4 temporal strata based on total sample size and duration. Sample sizes ranged between 159 and 191 aged fish per stratum. Postseason analysis revealed that sample sizes were adequate for estimating total and intra-annual age, sex, and length composition of Chinook salmon escapement past the weir.

The Chinook salmon escapement past the weir was nearly uniformly represented by 3 age classes (Table 2). Combined, these 3 age classes comprised over 95% of the total annual escapement. Age-1.2 was the most abundant age class (34.9%), followed by age-1.3 (30.9%), age-1.4 (29.4%), and age-1.5 (4.3%). No age-0.2, -2.1, -2.2, -2.3, -2.4, -1.6, or -2.5 male or female Chinook salmon were sampled, although they are known to occur in some systems. In addition, no age-1.1 or -1.2 females were sampled. Age composition was fairly consistent over the course of the run; however, some intra-annual variation in the proportion of the dominate age classes was observed (Table 2). As the run progressed, the proportion of age-1.2 decreased slightly, age-1.3 remained fairly consistent, and age-1.4 increased.

The ratio of males to females in the Chinook salmon escapement past the weir was approximately 2:1. Females comprised 33.4% of the total annual escapement based on weighted ASL samples, and 32.3% based on visual sex determination by crew members during daily enumeration routines (Tables 1 and 2). Sex composition varied, with the proportion of females increasing across most age classes as the run progressed. This trend was evident from both ASL samples and visual sex determination (Figure 4). The female escapement was dominated (66.4%) by age-1.4 individuals. Conversely, the male escapement was largely comprised of age-1.2 and -1.3 individuals, representing 52.4% and 34.5% of the total male escapement respectively (Table 2).

The Chinook salmon escapement past the weir suggested length partitioning by sex and age class (Table 3). Female length ranged from 680 to 979 mm (MEF) and males ranged from 353 to 934 mm (MEF). Females were consistently larger at age than males, and average length increased with age for both sexes. Average lengths for female fish age-1.3, -1.4 and -1.5 was 781, 852, and 873 mm (MEF) respectively. The average lengths for male fish age-1.1,-1.2, -1.3, -1.4 and -1.5 was 369, 559, 693, 792, and 814 mm (MEF) respectively. Average length-at-age showed little intra-annual variation for either males or females (Table 3).

Chum Salmon

Chum salmon ASL sampling at the Kogrukluk River weir consisted of effort conducted during 7 sampling pulses distributed evenly throughout the run. This effort resulted in a total sample of 1,470 fish. Age, sex, and length were successfully determined for 1,275 fish, 86.7% of the total sample, or 0.7% of the total annual escapement (Tables 4 and 5). The run was partitioned into 7 temporal strata based on the temporal distribution of sampling effort. Sample sizes ranged between 141 and 194 aged fish per stratum. Postseason analysis revealed that sample sizes were adequate for estimating total and intra-annual age, sex, and length composition of chum salmon escapement past the weir.

The chum salmon escapement past the weir was largely represented by 2 age classes (Table 4). Combined, these 2 age classes comprised over 98% of the total annual escapement. Age-0.3 was the most abundant age class (62.2%), followed by age-0.4 (36.0%), age-0.2 (1.6%), and age-0.5 (0.3%). All age/sex categories were represented in the total annual escapement. Age composition changed considerably over the course of the run. Specifically, as the run progressed the proportion of younger fish increased and the proportion of older fish decreased (Table 4). Age-0.2 fish increased from 0.0% to 6.5% while age-0.3 fish increased from 29.8% to 76.3%. The proportion of age-0.4 fish decreased from 69.6% to 17.2%.

The ratio of males to females in the chum salmon escapement past the weir was approximately 3:2. Females comprised 38.2% of the total annual escapement based on weighted ASL samples, and 38.9% based on visual sex determination by crew members during daily enumeration routines (Tables 1 and 4). Sex composition was fairly consistent, although the proportion of females increased slightly as the run progressed. This trend was evident from visual sex determination and to a lesser extent from ASL samples (Figure 4). The female escapement was dominated (70.0%) by age-0.3 individuals. The male escapement was more equally composed of age-0.3 and age-0.4 individuals, representing 57.3% and 41.7% respectively (Table 4).

The chum salmon escapement past the weir suggested length partitioning by sex and age class (Table 5). Female length ranged from 445 to 625 mm (MEF), and males ranged from 448 to 665 mm (MEF). Males were generally larger at age than females, and average length generally increased with age for both sexes. Average lengths for female fish age-0.2, -0.3, -0.4, and -05 was 505, 532, 547, and 555 mm (MEF) respectively. Average length for male fish age-0.2, -0.3, -0.4, and -0.5 was 498, 552, 572, and 582 mm (MEF) respectively. Average length-at-age showed little intra-annual variation for both males and females, although a slight decrease in length-at-age was observed as the run progressed (Table 5).

Sockeye Salmon

The sockeye salmon escapement past the Kogrukluk River weir was approximately 1:1 males to females. Female sockeye salmon comprised 51.9% of the total annual escapement based on visual sex determination by crew members during daily enumeration routine (Table 1). Sex composition showed some intra-annual variation. Percent females increased slightly during the onset of the run before decreasing gradually from 55.9% to 33.3% over the last two thirds of the run (Figure 4).

Coho Salmon

Coho salmon ASL sampling at the Kogrukluk River weir consisted of effort conducted during 3 sampling pulses. Efforts resulted in a total sample of 510 fish. Age, sex, and length were successfully determined for 426 fish, 83.5% of the total sample, or 2.5% of the annual escapement (Tables 6 and 7). The run was partitioned into 3 temporal strata based on the temporal distribution of sampling effort, with sample sizes of 144, 137, and 145 aged fish per stratum. Postseason analysis revealed that sample sizes were adequate for estimating total and intra-annual age, sex, and length composition of coho salmon escapement past the weir during the operational period.

The coho salmon escapement past the weir was dominated by 1 age class (Table 6). Age-2.1 was the most abundant age class (86.5%), followed by age-1.1 (10.6%), and age-3.1 (2.8%). No age-2.2 coho salmon were sampled. Age composition was fairly consistent over the course of the run;

however, intra-annual variation in the proportion of age-1.1, -2.1, and -3.1 was observed (Table 6). As the run progressed, the proportion of age-1.1 and -3.1 decreased, while the proportion of age-2.1 increased.

The ratio of males to females in the chum salmon escapement past the weir was approximately 1:1. Females comprised 55.0% of the total annual escapement based on weighted ASL samples, and 48.1% based on visual sex determination by crew members during daily enumeration routine (Tables 1 and 6). Sex composition was fairly consistent, although the proportion of females increased slightly as the run progressed based on visual sex determination (Figure 4). Age-2.1 was the dominate age class for both males and females representing 85.9% and 87.0% of the total escapement respectively (Table 6).

The coho salmon escapement past the weir suggested length partitioning by sex and age class (Table 7). Female lengths ranged from 406 to 601 mm (MEF), and males ranged from 365 to 595 mm (MEF). Female fish age-1.1 and age-2.1 were consistently larger at age than males, and average length consistently increased with age for both sexes. Low sample size of age-3.1 fish prevented any trend assessment. Average length for female fish age-1.1, -2.1, and -3.1 was 511, 520, and 503 mm (MEF), respectively. Average length for male fish age-1.1, 2.1, and -3.1 was 499, 509, and 510 mm (MEF), respectively. Average length-at-age showed little intra-annual variation for either males or females (Table 7).

WEATHER AND STREAM OBSERVATIONS

A total of 189 complete observations of weather and stream conditions were recorded between 6 June and 25 September (Appendix C1). Based on twice-daily thermometer observations, water temperature at the weir ranged from 6.0° to 15.0°C, with an average water temperature of 10.3°C. Based on hourly data logger readings, daily average water temperature ranged from 6.7°C to 13.9°C, with an average daily temperature of 10.4°C (Appendix D1). Air temperature at the weir ranged from -1° to 27°C, with an average air temperature of 12.5°C (Appendix C1). A total of 211.4 mm of precipitation was recorded throughout the season. River stage ranged from 2,690 to 3,540 mm, with an average of 2,969 mm.

Water levels were moderate throughout the Chinook, chum, and sockeye salmon runs. Overall, water level dropped as the season progressed. Increases and decreases in the Chinook, chum, and sockeye salmon runs did not correspond with obvious changes in water level (Figure 5). Consequently, no relationship between water level and Chinook, chum, or sockeye passage was observed. However, the rising limb of the coho salmon run did correspond with a high water event that rendered the weir inoperable for 14 days (Figure 5). No obvious relationship existed between water temperature and daily salmon passage during the 2006 season (Figure 6).

RELATED FISHERIES PROJECTS

Inriver Abundance of Chinook Salmon in the Kuskokwim River Project

The inriver abundance of Chinook salmon in the Kuskokwim River upstream of Kalskag was estimated at 233,233 (SE = 28,450). The abundance of Chinook salmon in the Kuskokwim River above the Aniak River was estimated at 165,538 (SE = 22,538). Aniak River Chinook salmon represented approximately 29% of the total Chinook salmon abundance above Kalskag. Kogrukluk River Chinook salmon represented 8.3% of the total Chinook salmon abundance above Kalskag and 11.7% above the Aniak River. Reported estimates of inriver abundance are preliminary. Complete results of this project was reported by Stuby (2007). Kogrukluk River-bound radio tagged Chinook salmon were fairly evenly distributed across the total radio tagged sample (Figure 7). Of the 37 radio-tagged Chinook salmon that were detected by radiotelemetry in the Kogrukluk River in 2006, 36 crossed the weir and were considered recaptures (Stuby 2007). A total of 20 radio-tagged Chinook salmon were observed by the crew passing the weir, and spaghetti-tag numbers were recovered from 6 of these fish. Daily escapement of radio-tagged fish past the weir corresponded well to the total daily escapement of Chinook salmon (Figure 8), although run-timing of tagged fish past the weir was slightly later than the overall run-timing (Figure 8). The median passage date for radio-tagged fish was 2 days later than the median passage date for all fish and 6 days earlier than the median passage date of anchor-tagged fish.

Kuskokwim River Sockeye Salmon Investigations

Tagged sockeye were tracked to tributaries throughout the basin using ground-based tracking stations and aerial tracking surveys conducted in July, August, and September. Of 498 tags deployed, 448 (90%) successfully resumed upstream migration, and 383 (77%) were successfully tracked to tributary streams. Radio-tagged sockeye salmon were identified in all major drainages between Kalskag and the Swift River drainage. Large aggregates were observed in the Aniak, Holokuk, Holitna, Hoholitna, and Stony River drainages. The highest concentrations were observed throughout the Holitna River (S.E. Gilk, ADF&G, Anchorage; personal communication).

Kogrukluk River-bound radio tagged sockeye salmon were fairly evenly distributed across the total radio tagged sample (Figure 7). A total of 61 radio-tagged sockeye salmon were detected by radiotelemetry in the Kogrukluk River in 2006 and considered recaptures (S.E. Gilk, ADF&G, Anchorage; personal communication). A total of 48 radio-tagged sockeye salmon were observed by the crew passing the weir, and spaghetti-tag numbers were recovered from 42 of these fish. Daily escapement of tagged fish past the weir was lower during the early phase of the overall run and higher toward the end of the run (Figure 9). Run-timing of tagged fish past the weir was slightly later than the overall run-timing (Figure 9). The median passage date for radio-tagged fish was 3 days later than the median passage date for all fish and 4 days earlier than the median passage of anchor-tagged fish.

Juvenile sampling was conducted during 6 sampling periods spread evenly throughout the season. All habitat types were successfully sampled during each sampling period. Preliminary results indicate that “river-type” juvenile sockeye prefer slough and side channel habitat near spawning areas.

Kuskokwim River Salmon Mark–Recapture Project

Chinook Salmon

Daily anchor tag deployment of Kogrukluk River Chinook salmon at the Kalskag fish wheels was fairly evenly distributed across the tagging effort (Figure 7). A total of 40 anchor-tagged Chinook salmon were observed passing the weir, of which 35 tag numbers were recovered. Daily escapement of anchor-tagged fish past the weir corresponded well to the total daily escapement of Chinook salmon (Figure 8). Run-timing of tagged fish past the weir was later than the overall run-timing (Figure 8). The median passage date for anchor-tagged fish was 8 days later than the median passage date for all fish and 6 days later than the median passage date of radio-tagged fish.

Run-timing of individual upriver stocks through the Kalskag fish wheels was similar in 2006, suggesting no obvious correlation between run-timing through the lower drainage and migration distance to spawning tributaries (Figure 10). The median passage date of Kogrukluk River fish past the tagging site was 29 June. Average run speed of Kogrukluk River Chinook salmon from the Kalskag fish wheels to the weir site was 25.0 (rkm/day).

A total of 615 Chinook salmon were examined for the presence of secondary marks that might have indicated tag loss. No evidence of tag loss was observed.

Sockeye Salmon

Daily anchor tag deployment of Kogrukluk River sockeye salmon at the Kalskag fish wheels was evenly distributed across the tagging effort (Figure 7). A total of 331 anchor-tagged sockeye salmon were observed passing the weir, of which 312 tag numbers were recovered. Daily escapement of tagged fish past the weir was lower during the early phase of the overall run and higher toward the end of the run (Figure 9). Run-timing of anchor-tagged fish past the weir was later than the overall run-timing (Figure 9). The median passage date for anchor-tagged fish was 7 days later than the median passage date for all fish and 4 days later than the median passage date for radio-tagged fish.

Run-timing of individual upriver stocks through the Kalskag fish wheels suggests no obvious relationship between migration distance to spawning tributaries and run-timing through the lower drainage (Figure 11). The median passage date of Kogrukluk River fish past the tagging site occurred on 6 July, earlier than all other escapement monitoring projects (Figure 11). Average run speed of Kogrukluk River sockeye salmon from the Kalskag fish wheels to the weir site was 25.1 (rkm/day).

A total of 30 sockeye salmon were examined for the presence of secondary marks that might have indicated tag loss. No evidence of tag loss was observed.

Other Related Projects

A total of 76 pink salmon and 22 Dolly Varden genetic samples were collected from the Kogrukluk River weir in 2006.

DISCUSSION

Escapement Monitoring

The 2006 field season at Kogrukluk River weir was successful at providing reliable estimates of Chinook, chum and sockeye salmon escapements. Estimates of coho salmon and observed pink salmon escapement are not as reliable due to the inoperable period that occurred during time of historically relatively high passage. The 2006 operational period of 29 June to 14 September was similar to the historical average operational period of 30 June to 19 September (Figure 12). Salmon passage was low to moderate for several days following weir installation (Table 1), suggesting that relatively few fish escaped to the Kogrukluk River prior to the onset of monitoring efforts. This statement is further supported by the fact that no radio-tagged salmon were detected by the nearby receiver station prior to the weir being installed even though tagging efforts began at the Kalskag fish wheels on 7 June. River conditions were favorable during much of the operational period allowing accurate and efficient escapement monitoring. However, the weir did become inoperable due to high water from 12 to 24 August. Historical run-timing data for the Kogrukluk River suggests that the inoperable period occurred after the majority of

Chinook, chum, and sockeye salmon had passed the weir; however, this was not the case for coho or pink salmon. Consequently, the timing of the inoperable period resulted in the need to estimate 24.7% and 44.3% of the 2006 coho and observed pink salmon escapement respectively. In addition, accurate assessment of coho salmon escapement was further confounded by an earlier-than-average end date. Historical run-timing data combined with the early 2006 start date suggests accurate assessments of Chinook, chum, and sockeyes salmon escapement that will provide an important reference for constructing future estimates and models for these species.

Escapement monitoring at the Kogrukluk River weir in 2006 revealed high relative abundances of Chinook, chum, sockeye, and pink salmon. A recent trend of high salmon escapements has been observed at this project over the past 2–3 years for all salmon species except coho, which have been on a steady decline since 2003. This recent pattern of strong salmon escapement has been spatially consistent throughout the Kuskokwim drainage, as indicated by several other weir projects and escapement indices operated throughout the watershed (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008). This spatially consistent increase in escapement follows a period of low escapement in 1999 and 2000 which led to the BOF classification of Kuskokwim River Chinook and chum salmon as “stocks of yield concern” (5 AAC 39.222, 2001) due to the chronic inability of these stocks to maintain expected harvest levels despite the use of specific management measures (Burkey et al. 2000a, b). The 2006 season represents the third consecutive year of higher-than-average salmon escapement to the Kuskokwim River and prompted the BOF to rescind the stocks of yield concern designation in February 2007

The increased escapement of most Pacific salmon species throughout the Kuskokwim drainage may be explained in part by the conservative subsistence and commercial harvest measures employed over the past few years by regional managers in response to the stocks of concern classification (Bergstrom and Whitmore 2004). Since 2001, ADF&G has annually initiated 3 conservation measures: 1) subsistence fishers were required to follow a fishing schedule in June and July, 2) commercial fishing was closed in Districts W-1 and W-2 in June and July or until managers had sufficient evidence that escapement goals would be achieved, and 3) the northern boundary of District W-4 was moved south by about 5 km to make it more distant from the Kuskokwim River (Whitmore et al. 2005). The yield concern finding was continued following the January 2004 BOF meeting (Bergstrom and Whitmore 2004), although the original northern boundary of District W-4 was reinstated. However, the effect of such conservation measures is uncertain because conservation measures have not been strictly implemented in recent years when most run assessment tools indicated strong returns of Chinook and chum salmon (Linderman and Bergstrom 2006).

Species-specific subsistence fishing pressure within the Kuskokwim River varies greatly, with Chinook and chum salmon being the more heavily targeted (Martz and Dull 2006). Historically, subsistence harvests have been relatively consistent from year to year for all species (Martz and Dull 2006), although the proportion of the total run of each salmon species impacted by subsistence fishers varies annually. Again in 2006, ADF&G implemented a subsistence fishing schedule in the lower river that entailed the prohibition of subsistence fishing for 3 days every week (Linderman and Bergstrom 2006). This closure was designed to allow subsistence users to achieve subsistence needs while spreading their harvest efforts across the run, allowing fish to continue upstream for use by other fishers, and meeting spawning ground escapement goals. This schedule was implemented on 4 June from Bogus Creek downstream and on 11 June from

Chuathbaluk downstream. The subsistence fishing schedule was discontinued on 18 June before it had gone into effect for the entire drainage because most run assessment tools indicated that the measure was no longer needed (J. C. Linderman Jr., Kuskokwim Area Management Biologist, ADF&G, Anchorage; personal communication). Thereafter, subsistence fishing was permitted continuously with the exception of closed periods 6 hours before, during, and 3 hours after commercial fishing periods. As a result, the subsistence fishing schedule probably provided little benefit to Kogrukluk River Chinook salmon.

Species-specific commercial fishing pressure varies annually due to variation in fish abundance, market value, and processing capabilities. In 2006, ADF&G permitted commercial fishing in District W-1 during late June for the third time since the Kuskokwim River Chinook and chum salmon stocks of concern designations in 2001. District W-2 remained closed, however, due to the lack of a commercial market. Two sub-district chum- and sockeye-directed commercial openings occurred between 26 June and 28 June, after most run assessment tools indicated strong returns of Chinook and chum salmon to the Kuskokwim River (J. Linderman, Kuskokwim Area Management Biologist, ADF&G, Anchorage; personal communication). In addition to the chum- and sockeye-directed commercial openings, 17 coho-directed commercial fishing periods occurred from 1 to 30 August in District W-1. Since 1987, there has been no directed commercial fishery for Chinook salmon in the Kuskokwim River. The only directed Chinook salmon fishery in the Kuskokwim region occurs in District 4 and targets fish bound for the Kanektok and Arolik Rivers (J. Linderman, Kuskokwim Area Management Biologist, ADF&G, Anchorage; personal communication).

In the early 1980s, fisheries management shifted from a strategy emphasizing guideline harvest levels to a strategy emphasizing escapement. ADF&G established species-specific escapement goals for streams such as the Kogrukluk River that had sufficient historical baseline information (Buklis 1993). These escapement goals were most recently called sustainable escapement goals (SEGs). SEGs are levels of escapement, indicated by an index or an escapement estimate, which are known to provide for sustained yield over a 5–10 year period (ADF&G 2004). The first formal escapement goals, expressed as thresholds, were established at the Kogrukluk River weir in 1983 for Chinook (10,000), chum (20,000), sockeye (2,000), and coho salmon (20,000). In 1984, escapement goals were increased to 30,000 for chum and 25,000 for coho salmon. Escapement goals for the Kogrukluk River weir were revised again in January 2004 and have been in effect since the 2005 season (ADF&G 2004). These most recent escapement goals, expressed as ranges, are 5,300 to 14,000 Chinook salmon, 15,000 to 49,000 chum salmon, and 13,000 to 28,000 coho salmon. The escapement goal of 2,000 sockeye salmon was discontinued around 1995 because, at that time, sockeye enumeration was considered ancillary and sockeye catch considered incidental (Burkey et al. 1997).

Chinook Salmon

Abundance

The early installation date and the limited number and timing of inoperable days of the Kogrukluk River weir in 2006 improved researchers' confidence that estimated annual escapement reflects closely on actual escapement. Consequently, the reported escapement of 19,414 fish is considered a reliable estimate of the total annual Chinook salmon escapement past the weir. Considerable variation in abundance of Chinook salmon has been observed throughout the 31 year history of escapement monitoring for this project (Figure 13; Appendices E1 and E2).

Over the past 3 years, high total annual escapements have been observed at this project. Total escapement in 2004, 2005, and 2006 represent the third, first, and fourth highest escapements respectively for this project. In addition, in each of the past 3 years escapements greatly exceeded the SEG range established by ADF&G (Figure 13). Similar periods of high escapement occurred at this project during the early 1980s and mid 1990s (Figure 13). This most recent trend of several years of high escapement following a critically low period was consistent throughout the Kuskokwim River drainage (Figure 14; Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008). However, the Kogrukluk River is the only tributary in the Kuskokwim basin with a long-term history of escapement monitoring and an established escapement goal for Chinook salmon. Consequently, a formal assessment of the adequacy of the Chinook salmon run is not possible throughout much of the drainage.

The recent increase in Chinook salmon escapements at all weir projects is mirrored by the increasing estimates of inriver abundance of Chinook salmon in all waters above the Aniak River from 2002–2006. Of the total estimated abundance above the Aniak River, the Holitna drainage supports a much larger proportion than any other tributary system, approximately 45% (Stuby 2006). The Kogrukluk River weir adequately indexes total abundance in the Holitna drainage as it consistently supports approximately 25% of the Chinook salmon escaping to this system (Stroka and Brase 2004; Stroka and Reed 2005). The proportion of the total inriver abundance above Aniak escaping to the Kogrukluk River (approximately 12%) is greater than all other upriver escapement projects combined. George River Chinook salmon generally represent 3% of the total upriver abundance, while Tatlawiksuk and Takotna River weirs represent approximately 2% and 0.3% respectively. The annual proportion of the total run above Aniak monitored by each upriver weir project has been fairly consistent. These relationships suggest that the Kogrukluk, George, Tatlawiksuk, and Takotna River weirs, singly and in concert, provide a reasonable index of inriver abundance of Chinook salmon within the upper Kuskokwim drainage.

Management initiatives employed in 2006 such as the implementation of the subsistence fishing schedule and the absence of a Chinook salmon-directed commercial fishery likely had differing effects on Kogrukluk River Chinook salmon. Recent analysis of past performances of the subsistence fishing schedule suggests that the intended purpose of spreading harvest effort across the run has not been achieved (T. Hamazaki, Biometrician, ADF&G, Anchorage; personal communication). Consequently, Kogrukluk River Chinook salmon likely received no benefit from early season subsistence fishing closures. Conversely, the lack of a Chinook-directed commercial fishery likely did benefit Kogrukluk River fish by ensuring low exploitation rates and increasing total annual escapement. Although no commercial fishing effort in the Kuskokwim River was directed at Chinook salmon, a modest level of incidental harvest did occur. The effect of the combined pressure of subsistence and commercial harvest on Kogrukluk River Chinook salmon is unknown. At time of writing, subsistence harvest estimates for Chinook salmon in the Kuskokwim River are not available for 2006; however, the most recent 10-year average (1995–2004) of 76,980 fish is a reasonable estimate (Martz and Dull 2006). The subsistence harvest combined with the relatively small incidental commercial harvest of 2,777 (Linderman and Bergstrom 2006) results in an estimate of less than 100,000 harvested Kuskokwim River Chinook salmon. These harvest estimates are in comparison to the estimated inriver abundance of 233,233 Chinook salmon above Kalskag and the 165,538 fish above the Aniak River (Stuby 2006). The region of the Kuskokwim River above Aniak experiences relatively limited harvest of Chinook salmon; consequently, estimations of abundance above this point are a reasonable estimate of total escapement to this region of the Kuskokwim drainage. These comparisons suggest an exploitation rate of less than 50% on Kuskokwim River Chinook salmon.

Run-timing at Weir

The 2006 Chinook salmon run at the Kogrukluk River weir occurred later and was more prolonged than most previous years (Figure 15; Appendix F1). The central 50% passage in 2006 occurred from 9 to 23 July, compared to the historical average that occurs from 7 to 17 July. The 2006 median passage date of 16 July was the second latest on record for the Kogrukluk River weir (Figure 15; Appendix E1). The earliest median passage date at the project is 7 July (1981 and 1996), the average date is 12 July, and the latest date is 20 July (1999). Chinook salmon run-timing was variable throughout the Kuskokwim River drainage in 2006. Nearly average run-timing was observed at Kwethluk and George river weirs, later-than-average run-timing was observed at Tatlawiksuk, Takotna, and Kogrukluk river weirs, and Tuluksak River weir was the only escapement project reporting earlier-than-average run-timing (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008).

Chum Salmon

Abundance

The early installation date and the limited number and timing of inoperable days of the Kogrukluk River weir in 2006 improved researchers' confidence that estimated annual escapement reflects closely on actual escapement. Consequently, the reported escapement of 180,594 fish is considered a reliable estimate of the total annual escapement past the weir. Although considerable variation in abundance of chum salmon has been observed throughout the 31 year history of escapement monitoring at this project, the escapements observed during the 2005 and 2006 season greatly exceed all previous years for this project (Figure 13; Appendices G1 and G2). Total annual escapement for 2005 and 2006 represent the first and second highest escapements on record at the project (Figure 13). This recent trend of unusually high escapements follows the critically low escapements of 1999 and 2000 which contributed to the stock of concern classification of Kuskokwim River chum salmon (Figure 13) (5 AAC 39.222, 2001; Burkey et al. 2000b). In addition, the past 2 years of escapement greatly exceeded the SEG range of 15,000 to 49,000 fish established by ADF&G (Figure 13). The trend of strong chum salmon escapement following a critically low period was consistent throughout the Kuskokwim River drainage; however, the magnitude of increase observed at the Kogrukluk River weir was unique to this project (Figure 16; Costello et al. *In prep* a, b; Hildebrand et al. *In prep*; Miller and Harper *In prep*; Plumb et al. *In prep*). Currently, the Kogrukluk River is 1 of only 2 tributaries in the Kuskokwim basin with a long-term history of escapement monitoring and an established escapement goal for chum salmon. Consequently, a formal assessment of the adequacy of the chum salmon escapements is not possible throughout much of the drainage.

Efforts to estimate the abundance of chum salmon in the upper Kuskokwim River drainage and the Holitna River have been met with difficulty due to limitations in methodology and a high degree of sample bias. A study conducted on the mainstem Kuskokwim River estimated total inriver abundance above Kalskag at 675,659 fish in 2002 and 412,443 fish in 2003 (Kerkvliet et al. 2003 and 2004). A separate study conducted concurrently within the Holitna drainage produced an estimate of 542,172 fish in 2002 and suggested a likely minimum of 400,000 fish in 2003 (Stroka and Brase 2004). A comparison of these estimates suggests that nearly all of the chum salmon above Kalskag escape to the Holitna drainage. This finding is unlikely, and emphasizes the need to further refine methods of chum salmon abundance estimation in the Kuskokwim drainage. The estimates of chum salmon inriver abundance above Kalskag are further suspect when we combine the Holitna estimates with the escapements observed at monitoring projects located on the Aniak, George, Tatlawiksuk, and Takotna Rivers. The sum of these escapements is considerably higher (1,049,969 in 2002; minimum of 914,603 in 2003) than the total inriver abundance estimate in both years. In 2002 and 2003 the Kogrukluk River chum salmon represented a relatively small proportion of the Holitna River escapement, and run-timing and composition differed markedly from fish spawning elsewhere in the drainage (Stroka and Brase 2004). This suggests that the Kogrukluk River weir alone likely does not adequately index run strength and composition of the entire Holitna or upper Kuskokwim River drainages.

Management initiatives employed in 2006 such as the implementation of the subsistence fishing schedule and the limited chum-directed commercial fishery likely had differing effects on Kogrukluk River chum salmon. Recent analysis of past performances of the subsistence fishing schedule suggests that the intended purpose of spreading harvest effort across the run has not been achieved (T. Hamazaki, Biometrician, ADF&G, Anchorage; personal communication). Consequently, Kogrukluk River chum salmon likely received no benefit from early season subsistence fishing closures. Conversely, the reduced chum-directed fishery resulted in a lower-than-average total annual harvest (Linderman and Bergstrom 2006) that likely did benefit Kogrukluk River chum salmon by reducing exploitation rates and increasing total escapement. The actual effect of the combined pressure of subsistence and commercial harvest on Kogrukluk River chum salmon is unknown, but believed to be minimal. At time of writing, there are no subsistence harvest estimates for chum salmon in the Kuskokwim River for 2006; however, the most recent 10-year average (1995–2004) of 57,981 fish is a reasonable estimate (Martz and Dull 2006). The subsistence harvest combined with the moderate commercial harvest of 44,070 (Linderman and Bergstrom 2006) results in an estimate of approximately 100,000 harvested Kuskokwim River chum salmon. These harvest estimates are in comparison to the estimated 180,594 chum salmon observed at the Kogrukluk River alone, the estimated 202,050 chum salmon observed across all other Kuskokwim River weir projects combined (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008), and the 1,108,626 chum salmon observed at the Aniak River Sonar (McEwen *In prep*). These comparisons suggest a low exploitation rate of Kuskokwim River chum salmon.

Run-timing at Weir

The 2006 chum salmon run at the Kogrukluk River weir was near average in timing and duration (Figure 17, Appendix F1). The central 50% passage in 2006 occurred from 9 to 24 July, compared to the historical average that occurs from 8 to 20 July. The 2006 median passage date was 16 July (Figure 17; Appendix G3). The earliest median passage date at the project is 9 July (1981, 1988, and 1996), the average is 14 July, and the latest date is 20 July (2005). Chum salmon run-timing was variable throughout the Kuskokwim River drainage in 2006. Nearly average run-timing was observed at Takotna and Kogrukluk river weirs, while earlier-than-average run-timing was observed at Tuluksak and Tatlawiksuk river weirs, and later-than-average run-timing was observed at Kwethluk and George river weirs (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008).

Sockeye Salmon

Abundance

The early installation date and the limited number and timing of inoperable days of the Kogrukluk River weir in 2006 improved researchers' confidence that estimated annual escapement reflects closely on actual escapement. Consequently, the reported escapement of 60,807 fish is considered a reliable estimate of the total annual escapement past the weir. Although considerable variation in abundance of sockeye salmon has been observed throughout the 31 year history of escapement monitoring at this project, the escapement observed during the 2006 season greatly exceed all previous years, including the 2005 escapement which was the previous record high for this project (Figure 18; Appendices H1 and H2). This recent trend of unusually high escapements follows a period of relatively low escapements from 1999 to 2004 (Figure 18). This recent trend of relative high abundance has been consistent throughout the Kuskokwim River drainage (Figure 19). However, there is currently no sockeye salmon escapement goal established for any Kuskokwim River tributary including the Kogrukluk River, which precludes a formal assessment of the adequacy of the escapements.

Little is known about the distribution and abundance of Kuskokwim River sockeye salmon. Sockeye salmon have been observed in several tributaries throughout the drainage (Burkey and Salomone 1999), but only the Kogrukluk River has a history of enumerating large numbers. An ongoing investigation aimed at narrowing critical knowledge gaps in the biology and ecology of Kuskokwim River sockeye salmon shows substantial, though previously unknown, spawning aggregates in several middle and upper Kuskokwim tributaries. Of these, the largest concentrations of sockeye occur in the Holitna River system (Gilk *Unpublished*). Of particular interest in these systems is the general lack of lentic habitat, which is most commonly associated with sockeye salmon. Preliminary results of this study suggest that the ecological contribution of these atypical "river type" sockeye salmon to the Kuskokwim drainage may be larger than previously believed.

Sockeye salmon in the Kuskokwim River have not been identified as a stock of concern, although escapements may have benefited from the conservation measures discussed above for Chinook and chum salmon because of the concurrent run-timing of these 3 species in June and early July. The actual effect of the combined pressure of subsistence and commercial harvest on Kogrukluk River sockeye salmon is unknown. At time of writing, there are no subsistence harvest estimates for sockeye salmon in the Kuskokwim River for 2006; however, the most recent 10-year average (1995–2004) of 37,076 fish is a reasonable estimate (Martz and Dull 2006). The subsistence harvest combined with the moderate commercial harvest of 12,618 (Linderman and Bergstrom 2006) results in an estimate of approximately 50,000 harvested Kuskokwim River sockeye salmon. These harvest estimates are in comparison to the estimated 60,807 sockeye salmon observed at the Kogrukluk River alone and the estimated 12,346 sockeye salmon observed across all other Kuskokwim River weir projects combined (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008).

Run-timing at Weir

The 2006 sockeye salmon run at the Kogrukluk River weir occurred later than average for this project but was typical in duration (Figure 20; Appendix F1). The central 50% passage in 2006 occurred from 12 to 23 July, compared to the historical average from 10 to 20 July. The 2006 median passage date was 18 July (Figure 20; Appendix H3). The earliest median passage date at the project is 9 July (1981), the average is 14 July, and the latest date is 22 July (1999). Sockeye salmon run-timing was variable throughout the Kuskokwim River drainage in 2006. Earlier-than-average run-timing was observed at all escapement monitoring projects except Kogrukluk and Tatlawiksuk river weirs, which observed later-than-average run-timing (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008). However, spatial comparisons are limited by the fact that no other monitored tributary supports considerable numbers of sockeye salmon.

Coho Salmon

Abundance

The timing and duration of 2 high water events and the earlier-than-average end date at the Kogrukluk River weir in 2006 limited the ability to enumerate coho salmon escapement with a high degree of confidence. Consequently, the reported escapement of 17,011 fish is considered a mediocre estimate of the total annual escapement past the weir. Considerable variation in abundance of coho salmon has been observed throughout the 31 year history of escapement monitoring at this project (Figure 18; Appendices I1 and I2). Kogrukluk River coho salmon escapements have declined annually since the record high escapement of 74,624 fish in 2003. Although this recent trend of declining abundance is of concern, the 2004, 2005, and 2006 escapement were within the SEG range of 13,000 to 28,000 fish established by ADF&G (Figure 18). This trend of declining escapements following a year of record high abundance was consistent throughout the Kuskokwim River drainage (Figure 21; Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008). However, the Kogrukluk River is the only tributary in the Kuskokwim basin with a long-term history of escapement monitoring and an established escapement goal for coho salmon. Consequently, a formal assessment of the adequacy of the coho salmon escapement is not possible throughout much of the drainage.

Recent coho salmon mark–recapture studies suggest that the Holitna River drainage supports approximately 16% of the total coho salmon escapement to the upper Kuskokwim River drainage (Stroka and Brase 2004; Pawluk, Baumer et al. 2006). The proportion of the Holitna River escapement that passed the Kogrukluk River weir varied considerably during the 2 year investigation: 23% in 2002 and 47% in 2003 (Stroka and Brase 2004). However, run-timing and composition of coho salmon passing the weir was representative of the entire Holitna system in both years (Stroka and Brase 2004). It appears that the Kogrukluk River weir provides a reasonable index of run-timing and composition for the Holitna system, but its ability to index run strength is questionable. Conversely, the Kogrukluk River appears to adequately index total inriver abundance above Kalskag by consistently monitoring approximately 5% of the total run (3% to 8% from 2001 to 2005). The proportion of the total inriver abundance above Kalskag escaping to the Kogrukluk River is greater than all other upriver escapement projects. George River generally represents 3% of the total upriver abundance, while Tatlawiksuk and Takotna River weirs represent approximately 2% and 0.6% respectively. The annual proportion of the total run above Aniak monitored by each upriver weir project is fairly consistent across years. These relationships suggest that the Kogrukluk, George, Tatlawiksuk, and Takotna river weirs, singly and in concert, provide a reasonable index of inriver abundance of coho salmon within the upper Kuskokwim drainage. This also reveals that the majority of the Kuskokwim River coho salmon escape to tributaries that are not monitored, and highlights the need for further investigation into the distribution and abundance of this species in the Kuskokwim River drainage.

Kuskokwim River coho salmon have not been identified as a stock of concern, even though harvests and escapements have generally been below average since 1996 (Whitmore et al. 2005). Kuskokwim River coho salmon have likely received no benefit from the conservation measures discussed above for Chinook and chum salmon because of the difference in run-timing of these 3 species. Kuskokwim River coho salmon pass through the lower regions of the drainage beginning early August, well after the closure of the subsistence schedule. In addition, 2006 saw an increase in the number and duration of commercial coho-directed fishing periods compared with recent years. The actual effect of the combined pressure of subsistence and commercial harvest on Kogrukluk River coho salmon is unknown. At the time of writing, there are no subsistence harvest estimates available for coho salmon in the Kuskokwim River for 2006; however, the most recent 10-year average (1995–2004) of 31,729 fish is a reasonable estimate (Martz and Dull 2006). The subsistence harvest combined with the less than average commercial harvest of 185,598 (Linderman and Bergstrom 2006) results in an estimate of over 200,000 harvested Kuskokwim River coho salmon. These harvest estimates are in comparison to the estimated 17,011 coho salmon observed at the Kogrukluk River and the estimated 57,725 coho salmon observed across all other Kuskokwim River weir projects combined (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008). Though imprecise, these comparisons suggest a relatively high exploitation rate.

Run-timing at Weir

The 2006 coho salmon run at the Kogrukluk River weir was near average in timing and duration for this project (Figure 22; Appendix F1). The central 50% passage in 2006 occurred from 23 August to 6 September, compared to the historical average that occurs from 25 August to 8 September. The 2006 median passage date was 31 August (Figure 22, Appendix I3). The earliest median passage date at the project is 25 August (1996), the average is 1 September, and the latest date is 10 September (1983). Coho salmon run-timing was variable throughout the Kuskokwim River drainage in 2006. Near-average run-timing was observed at George, Tatlawiksuk, and Kogrukluk River weirs, earlier-than-average run-timing was observed at Kwethluk and Tuluksak River weirs, and Takotna River weir was the only project reporting later-than-average run-timing (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008).

Pink Salmon

Historically, the contribution of pink salmon to the overall salmon escapement at the Kogrukluk River weir has been negligible, often contributing less than 10 individuals per year. Generally, pink salmon make less extensive spawning migrations into freshwater than other Pacific salmon species (Heard 1991), and given the spatial orientation of the Kogrukluk River weir (approximately 710 rkm from the mouth of the Kuskokwim River) the small escapements observed at this site is not surprising. However, in the past 2 years a marked increase in escapement has been observed at this project. The observed passage (excluding estimated passage during inoperable periods) in 2005 was 109 individuals, more than four times greater than any other year in which this species was reported. The 2006 observed passage of 933 fish greatly exceeded all other years for this project. The difference in observed passage of pink salmon between 2005 and 2006 is likely a result of the unique life history strategy of the species;

namely, that pink salmon exhibit a fixed 2-year life span resulting in even- and odd-year spawning aggregates that are reproductively isolated (Heard 1991). Adequate enumeration of pink salmon runs using weirs is difficult due to the species small size and ability to pass between weir pickets. The recent increase in observed escapement at this project is likely due, in part, to a reduction in picket spacing by 12.5 mm at the beginning of the 2005 season. Passage of pink salmon through weir pickets is likely still substantial, and observed escapement likely does not provide an adequate assessment of total annual escapement to this system. However, it does appear that the contribution of pink salmon to this system, although small compared to other Pacific salmon species, is greater than previously believed. To date, the relatively few pink salmon that pass the Kogrukluk River weir are among the farthest known migrating pink salmon in the world (Morrow 1980; Heard 1991), and continued monitoring is needed to better understand the abundance dynamics of this unique stock and their importance to the ecosystem.

No tributary system in the middle to upper Kuskokwim River drainage has a history of enumerating large escapements of pink salmon. Historically (pre-2006), the George River weir averages 181 individuals per year, the Tatlawiksuk River weir averages only 1 fish per year, and few pink salmon have been observed at the Takotna River weir. The increase in escapement of pink salmon at Kogrukluk River weir appears to be a consistent phenomenon in the Kuskokwim River drainage; the George and Tatlawiksuk River weirs also report marked increases in pink salmon (Costello et al. 2007 b; Hildebrand et al. 2007). The George River weir observed 1,232 pink salmon in 2006, nearly twice as high as the previous record escapement of 644 in 1996 and nearly seven times greater than the historical average (Hildebrand et al. 2007). In addition, the Tatlawiksuk River weir observed 20 pink salmon, nearly seven times greater than the previous high of 3 fish in 2001. Consistent with past years, no pink salmon were observed at Takotna River weir (Costello et al. 2007 a). Interestingly, the picket spacing used at the George and Tatlawiksuk River weirs has not changed in recent years. This suggests that the observed increase in pink salmon escapements at Kogrukluk River weir is due to a natural increase in abundance and not methodology changes in escapement monitoring. The reason for the increased abundance in upper river tributaries is unknown. Further monitoring is necessary to determine the relevance and possible implications of this observed increase in returns of pink salmon to the Kuskokwim River drainage.

Carcasses

In general, the recovery of salmon carcasses from the Kogrukluk River weir in 2006 was less than average for this project (Appendix J1). The 10% of the annual observed Chinook salmon escapement later recovered as carcasses from the weir was slightly less than the historical average of 11%. The carcass recovery of 17% of the chum salmon observed passage and 3% of the sockeye salmon observed passage was considerably less than the historical averages of 23% and 11% respectively. Carcass washout rates are highly dependent on river flow. Moderate water levels during much of the Chinook, chum, and sockeye salmon run likely resulted in a relatively high retention of carcasses in the upper reaches of the Kogrukluk River. However, the disparity between carcass recovery in 2006 and historical data is likely due to the circumstances surrounding the inoperable period. This inoperable period was 13 days long and much (30%) of the weir was removed to allow high debris loads to pass. It is likely that carcass washout rates were high during this time, but accurately quantifying this rate was not possible. Carcass recovery in 2006 should be considered a minimum, as the true carcass washout abundance was likely considerably greater. Regardless, invariably some remainder of the spawned-out fish were retained in or near the river upstream of the weir for a protracted period of time, thereby contributing to the productivity of the system through the introduction of marine derived nutrients as described by Cederholm et al. (1999).

Similar to past years, few coho salmon carcasses were observed at the weir (0.2% of the observed escapement). Most post-spawning mortality likely occurred after the weir was removed for the season, so no conclusions can be made about the occurrence of coho salmon carcasses.

The recovery of 297 pink salmon carcasses is the highest on record for this project, and is in fact larger than any observed annual escapement for this project prior to this season. Approximately 32% of the total observed annual escapement was later recovered from the weir. Similar to other species, the number of pink salmon carcasses is likely underrepresented due to weir removal during the inoperable period. These observations suggest that true escapement past the weir was likely much greater than was documented and that the nutritional contribution of this species may play an important role in the watershed.

AGE, SEX, AND LENGTH COMPOSITION

Chinook Salmon

The age, sex, and length composition of Kuskokwim River Chinook salmon escaping to the Kogrukluk River drainage varied in concert throughout the 2006 run. As the run progressed, the proportion of young (age-1.2, -1.3) individuals decreased, while the proportion of older (age-1.4) individuals increased. These younger age classes were composed predominately by males; conversely, females made up a large proportion of the older age classes. As expected, mean length increased with age. In addition, females tended to be larger at age than males. Consequently, as the run progressed the overall age, sex, length composition shifted from a smaller, younger, male-dominated run to one consisting of larger, older individuals as a result of an increasing female component.

Kuskokwim River Chinook salmon tend to show a strong sibling relationship wherein the relative strength of each age class produced from a given brood year is often mirrored in subsequent year escapements, given consistency in survival (Table 8). By this relationship, it is possible to make limited predictions about age specific run strength in subsequent years based on past sibling returns (Molyneaux et al. 2006). In this manner, the high abundance of age-5 Chinook salmon in 2006 was anticipated by the strong showing of age-4 fish in 2005 (Figure 23). However, the unusually high abundance of age-5 fish observed in 2005 did not return an unusually high abundance of age-6 fish in 2006, a trend observed throughout the Kuskokwim River Drainage (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008). Assuming consistency in ocean survival, the abundance of age-4 and -5 fish in 2006 may forecast a healthy return of age-5 fish and a modest return of age-6 fish in 2007. The strong showing of age-4 Chinook salmon in 2006 is a result of the near average escapement in 2002 (Table 8; Figure 14), suggesting that favorable oceanic conditions may have increased survivability and thus resulted in a higher-than-expected return. Chinook salmon brood years of 2002 and 2003 were similar (10,104 and 11,771 respectively); therefore, assuming similar survival, we may anticipate an abundance of age-4 Chinook salmon in 2007 similar to that observed in 2006.

Similar to past years, the 2006 Chinook salmon escapement past the Kogrukluk River weir was largely represented by age-1.2, -1.3, and -1.4 individuals, with age-1.5 and other less common age classes comprising less than 10% of the total annual escapement (Figure 24). Since 1999, the proportional contribution of age-1.2 individuals to the total escapement has been increasing, while age-1.3 has remained fairly consistent and age-1.4 has been decreasing (Figure 24). These 3 dominant age classes comprised the majority of the run at all escapement projects in 2006 (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008), a pattern consistently seen throughout the Kuskokwim River drainage (Molyneaux and Dubois 1999). Historical trends in annual age composition tend to vary among escapement projects throughout the Kuskokwim River drainage. For example, only Tatlawiksuk River weir reported an annual age composition similar to past years, while most projects reported higher than average proportions of age-1.2 and lower than average proportions of age-1.4 individuals (Costello et al. 2007 a, b; Hildebrand et al. 2007; Plumb and Harper 2008). However, Kogrukluk River weir is the only escapement monitoring project within the Kuskokwim River with a long-term historical data set that suggests a general shift toward a younger overall age composition.

In 2006 the total contribution of each of the dominant age classes to the annual Chinook salmon escapement past the Kogrukluk River weir was similar; however, the proportional contribution of each age class changed as the run progressed. Younger individuals dominated the early phases of the run while older individuals were more abundant toward the end of the run, a trend often observed at this project (Figure 25). Intra-annual trends in age composition vary spatially and temporally; however, in 2006 most projects throughout the drainage reported an increase in age-1.4 fish as the run progressed (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008). This pattern is commonly observed throughout the Kuskokwim River drainage and is likely explained by the later migration times of Kuskokwim area female Chinook salmon which tend to return in greater abundances as age-1.4 fish (Molyneaux et al. 2006). Intra-annual trends in age composition are difficult to clearly define for a given monitoring project and the Kuskokwim drainage as a whole, because variations between strata are often greater than the total change in proportion from the first to the last (Molyneaux et al. 2006).

The 2006 Chinook salmon sex ratio of 2:1 males to females is consistent with historical data for the Kogrukluk River weir (Figure 26). Based on all methods of sex determination from 1976 to 2006, females typically comprise about 34% of the run returning to this system; however, the proportion of females has ranged from a high of 60% in 1977 to a low of 16% in 1980 and 2004. The annual proportion of females reported by other escapement projects throughout the Kuskokwim River drainage generally range between 20% and 40% though considerable spatial and temporal variation is observed (Molyneaux et al. 2006). Most of these projects reported an annual sex ratio similar to past years; the exception was Kwethluk River weir which saw a considerable increase in the proportional contribution of females (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008).

Similar to past years, the proportion of females passing the Kogrukluk River weir in 2006 increased as the run progressed (Figure 4 and 27). Regardless of the total proportion of females observed in a given spatial and temporal context, the tendency for the proportion of females to increase as the run progresses is a common trend throughout the Kuskokwim River drainage (Molyneaux et al. 2006). In addition, majority of Kuskokwim River Chinook salmon females are age-1.4 fish while males tend to dominate the age-1.2 class (Molyneaux et al. 2006), a trend also seen in 2006 at this project. Consequently, the intra-annual increase in the proportion of females corresponded to the observed increase in age-1.4 individuals during later phases of the run.

However, consistent intra-annual trends in sex composition do not translate into consistent intra-annual trends in age composition throughout much of the Kuskokwim River drainage.

In 2006, mean Chinook salmon length-at-age at the Kogrukluk River weir was within the historical range reported for both males and females (Figure 28). A retrospective analysis of age-1.3 and -1.4 males and females at this project has led some to suggest a general increase in length-at-age between 1984 and 1991, and then a general decrease until 2005 (Figure 29; Molyneaux et al. 2006, Jasper and Molyneaux *In prep*). However, an increasing trend in mean length from 1984 to 1991 is apparent for only age-1.3 fish; no obvious trend exists for age-1.4 fish at this project. Furthermore, with each successive year of data collection the decreasing trend in mean length in recent years has faded and since about 1999 mean lengths-at-age have remained relatively consistent. In fact, length-at-age at most projects has remained very consistent (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008). It is important to note that Chinook salmon length trends observed at escapement projects may not be statistically significant due to low sample sizes.

In 2006 at Kogrukluk River weir, mean Chinook salmon length increased with age and females were consistently larger at age than males, both of which are fairly consistent trends observed at this project (Figure 28) and throughout the Kuskokwim River drainage (Molyneaux et al. 2006). In general, this pattern was observed at all escapement monitoring projects in 2006 (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008). Although female Chinook salmon are generally larger at age than males throughout the drainage, this pattern is less consistent within older (age-1.5) age classes where sample size precludes any reliable trend assessment. Chinook salmon rarely show an obvious intra-annual trend in length by age class over the course of the season, and apparent trends tend to be weak and their significance is unknown.

Pooled ASL data from escapement projects throughout the Kuskokwim River drainage provides a reasonable index of ASL composition for the total Chinook salmon run. However, annual ASL compositions of weir escapement must be considered with respect to the ASL compositions of the subsistence and commercial fisheries that harvest a portion of the stock returning to each tributary. ASL data obtained from all 3 sources allows for comparison and a better understanding of total run dynamics. Size selectivity of gear types used in commercial and subsistence fishing and escapement monitoring is responsible for most of the disparity observed in ASL composition. The mesh-size restriction (6 inches or less) imposed on commercial fishers in 2006 and previous years was intended to limit the number and size of Chinook salmon harvested for commercial purposes. Since smaller fish tend to be younger fish and younger fish tend to be males, the incidental harvest by the W-1 commercial fishery was composed primarily of small (average length = 620 cm MEF) young (61% age-1.2) males (90%; Figure 30). However, the impact of the commercial harvest to the ASL composition of tributary escapements has likely been negligible in recent years due to relatively small harvests. The subsistence fishery has no limitations on mesh size (Martz and Dull 2006) and most subsistence fishers use nets with a mesh size of 8 inches or greater because this gear is more efficient at capturing large Chinook salmon while minimizing harvest of the more abundant and smaller chum salmon (Martz and Dull 2006). Since larger fish tend to be older and older fish tend to be females the use of large-mesh gillnets results in a subsistence harvest comprised of larger (average length = 787 cm MEF) older (36% age-1.3, 53% age-1.4) fish representing a more even sex ratio (2:1 males to females; Figure 30). The quantity of Chinook salmon removed through the subsistence harvest is considerably greater than the commercial harvest (Linderman and Bergstrom 2006; Martz and Dull 2006) and likely affects the composition of escapements observed at tributary weirs by culling larger, older fish. As a result, average length of the escapement past a given tributary weir is thought to be somewhat less than the average length of the total return bound for that tributary. Conversely, the proportion of younger age classes and males in tributary escapements are thought to be higher than in the total return.

Chum Salmon

The ASL composition of Kuskokwim River chum salmon escaping to the Kogrukluk River drainage varied in concert throughout the 2006 run. As the run progressed, the proportion of older (age-0.4) individuals decreased while the proportion of younger (age-0.3) individuals increased. Males made up the majority of each age class, although females were most strongly represented in the age-0.3 class. As expected, mean length increased with age. In addition, males tended to be larger at age than females. Consequently, as the run progressed, the overall age, sex, length composition shifted from an older, larger, male-dominated run to one consisting of smaller, younger individuals, with a higher proportion of females.

Sibling relationships for chum salmon are not as reliable as with Chinook salmon at the Kogrukluk River weir, even with the relatively low and stable harvest that has occurred since 1999. However, the exceptionally high abundance of age-4 and -5 chum salmon was expected in 2006 given the record high abundance of age-3 and -4 fish in 2005. Although not as large as expected, the escapement of age-4 and -5 fish in 2006 were the second highest and highest respectively on record for this project (Figure 23). In addition, this pattern of larger-than-average escapements of age-4 and -5 fish was consistent throughout the Kuskokwim River drainage (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008). The abundance of age-3, -4, and -5 chum salmon in 2006 may forecast a higher-than-average return of age-4, -5, and -6 fish in 2007, assuming consistency in survival. However, the 2007 return of age-4 and -5 chum salmon is expected to be less than that observed in 2006 and 2005, based on recent sibling returns (Figure 23). Similarly, returns in the brood year of 2003 was smaller than 2002 and 2001, but larger than most years for this project; therefore, we may anticipate a healthy return of age-3 fish in 2007, but in smaller numbers compared to 2006 (Table 9; Figure 23).

Similar to past years, the 2006 chum salmon escapement at the Kogrukluk River weir was largely represented by age-0.3 and -0.4 individuals, with age-0.2 and -0.5 making up a negligible portion of the total annual escapement (Figure 24). Historically and in 2006, age-0.3 fish comprised the majority of the escapement at this project (Figure 24). Historical trends in age composition tend to vary spatially and temporally throughout the Kuskokwim River drainage; however, age-0.3 and -0.4 fish have consistently comprised the majority of the run at all escapement projects (Molyneaux et al. 2006). The 2006 return was no exception, age-0.3 and -0.4 fish composed over 96% of the total annual escapement at each Kuskokwim River escapement project (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008). Age-0.3 was dominant at all projects except Tuluksak and Kwethluk River weirs which are both located in the lower drainage (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008).

In 2006 the proportional contribution of the dominate age classes to the chum salmon escapement past the Kogrukluk River weir changed over the course of the run. Older individuals (age-0.4) dominated earlier phases of the run while younger individuals (age-0.3) dominated as the run progressed, a trend often observed at this project (Figure 31). In 2006 this pattern was observed at all Kuskokwim area escapement projects and was most evident by comparing the inverse proportions of age-0.3 and -0.4 fish (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008). Historically, the shift in chum salmon age composition from older to younger individuals as the run progresses is a consistent trend observed throughout the drainage (Molyneaux et al. 2006). For example, as the run progresses the proportion of age-0.2 fish range from as low as 0% early in the run to as high as 40% at the end of the run. Age-0.3 fish typically range from 10% to 30% at the onset of the run rising to 70% to 90% late in the run. Conversely, age-0.4 fish generally comprise 70% to 80% early in the run and fall to less than 40% by the end of the run (Molyneaux et al. 2006).

The 2006 sex ratio of 3:2 males to females is within the historical range observed at the Kogrukluk River weir (Figure 26). Females returning to this system are estimated to comprise 26% of the total escapement based on visual and weighted ASL samples from 1976 to 2006, although the proportion of females has ranged from a high of 49% in 1982 to a low of 4% in 1997. From 1990 through 2004 the percentage of females at this project had generally been low, averaging only 18% (Figure 26). Both 2005 and 2006 show a marked increase in the proportion of females returning to this system. The cause of the decline in females during the 1990s is unknown, but does not appear to be correlated to abundance. Historically, the percentage of female chum salmon has been near 50% in most Kuskokwim Area data sets (Molyneaux et al. 2006). All other Kuskokwim Area escapement projects reported a proportion of females consistent with past years (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008).

Similar to past years, the proportion of females passing the Kogrukluk River weir in 2006 increased slightly as the run progressed (Figure 4 and 27). Regardless of the total proportion of females observed in a given spatial and temporal context, the tendency for the proportion of females to increase as the run progresses is a common trend throughout the Kuskokwim River drainage (Molyneaux et al. 2006). In addition, the majority of Kuskokwim River female chum salmon are age-0.3 fish (Molyneaux and Folletti 2007), a trend also seen in 2006 at this project. Consequently, the commonly observed intra-annual increase in the proportion of females as the run progresses corresponds to consistent intra-annual shifts in age composition.

In 2006 at the Kogrukluk River weir, mean chum salmon lengths-at-age for all age-sex categories were smaller than historical averages (Figure 32), and are some of the lowest on record for this project. A retrospective analysis of age-0.3 and -0.4 males and females at this project shows a general increase in length-at-age between 1984 and 1996, and then a general decrease until 2005 (Molyneaux et al. 2006, Jasper and Molyneaux *In prep*). Data from 2006 is consistent with this pattern (Figure 33). This decreasing trend is most obvious in age-0.3 and -0.4 males. This recent pattern of decreasing length-at-age has been suggested at all other weir projects to varying degrees (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008). The Tatlawiksuk and Kwethluk river weirs show slight decreasing trends for all age-sex categories though the annual decrease in mean length is less than that observed at Kogrukluk (Costello et al. 2007 a; Miller and Harper 2007). The overall trend at George and Tuluksak is decreasing, though considerable annual variation is observed (Hildebrand et al. 2007; Plumb and Harper 2008). This trend has only been weakly observed at Takotna River weir (Costello et al. 2007 b). It is important to note, however, that chum salmon length trends observed at escapement projects may not be statistically significant due to low sample sizes.

Although lengths were smaller than average in 2006 at Kogrukluk River weir, mean length increased with age and males were larger than females at age, both of which are fairly consistent trends at this project (Figure 32) and throughout the Kuskokwim River drainage (Molyneaux et al. 2006). Chum salmon rarely show a strong intra-annual trend in length-at-age over the course of the season, but a slight decrease in length-at-age as the run progresses has been consistently observed at this and other Kuskokwim Area projects (Figure 32; Molyneaux et al. 2006).

The use of tighter picket spacing in 2005 and 2006 coincided with the observed increase in percent female chum salmon and an overall reduction in chum salmon size, which led to concerns that in the past leakage of smaller fish through the weir has led to erroneous sex and length data. However, examination of length frequency histograms from past years (Figure 34) does not show that smaller fish have been underrepresented to such a degree as to account for the anomalous sex ratios that were observed in the past 2 years. Similarly, the distribution of length has been shifting towards smaller fish for several years preceding the picket change in 2005, as far back as 1996 (Figure 33). The degree to which the new picket spacing contributed to the increase in the proportion of females and decrease in length since 2005 is unknown. However, the relative annual decrease in chum salmon size at age has remained fairly consistent since 1996 suggesting the observed pattern of declining size is not simply a function of tighter picket spacing. Leakage of smaller fish through the pre-2005 weir design has been observed on many occasions, whereas it was not observed in 2005 or 2006.

Sockeye Salmon

The practice of collecting complete ASL data from sockeye salmon was discontinued at Kogrukluk River weir in 1995 because of scale absorption that confounds reliable aging (Burkey 1995; Cappiello and Burkey 1997), but crews continue to estimate sex composition as the fish are passed upstream of the weir.

The 2006 sex ratio of 1:1 males to females at Kogrukluk River weir was more balanced than what has historically been observed at this project (Figure 26). Females returning to this system are estimated to comprise 40% of the run based on visual inspection from 1976 to 2006, although the proportion of female has ranged from a high of 57% in 1986 to a low of 14% in 1976. During much of the 1970s and 1980s the percentage of females was typically near 50% (Figure 26). Throughout the 1990s, however, there was a progressive decrease in the percentage of reported females in the annual escapement (Figure 26). Thereafter the percentage was variable though an increasing trend is evident. In both 2005 and 2006 the percentage of female sockeye salmon was greater than 50%. The cause of the decline in females during the 1990s is unknown, but does not appear to be correlated to abundance. This information gap may be addressed through a sockeye radiotelemetry project which began in 2006 (S. Gilk, Commercial Fisheries Biologist, ADF&G, Anchorage; personal communication). Currently, the Kogrukluk River weir is the only escapement project in the Kuskokwim River drainage with a history of enumerating large escapements of sockeye salmon which precludes meaningful comparisons to other projects. However, no clear inseason temporal pattern for sex composition is apparent based on Kuskokwim Area sampling data (Molyneaux et al. 2006).

Coho Salmon

The age, sex, and length composition of Kuskokwim River coho salmon escaping to the Kogrukluk River drainage showed little variation throughout the 2006 run. Age-2.1 coho salmon were dominant throughout the run. This age class was nearly evenly comprised of males and females, although the proportion of females increased slightly as the run progressed. Mean length increased with age and female coho salmon were consistently larger at age than males. However, since little intra-annual variation was observed in the age or sex composition, length partitioning by age and sex did not result in any obvious intra-annual trends.

Sibling relationships are not reliable for Kuskokwim River coho salmon and provide managers little insight into future year escapements (Table 10). In 2006 at the Kogrukluk River weir, age-2.1 was the dominate age class comprising the coho salmon run. Historically, age-2.1 fish account for more than 90% of the return at this project and throughout the Kuskokwim River drainage (Figure 24; Molyneaux et al. 2006). The 2006 escapement at this project was comprised of a higher-than-average proportion (10.7%) of age-1.1 fish. This relatively large return of age-1.1 fish was also reported at the Tatlawiksuk and Kwethluk River weirs where this age class comprised 14.9% and 14.2% of the total escapement respectively (Costello et al. 2007 b; Miller and Harper 2007). Although this return of age-1.1 fish was rare for Kogrukluk and Tatlawiksuk river weirs, it is fairly common for Kwethluk River weir (Molyneaux and Folletti 2007). The majority of the age-1.1 fish passed the weir during the earlier phases of the run, though limited intra-annual variation in age composition was observed (Figure 35). Furthermore, historical trends at this project and throughout the Kuskokwim River drainage show fairly stable intra-annual coho salmon age compositions (Figure 35; Molyneaux and Folletti 2007).

The 2006 sex ratio of 1:1 males to females at Kogrukluk River weir was more balanced than what has historically been observed at this project (Figure 26). Females returning to this system are estimated to comprise 37% based on visual and weighted ASL samples from 1981 to 2006, although the proportion of females has ranged from a high of 55% in 2006 to a low of 14% in 1990. Although considerable annual variation has been observed at this project, in general the female component of the run has been increasing slightly since the onset of coho monitoring in 1981 (Figure 26). The cause of the increase in females is unknown, but does not appear to be correlated to abundance. Historically, the percentage of female coho salmon has been near 50% in most Kuskokwim Area data sets (Molyneaux and Folletti 2007). All other Kuskokwim area escapement projects reported a proportion of females consistent with past years except Kwethluk River weir, which reported 37% females, a record low for that project (Costello et al. 2007 a, b; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008).

Similar to past years, the proportion of females passing the Kogrukluk River weir in 2006 increased as the run progressed (Figure 4 and 27). Regardless of the total proportion of females observed in a given spatial and temporal context, the tendency for the proportion of females to increase as the run progresses is a generally consistent trend throughout the Kuskokwim River drainage (Molyneaux et al. 2006). However, this trend is not always pronounced in some datasets, possibly due to errors in sex identification (Molyneaux et al. 2006). DuBois and Molyneaux (2000) identified erroneous sex identification as being a persistent problem with coho salmon, which necessitates continued diligence in sexing fish at all escapement projects including the Kogrukluk River weir.

In 2006 at Kogrukluk River weir, mean coho salmon length-at-age was lower for both males and females than historical averages (Figure 36). In fact, mean length-at-age was the lowest on record for this project. All Kuskokwim Area escapement projects that operated through coho salmon season in 2006 reported record low mean lengths for male and female age-2.1 fish, with the exception of Takotna River Weir which cited its second lowest length for males (Costello et al. 2007 a; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008). In addition, average weight per fish in the District-W1 commercial harvest was well below average and the historical range (J. Linderman, Kuskokwim Area Management Biologist, ADF&G, Anchorage; personal communication). A retrospective analysis of age-2.1 males and females at the Kogrukluk River weir shows a general increase from 1990 to 1996 followed by a marked decrease (Figure 37). This recent decreasing pattern shows considerable annual variation, and is driven by the unusually high mean length in 1996 and the series of record low mean lengths since 2004 (Figure 37). This pattern of decreasing length for both male and female age-2.1 fish has been observed throughout much of the Kuskokwim River drainage to varying degrees, with the exception of Tatlawiksuk River weir (Costello et al. 2007 a; Costello et al. 2006; Hildebrand et al. 2007; Miller and Harper 2007; Plumb and Harper 2008). George and Takotna River weirs show a slight decreasing trend, although mean length has been fairly stable through much of the historical time series (Costello et al. 2007 a; Hildebrand et al. 2007). A decreasing trend exists at Tuluksak and Kwethluk river weirs with considerable annual variation (Miller and Harper 2007; Plumb and Harper 2008). It is important to note that coho salmon length trends observed at escapement projects may not be statistically significant due to low sample sizes.

In 2006 at Kogrukluk River weir mean coho salmon length was generally larger than males, a pattern commonly seen at this project and throughout the Kuskokwim River drainage (Molyneaux et al. 2006). This pattern tends to show high spatial and temporal variability. Similar to past years for this project, no consistent intra-annual pattern was obvious in the average length composition (Figure 36). Across all Kuskokwim River datasets mean length does tend to increase as the season progresses (Molyneaux et al. 2006), but this pattern is highly variable and was not observed at Kogrukluk in 2006.

WEATHER AND STREAM OBSERVATIONS

The 2006 average water temperatures of 10.3°C and 10.4°C derived from thermometer and data logger recordings respectively were slightly lower than the historical average of 11.0°C. It is unclear whether water temperature affected salmon passage because changes in water temperature at Kogrukluk River weir usually occur concurrently with fluctuations in water level, which is believed to exert a greater influence on salmon behavior and passage. Generally, no obvious relationship between fish passage and water temperature has been reported for this project.

Similar to past years at this project, no obvious relationship was observed between Chinook, chum, or sockeye salmon passage through the weir and local weather conditions. However, increases in coho salmon escapement did seem to coincide with an increase in water level (Figure 5), but this relationship is probably due the complementary timing of the coho salmon run and increases in water level. Past years at this project have also seen a similar relationship (Jasper and Molyneaux *In prep*). In addition, this behavior has been observed in other stocks of coho salmon throughout their range (Sandercock 1991). However, in 2006 coho salmon were not observed milling in large numbers below the weir prior to the high water event, possibly indicating a reluctance to move upstream. Furthermore, the run-timing of coho salmon past the weir was consistent with past years. Together, these observations suggest that the increased daily coho salmon escapement was likely not directly caused by increased water level and the concurrent timing was simply coincident.

Environmental stimuli are reported to influence migration of Pacific salmon (Quinn 2005). While Kuskokwim Area escapement monitoring projects are not specifically designed to evaluate environmental cues to upstream migration, knowledge of environmental conditions and a commitment to long-term monitoring is valuable to understanding migration and survival of Pacific salmon (Quinn 2005). Even though annual relationships between environmental conditions and salmon migration and abundance are not always clear, long-term data sets may prove crucial to understanding the biology and ecology of these species. We cannot begin to assess the effects of changing environmental conditions on Kuskokwim River salmon without sufficient baseline data consisting of complete and accurate measures of environmental variables. Escapement projects must continue to be diligent in the collection of weather and stream data. Perhaps with sufficient data researchers and managers will be able to assess relationships between migration and environmental factors relevant in the broader spatial-temporal context.

RELATED FISHERIES PROJECTS

Inriver Abundance of Chinook Salmon in the Kuskokwim River Project

The Kogrukluk River weir contributed successfully to the *Inriver Abundance of Chinook Salmon in the Kuskokwim River Project*. In past years objectives were achieved for this project with the exception that Aniak River Chinook salmon were excluded from the analysis for all years due to potential bias associated with bank orientation (Stuby 2005). To address this issue tagging efforts were modified and a weir was installed in 2006 on the Salmon River, a headwater tributary of the Aniak River. The 2006 season marked the first time an estimate of the total Chinook salmon abundance above Kalskag was achieved. For the purpose of comparison with past years, an estimate was also generated representing abundance of Chinook salmon above the Aniak River. The 2006 inriver estimate above the Aniak River was the highest on record for this 5-year project. A detailed discussion of this project will be presented by Stuby (2007).

Kuskokwim River Sockeye Salmon Investigations

The Kogrukluk River weir contributed successfully to the *Kuskokwim River Sockeye Salmon Investigations*. The Kogrukluk River weir is currently the only site in the Kuskokwim River drainage with a history of enumerating large numbers of sockeye salmon. Large lakes typical of sockeye salmon rearing habitat are absent from the Holitna River drainage, although sockeye salmon have been observed spawning in a number of backwater sloughs in Shotgun Creek and in the Holitna, Kogrukluk, Chukowan, and Hoholitna rivers (Baxter *Unpublished* b; Baxter 1979). Sockeye salmon have been documented in several other tributaries in the Kuskokwim River basin (Burkey and Salomone 1999), but little is known about these populations. Rearing ecology of these "river-type" sockeye salmon is not well known in the Kuskokwim Area, though river-spawning behavior among sockeye salmon is documented in other areas of both Asia and North America (Burgner 1991). Wood et al. (1987) found that river-type sockeye salmon contributed from 39% to 48% of total sockeye salmon returns to the Stikine River in 1984 and 1985. The contribution of these river-type sockeye salmon to the overall Kuskokwim River sockeye salmon production could be substantial.

Kuskokwim River Salmon Mark–Recapture Project

The Kogrukluk River weir contributed successfully to the *Kuskokwim River Salmon Mark–Recapture Project*, which afforded an opportunity to study migration characteristics of Kogrukluk River Chinook and sockeye salmon in 2006. Efforts in 2006 mark the sixth year that mark–recapture has been used to assess stock-specific run-timing and travel speed. A detailed discussion of this project will be presented by Schaberg et al. (*In prep*). At the time of writing, complete travel speed data was not available, so discussion was written assuming similar travel speeds as seen in past years (i.e. 22 rkm/day for Chinook and 26 rkm/day for sockeye). If this is not the case may need to update discussion.

Chinook Salmon

Mark–recapture data from 2002 to 2005 suggest an inverse relationship between natal stream distance and stock-specific run-timing; that is, Chinook salmon stocks bound for tributaries farthest upriver tend to pass through the tagging site earlier than stocks bound for tributaries nearer the tagging site (Pawluk, Baumer et al. 2006). However, the Kogrukluk River Chinook salmon stock is consistently contrary to this trend. Similar to past years, Kogrukluk River Chinook salmon passed through the Kalskag tagging sites at the same time as Tatlawiksuk River fish although Kogrukluk River fish have considerably farther to travel. In addition, Salmon River Chinook salmon exhibited the earliest run-timing of any investigated stock in 2006 despite having the closest proximity to the tagging sites. The median passage dates for tagged Kogrukluk River-bound Chinook salmon past the tagging sites was the latest on record for this stock (Schaberg et al. *In prep*).

Average travel speed of Kogrukluk River Chinook salmon was slightly faster (2–3 rkm/day) compared to past years, and to the speeds exhibited by Chinook salmon returning to the Tatlawiksuk and George rivers (Schaberg et al. *In prep*). Fish bound for the Salmon River exhibited considerably slower travel speeds in 2006 than all other upriver stocks, which explains the stock’s early run-timing through the tagging sites but relatively late run-timing at the weir based on cumulative percent passage.

Travel speed and run-timing indicators provided by the Chinook salmon mark–recapture projects are valuable tools for fisheries management. The timing of commercial fishery openings and the annual discontinuation of the subsistence fishing schedule is considered with respect to the stock-specific run-timing and migration speed evident through tagging and tracking of Chinook salmon. In 2006, the dates of the commercial openings in Districts W-1A and W-1B were 28 and 26 June respectively. Median passage date for Kogrukluk River Chinook salmon passed the Kalskag tagging site (rkm 270) was 29 June. Assuming their travel speed remained constant along their migration path from the lower river to the upper river, the majority of these fish would have passed through District W-1B (rkm 0–106) from approximately 17–22 June and District W-1A (rkm 106–203) from approximately 22–26 June. Consequently, the timing of the commercial opening in District-W1B was after the majority of Kogrukluk River Chinook salmon passed. Conversely, the timing of the commercial opening in District-W1A was concurrent with the run-timing of this stock. The low incidental Chinook harvest in 2006 (2,777) likely had limited affect on Kogrukluk River and other upper river stocks. However, the subsistence fishery regularly harvests considerably more Chinook salmon than the commercial fishery and likely does affect stock-specific escapement and composition. The majority of subsistence fishing in the Kuskokwim River occurs in the lower reaches of the watershed. The rescission of the subsistence fishing schedule on 18 June probably occurred before most of the Chinook salmon bound for upper river tributaries (such as the Kogrukluk River) had migrated through the lower watershed. Thus, the fishing schedule probably provided little benefit for Kogrukluk River Chinook salmon.

It is imperative that researchers continue to collect stock-specific run-timing and run-speed information so that managers have the necessary tools to evaluate the effects of management initiatives. Past examples of the utility of this type of data can be seen from the work of ADF&G biometricians who recently evaluated the effects of the subsistence fishing schedule. The schedule was shown to be ineffective at distributing harvest efforts evenly across the run (T. Hamazaki, Biometrician, ADF&G, Anchorage; personal communication). An example of the continued need for this data is apparent in a recent BOF decision. In 2007 the BOF agreed to allow a Chinook salmon-directed commercial fishery in the Kuskokwim River, using up to 8-inch mesh gear, beginning as early as 15 June. It is unknown how this earlier harvest strategy and gear change will affect any given stock. Without quality information regarding migration dynamics of Kuskokwim Area Chinook salmon managers cannot begin to assess the affects of this and other decisions.

Sockeye Salmon

Tagging data from 2002 to 2005 suggest an inverse relationship between natal stream distance and stock-specific run-timing; that is, sockeye salmon stocks bound for tributaries farthest upriver tend to pass through the tagging site earlier than stocks bound for tributaries nearer the tagging site (Pawluk, Baumer et al. 2006). In 2006, the Kogrukluk River stock had a similar run-timing past the tagging site compared to past years (Schaberg et al. *In prep*); however, the overall stock-specific run-timing results did not follow the previously observed pattern. In fact, with the exception of the Kogrukluk River stock, the 2006 pattern appears opposite what has previously been observed (Pawluk, Baumer et al. 2006; Schaberg et al. *In prep*). The George River stock had an earlier than average run-timing compared with previous years with similar sample sizes. The 2006 season was the first year that this project monitored the Salmon River stock which had an earlier run-timing than was expected based on past spatial patterns. Similar to past years the Takotna River stock had the latest run-timing past the tagging site even though it had the farthest distance to travel (835 rkm). Average travel speed of Kogrukluk River sockeye salmon was similar to past years, and to the speeds exhibited by sockeye salmon returning to other upriver systems (Schaberg et al. *In prep*).

Travel speed and run-timing indicators provided by the sockeye salmon tagging projects are valuable tools for fishery management. The timing of commercial fishery openings and the annual discontinuation of the subsistence fishing schedule is considered with respect to the stock-specific run-timing and migration speed evident through tagging and tracking of sockeye salmon. In 2006, the dates of the commercial openings in Districts W-1A and W-1B were 28 and 26 June respectively. Median passage date for Kogrukluk River sockeye salmon past the Kalskag tagging site (rkm 270) was 6 July. Assuming their travel speed remained constant along their migration path from the lower river to the upper river, the majority of these fish would have been passing through District W-1B (rkm 0–106) from approximately 26 through 30 June and District W-1A (rkm 106–203) from approximately 30 June through 3 July. Consequently, the timing of the commercial opening in District-W1B was concurrent with the run-timing of the Kogrukluk River sockeye salmon stock. Conversely, the timing of the commercial opening in District-W1A was earlier than the run-timing of this stock. The below average sockeye salmon harvest in 2006

(12,618) likely had limited affect on Kogrukluk River, considering the record escapement seen at this project. However, the subsistence fishery regularly harvests considerably more sockeye salmon than the commercial fishery, even though it is generally not targeted for subsistence. The majority of the subsistence fishing in the Kuskokwim River occurs in the lower reaches of the watershed. The subsistence fishing schedule imposed to benefit Chinook and chum salmon had the potential to affect the harvest of sockeye salmon as well, but in 2006 it was rescinded before most of the sockeye salmon bound for upper river tributaries (such as the Kogrukluk River) had migrated through the lower watershed.

CONCLUSIONS

ESCAPEMENT MONITORING

- The weir was installed on 29 June and was operational through 14 September.
- The weir was inoperable for 13 days due to high water and heavy debris.
- Total annual escapement of 19,414 Chinook salmon in 2006 was the fourth highest on record, exceeded the SEG range, and was similar to escapement trends observed elsewhere in the Kuskokwim River drainage. Run-timing at the weir occurred later and was more prolonged than past years.
- Total annual escapement of 180,594 chum salmon in 2006 was the second highest on record, greatly exceeded the SEG range, and was similar to escapement trends observed elsewhere in the Kuskokwim River drainage. Run-timing at the weir was near average.
- Total annual escapement of 60,807 sockeye salmon in 2006 was the highest on record. Run-timing at the weir was later than average.
- Total annual escapement of 17,011 coho salmon in 2006 was within the SEG range, and was similar to escapement trends observed elsewhere in the Kuskokwim River drainage. Run-timing at the weir was near average.

AGE, SEX, AND LENGTH COMPOSITION

- The Chinook salmon run was nearly uniformly represented by age-1.2, -1.3, and -1.4 fish. The proportion of young age-1.2 fish decreased throughout the run while the proportion of older age-1.4 fish increased.
- Female Chinook salmon made up approximately 30% of the total annual run. The proportion of females increased as the run progressed.
- The Chinook salmon run showed length partitioning by sex and age class. Average length increased with age and females were larger than males at age.
- The relatively high return of all Chinook salmon age classes in 2006 from brood years of low escapement suggests an improvement in ocean survival.
- Assuming consistency in ocean survival, the abundance of age-4 and -5 Chinook salmon in 2006 may indicate a healthy return of age-5 fish and a modest return of age-6 fish to the Kuskokwim River in 2007.

- The chum salmon run was primarily represented by age-0.3 and -0.4 fish. The proportion of age-0.4 fish decreased dramatically as the run progressed while the proportion of age-0.3 fish increased.
- Female chum salmon made up approximately 40% of the total annual run. The proportion of females increased slightly as the run progressed. The proportion of female chum salmon observed in 2005 and 2006 is considerably higher than that observed since the late 1980's.
- The chum salmon run showed length partitioning by sex and age class. Average length increased with age and males were larger than females at age.
- Healthy escapements of all chum salmon age classes suggests higher ocean survival rates in recent years than the poor runs in 1998, 1999, and 2000 indicated occurred in the mid 1990s.
- Assuming consistency in ocean survival, the abundance of age-3 and -4 chum salmon in 2006 may indicate a healthy return of age-4 and -5 fish to the Kuskokwim River in 2007. However abundances will likely be less than that observed in 2005 and 2006.
- Mean length-at-age of male and female chum salmon were some of the smallest on record for this project.
- Female sockeye salmon made up approximately 50% of the total annual run. The proportion of female sockeye salmon observed in 2005 and 2006 is considerable higher than that observed since the late 1980's.
- The coho salmon run was dominated by age-2.1 fish.
- Female coho salmon made up approximately 50% of the total annual run. The proportion of female increased slightly as the run progressed.
- The coho salmon run showed length partitioning by sex. Females were larger at age than males.
- Mean length-at-age of male and female coho salmon were the smallest on record for this project.

WEATHER AND STREAM OBSERVATIONS

- For the 2006 season, daily water levels were moderate at Kogrukluk River weir. Low water occurred in late July and early August and high water occurred in mid August through September.
- Daily water temperatures at Kogrukluk River weir in 2006 were near average.
- No obvious relationship was observed between fish passage and water level or water temperature.

RECOMMENDATIONS

WEIR OPERATIONS

- Adopt a target operational period for describing the bulk of the annual escapement. Considerable variability in start and stop dates for the Kogrukluk River weir confound between-year comparisons of summary statistics such as total annual escapement. Circumstances that dictate start and stop dates are often beyond the control of project leaders or crews, but comparability can be enhanced by adopting a target operational period across all years. The span of dates selected for the target operational period would need to balance between what has been proven historically to be practical start and stop dates, while still providing a reasonable assessment of the total escapement estimate for each species. Project leaders would be required to estimate fish passage for inoperable periods that occurred within the target operational dates. However, project leaders should continue to operate the weir as early and as late into the season as possible. Counts made before or after the target operational period should be included in the reported cumulative passage and percent passage in order to track changes in run-timing and duration and adequately index early and late returning species. Based on historical passage data and operational periods a reasonable target operational period for this project would be 20 June – 25 September. These dates would ensure that the weir operations would encompass the entire Chinook, chum, and sockeye runs and majority of the coho run.

- Develop a method for estimating the amount of fish leakage through the pre-2005 weir design to correct previous years' counts. As stringers have been replaced over the years, the picket spacing has changed resulting in a design that incorporated panels of up to 3 different picket widths. The estimation method would require: 1) quantifying the amount of fish leakage through each type of panel, and 2) quantifying the amount of each type of panel in every year's weir design. The former would entail installing older panels into the new weir design and enumerating fish passage through the pickets. The latter may be difficult since the occurrence of stringer changes has been poorly documented. An alternative method may be to examine length frequency histograms for each year to determine the extent to which smaller fish have been excluded from the ASL data. If smaller fish were passing through the pickets to a large degree, one would expect to see a positive skew in the length frequency histograms.

FISH PASSAGE

- Incorporate counting tower escapement data into future project reports. Estimates of total annual escapement currently date to 1976, but extension of that timeline back to 1969 may be possible using counting tower data. Some paired data exist for years when both the tower and weir operated concurrently that may allow for estimates of total annual Chinook and chum salmon escapement back to 1969.

- Reestablish a SEG for sockeye salmon. The escapement goal of 2,000 sockeye salmon was discontinued around 1995 because sockeye enumeration was considered ancillary and sockeye catch considered incidental (Burkey et al. 1997). In past years the Kogrukluk River weir has seen record escapements of sockeye salmon. In addition, ongoing large scale sockeye salmon investigations have suggested that the Kogrukluk River supports a considerable portion of the Kuskokwim River sockeye salmon population (Gilk *Unpublished*). SEG's are essential tools for evaluating the adequacy of salmon escapements to spawning tributaries. The lack of an established sockeye salmon SEG for the Kogrukluk River inhibits sustainable management of this stock. Based on the Bue and Hasbrouck method (Bue and Hasbrouck 2001), we recommend the establishment of a weir-based SEG of 4,200 to 16,000 sockeye salmon. The prescribed SEG rates excellent based on data quality and quantity. This estimate was generated from 21 years of weir escapement data, each with less than 20% of the total annual escapement estimated. This stock is characterized by a high spawning contrast and a moderate exploitation rate. The prescribed SEG range was rounded up from the 25th to 75th percentiles (4,133 to 15,386 fish) based on rounding convention used for escapement goal recommendation. A SEG was recommended because stock-specific harvest data is lacking, precluding the development of a Biological Escapement Goal (BEG).

SALMON AGE, SEX, AND LENGTH COMPOSITION

- Future project reports for the Kogrukluk River weir should continue and enhance inclusion of detailed Figures depicting trends in age, sex, and length composition. Kogrukluk River has the longest history of salmon escapement monitoring in the Kuskokwim Area, but inquiry into the rich history of data collected at this project is elusive because of the limited historical perspective provided by the standard project report. Future project reports for the Kogrukluk River weir should continue to include historical perspectives such as the following:
    - Brood Tables and 3 dimensional graphics that illustrate the number of fish by age class for the recent past,
    - Inter-seasonal differences in sex composition as determined from weighted ASL samples and visual crew counts (both percent and total number),
    - Inter-seasonal trends in the number and percent of females in the escapement,
    - Inter-seasonal trends in average length-at-age and sex.
- Weir crews should resume collecting ASL information from Kogrukluk River sockeye salmon. This effort was discontinued in the past because the ability to reliably estimate sockeye salmon age is limited. However, the value of ASL information goes beyond documenting total age information. For instance, sockeye salmon ASL information from this project would provide reliable estimates of annual, and possibly intra-annual, sex ratios and length composition. In addition, scale collection would provide a pool of annual scales that can be used to assess freshwater age and growth. Such information may prove invaluable to managers. This is especially true considering the preliminary results of an ongoing study aimed at describing the biology and ecology of Kuskokwim River sockeye salmon. This study suggests that sockeye salmon spawning throughout the watershed is considerably greater than previously recognized and these stocks display a fairly unique life history strategy for this species (Gilk *Unpublished*).
- Examine the variability in sex determination from the ASL samples compared to visual weir crew estimates derived from the daily counting routine. It may be valuable to design a method to test the accuracy of visual speciation and sex determination by field crews. If a level of error could be determined for visual differentiation, counts and sex ratios could be better compared to ASL data. This, along with documentation of observed salmon behavior with emphasis on patterns of migration through the weir, could lend insight into the discrepancies between ASL and visually-derived sex ratios.

CLIMATOLOGICAL MONITORING

- Install a remote logging station to record climatological data on the Kogrukluk River through the winter. Information could be correlated against future runs to help discern favorable or unfavorable brood conditions for Kogrukluk River salmon stocks. Examples of data that should be collected include, air and water temperature, dissolved oxygen, pH, flow rate, and snow cover. Comparable climatic data loggers could be developed at other weir projects.

- Stream gauging stations should be installed strategically throughout the Holitna basin in order to establish baseline hydrologic data for the purpose of establishing water reservations. ADF&G is charged with the responsibility to "…manage, protect, maintain, improve, and extend the fish, game, and aquatic plant resources of the state in the interest of the economy and general well-being of the state" (AS 16.05.020). Toward this end, Alaskan State law (AS 16.05.050) allows ADF&G to acquire water rights based on data and analysis that substantiates the need for the amount of water being requested (Estes 1996). A water reservation is a legal right (or appropriation of water) to maintain a specific flow rate or level in a given body of water for one or a combination of purposes: 1) protection of fish and wildlife habitat, migration, and propagation; 2) recreation and parks purposes; 3) navigation and transportation purposes; and 4) sanitary and water quality purposes (Estes 1996). Based on the high ecologic and resource value and current and proposed uses of the Holitna watershed, water reservations would be directed at nearly all of the above-mentioned purposes. To date, sufficient hydrologic data for the establishment of water rights on Holitna River, in part or in its entirety, is currently lacking. Multiple gauging stations will likely be needed to adequately describe instream flow characteristics, due to variation in hydrology and geology throughout drainage. We recommend installing a minimum of 3 gauging stations near: 1) the Kogrukluk River weir to describe the upper Holitna; 2) the mouth of the Hoholitna; and 3) the mouth of Holitna near its confluence with the Kuskokwim River.

  In addition, for most readers, the utility in reporting river stage in mm above an arbitrary datum, as determined annually by the crew (see Methods) is limited. Installation of a gauging station combined with the systematic discharge measurements needed for calibration would allow project leaders to convert river stage data to a more meaningful measure of discharge in m^3/sec.

SPAWNER-RECRUIT ANALYSIS

- Continue to develop a spawner-recruit analysis for Kogrukluk River salmon. One of the caveats in undertaking this initiative in the past was accounting for the unknown fraction of Kogrukluk River fish harvested in the commercial and subsistence fisheries. Preliminary findings from the mark–recapture projects operated in 2002, 2003, and 2004 provide insight into the timing of Kogrukluk River salmon stocks in the lower Kuskokwim River, which may allow for some reasonable assumptions of the temporal fraction of the harvest likely to contain fish bound for the Kogrukluk River. Isolating harvest during that time period and applying an estimated spawning stock apportionment to account for Kogrukluk River fish may provide the resolution required for identifying a reasonable spawner-recruit relationship.

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TABLES AND FIGURES

Table 1.–Actual daily and estimated counts of Chinook, chum, sockeye and coho salmon at the Kogrukluk River weir, 2006.

Date	Chinook			Chum			Sockeye			Coho		
	Male	Female	Totals	Male	Female	Totals	Male	Female	Totals	Male	Female	Totals
6/28[a]	0	0	0	231	105	336	5	0	5	0	0	0
6/29	2	4	6	652	305	957	4	4	8	0	0	0
6/30	19	6	25	924	427	1,351	24	23	47	0	0	0
7/1	60	20	80	1,374	668	2,042	60	103	163	0	0	0
7/2	160	73	233	1,669	834	2,503	120	140	260	0	0	0
7/3	141	54	195	2,002	1,214	3,216	222	214	436	0	0	0
7/4	476	155	631	3,129	1,704	4,833	633	616	1,249	0	0	0
7/5	389	122	511	4,239	2,560	6,799	453	389	842	0	0	0
7/6	480	160	640	4,857	2,863	7,720	820	521	1,341	0	0	0
7/7	499	156	655	4,083	2,329	6,412	589	506	1,095	0	0	0
7/8	801	239	1,040	4,711	2,724	7,435	792	682	1,474	0	0	0
7/9	603	149	752	3,738	2,216	5,954	1,176	1,083	2,259	0	0	0
7/10	651	197	848	4,333	2,804	7,137	1,060	1,063	2,123	0	0	0
7/11	292	117	409	3,153	1,854	5,007	700	644	1,344	0	0	0
7/12	583	176	759	4,195	2,419	6,614	1,188	1,131	2,319	0	0	0
7/13	375	142	517	3,690	2,204	5,894	850	681	1,531	0	0	0
7/14	461	125	586	3,146	1,882	5,028	1,290	1,098	2,388	0	0	0
7/15	460	169	629	3,132	1,521	4,653	1,265	1,355	2,620	0	0	0
7/16	874	359	1,233	3,825	2,066	5,891	1,994	2,143	4,137	0	0	0
7/17	456	155	611	3,173	1,589	4,762	1,193	1,497	2,690	0	0	0
7/18	355	157	512	3,837	1,986	5,823	830	1,004	1,834	0	0	0
7/19	369	193	562	4,665	2,661	7,326	1,090	1,013	2,103	0	0	0
7/20	683	399	1,082	3,881	3,329	7,210	2,035	2,629	4,664	0	0	0
7/21	396	251	647	4,097	3,572	7,669	1,495	1,981	3,476	0	0	0
7/22	354	231	585	3,167	2,780	5,947	1,502	1,917	3,419	0	0	0
7/23	600	283	883	3,074	2,508	5,582	1,154	1,566	2,720	1	1	2
7/24	349	198	547	2,860	1,636	4,496	713	1,042	1,755	11	18	29
7/25	477	346	823	2,809	1,437	4,246	607	763	1,370	21	21	42
7/26	212	158	370	2,350	1,334	3,684	602	780	1,382	5	5	10
7/27	201	149	350	2,215	1,334	3,549	499	533	1,032	5	5	10
7/28	166	279	445	1,723	1,193	2,916	407	452	859	3	4	7
7/29	218	200	418	1,373	918	2,291	555	609	1,164	5	4	9
7/30	120	154	274	1,320	1,009	2,329	227	243	470	8	3	11
7/31	131	118	249	1,420	1,002	2,422	331	303	634	11	7	18
8/1	88	98	186	1,231	972	2,203	233	204	437	6	6	12
8/2	98	71	169	1,288	1,030	2,318	263	209	472	16	9	25
8/3	73	89	162	1,419	1,081	2,500	344	303	647	25	18	43
8/4	68	59	127	1,188	1,028	2,216	347	349	696	38	27	65
8/5	69	92	161	1,091	980	2,071	344	436	780	75	28	103
8/6	30	33	63	649	713	1,362	229	284	513	36	31	67
8/7	41	21	62	473	566	1,039	144	145	289	69	37	106
8/8	23	15	38	487	524	1,011	115	118	233	45	44	89
8/9	10	7	17	213	263	476	74	69	143	39	26	65
8/10	12	10	22	275	249	524	58	44	102	36	22	58
8/11	25	14	39	334	267	601	86	92	178	128	78	206
8/12	--[b]	--[b]	29[c]	--[b]	--[b]	527[c]	--[b]	--[b]	131[c]	--[b]	--[b]	156[c]
8/13	--[b]	--[b]	27[c]	--[b]	--[b]	491[c]	--[b]	--[b]	123[c]	--[b]	--[b]	181[c]
8/14	--[b]	--[b]	25[c]	--[b]	--[b]	455[c]	--[b]	--[b]	114[c]	--[b]	--[b]	205[c]
8/15	--[b]	--[b]	23[c]	--[b]	--[b]	419[c]	--[b]	--[b]	105[c]	--[b]	--[b]	230[c]
8/16	--[b]	--[b]	21[c]	--[b]	--[b]	383[c]	--[b]	--[b]	96[c]	--[b]	--[b]	254[c]
8/17	--[b]	--[b]	19[c]	--[b]	--[b]	347[c]	--[b]	--[b]	88[c]	--[b]	--[b]	279[c]
8/18	--[b]	--[b]	17[c]	--[b]	--[b]	311[c]	--[b]	--[b]	79[c]	--[b]	--[b]	303[c]
8/19	--[b]	--[b]	16[c]	--[b]	--[b]	275[c]	--[b]	--[b]	70[c]	--[b]	--[b]	328[c]

-continued-

Table 1.–Page 2 of 2.

Date	Chinook			Chum			Sockeye			Coho		
	Male	Female	Totals	Male	Female	Totals	Male	Female	Totals	Male	Female	Totals
8/20	--[b]	--[b]	14[c]	--[b]	--[b]	239[c]	--[b]	--[b]	61[c]	--[b]	--[b]	352[c]
8/21	--[b]	--[b]	12[c]	--[b]	--[b]	203[c]	--[b]	--[b]	53[c]	--[b]	--[b]	377[c]
8/22	--[b]	--[b]	10[c]	--[b]	--[b]	167[c]	--[b]	--[b]	44[c]	--[b]	--[b]	401[c]
8/23	--[b]	--[b]	8[c]	--[b]	--[b]	131[c]	--[b]	--[b]	35[c]	--[b]	--[b]	426[c]
8/24	--[b]	--[b]	6[c]	--[b]	--[b]	95[c]	--[b]	--[b]	26[c]	--[b]	--[b]	450[c]
8/25	1[d]	0[d]	4[e]	3[d]	6[d]	59[e]	8[d]	1[d]	18[e]	138[d]	79[d]	475[e]
8/26	0	1	1	14	12	26	6	4	10	305	243	548
8/27	3	1	4	15	4	19	3	5	8	275	175	450
8/28	4	1	5	5	7	12	1	4	5	332	268	600
8/29	3	0	3	7	4	11	3	0	3	399	353	752
8/30	1	0	1	2	7	9	3	1	4	249	178	427
8/31	0	0	0	6	5	11	1	0	1	345	293	638
9/1	4	0	4	7	1	8	0	1	1	351	284	635
9/2	1	0	1	3	2	5	2	0	2	482	387	869
9/3	1	0	1	5	3	8	1	1	2	400	352	752
9/4	0	0	0	3	0	3	0	2	2	318	286	604
9/5	1	0	1	5	0	5	2	0	2	361	392	753
9/6	3	0	3	0	1	1	3	0	3	299	320	619
9/7	2	0	2	3	0	3	1	1	2	281	298	579
9/8	0	0	0	2	2	4	0	3	3	452	470	922
9/9	1	0	1	0	0	0	1	0	1	316	379	695
9/10	0	0	0	5	0	5	1	1	2	219	278	497
9/11	0	0	0	2	3	5	2	2	4	169	243	412
9/12	0	0	0	1	5	6	3	0	3	160	224	384
9/13	3	0	3	0	0	0	2	0	2	107	134	241
9/14	0	0	0	3	0	3	1	0	1	108	132	240
Total Escapement[f]	12,978	6,206	19,414	107,786	68,722	180,594	28,766	31,007	60,807	6,649	6,162	17,011
Observed Escapement			19,184			176,508			59,773			12,811
% Estimated			1.2%			2.3%			1.7%			24.7%

[a] Partial day count; passage was not estimated.
[b] Daily estimates were not partitioned by sex.
[c] The weir was not operational; daily passage was estimated.
[d] Partial day count. Total daily passage was estimated but not partitioned by sex.
[e] Partial day count. Passage was estimated.
[f] “Total escapement” does not include passage on days outside of the target operational period. Numbers in this row are not necessarily the sum of the daily passages in the “totals” column because the daily passage estimates are rounded from actual estimates.

Table 2.–Age and sex composition of Chinook salmon at the Kogrukluk River weir based on escapement samples collected with a live trap, 2006.

Sample Dates (Stratum Dates)	Sample Size	Sex	Age Class 0.2 Esc.	%	1.1 Esc.	%	1.2 Esc.	%	2.1 Esc.	%	1.3 Esc.	%	2.2 Esc.	%	1.4 Esc.	%	2.3 Esc.	%	1.5 Esc.	%	2.4 Esc.	%	1.6 Esc.	%	2.5 Esc.	%	Total Esc.	%
7/4-12	191	M	0	0.0	36	0.5	3,019	44.5	0	0.0	1,811	26.7	0	0.0	462	6.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5,328	78.5
(6/28-7/12)		F	0	0.0	0	0.0	0	0.0	0	0.0	391	5.8	0	0.0	959	14.1	0	0.0	107	1.6	0	0.0	0	0.0	0	0.0	1,456	21.5
		Subtotal[a]	0	0.0	36	0.5	3,019	44.5	0	0.0	2,202	32.5	0	0.0	1,421	20.9	0	0.0	107	1.6	0	0.0	0	0.0	0	0.0	6,784	100.0
7/13-19	186	M	0	0.0	0	0.0	1,475	31.7	0	0.0	1,050	22.6	0	0.0	550	11.8	0	0.0	125	2.7	0	0.0	0	0.0	0	0.0	3,200	68.8
(7/13-19)		F	0	0.0	0	0.0	0	0.0	0	0.0	400	8.6	0	0.0	800	17.2	0	0.0	250	5.4	0	0.0	0	0.0	0	0.0	1,450	31.2
		Subtotal[a]	0	0.0	0	0.0	1,475	31.7	0	0.0	1,450	31.2	0	0.0	1,350	29.0	0	0.0	375	8.1	0	0.0	0	0.0	0	0.0	4,650	100.0
7/20-26	175	M	0	0.0	28	0.6	1,382	28.0	0	0.0	1,129	22.9	0	0.0	282	5.7	0	0.0	56	1.1	0	0.0	0	0.0	0	0.0	2,878	58.3
(7/20-26)		F	0	0.0	0	0.0	0	0.0	0	0.0	451	9.1	0	0.0	1,411	28.6	0	0.0	198	4.0	0	0.0	0	0.0	0	0.0	2,059	41.7
		Subtotal[a]	0	0.0	28	0.6	1,382	28.0	0	0.0	1,580	32.0	0	0.0	1,693	34.3	0	0.0	254	5.1	0	0.0	0	0.0	0	0.0	4,937	100.0
7/27-8/11	159	M	0	0.0	38	1.3	900	29.6	0	0.0	479	15.7	0	0.0	115	3.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1,531	50.3
(7/27-9/14)		F	0	0.0	0	0.0	0	0.0	0	0.0	287	9.5	0	0.0	1,129	37.1	0	0.0	96	3.1	0	0.0	0	0.0	0	0.0	1,512	49.7
		Subtotal[a]	0	0.0	38	1.3	900	29.6	0	0.0	766	25.2	0	0.0	1,244	40.9	0	0.0	96	3.1	0	0.0	0	0.0	0	0.0	3,043	100.0
Season [b]	711	M	0	0.0	102	0.5	6,776	34.9	0	0.0	4,469	23.0	0	0.0	1,408	7.3	0	0.0	181	0.9	0	0.0	0	0.0	0	0.0	12,936	66.6
		F	0	0.0	0	0.0	0	0.0	0	0.0	1,529	7.9	0	0.0	4,299	22.1	0	0.0	650	3.4	0	0.0	0	0.0	0	0.0	6,478	33.4
		Total	0	0.0	102	0.5	6,776	34.9	0	0.0	5,998	30.9	0	0.0	5,707	29.4	0	0.0	831	4.3	0	0.0	0	0.0	0	0.0	19,414	100.0

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepancies in sums are attributed to rounding errors.

[b] The number of fish in "Season" summaries are the strata sums; "Season" percentages are derived from the sums of the estimated escapement that occurred in each stratum.

Table 3.–Mean length (mm) of Chinook salmon at the Kogrukluk River weir based on escapement samples collected with a live trap, 2006.

Sample Dates (Stratum Dates)	Sex		Age Class 0.2	1.1	1.2	2.1	1.3	2.2	1.4	2.3	1.5	2.4	1.6	2.5
7/4-12	M	Mean Length		368	557		684		783					
(6/28-7/12)		SE		-	4		10		22					
		Range		368- 368	433- 685		552- 869		648- 912					
		Sample Size	0	1	85	0	51	0	13	0	0	0	0	0
	F	Mean Length					764		857		905			
		SE					12		11		9			
		Range					695- 810		680- 932		890- 921			
		Sample Size	0	0	0	0	11	0	27	0	3	0	0	0
7/13-19	M	Mean Length			567		722		807		813			
(7/13-19)		SE			6		9		17		23			
		Range			409- 654		580- 831		585- 933		741- 862			
		Sample Size	0	0	59	0	42	0	22	0	5	0	0	0
	F	Mean Length					796		850		884			
		SE					9		8		11			
		Range					738- 872		761- 979		836- 955			
		Sample Size	0	0	0	0	16	0	32	0	10	0	0	0
7/20-26	M	Mean Length		370	563		687		775		818			
(7/20-26)		SE		-	6		11		16		116			
		Range		370- 370	463- 656		483- 805		681- 830		702- 934			
		Sample Size	0	1	49	0	40	0	10	0	2	0	0	0
	F	Mean Length					779		850		832			
		SE					12		7		29			
		Range					684- 870		719- 931		698- 918			
		Sample Size	0	0	0	0	16	0	50	0	7	0	0	0
7/27-8/11	M	Mean Length		370	545		673		795					
(7/27-9/14)		SE		17	7		14		39					
		Range		353- 387	415- 655		520- 832		648- 914					
		Sample Size	0	2	47	0	25	0	6	0	0	0	0	0
	F	Mean Length					788		852		897			
		SE					10		6		21			
		Range					688- 840		740- 954		839- 945			
		Sample Size	0	0	0	0	15	0	59	0	5	0	0	0
Season [a]	M	Mean Length		369	559		693		792		814			
		Range		353- 387	409- 685		483- 869		585- 933		702- 934			
		Sample Size	0	4	240	0	158	0	51	0	7	0	0	0
	F	Mean Length					781		852		873			
		Range					684- 872		680- 979		698- 955			
		Sample Size	0	0	0	0	58	0	168	0	25	0	0	0

Note: The sum of the sample sizes in each stratum equal the total sample size reported for that stratum in Table 2.

[a] "Season" mean lengths are weighted by the escapement passage in each stratum.

Table 4.–Age and sex composition of chum salmon at the Kogrukluk River weir based on escapement samples collected with a live trap, 2006.

Sample Dates (Stratum Dates)	Sample Size	Sex	Age Class 0.2 Esc.	0.2 %	0.3 Esc.	0.3 %	0.4 Esc.	0.4 %	0.5 Esc.	0.5 %	Total Esc.	Total %
6/29-7/1	181	M	0	0.0	1,112	15.5	3,455	48.1	0	0.0	4,568	63.5
(6/28-7/2)		F	0	0.0	1,033	14.3	1,549	21.5	40	0.6	2,621	36.5
		Subtotal[a]	0	0.0	2,145	29.8	5,004	69.6	40	0.6	7,189	100.0
7/3-5	186	M	0	0.0	6,076	21.0	11,374	39.2	156	0.5	17,606	60.8
(7/3-7)		F	156	0.5	6,700	23.1	4,518	15.6	0	0.0	11,374	39.2
		Subtotal[a]	156	0.5	12,776	44.1	15,892	54.8	156	0.5	28,980	100.0
7/10-12	169	M	255	0.6	14,526	33.7	9,939	23.1	0	0.0	24,720	57.4
(7/8-14)		F	0	0.0	12,488	29.0	5,861	13.6	0	0.0	18,349	42.6
		Subtotal[a]	255	0.6	27,014	62.7	15,800	36.7	0	0.0	43,069	100.0
7/17-19	179	M	0	0.0	18,148	36.9	13,199	26.8	275	0.6	31,622	64.2
(7/15-22)		F	275	0.6	13,199	26.8	4,125	8.4	0	0.0	17,599	35.8
		Subtotal[a]	275	0.6	31,347	63.7	17,324	35.2	275	0.6	49,221	100.0
7/25-27	190	M	0	0.0	13,782	56.3	5,024	20.5	0	0.0	18,806	76.8
(7/23-28)		F	773	3.2	4,380	17.9	515	2.1	0	0.0	5,667	23.2
		Subtotal[a]	773	3.2	18,162	74.2	5,539	22.6	0	0.0	24,473	100.0
7/31-8/1	184	M	267	1.6	6,128	37.5	2,398	14.7	0	0.0	8,793	53.8
(7/29-8/4)		F	355	2.2	6,040	37.0	1,155	7.0	0	0.0	7,549	46.2
		Subtotal[a]	622	3.8	12,168	74.5	3,553	21.7	0	0.0	16,342	100.0
8/8-11	186	M	183	1.6	4,200	37.1	1,157	10.2	0	0.0	5,540	48.9
(8/5-9/14)		F	548	4.9	4,444	39.2	791	7.0	0	0.0	5,783	51.1
		Subtotal[a]	731	6.5	8,644	76.3	1,948	17.2	0	0.0	11,323	100.0
Season[b]	1,275	M	704	0.4	63,974	35.4	46,545	25.8	431	0.3	111,654	61.8
		F	2,107	1.2	48,282	26.8	18,515	10.2	40	0.0	68,943	38.2
		Total	2,811	1.6	112,256	62.2	65,060	36.0	471	0.3	180,597	100.0

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepancies in sums are attributed to rounding errors.

[b] The number of fish in "Season" summaries are strata sums; "Season" percentages are derived from the sums of the estimated escapement that occurred in each stratum.

Table 5.–Mean length (mm) of chum salmon at the Kogrukluk River weir based on escapement samples collected with a live trap, 2006.

Sample Dates (Stratum Dates)	Sex		Age Class 0.2	0.3	0.4	0.5
6/29-7/1	M	Mean Length		561	569	
(6/28-7/2)		SE		5	3	
		Range		514- 604	479- 635	
		Sample Size	0	28	87	0
	F	Mean Length		535	544	555
		SE		4	4	-
		Range		487- 569	500- 621	555- 555
		Sample Size	0	26	39	1
7/3-5	M	Mean Length		564	574	597
(7/3-7)		SE		4	4	-
		Range		513- 620	514- 665	597- 597
		Sample Size	0	39	73	1
	F	Mean Length	544	539	547	
		SE	-	4	3	
		Range	544- 544	488- 625	516- 584	
		Sample Size	1	43	29	0
7/10-12	M	Mean Length	501	557	579	
(7/8-14)		SE	-	4	5	
		Range	501- 501	485- 638	522- 638	
		Sample Size	1	57	39	0
	F	Mean Length		536	554	
		SE		3	5	
		Range		471- 587	495- 600	
		Sample Size	0	49	23	0
7/17-19	M	Mean Length		548	569	573
(7/15-22)		SE		4	5	-
		Range		472- 631	499- 647	573- 573
		Sample Size	0	66	48	1
	F	Mean Length	476	535	543	
		SE	-	4	5	
		Range	476- 476	466- 585	501- 565	
		Sample Size	1	48	15	0
7/25-27	M	Mean Length		551	568	
(7/23-28)		SE		3	6	
		Range		498- 651	498- 635	
		Sample Size	0	107	39	0
	F	Mean Length	510	527	565	
		SE	8	5	19	
		Range	482- 532	467- 584	527- 617	
		Sample Size	6	34	4	0

-continued-

Table 5.–Page 2 of 2

Sample Dates (Stratum Dates)	Sex		Age Class 0.2	0.3	0.4	0.5
7/31-8/1	M	Mean Length	489	550	571	
(7/29-8/4)		SE	16	4	8	
		Range	456- 505	468- 637	448- 655	
		Sample Size	3	69	27	0
	F	Mean Length	503	524	535	
		SE	9	4	6	
		Range	485- 527	452- 595	502- 563	
		Sample Size	4	68	13	0
8/8-11	M	Mean Length	506	542	549	
(8/5-9/14)		SE	15	4	6	
		Range	486- 535	482- 621	511- 600	
		Sample Size	3	69	19	0
	F	Mean Length	501	519	531	
		SE	10	4	8	
		Range	445- 542	452- 595	490- 593	
		Sample Size	9	73	13	0
Season [a]	M	Mean Length	498	552	572	582
		Range	456- 535	468- 651	448- 665	573- 597
		Sample Size	7	435	332	2
	F	Mean Length	505	532	547	555
		Range	445- 544	452- 625	490- 621	555- 555
		Sample Size	21	341	136	1

Note: The sum of the sample sizes in each stratum equal the total sample size reported for that stratum in Table 4.

[a] "Season" mean lengths are weighted by the escapement passage in each stratum.

Table 6.–Age and sex composition of coho salmon sampled at the Kogrukluk River weir based on escapement samples collected with a live trap, 2006.

Sample Dates (Stratum Dates)	Sample Size	Sex	Age Class 1.1 Esc.	1.1 %	2.1 Esc.	2.1 %	2.2 Esc.	2.2 %	3.1 Esc.	3.1 %	Total Esc.	Total %
8/28-30	144	M	590	6.2	3,869	41.0	0	0.0	131	1.4	4,591	48.6
(6/28-9/1)		F	459	4.9	4,132	43.7	0	0.0	262	2.8	4,853	51.4
		Subtotal [a]	1,049	11.1	8,001	84.7	0	0.0	393	4.2	9,444	100.0
9/4-6	137	M	254	4.4	1,987	34.3	0	0.0	42	0.7	2,283	39.4
(9/2-9)		F	423	7.3	3,087	53.3	0	0.0	0	0.0	3,510	60.6
		Subtotal [a]	677	11.7	5,074	87.6	0	0.0	42	0.7	5,793	100.0
9/12-14	145	M	37	2.1	722	40.7	0	0.0	25	1.4	783	44.1
(9/10-14)		F	49	2.7	917	51.7	0	0.0	24	1.4	991	55.9
		Subtotal [a]	86	4.8	1,639	92.4	0	0.0	49	2.8	1,774	100.0
Season [b]	426	M	881	5.2	6,579	38.7	0	0.0	198	1.1	7,657	45.0
		F	931	5.4	8,136	47.8	0	0.0	287	1.7	9,354	55.0
		Total	1,812	10.6	14,715	86.5	0	0.0	485	2.8	17,011	100.0

[a] The number of fish in each stratum age and sex category are derive from the sample percentages; discrepancies in sums are attributed to rounding errors.

[b] The number of fish in “Season” summaries are the strata sums; “Season” percentages are derived from the sums of the estimated stratum.

Table 7.–Mean length (mm) of coho salmon at the Kogrukluk River weir based on escapement samples collected with a live trap, 2006.

Sample Dates (Stratum Dates)	Sex		Age Class 1.1	2.1	2.2	3.1
8/28-30	M	Mean Length	495	505		540
(6/28-9/1)		SE	17	6		56
		Range	412- 542	365- 584		484- 595
		Sample Size	9	59	0	2
	F	Mean Length	500	518		499
		SE	20	5		9
		Range	406- 552	445- 601		485- 521
		Sample Size	7	63	0	4
9/4-6	M	Mean Length	507	519		413
(9/2-9)		SE	16	6		-
		Range	456- 549	445- 598		413- 413
		Sample Size	6	47	0	1
	F	Mean Length	521	522		
		SE	8	4		
		Range	460- 552	450- 590		
		Sample Size	10	73	0	0
9/12-14	M	Mean Length	508	500		516
(9/10-14)		SE	44	6		29
		Range	421- 561	395- 571		487- 545
		Sample Size	3	59	0	2
	F	Mean Length	531	520		546
		SE	20	4		50
		Range	491- 586	421- 598		496- 596
		Sample Size	4	75	0	2
Season [a]	M	Mean Length	499	509		510
		Range	412- 561	365- 598		413- 595
		Sample Size	18	165	0	5
	F	Mean Length	511	520		503
		Range	406- 586	421- 601		485- 596
		Sample Size	21	211	0	6

Note: The sum of the sample sizes in each stratum equal the total sample size reported for that stratum in Table 6.

[a] "Season" mean lengths are weighted by the escapement passage in each stratum.

Table 8.–Brood table for Kogrukluk River Chinook salmon.

Brood Years	Escapement (spawners)	Number by Age in Return Year 3	4	5	6	7	8	Returns	Return per Spawner
1969[a]	-	ND	ND	ND	ND	24	ND	-	-
1970[a]	-	ND	ND	ND	2,847	ND	0	-	-
1971[a]	-	ND	ND	2,301	ND	2,054	0	-	-
1972[a]	-	ND	428	ND	7,830	352	-	-	-
1973[a]	-	0	ND	1,433	1,851	-	0	-	-
1974[a]	-	ND	2,327	1,630	-	649	0	-	-
1975[a]	-	24	7,505	-	9,774	597	0	-	-
1976	5,600	0	-	5,096	7,106	128	4	-	-
1977[b]	1,385	-	1,243	2,588	1,690	171	5	-	-
1978	13,667	45	698	594	1,301	148	0	2,741	0.2
1979	11,338	4	606	2,341	2,072	365	-	-	-
1980[c]	6,572	7	1,106	1,647	1,652	-	0	-	-
1981	16,809	4	746	2,563	-	678	-	-	-
1982	10,993	0	433	-	2,672	-	0	-	-
1983	3,025	22	-	4,479	-	30	0	-	-
1984	4,928	-	678	-	1,148	83	-	-	-
1985	4,625	0	-	6,288	4,677	-	-	-	-
1986	5,038	-	2,463	2,264	-	-	-	-	-
1987[d]	4,063	293	479	-	-	-	0	-	-
1988	8,520	0	-	-	-	48	0	-	-
1989[d]	11,940	-	-	-	10,427	964	0	-	-
1990[e]	10,214	-	-	4,827	3,639	55	-	-	-
1991	7,850	-	3,614	7,801	6,034	-	0	-	-
1992[c]	6,755	0	1,788	2,715	-	86	0	-	-
1993[c]	12,332	0	4,481	-	3,749	59	0	-	-
1994[c]	15,227	0	-	1,418	1,294	143	0	-	-
1995	20,630	-	303	1,630	4,070	143	0	-	-
1996	14,199	14	327	3,656	3,149	330	0	7,462	0.5
1997	13,286	0	1,425	5,054	4,234	121	0	10,834	0.8
1998[c]	12,107	0	1,754	5,011	3,643	207	0	10,615	0.9
1999	5,570	0	2,196	7,105	6,172	831	ND	-	-
2000	3,310	0	8,782	10,228	5,707	ND	ND	-	-
2001	9,297	0	5,337	5,998	ND	ND	ND	-	-
2002	10,099	56	6,776	ND	ND	ND	ND	-	-
2003	11,771	102	ND	ND	ND	ND	ND	-	-
2004	19,651	ND	ND	ND	ND	ND	ND	-	-
2005	22,000	ND	ND	ND	ND	ND	ND	-	-
2006	19,414	ND	ND	ND	ND	ND	ND	-	-

[a] Escapement was monitored with a counting tower, no comparable estimate.

[b] No ASL data collected.

[c] Sampling dates do not meet criteria for estimating escapement percentages.

[d] Weir washed out due to high river flows.

[e] Potential age estimation errors.

Table 9.–Brood table for Kogrukluk River chum salmon.

Brood Years	Escapement (spawners)	Number by Age in Return Year 3	4	5	6	Returns	Return per Spawner
1969[a]	-	ND	ND	ND	ND	-	-
1970[a]	-	ND	ND	ND	113	-	-
1971[a]	-	ND	ND	4,913	ND	-	-
1972[a]	-	ND	3,072	ND	0	-	-
1973[a]	-	22	ND	23,716	ND	-	-
1974[a]	-	ND	24,031	ND	0	-	-
1975[a]	-	378	ND	157	368	-	-
1976	8,117	ND	1,487	48,390	39	-	-
1977[b]	10,388	0	8,607	25,656	-	-	-
1978	48,125	0	38,382	-	534	-	-
1979	18,599	0	-	7,205	75	-	-
1980	6,323	-	33,754	10,703	343	-	-
1981	57,372	0	4,188	3,774	-	-	-
1982	61,859	37	10,513	-	ND	-	-
1983[d]	4,094	69	-	ND	-	-	-
1984	41,484	-	ND	-	378	-	-
1985	15,005	ND	-	8,477	0	-	-
1986	14,693	-	17,532	10,066	277	-	-
1987[cdf]	2,365	378	14,013	18,320	1,587	34,297	14.5
1988[b]	39,543	105	14,617	19,452	-	-	-
1989[cd]	39,547	906	10,860	-	246	-	-
1990[e]	26,765	0	-	15,088	788	-	-
1991	24,188	-	13,355	13,953	51	-	-
1992	34,104	411	32,893	4,448	-	-	-
1993	31,901	860	3,404	-	47	-	-
1994[c]	46,635	34	-	6,965	35	-	-
1995	31,265	-	6,807	3,565	0	-	-
1996	48,494	0	7,750	12,542	551	20,843	0.4
1997	7,958	141	17,874	11,912	136	30,063	3.8
1998[cd]	36,441	148	39,028	7,426	41	46,643	1.3
1999	13,820	79	15,431	14,952	0	30,462	2.2
2000	11,491	420	15,182	11,002	471	27,075	2.4
2001	30,570	6,939	178,882	65,060	ND	-	-
2002	51,570	7,839	112,256	ND	ND	-	-
2003	23,413	2,811	ND	ND	ND	-	-
2004	24,201	ND	ND	ND	ND	-	-
2005	197,723	ND	ND	ND	ND	-	-
2006	180,594	ND	ND	ND	ND	-	-

[a] Escapement was monitored with a counting tower, no comparable estimate.
[b] No ASL data collected.
[c] Sampling dates do not meet criteria for estimating escapement percentages.
[d] Weir washed out due to high river flows.
[e] Potential age estimation errors.
[f] Incomplete sampling (recruit per spawner ratio is artificially high).

Table 10.–Brood table for Kogrukluk River coho salmon.

Brood Years	Escapement (spawners)	Number by Age in Return Year			Returns	Return per Spawner
		3	4	5		
1981[a]	11,455	ND	ND	ND	-	-
1982[a]	37,796	ND	ND	ND	-	-
1983[a]	8,538	ND	ND	ND	-	-
1984[a]	27,595	ND	ND	ND	-	-
1985[a]	16,441	ND	ND	604	-	-
1986[a]	22,506	ND	5,169	223	-	-
1987[a]	22,821	357	9,565	ND	-	-
1988[a]	13,512	175	ND	134	-	-
1989[b]	1,272	ND	4,071	2,880	-	-
1990[c]	6,132	108	31,259	1,320	32,687	5.3
1991	9,964	504	16,743	1,068	18,315	1.8
1992[b]	26,057	775	47,970	ND	-	-
1993	20,517	1,511	ND	1,029	-	-
1994	34,695	ND	22,915	1,184	-	-
1995	27,862	401	11,109	680	12,190	0.4
1996	50,555	317	32,117	1,395	33,829	0.7
1997[a]	12,238	338	17,699	1,967	20,004	1.6
1998	24,348	293	12,550	12,585	25,428	1.0
1999	12,609	0	60,942	3,175	64,117	5.1
2000	33,135	1,227	23,700	2,201	27,128	0.8
2001	19,387	166	20,470	485	21,121	1.1
2002	14,516	1,445	14,715	ND	-	-
2003	74,604	1,812	ND	ND	-	-
2004	27,041	ND	ND	ND	-	-
2005	24,116	ND	ND	ND	-	-
2006	17,011	ND	ND	ND	-	-

Note: Escapement monitoring at Kogrukluk River weir dates back to 1976; however, coho salmon monitoring did not begin until 1981.

[a] No ASL data collected.

[b] Weir washed out due to high water.

[c] Potential age estimation errors.

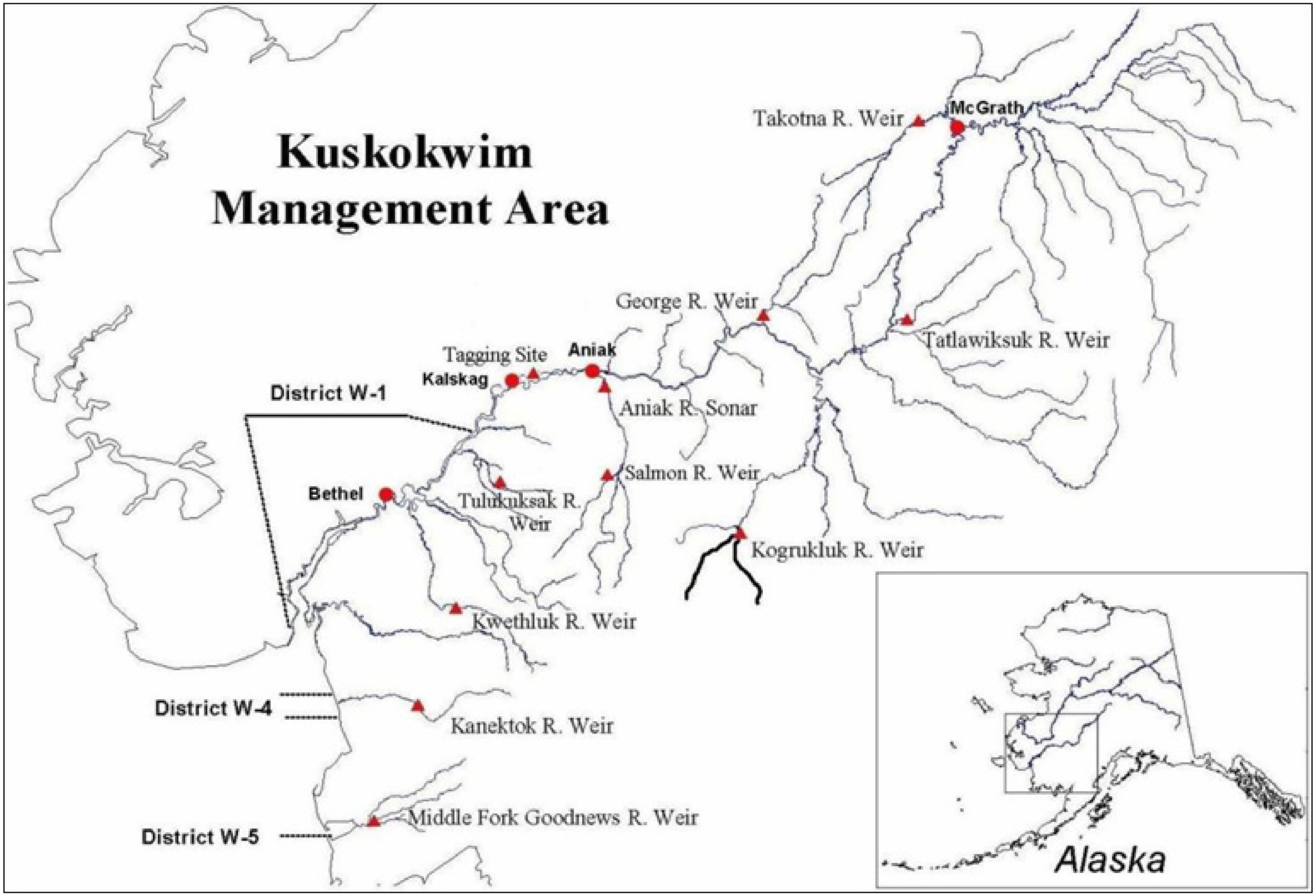


Figure 1.–Kuskokwim Area salmon management districts and escapement monitoring projects with emphasis on the Kogrukluk River.

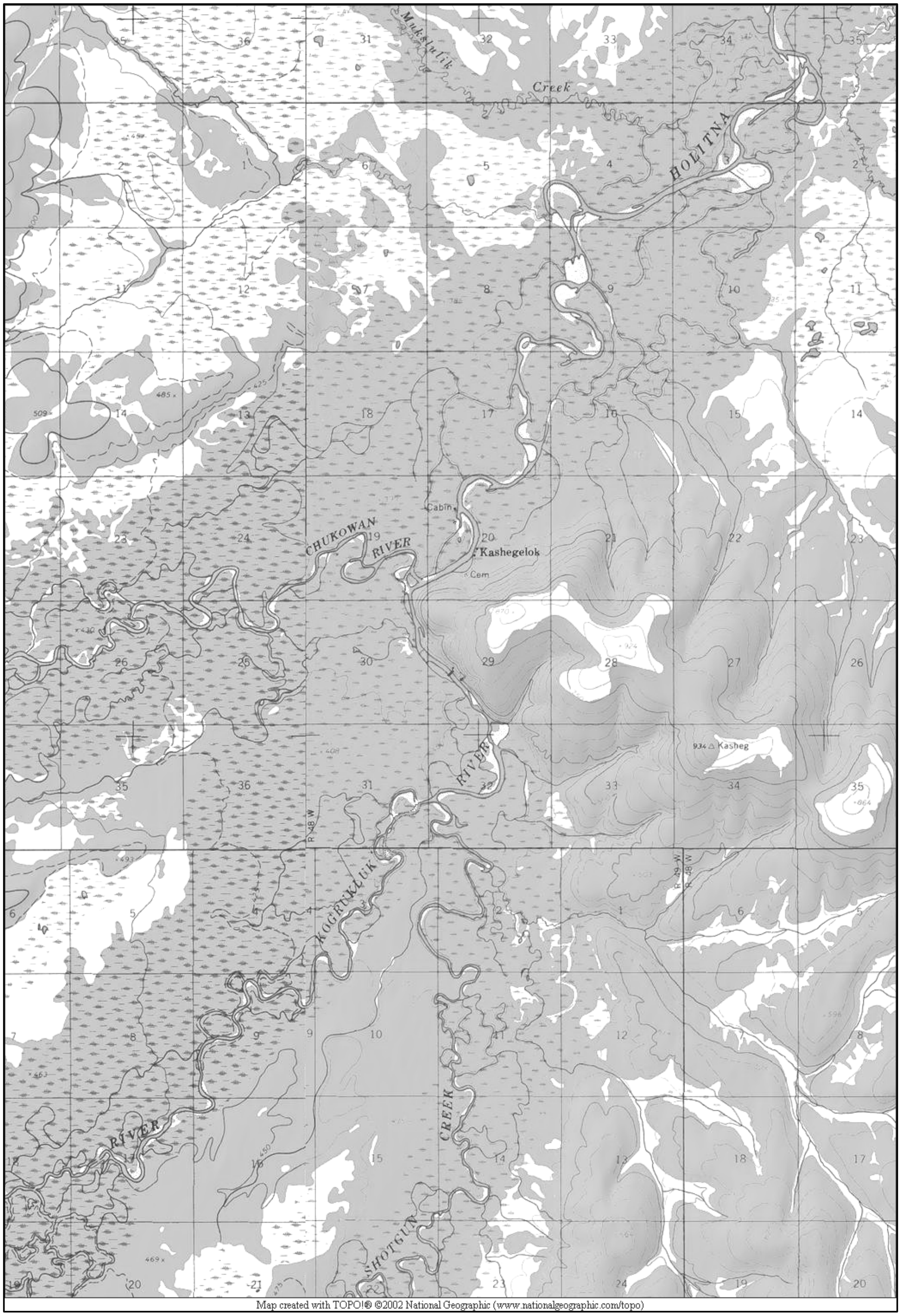
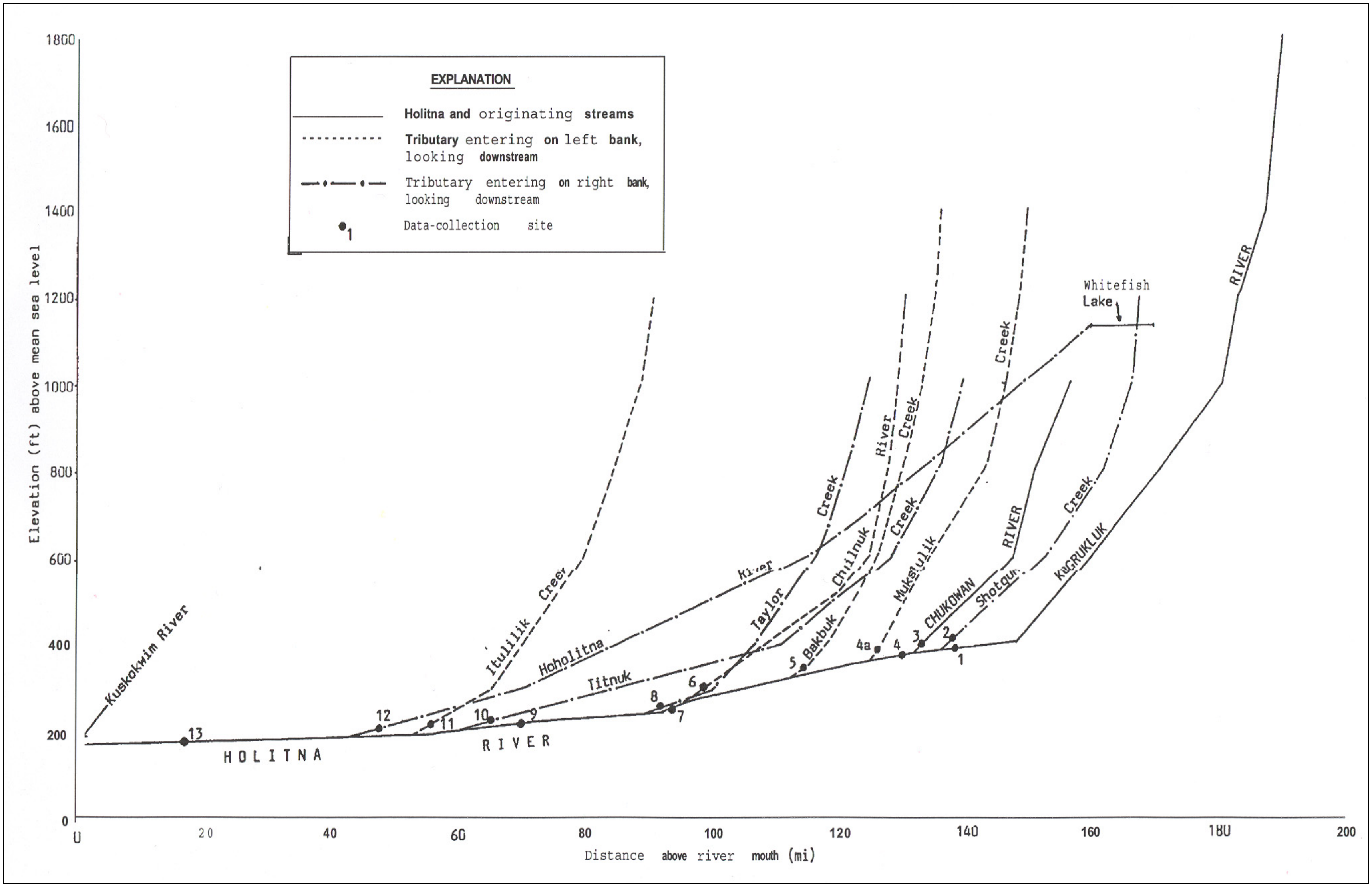
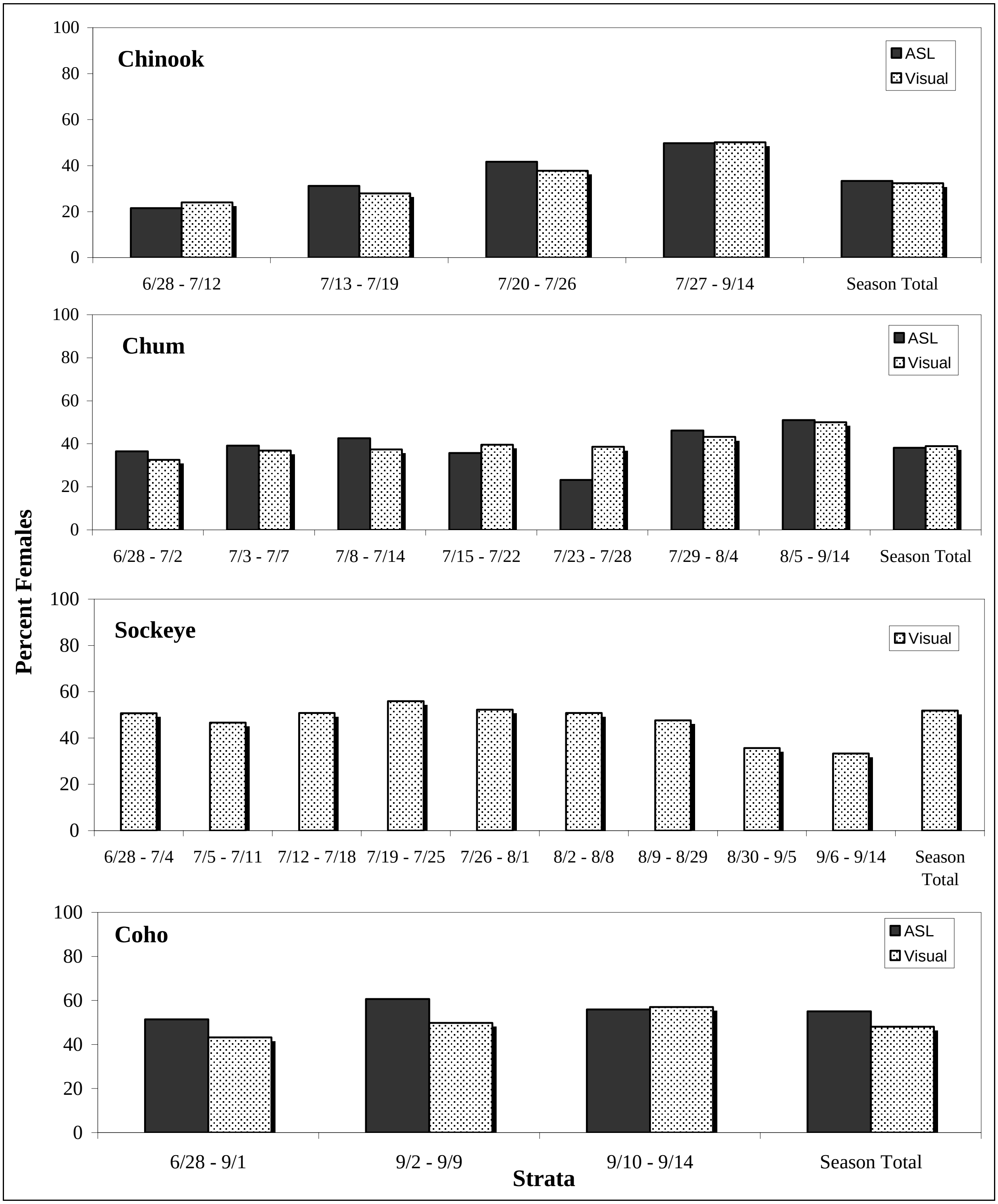


Figure 2.–Kogrukluk River study area and location of historical escapement monitoring projects.



Source: Collazzi 1989.

Figure 3.–Profile of the Holitna River and major tributaries, Alaska.



Note: The sockeye salmon run was partitioned into 9 stratum each containing approximately 7 operational days.

Figure 4.–Percentage of females per strata as determined by ASL sampling and visual identification at Kogrukluk River weir, 2006.

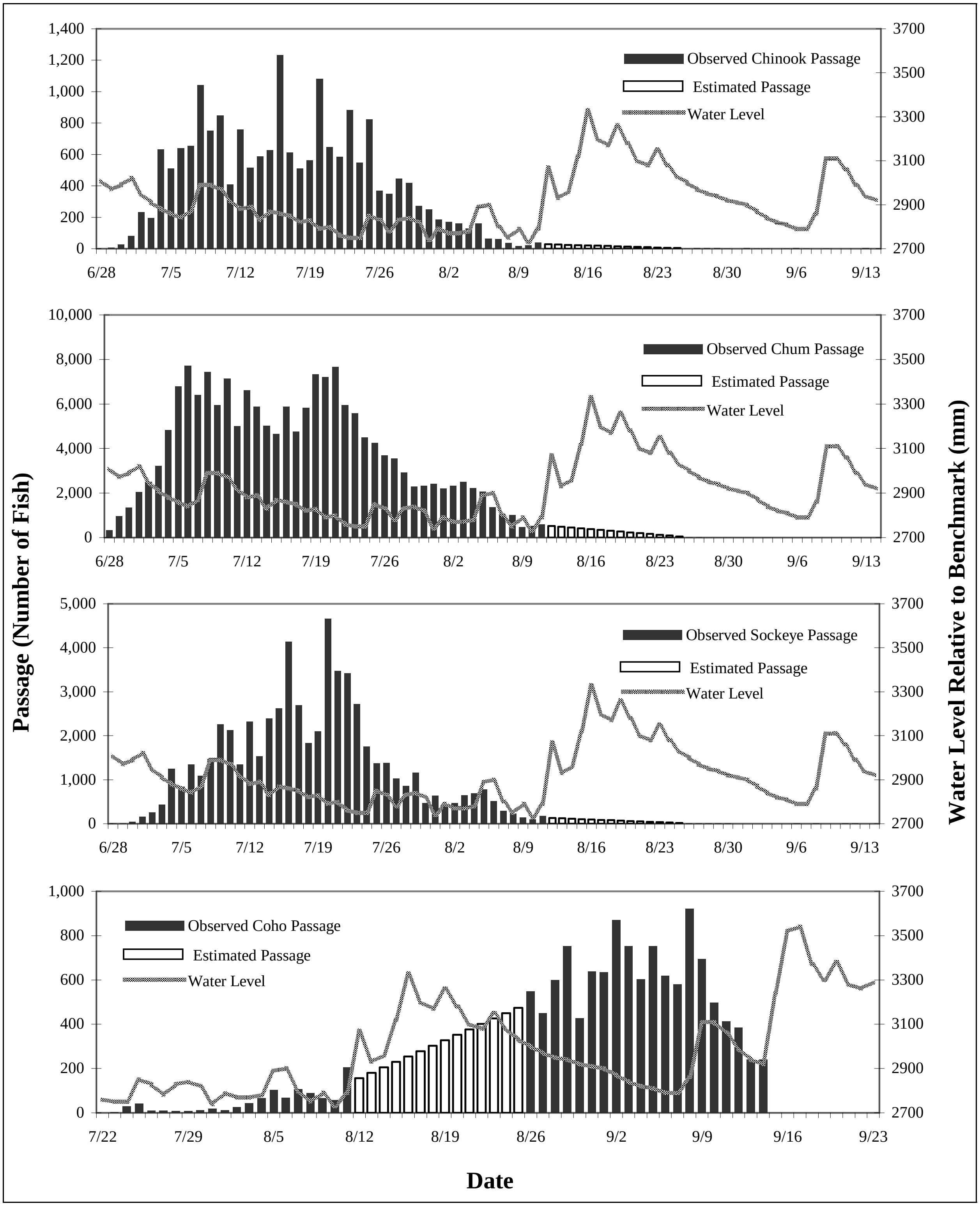


Figure 5.–Daily Chinook, chum, sockeye, and coho salmon passage at Kogrukluk River weir relative to daily morning water level, 2006.

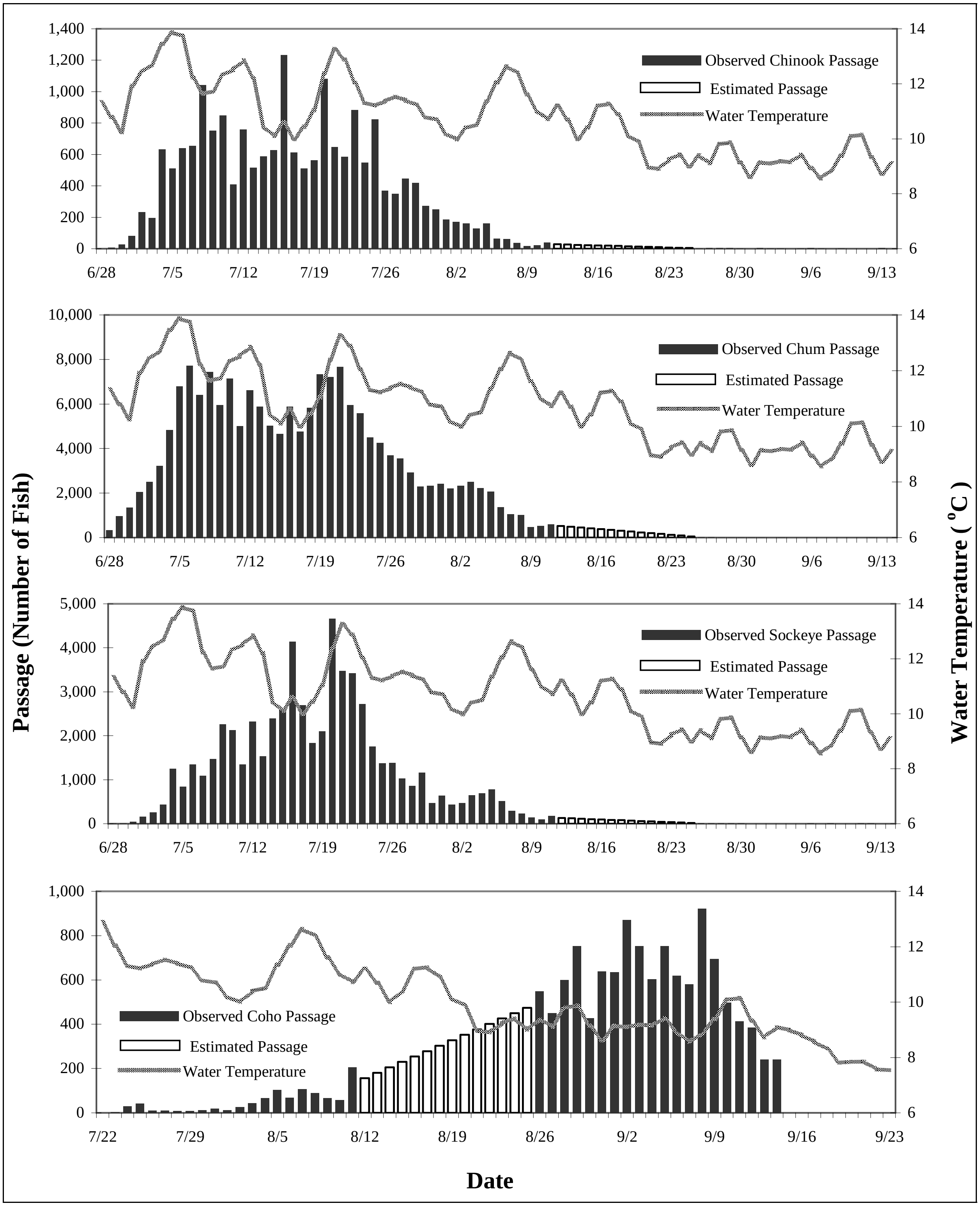
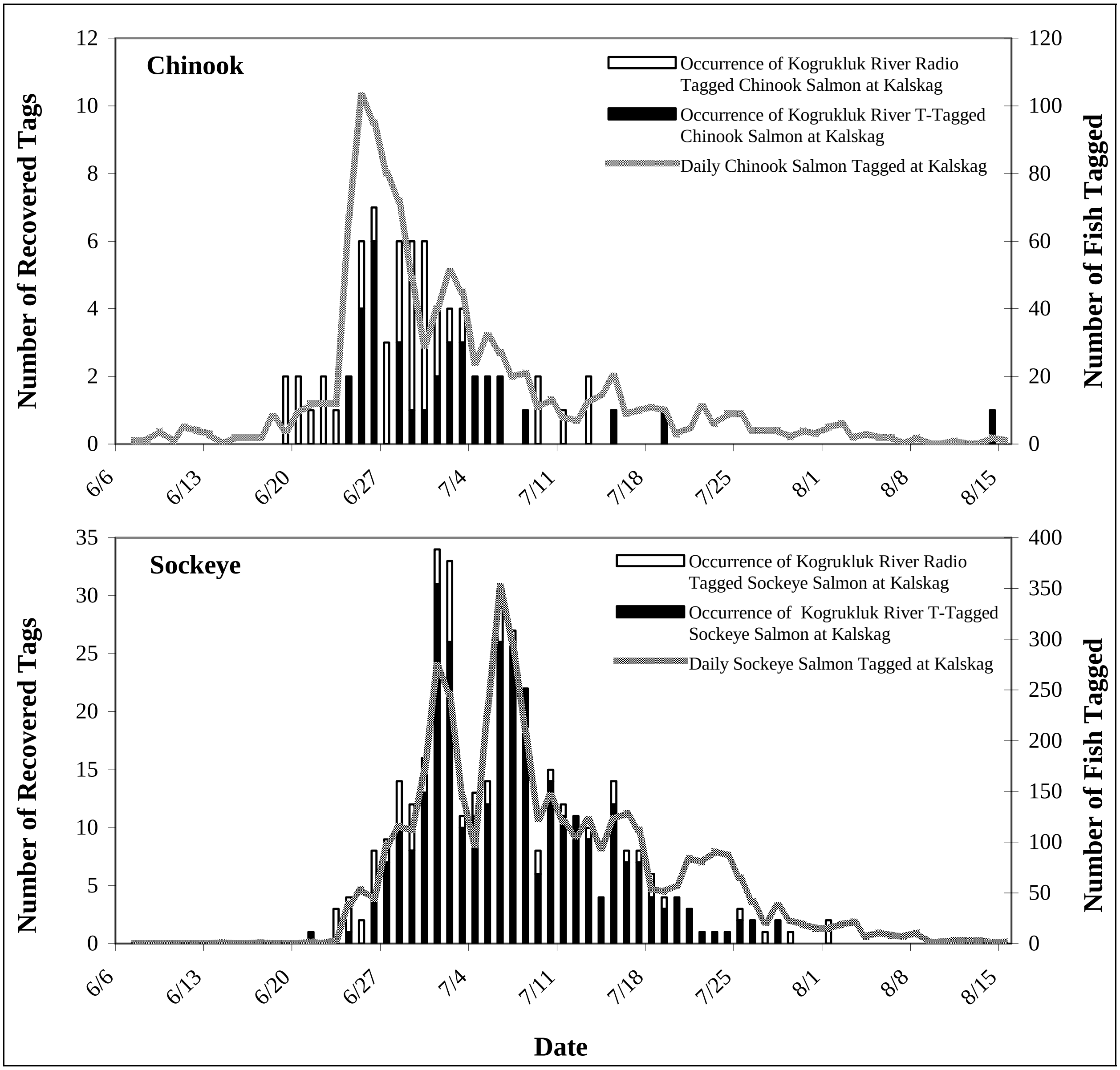


Figure 6.–Daily Chinook, chum, sockeye, and coho salmon passage at Kogrukluk River weir relative to daily average water temperature derived from hourly data logger readings, 2006.



Note: Only samples greater than 6 fish were included in this figure. Tagging began on 7 June.

Figure 7.–Run timing of Chinook and sockeye salmon captured at the Kalaskag tagging site, compared to run timing of salmon recovered at Kogrukluk River weir by date tagged, 2006.

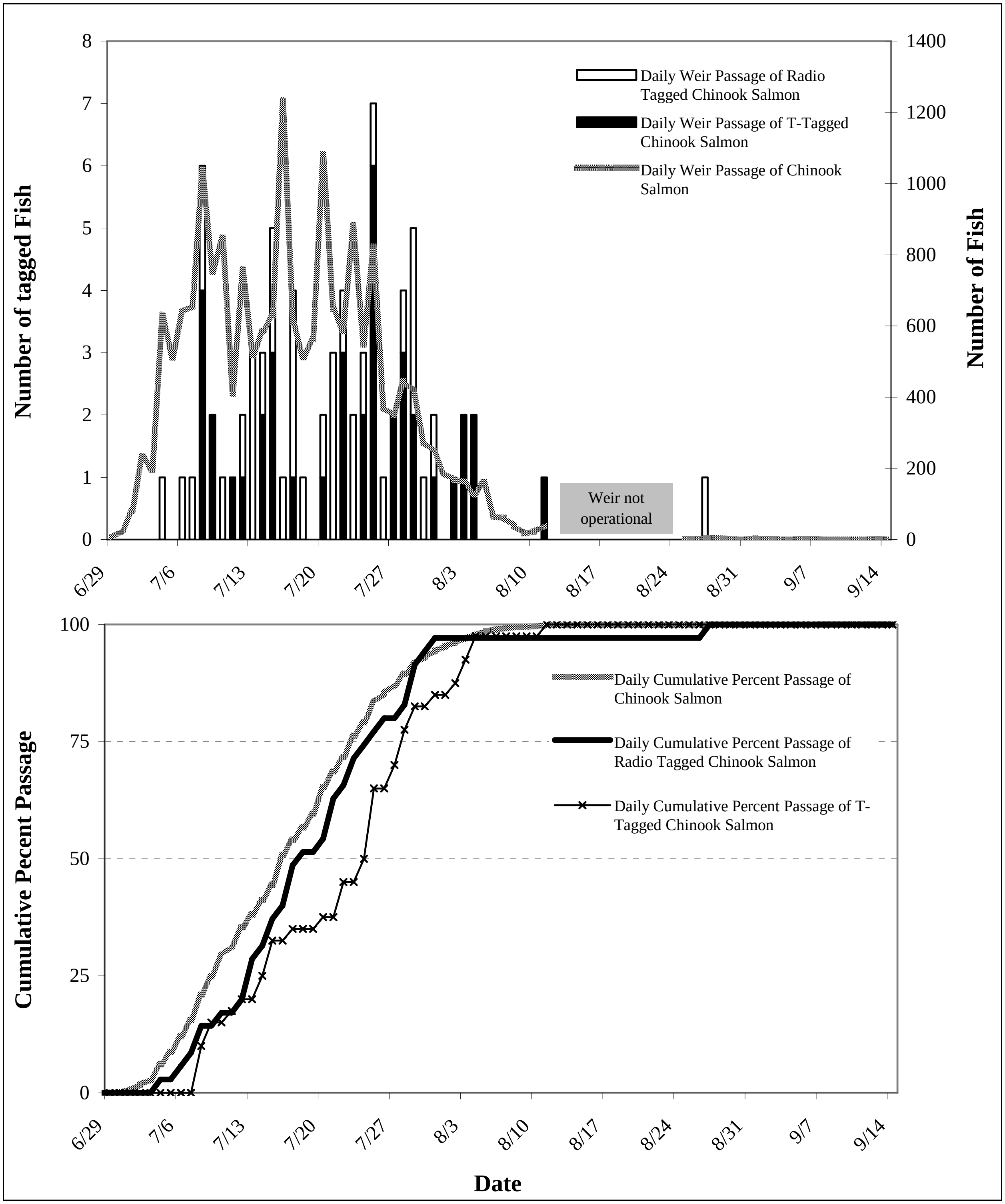


Figure 8.–Daily and cumulative percent passage of overall Chinook passage compared to tagged Chinook salmon passage at Kogrukluk River weir in 2006.

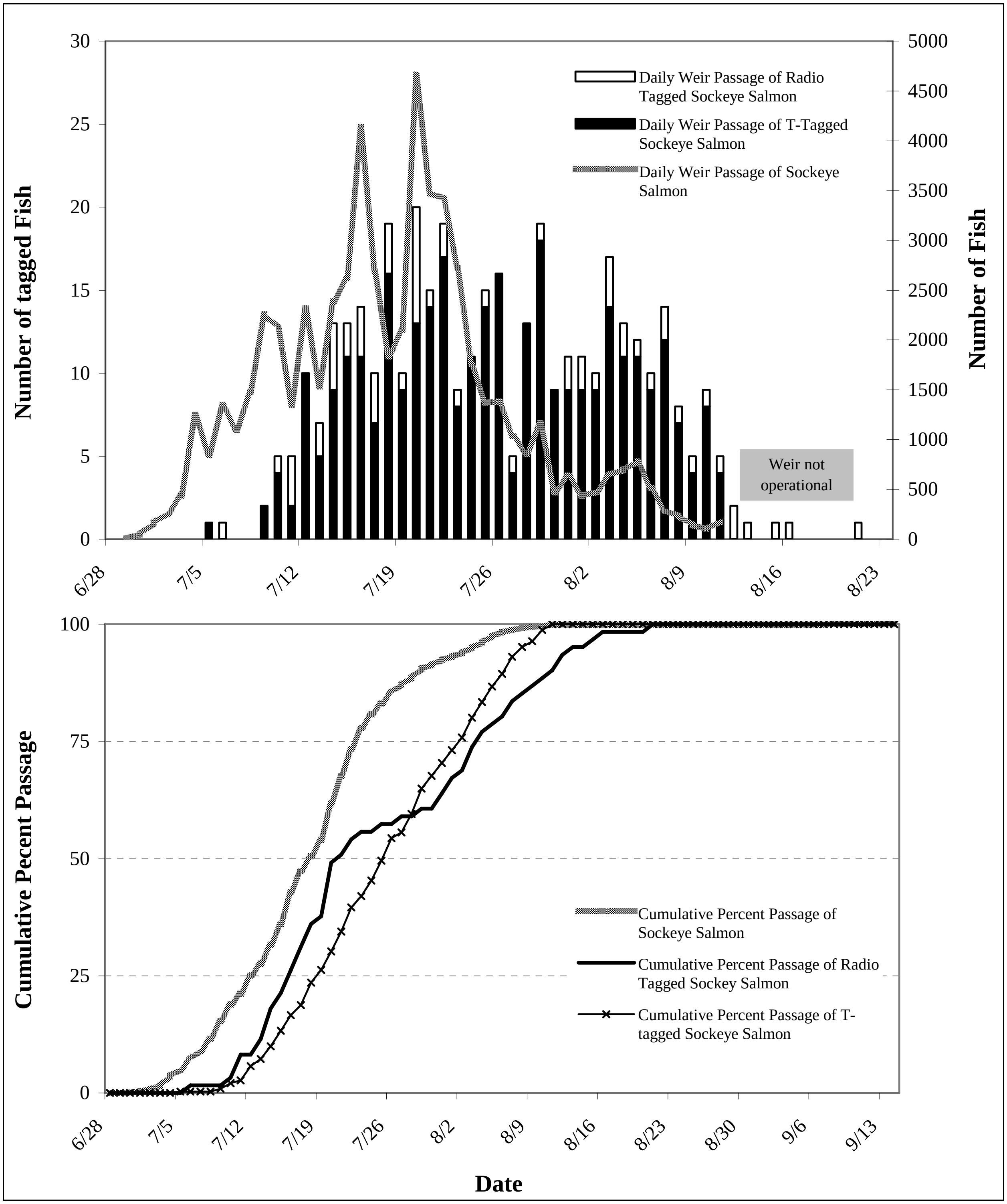
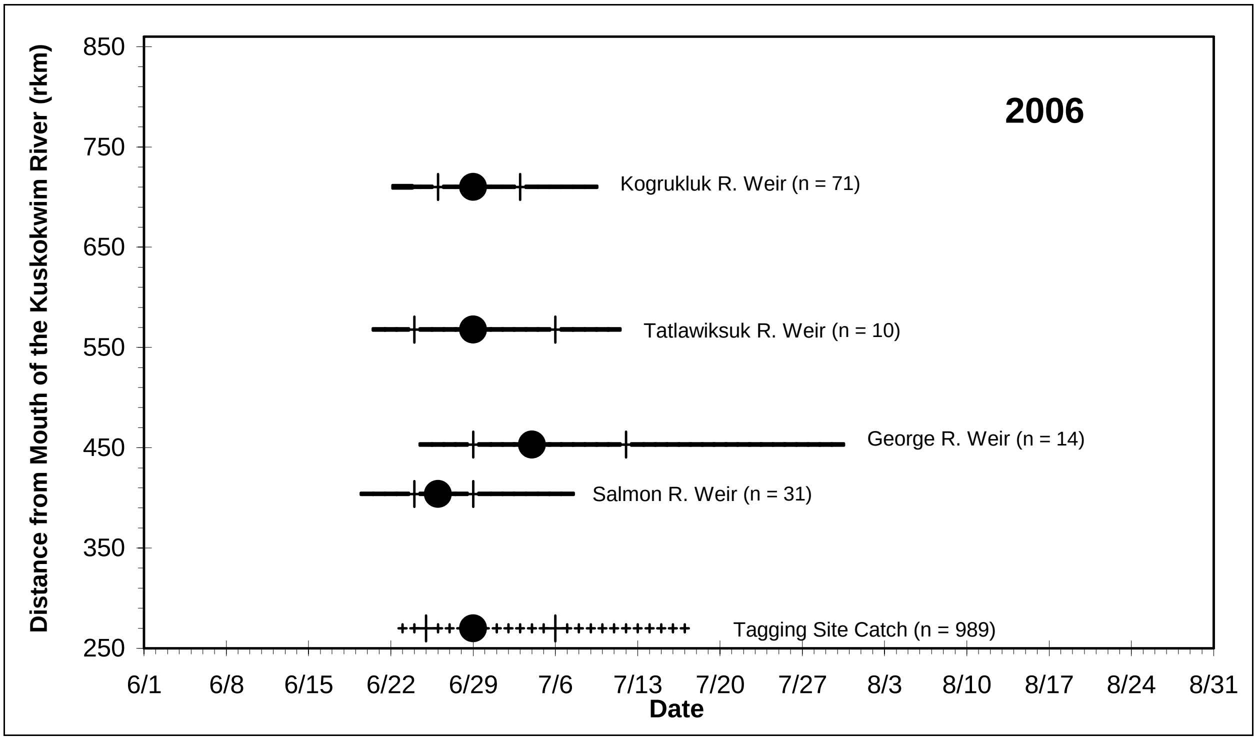


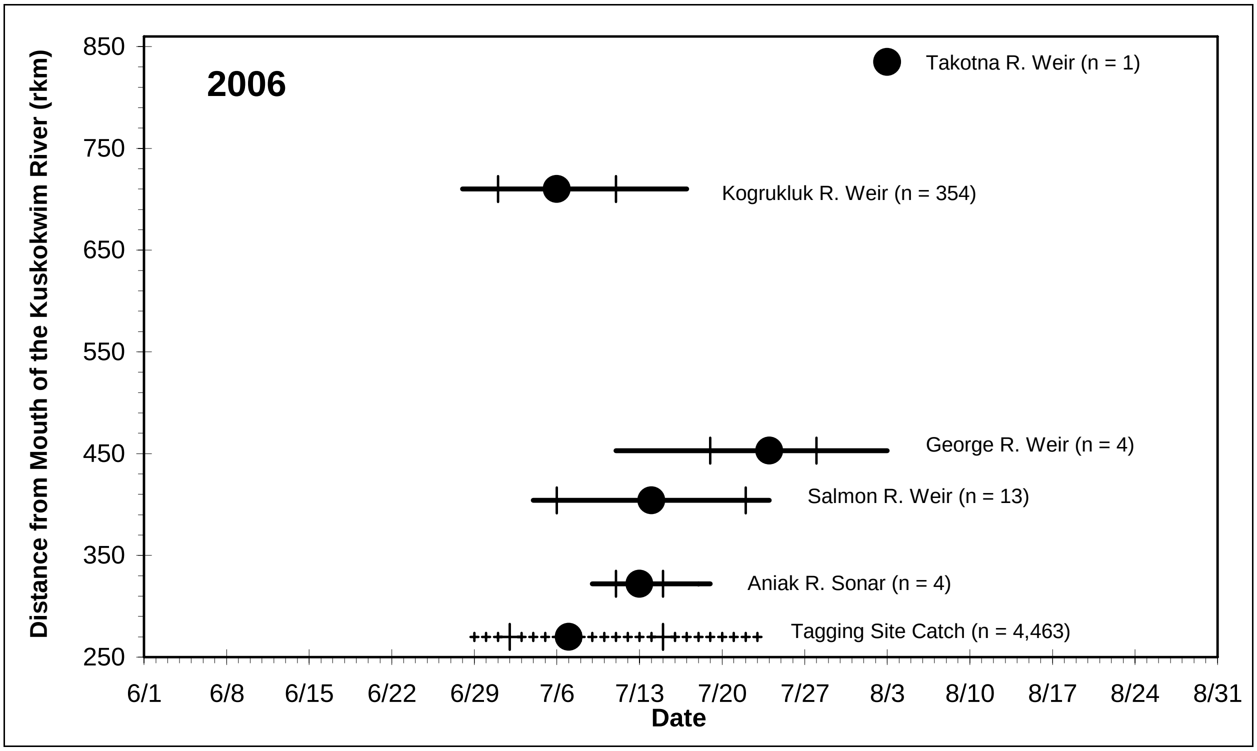
Figure 9.–Daily and cumulative percent passage of overall sockeye passage compared to tagged sockeye passage at Kogrukluk River weir in 2006.



Source: Schaberg et al. *In prep.*

Note: Horizontal lines represent the central 80%, cross-bars represent the central 50%, and circles represent the median passage date.

Figure 10.–Dates when individual Chinook salmon stocks pass through the Kalaskag tagging sites (rkm 271) based on anchor- and radio-tagging studies.



Source: Schaberg et al. *In prep.*

Note: Horizontal lines represent the central 80%, cross-bars represent the central 50%, and circles represent the median passage date.

Figure 11.–Dates when individual sockeye salmon stocks pass through the Kalaskag tagging site (rkm 271) based on anchor- and radio-tagging studies.

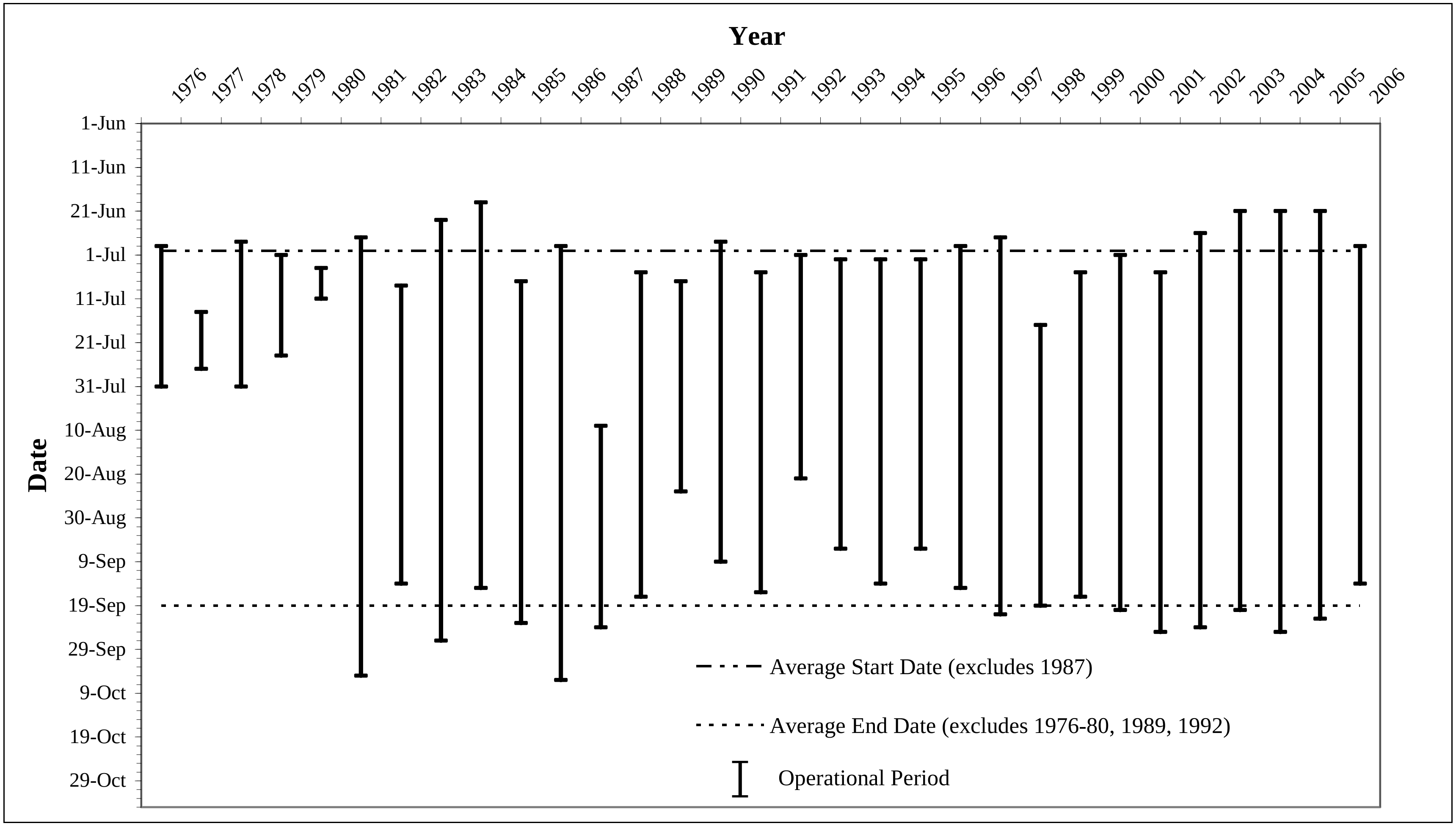
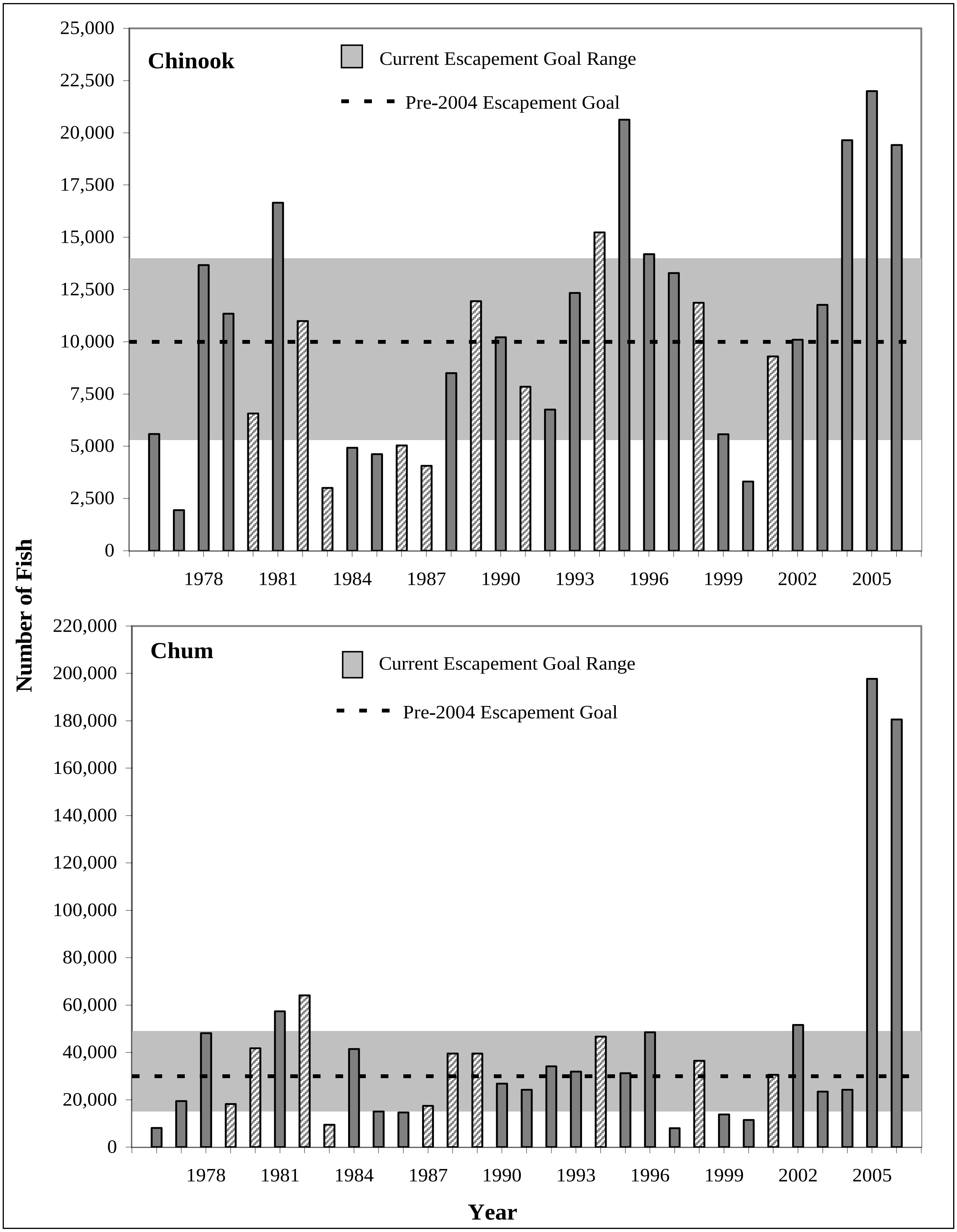
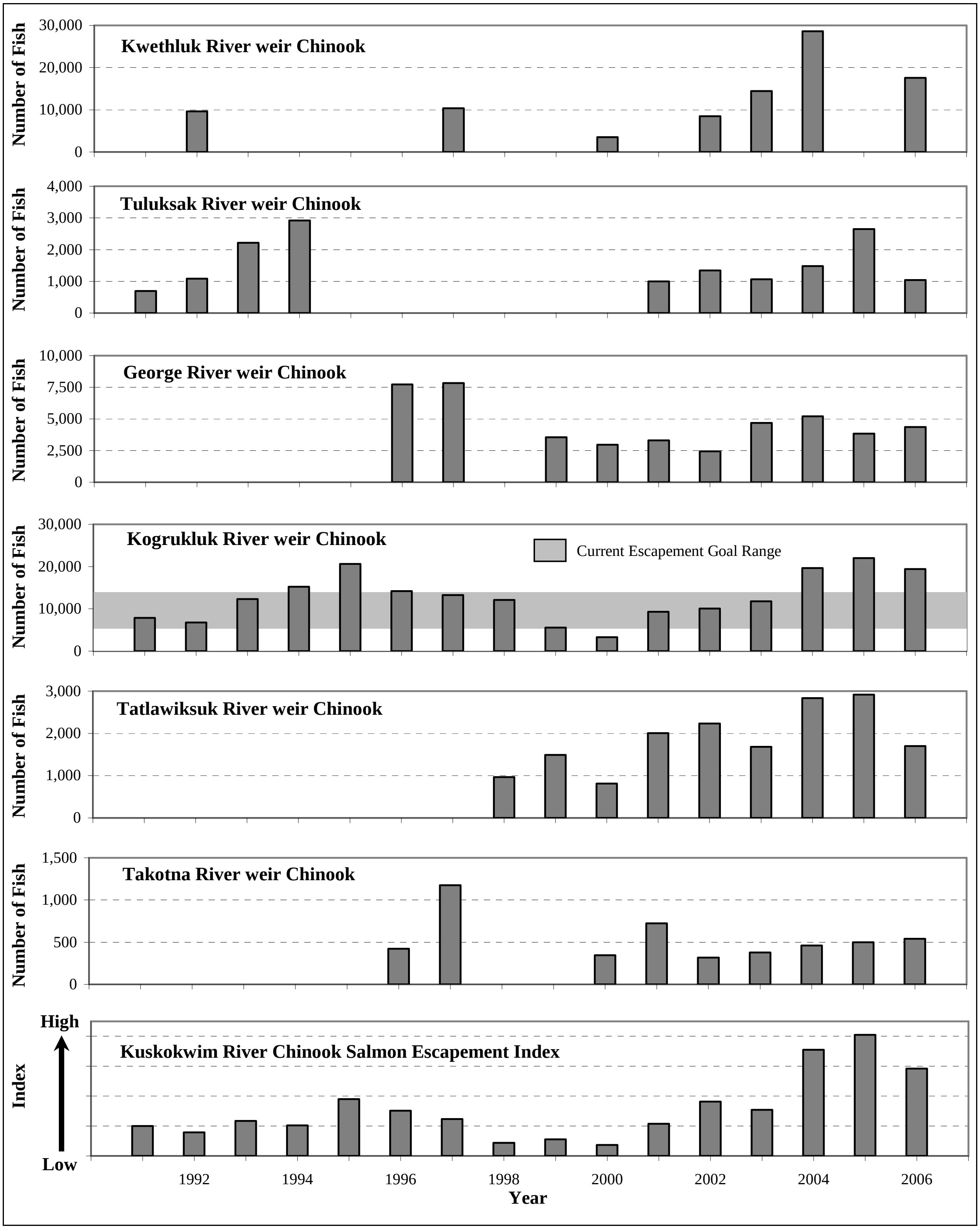


Figure 12.–Historical operational dates for Kogrukluk River weir.



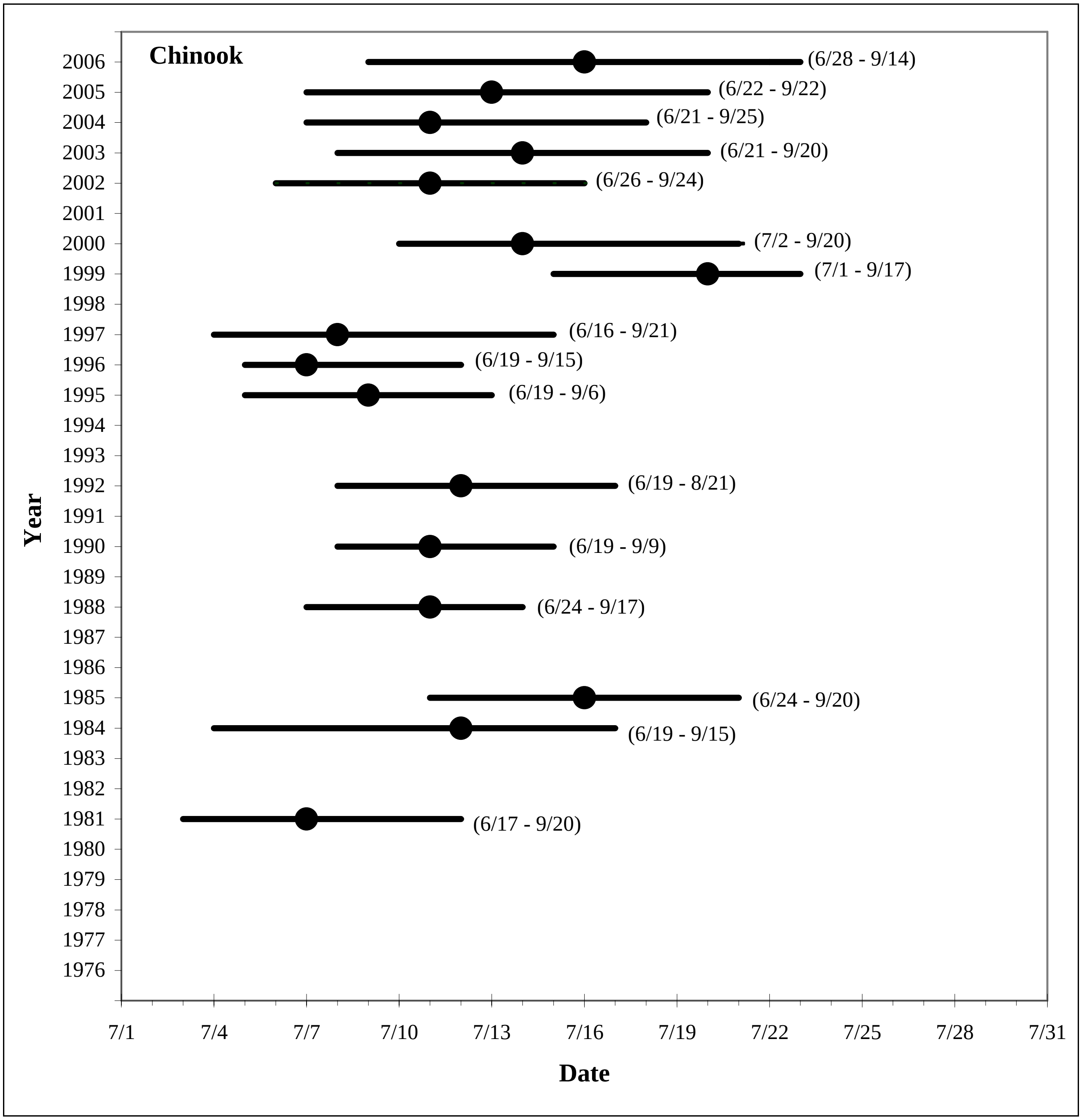
Note: Shaded bars are years when more than 20% of the escapement was estimated.

Figure 13.–Historical Chinook and chum salmon escapement with pre-2004 minimum escapement goal and current escapement goal range at Kogrukluk River weir.



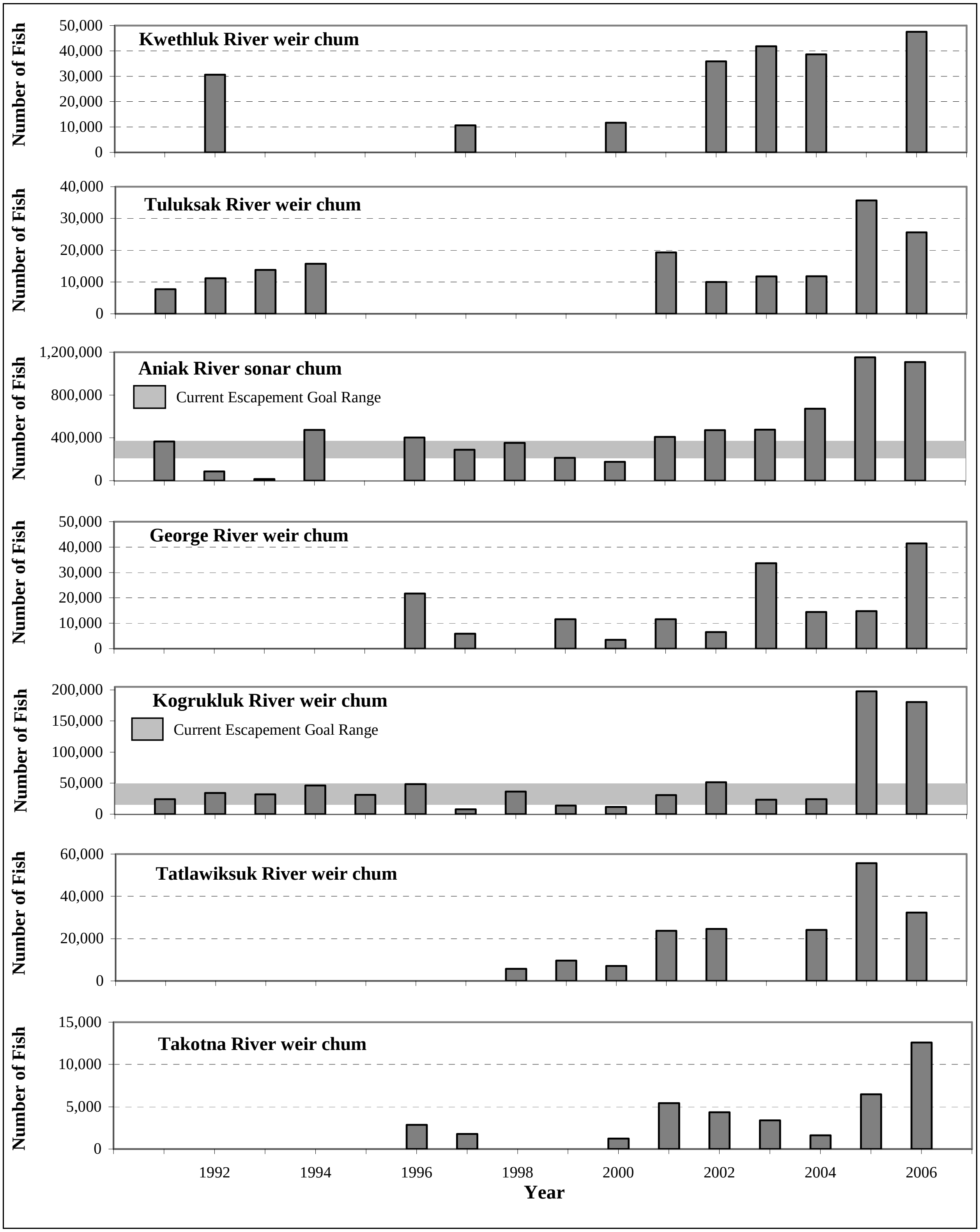
Source: Linderman and Bergstrom 2006.

Figure 14.–Historical Chinook salmon escapement into 6 Kuskokwim River tributaries, and the Kuskokwim River Chinook salmon escapement indices, 1991–2006.



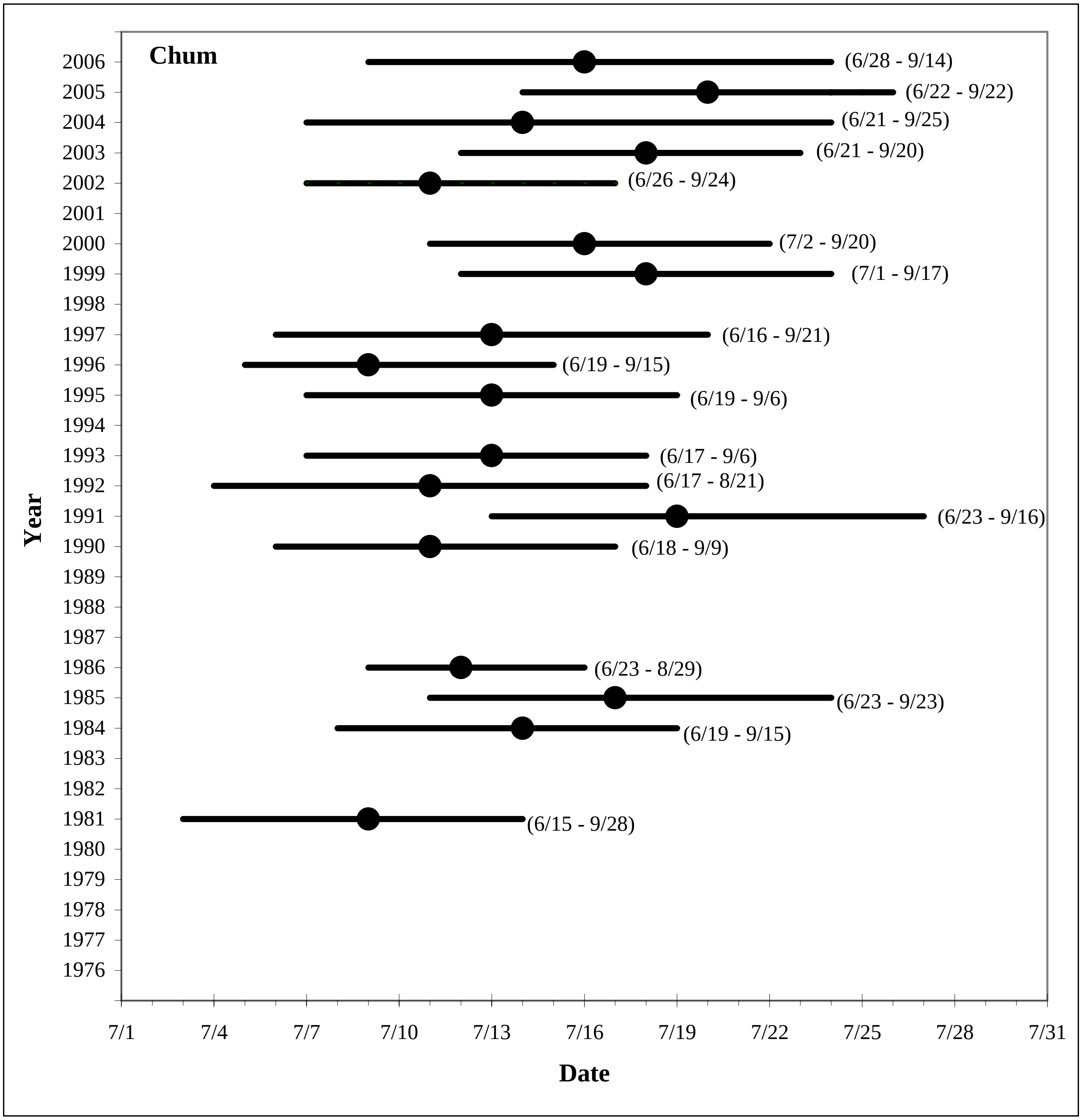
Note: Solid black lines represent dates when the central fifty percent of the run passed. Circles represent the median passage date. As a means to gauge the certainty of the run timing estimates, date ranges with escapement information (observed passage plus passage estimates) are in parentheses beside each annual line. Years when the weir was not operational for the bulk of the Chinook salmon run (1976-1980 and 1987) and/or include more than 20% estimated passage were excluded from the figure.

Figure 15.–Historical annual run timing of Chinook salmon based on cumulative percent passage at Kogrukluk River weir, 1976–2006.



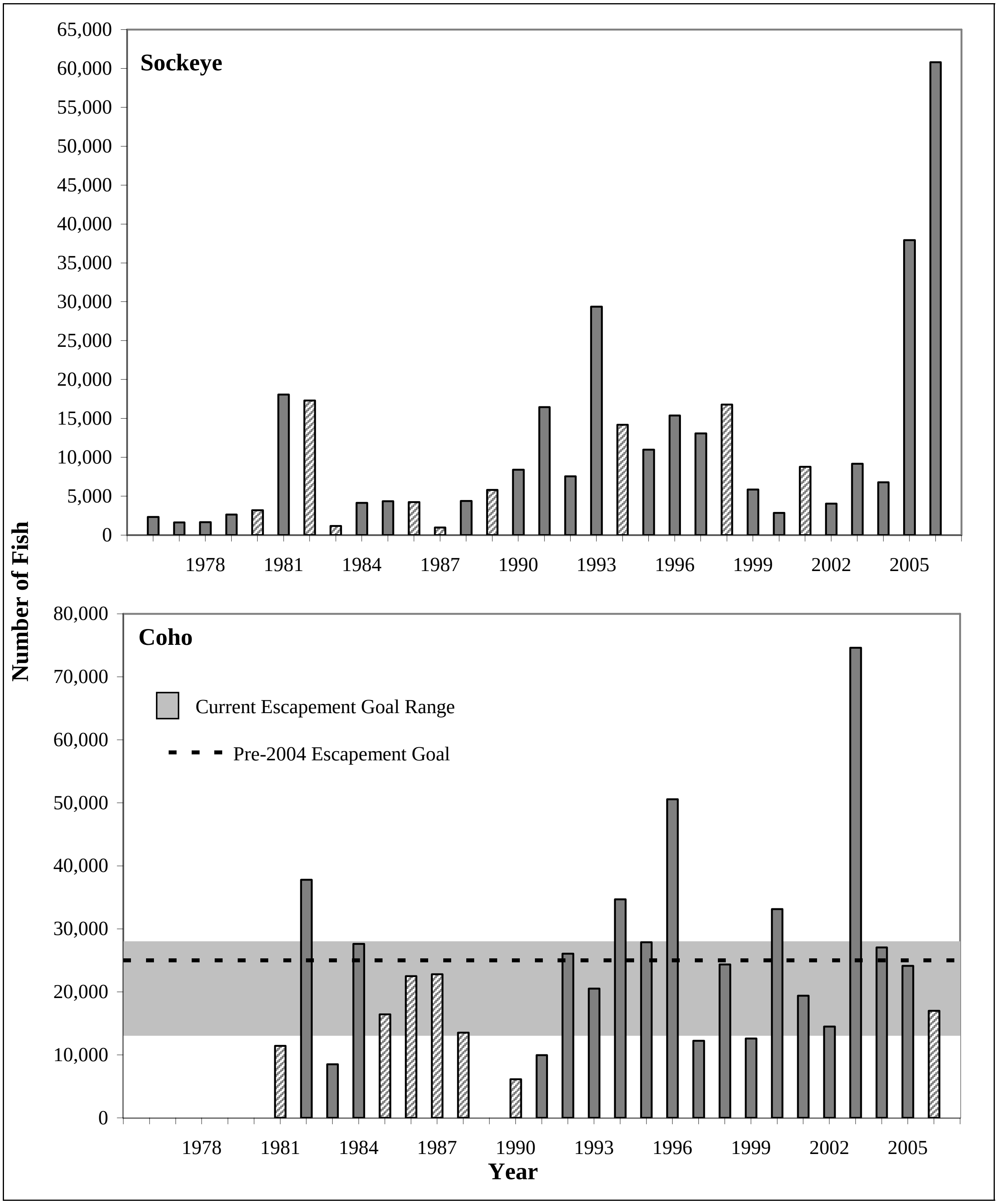
Source: Linderman and Bergstrom 2006.

Figure 16.–Historical chum salmon escapement into 7 Kuskokwim River tributaries, 1991-2006.



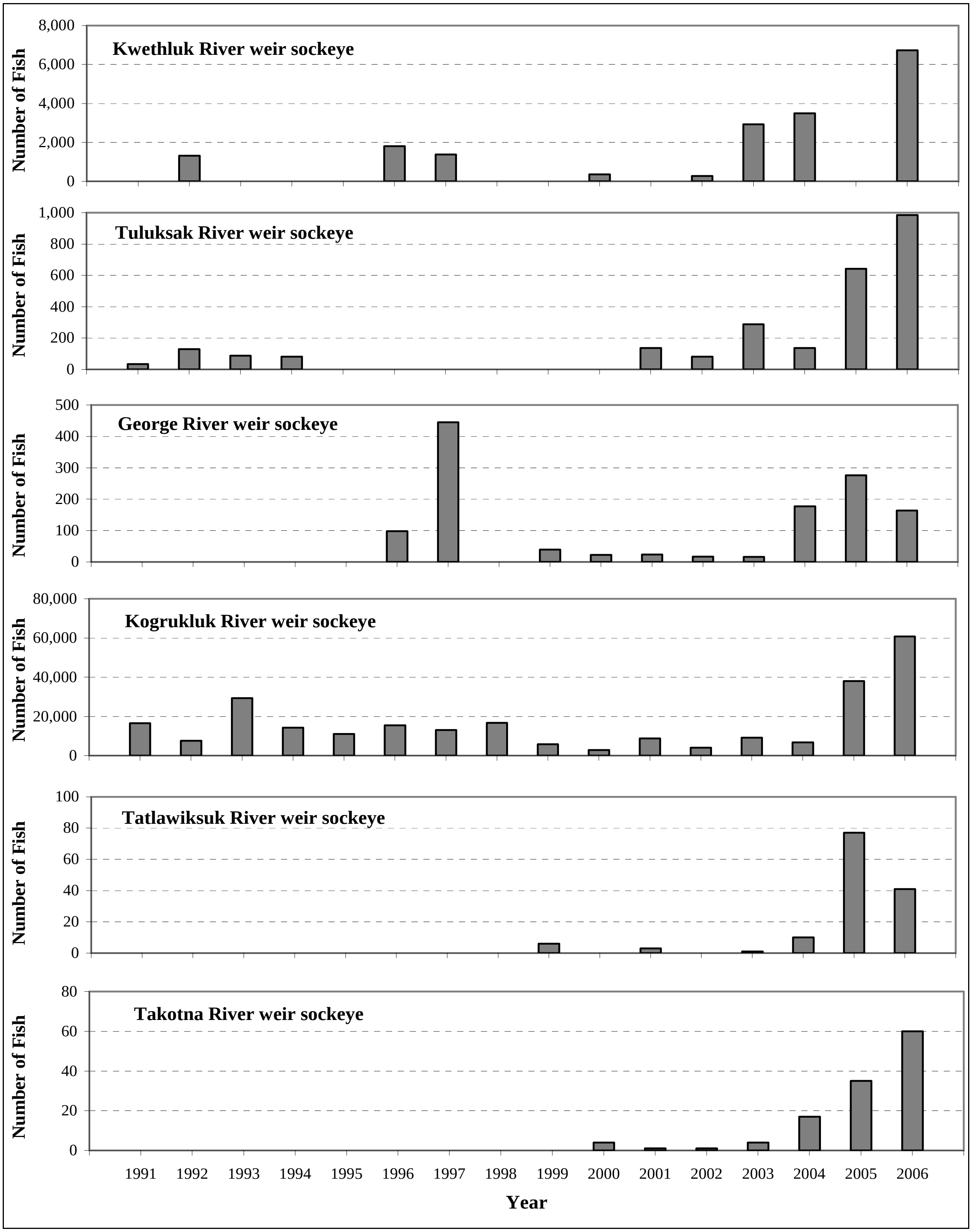
Note: Solid black lines represent dates when the central fifty percent of the run passed. Circles represent the median passage date. As a means to gauge the certainty of the run timing estimates, date ranges with escapement information (observed passage plus passage estimates) are in parentheses beside each annual line. Years when the weir was not operational for the bulk of the chum salmon run (1976–1980 and 1987) and/or include more than 20% estimated passage were excluded from the figure.

Figure 17.–Historical annual run timing of chum salmon based on cumulative percent passage at Kogrukluk River weir, 1976–2006.



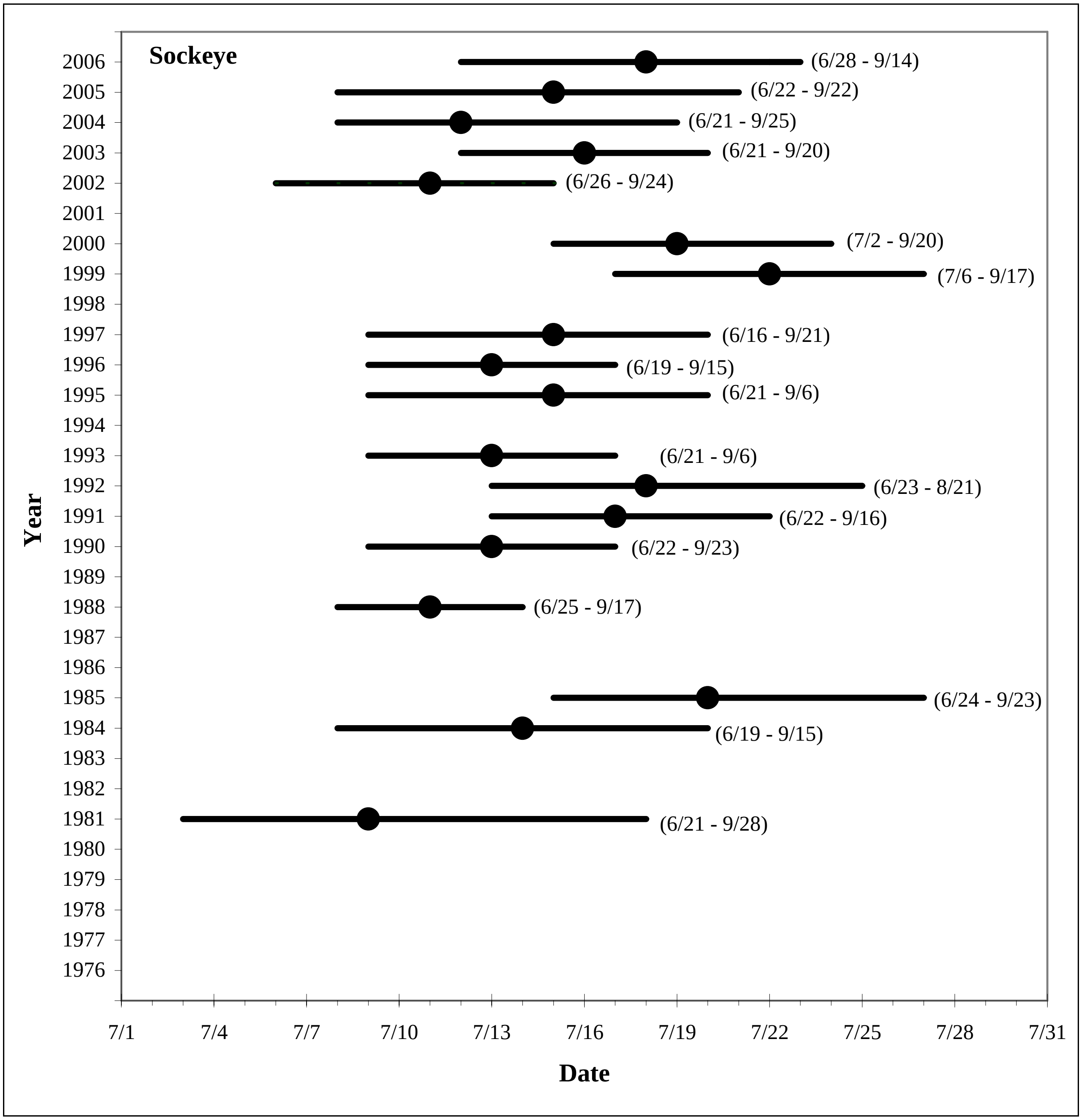
Note: Shaded bars are years when more than 20% of the escapement was estimated.

Figure 18.–Historical sockeye and coho salmon escapement with the pre-2004 minimum escapement goal and the current escapement goal range.



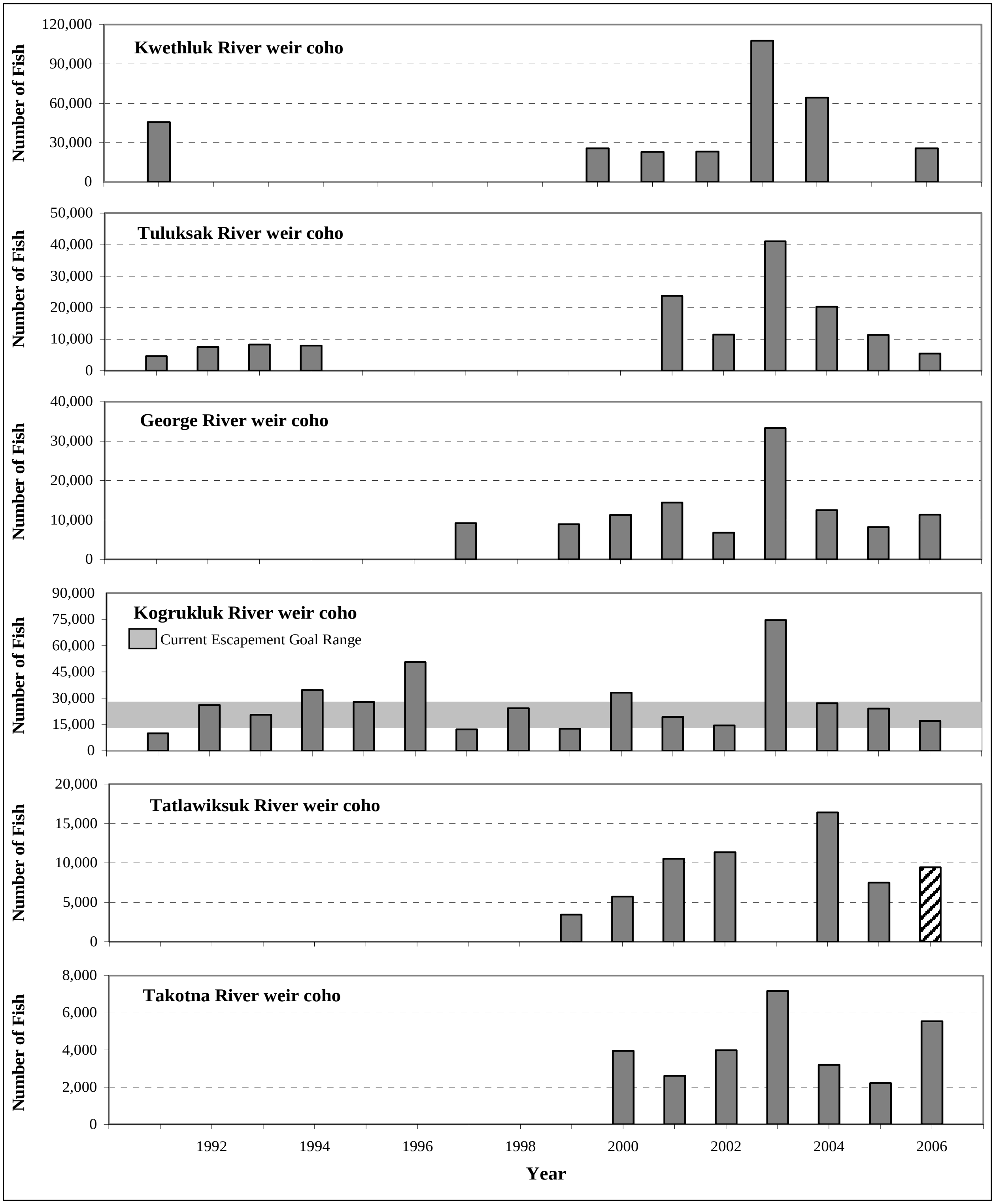
Source: Linderman and Bergstrom 2006.

Figure 19.–Historical Sockeye salmon escapement into 6 Kuskokwim River tributaries, 1991–2006.



Note: Solid black lines represent dates when the central fifty percent of the run passed. Circles represent the median passage date. As a means to gauge the certainty of the run timing estimates, date ranges with escapement information (observed passage plus passage estimates) are in parentheses beside each annual line. Years when the weir was not operational for the bulk of the sockeye salmon run (1976–1980 and 1987) and/or include more than 20% estimated passage were excluded from the figure.

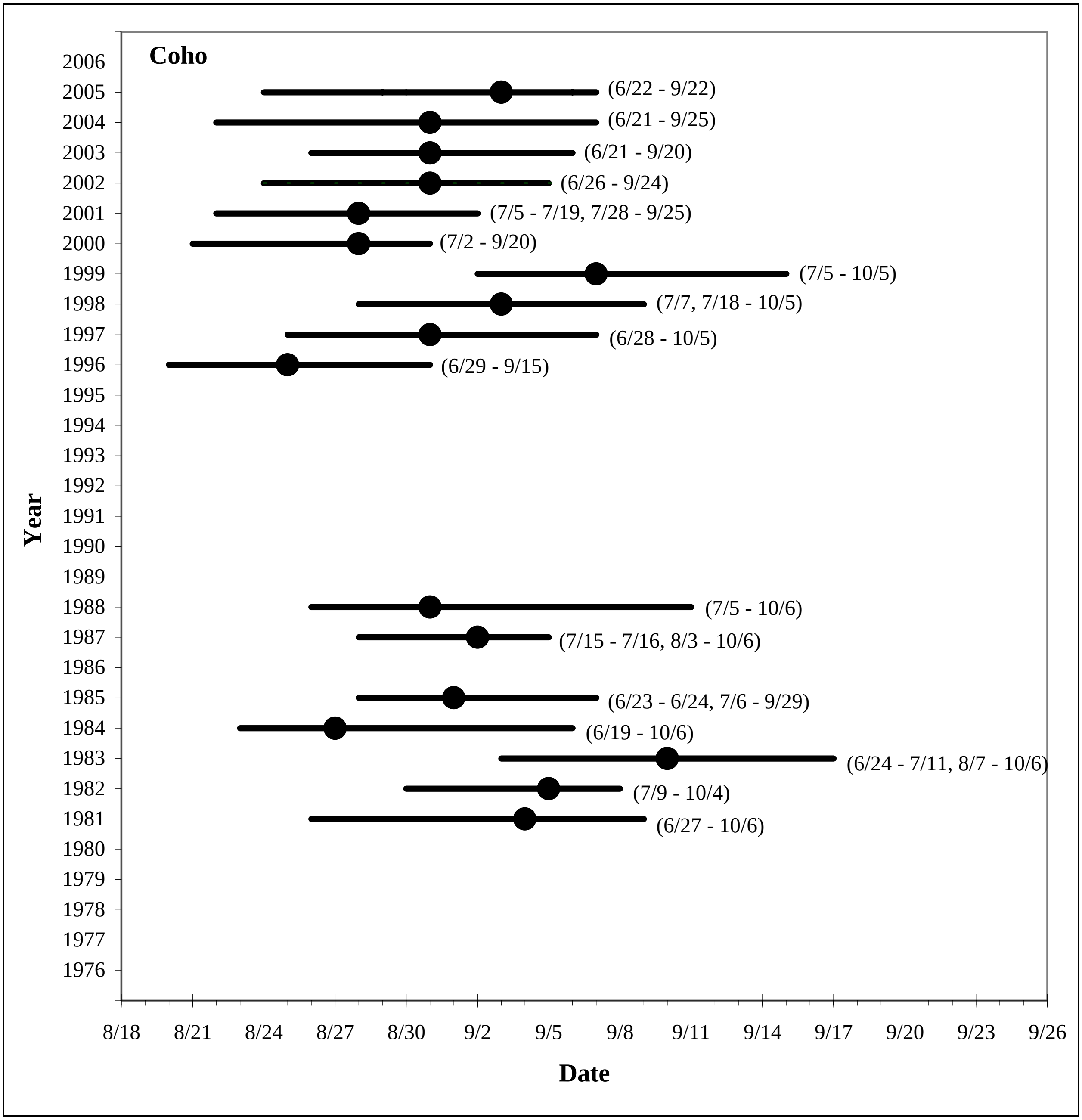
Figure 20.–Historical annual run timing of sockeye salmon based on cumulative percent passage at Kogrukluk River weir, 1976–2006.



Source: Linderman and Bergstrom 2006.

Note: The bar representing Tatlawiksuk River weir 2006 escapement is hatched because it includes 75% estimated escapement.

Figure 21.–ASL Historical coho salmon escapement into 6 Kuskokwim River tributaries, 1991–2006.



Note: Solid black lines represent dates when the central fifty percent of the run passed. Circles represent the median passage date. As a means to gauge the certainty of the run timing estimates, date ranges with escapement information (observed passage plus passage estimates) are in parentheses beside each annual line. Years when the weir was not operational for the bulk of the coho salmon run (1976–1980 and 1987) and/or include more than 20% estimated passage were excluded from the figure.

Figure 22.–Historical annual run timing of coho salmon based on cumulative percent passage at Kogrukluk River weir, 1976–2006.

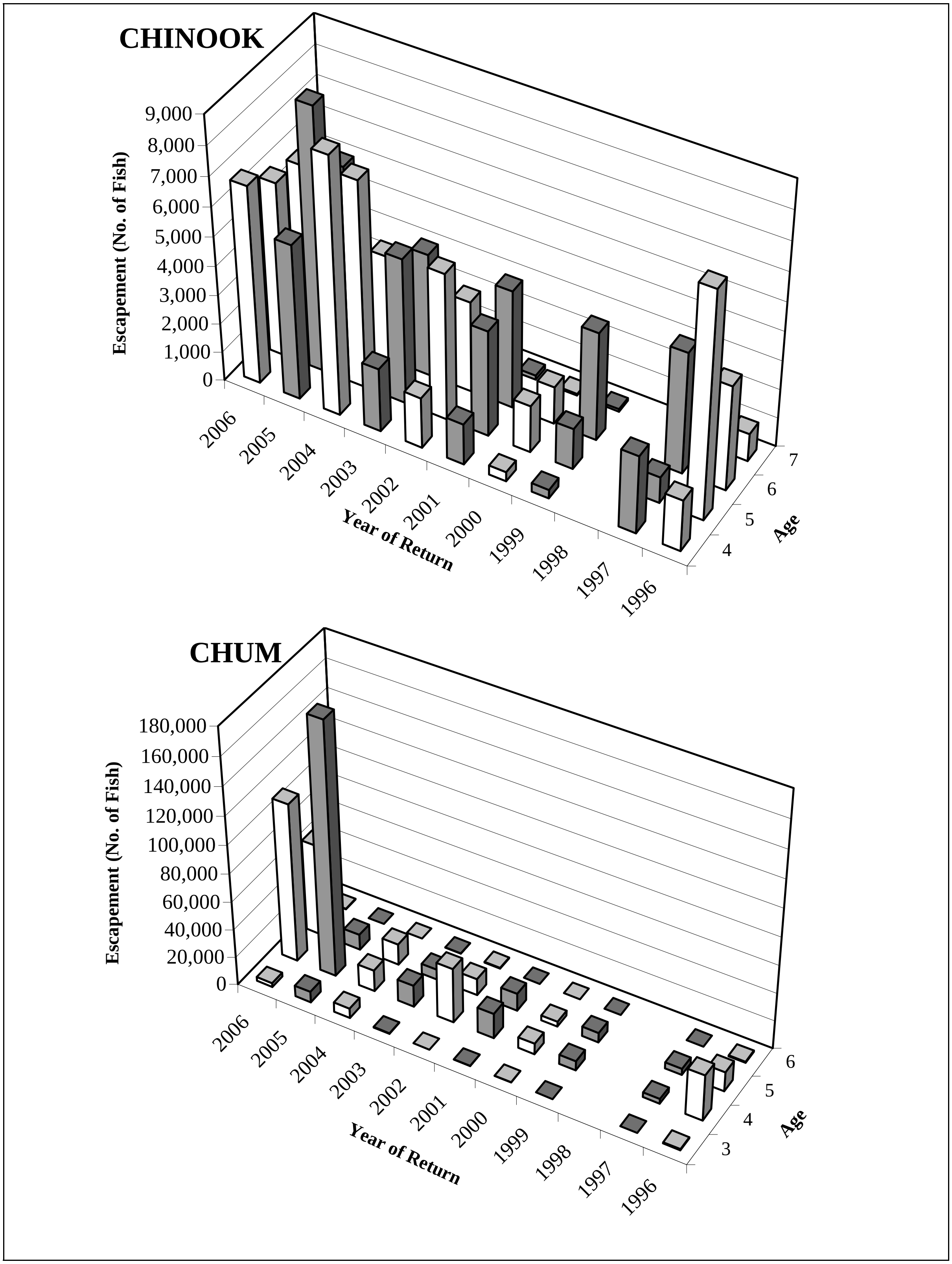


Figure 23.–Historical Chinook and chum salmon age distribution at Kogrukluk River weir.

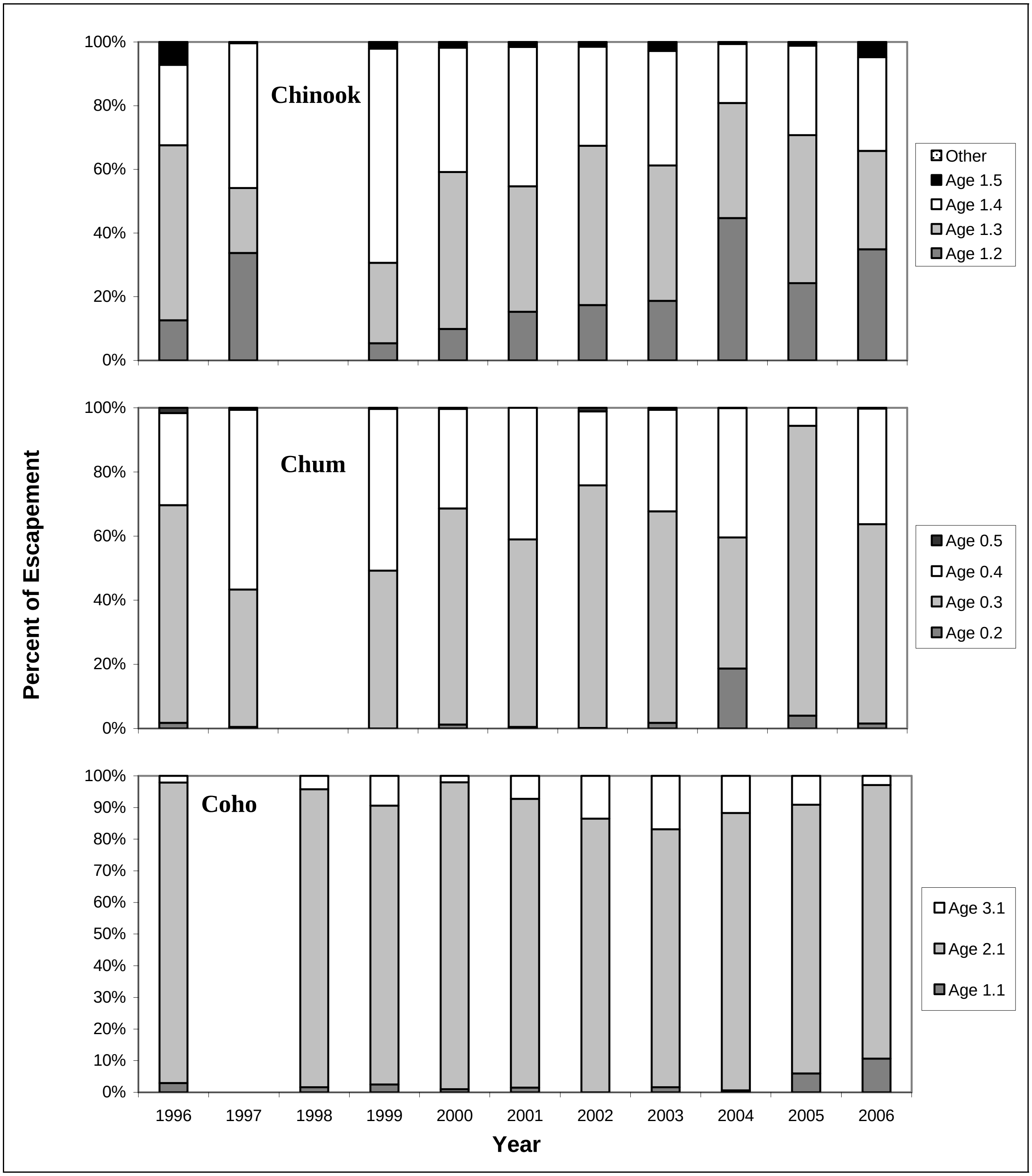
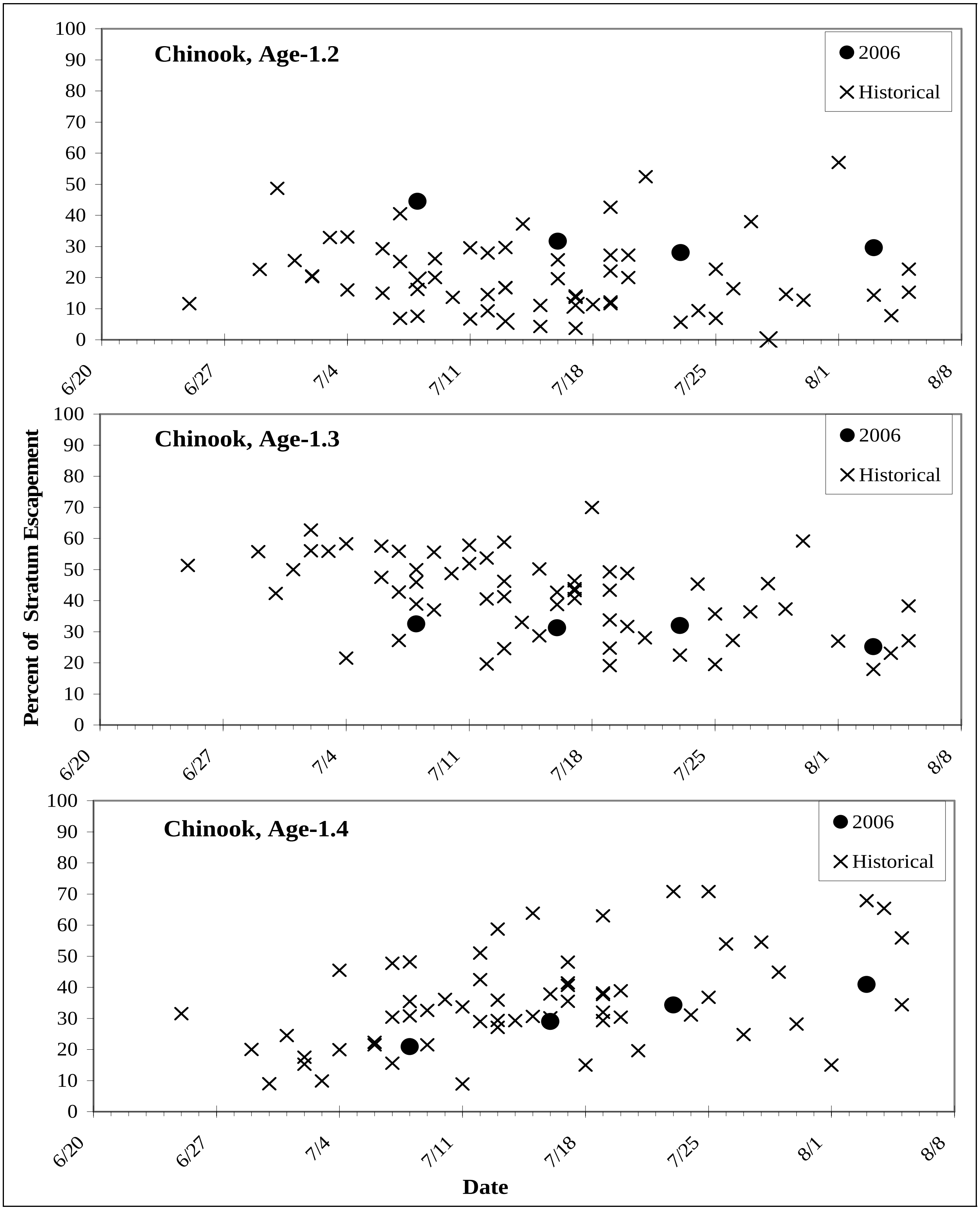
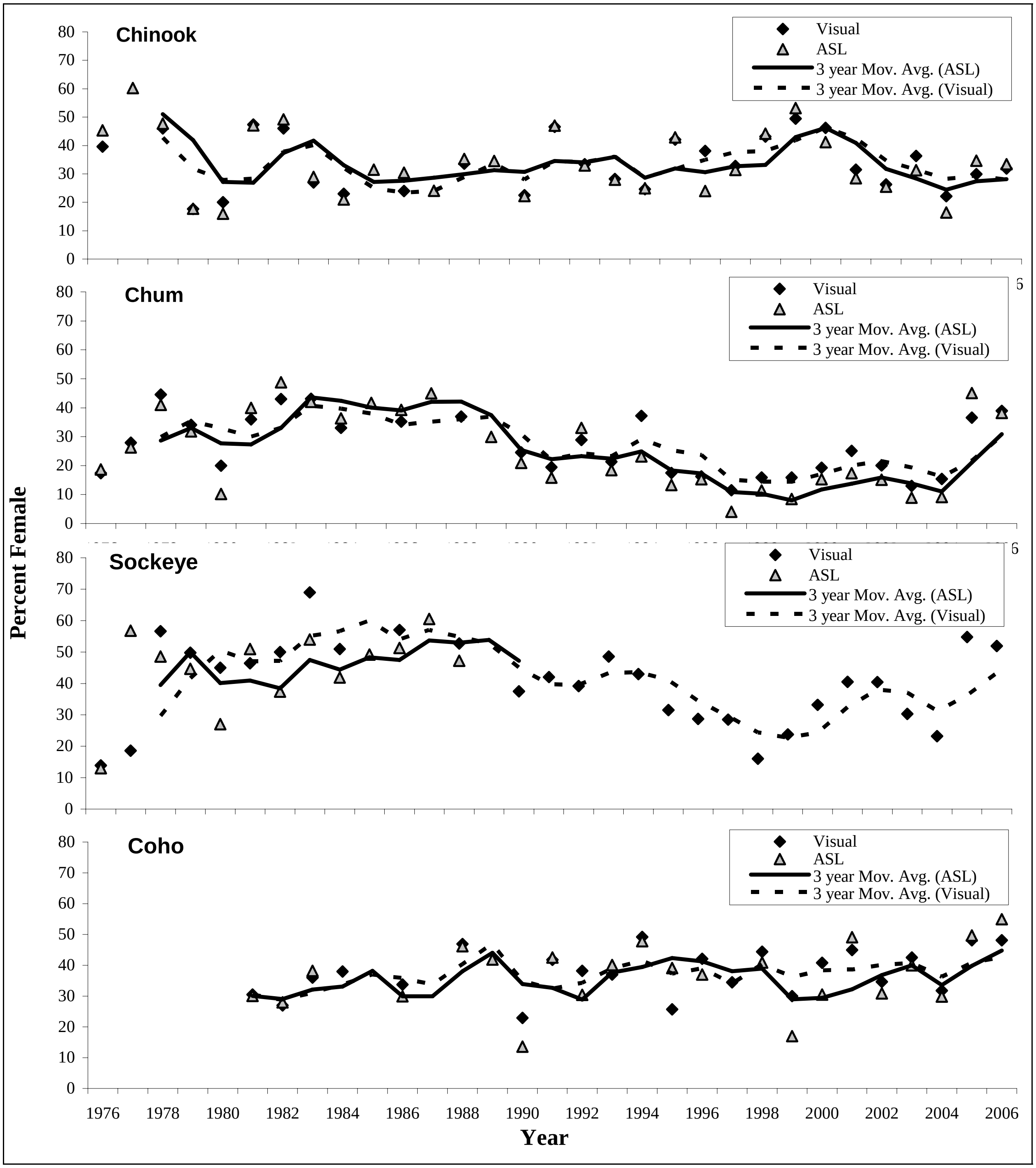


Figure 24.–Daily Historical age composition of Chinook, chum, and coho salmon at the Kogrukluk River weir, 1996–2006.



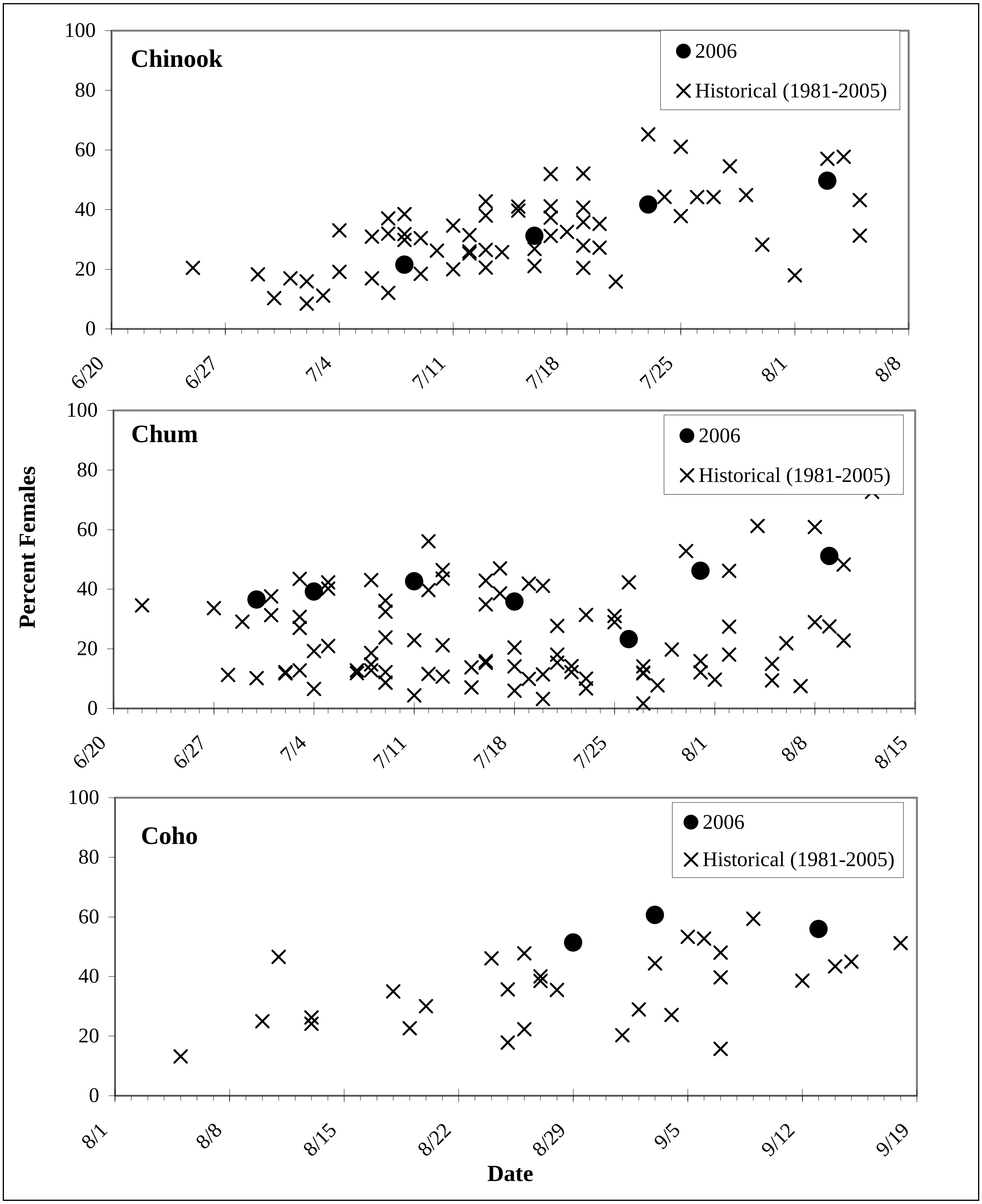
Note: Years when the weir was not operational for the bulk of the Chinook salmon run (1976–1980 and 1987) and/or include more than 20% estimated passage were excluded.

Figure 25.–Chinook historical age composition by date for Chinook salmon at Kogrukluk River weir.



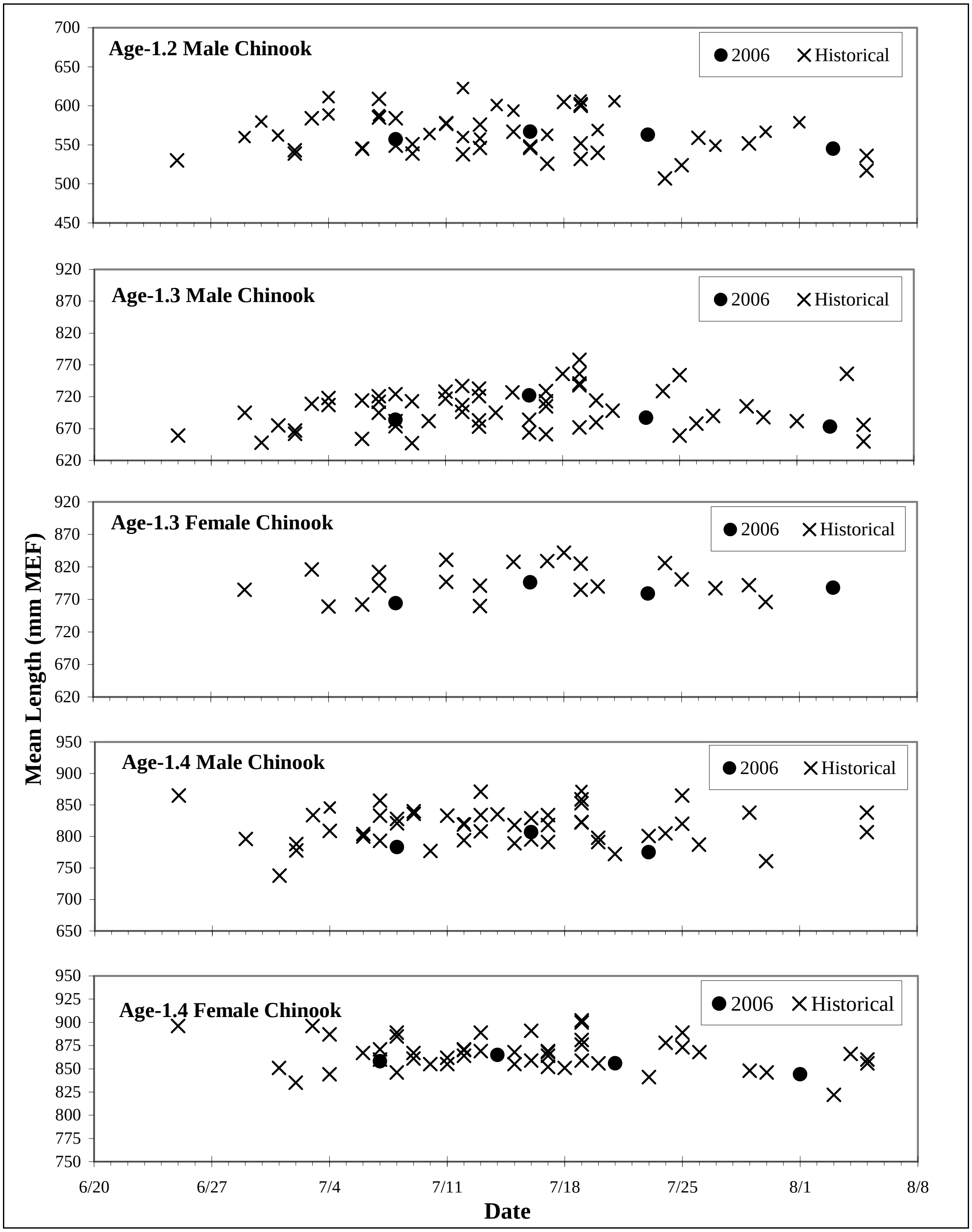
Note: Trend lines represent 3 year moving averages.

Figure 26.–Historical annual percentage of female salmon as determined by weighted ASL sampling and visual identification at Kogrukluk River weir.



Note: Years when the weir was not operational for the bulk of the salmon run for the graphed species and/or include more than 20% estimated passage were excluded.

Figure 27.–Historical percentage of female Chinook, chum, and coho salmon by date at Kogrukluk River weir.



Note: Years when the weir was not operational for the bulk of the Chinook salmon run (1976–1980 and 1987) and/or include more than 20% estimated passage were excluded.

Figure 28.–Historical intra-annual mean length at age of Chinook salmon by date at Kogrukluk River weir.

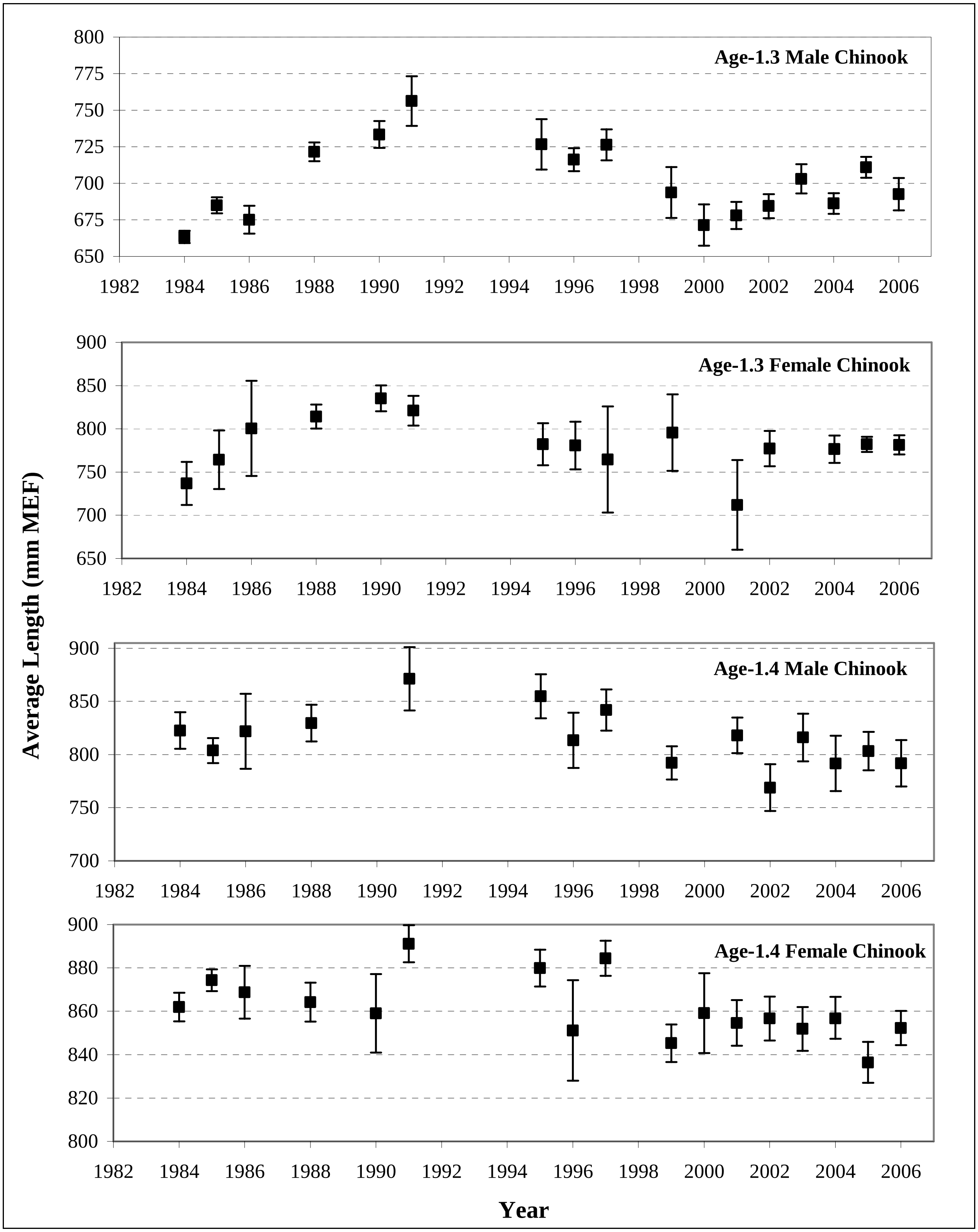


Figure 29.–Historical average annual length of Chinook salmon at Kogrukluk River weir with 95% confidence intervals.

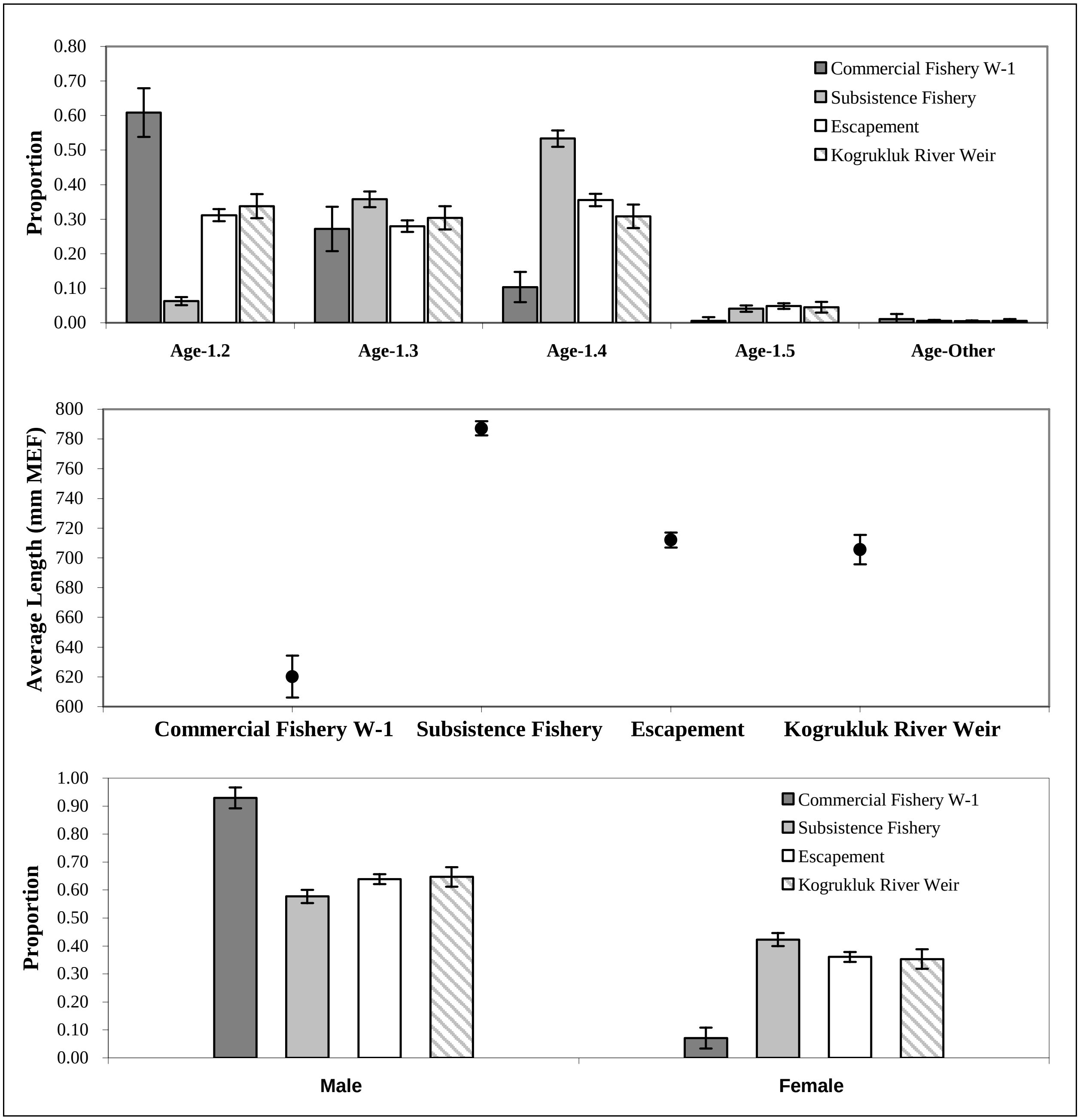
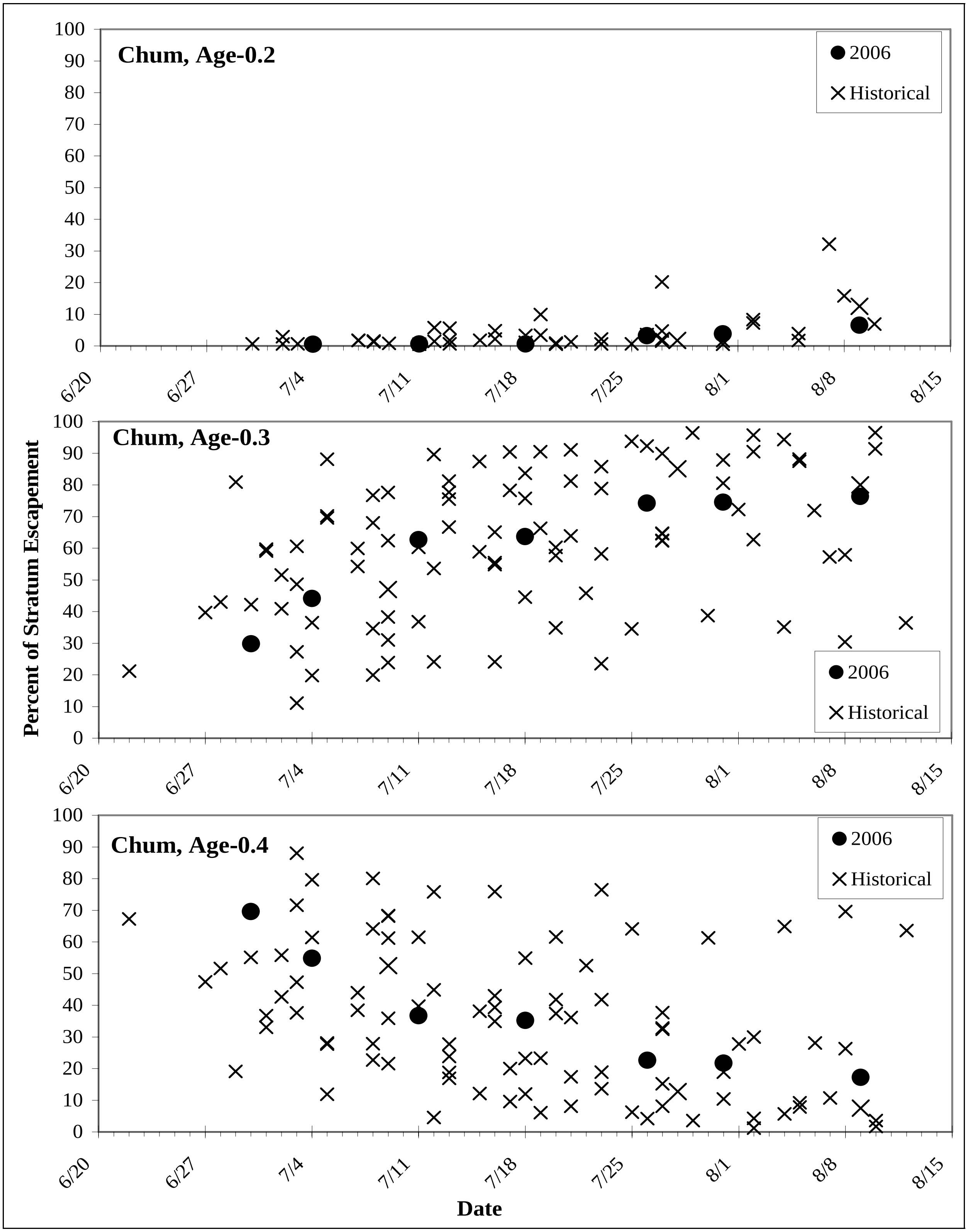
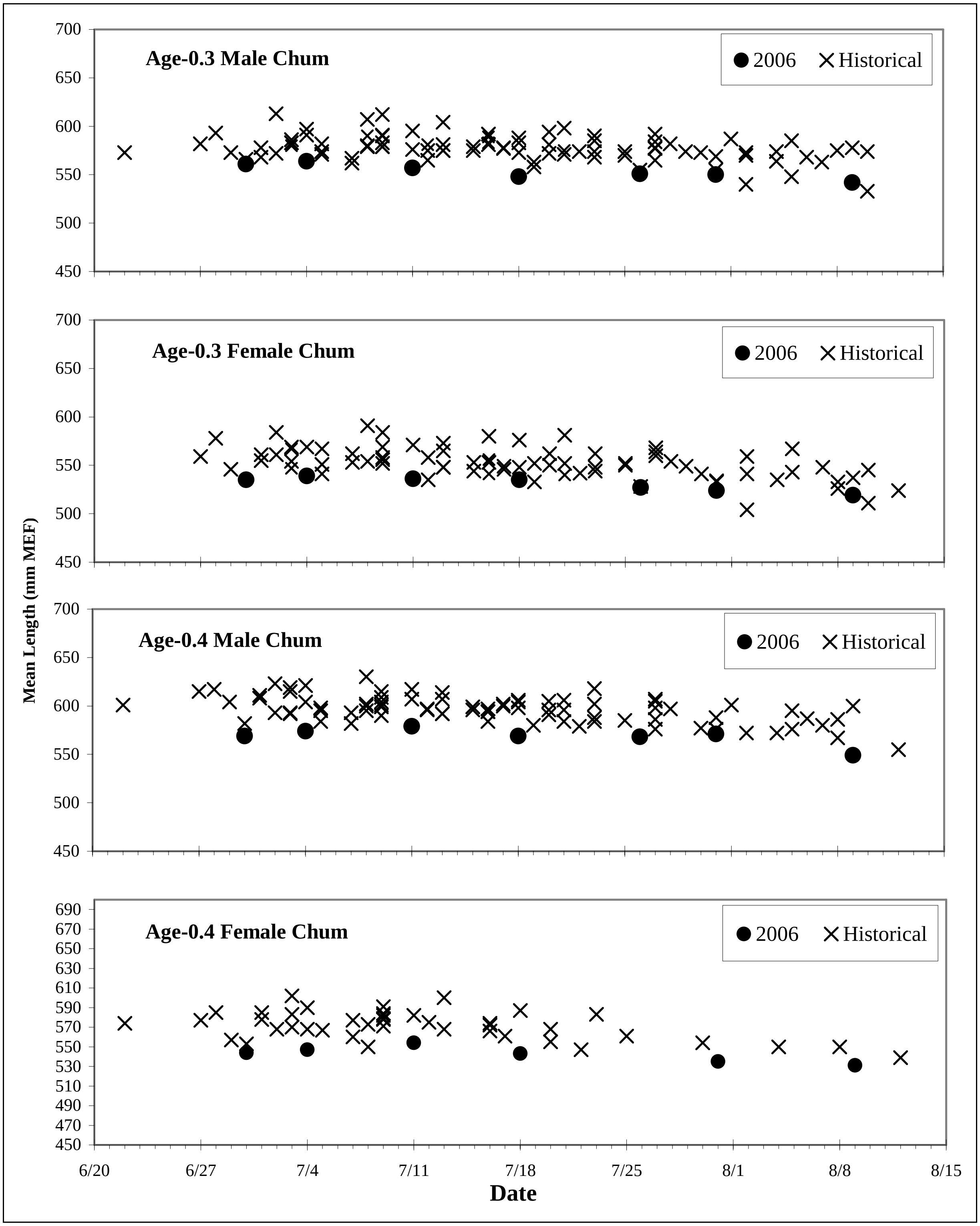


Figure 30.–ASL composition of the 2006 Kuskokwim River Chinook salmon commercial and subsistence harvests and total monitored escapement and Kogrukluk River weir with +/- 95% confidence interval.



Note: Years when the weir was not operational for the bulk of the chum salmon run (1976–1980 and 1987) and/or include more than 20% estimated passage were excluded.

Figure 31.–Historical age composition by date for chum salmon at Kogrukluk river weir.



Note: Years when the weir was not operational for the bulk of the chum salmon run (1976–1980 and 1987) and/or include more than 20% estimated passage were excluded.

Figure 32.–Historical intra-annual mean length at age of chum salmon by date at Kogrukluk River weir.

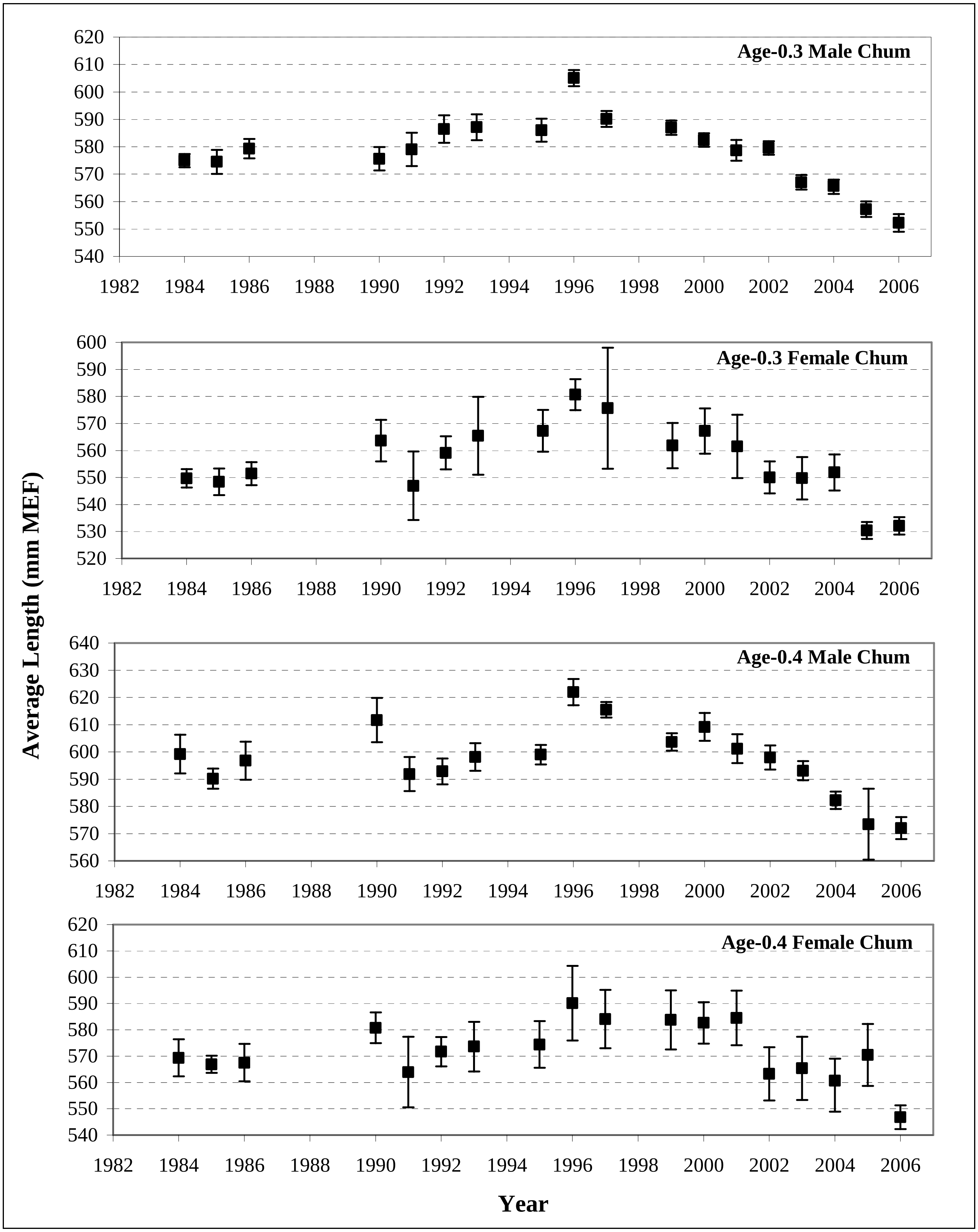


Figure 33.–Historical average annual length of chum salmon at Kogrukluk River weir with 95% confidence intervals.

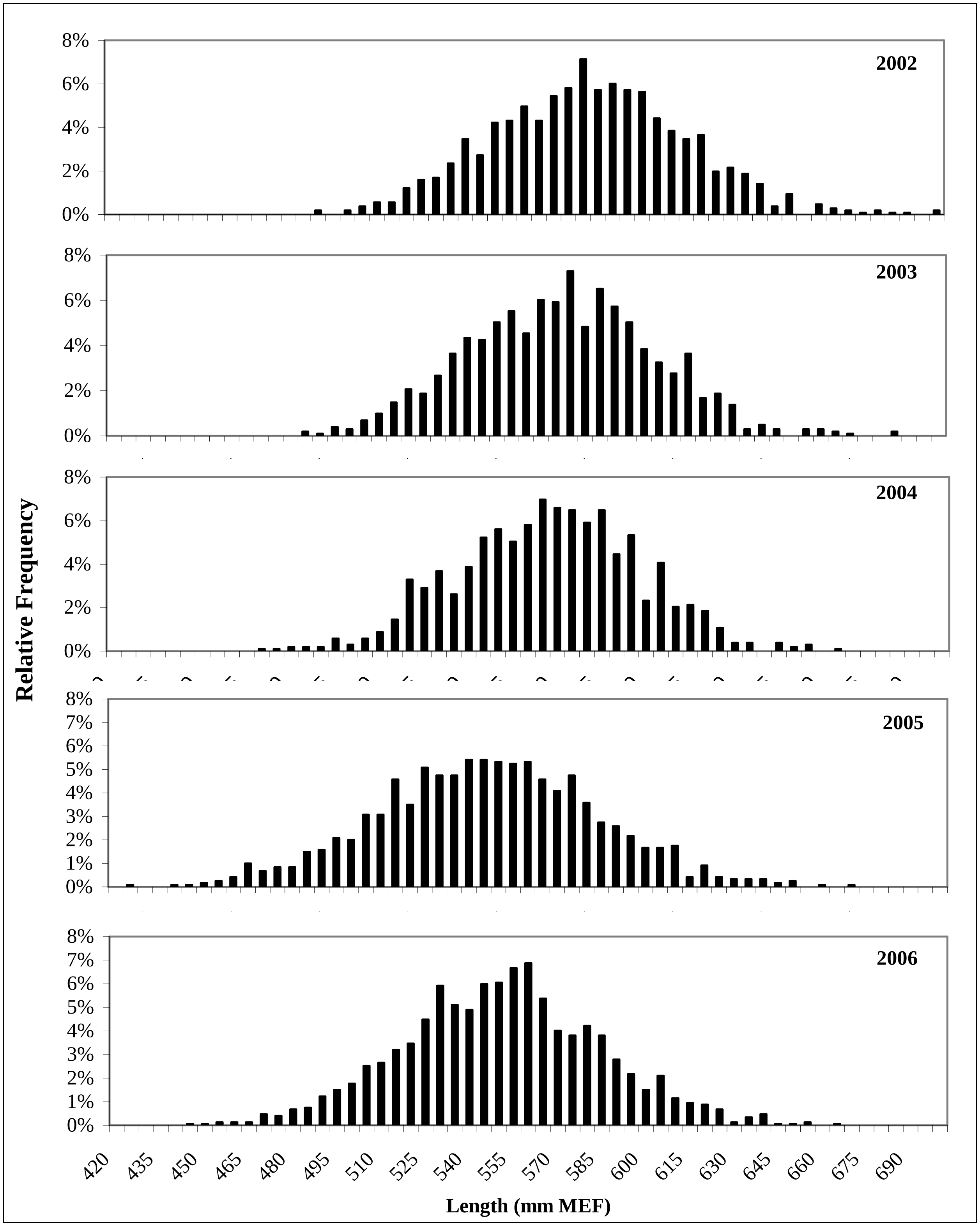
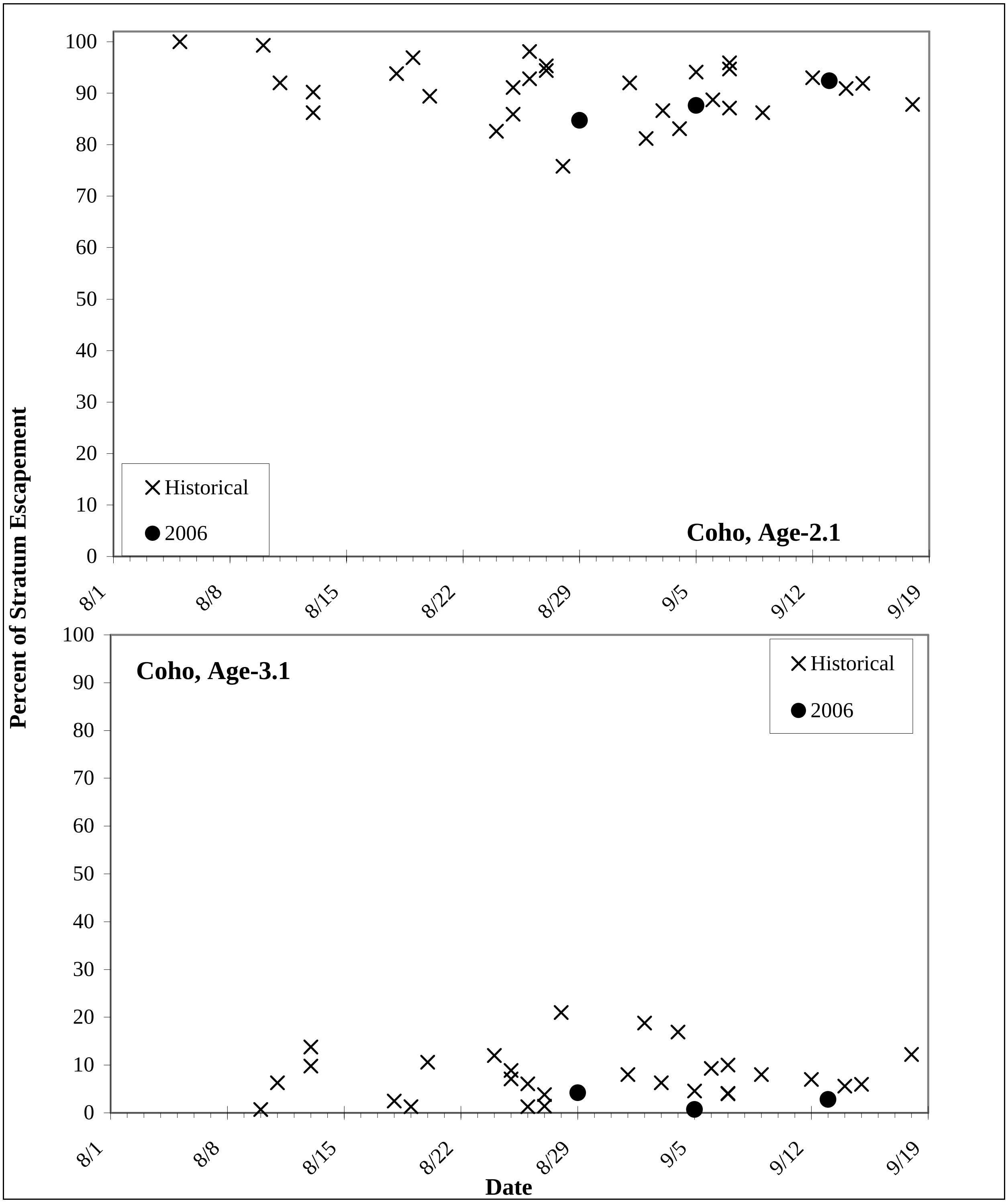
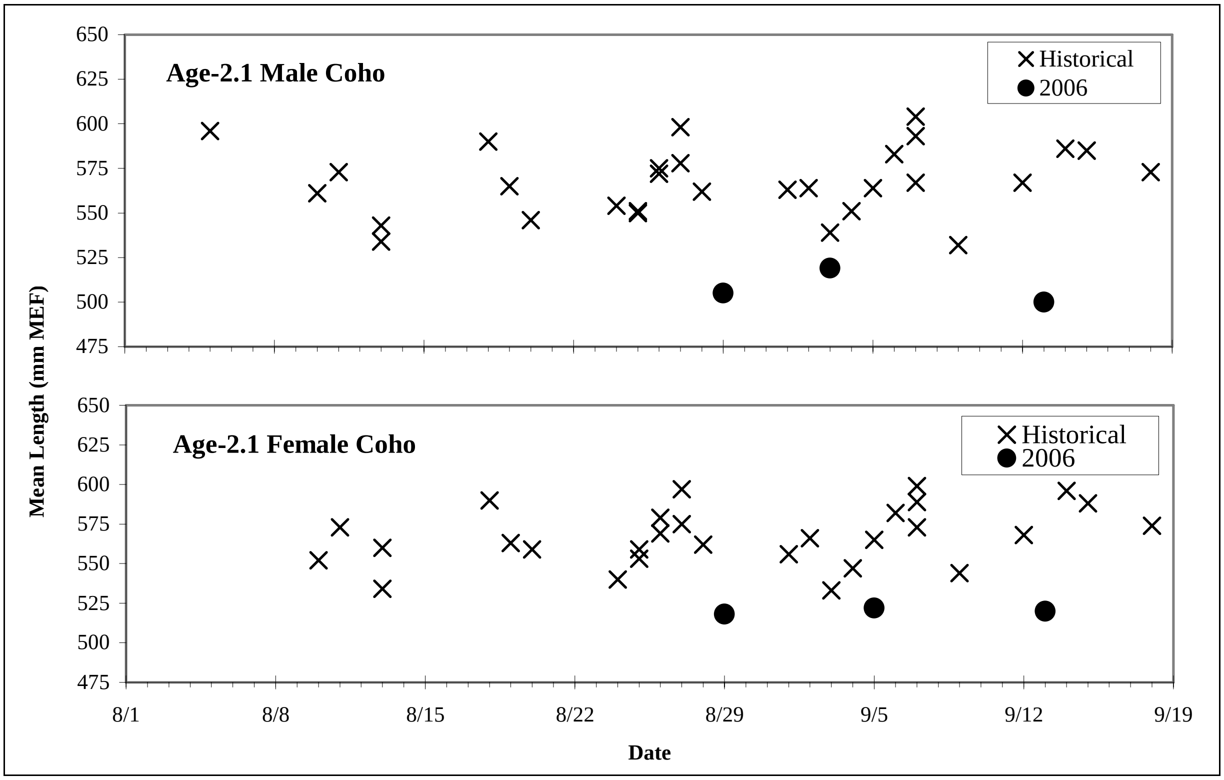


Figure 34.–Length frequency histograms for chum salmon at Kogrukluk River weir for 2002–2006.



Note: Years when the weir was not operational for the bulk of the coho salmon run (1976–1980 and 1987) and/or include more than 20% estimated passage were excluded. 2006 had more than 20% estimated passage but was included to assist in comparison.

Figure 35.–Historical age composition by date for coho salmon at Kogrukluk river weir.



Note: Years when the weir was not operational for the bulk of the coho salmon run (1976–1980 and 1987) and/or include more than 20% estimated passage were excluded. 2006 had more than 20% estimated passage but was included to assist in comparison.

Figure 36.–Historical intra-annual mean length at age of coho salmon by date at Kogrukluk River weir.

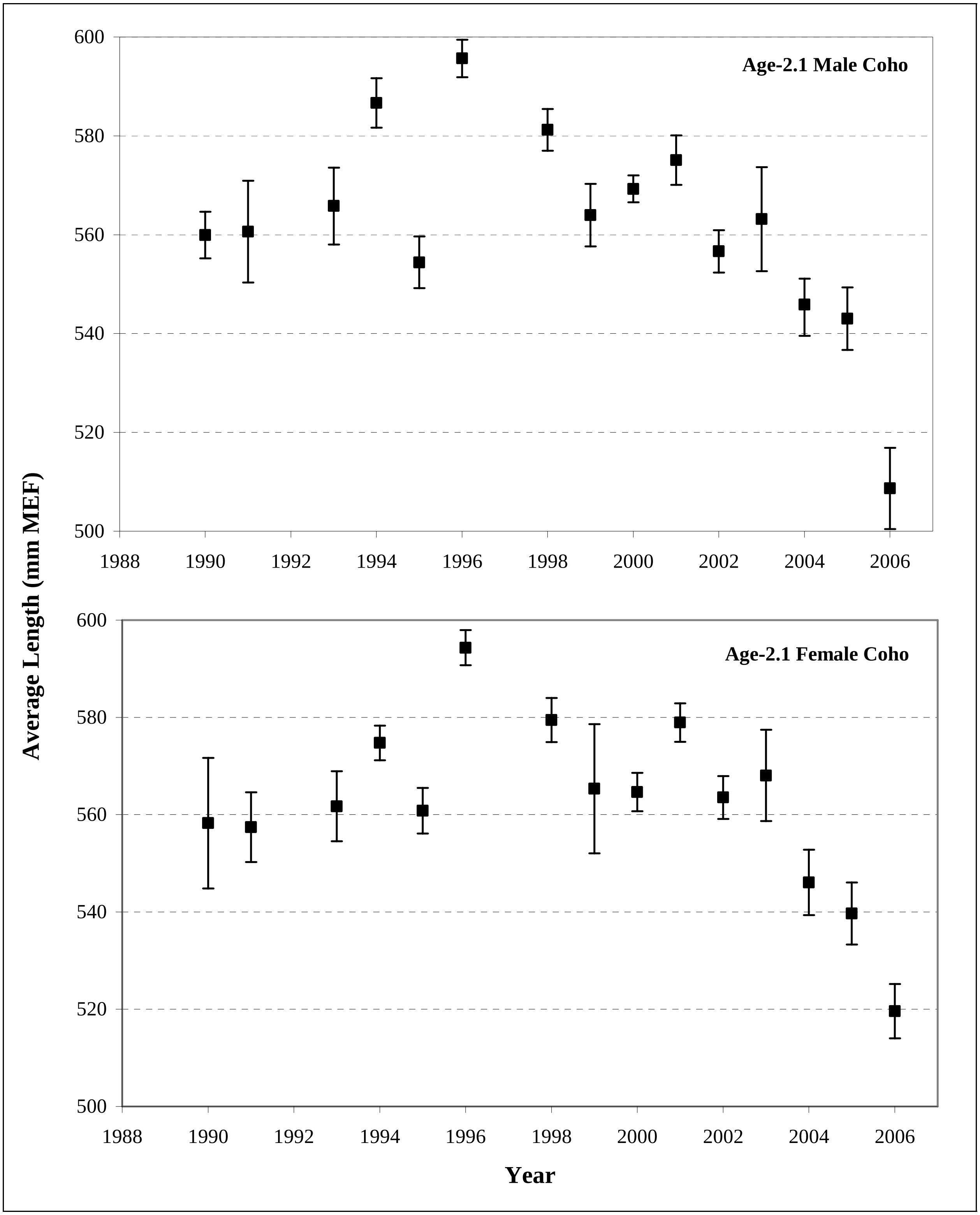


Figure 37.–Historical age average annual length for coho salmon with 95% confidence intervals at Kogrukluk River weir.

APPENDIX A. SALMON PASSAGE AT THE KOGRUKLUK RIVER WEIR, 2006

Appendix A1.–Daily, cumulative, and percent passage for Chinook, chum, coho, sockeye, and pink salmon at Kogrukluk River weir, 2006.

Date	Chinook Salmon			Chum Salmon			Coho Salmon			Sockeye Salmon			Pink Salmon		
	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage
28-Jun	0 [a]	0	0	336 [a]	336	0	0 [a]	0	0	5 [a]	5	0	0 [a]	0	0
29-Jun	6	6	0	957	1,293	1	0	0	0	8	13	0	0	0	0
30-Jun	25	31	0	1,351	2,644	1	0	0	0	47	60	0	0	0	0
1-Jul	80	111	1	2,042	4,686	3	0	0	0	163	223	0	0	0	0
2-Jul	233	344	2	2,503	7,189	4	0	0	0	260	483	1	1	1	0
3-Jul	195	539	3	3,216	10,405	6	0	0	0	436	919	2	2	3	0
4-Jul	631	1,170	6	4,833	15,238	8	0	0	0	1,249	2,168	4	3	6	0
5-Jul	511	1,681	9	6,799	22,037	12	0	0	0	842	3,010	5	4	10	1
6-Jul	640	2,321	12	7,720	29,757	16	0	0	0	1,341	4,351	7	3	13	1
7-Jul	655	2,976	15	6,412	36,169	20	0	0	0	1,095	5,446	9	0	13	1
8-Jul	1,040	4,016	21	7,435	43,604	24	0	0	0	1,474	6,920	11	7	20	1
9-Jul	752	4,768	25	5,954	49,558	27	0	0	0	2,259	9,179	15	3	23	1
10-Jul	848	5,616	29	7,137	56,695	31	0	0	0	2,123	11,302	19	8	31	2
11-Jul	409	6,025	31	5,007	61,702	34	0	0	0	1,344	12,646	21	6	37	2
12-Jul	759	6,784	35	6,614	68,316	38	0	0	0	2,319	14,965	25	7	44	3
13-Jul	517	7,301	38	5,894	74,210	41	0	0	0	1,531	16,496	27	9	53	3
14-Jul	586	7,887	41	5,028	79,238	44	0	0	0	2,388	18,884	31	5	58	3
15-Jul	629	8,516	44	4,653	83,891	46	0	0	0	2,620	21,504	35	2	60	4
16-Jul	1,233	9,749	50	5,891	89,782	50	0	0	0	4,137	25,641	42	7	67	4
17-Jul	611	10,360	53	4,762	94,544	52	0	0	0	2,690	28,331	47	2	69	4
18-Jul	512	10,872	56	5,823	100,367	56	0	0	0	1,834	30,165	50	4	73	4
19-Jul	562	11,434	59	7,326	107,693	60	0	0	0	2,103	32,268	53	6	79	5
20-Jul	1,082	12,516	64	7,210	114,903	64	0	0	0	4,664	36,932	61	3	82	5
21-Jul	647	13,163	68	7,669	122,572	68	0	0	0	3,476	40,408	66	6	88	5
22-Jul	585	13,748	71	5,947	128,519	71	0	0	0	3,419	43,827	72	4	92	5
23-Jul	883	14,631	75	5,582	134,101	74	2	2	0	2,720	46,547	77	6	98	6
24-Jul	547	15,178	78	4,496	138,597	77	29	31	0	1,755	48,302	79	6	104	6
25-Jul	823	16,001	82	4,246	142,843	79	42	73	0	1,370	49,672	82	12	116	7
26-Jul	370	16,371	84	3,684	146,527	81	10	83	0	1,382	51,054	84	8	124	7
27-Jul	350	16,721	86	3,549	150,076	83	10	93	1	1,032	52,086	86	5	129	8
28-Jul	445	17,166	88	2,916	152,992	85	7	100	1	859	52,945	87	9	138	8
29-Jul	418	17,584	91	2,291	155,283	86	9	109	1	1,164	54,109	89	11	149	9
30-Jul	274	17,858	92	2,329	157,612	87	11	120	1	470	54,579	90	18	167	10
31-Jul	249	18,107	93	2,422	160,034	89	18	138	1	634	55,213	91	27	194	12

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Appendix A1.–Page 2 of 3.

Date	Chinook Salmon			Chum Salmon			Coho Salmon			Sockeye Salmon			Pink Salmon		
	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage
1-Aug	186	18,293	94	2,203	162,237	90	12	150	1	437	55,650	92	15	209	12
2-Aug	169	18,462	95	2,318	164,555	91	25	175	1	472	56,122	92	28	237	14
3-Aug	162	18,624	96	2,500	167,055	93	43	218	1	647	56,769	93	42	279	17
4-Aug	127	18,751	97	2,216	169,271	94	65	283	2	696	57,465	95	51	330	20
5-Aug	161	18,912	97	2,071	171,342	95	103	386	2	780	58,245	96	74	404	24
6-Aug	63	18,975	98	1,362	172,704	96	67	453	3	513	58,758	97	52	456	27
7-Aug	62	19,037	98	1,039	173,743	96	106	559	3	289	59,047	97	107	563	34
8-Aug	38	19,075	98	1,011	174,754	97	89	648	4	233	59,280	97	78	641	38
9-Aug	17	19,092	98	476	175,230	97	65	713	4	143	59,423	98	61	702	42
10-Aug	22	19,114	98	524	175,754	97	58	771	5	102	59,525	98	87	789	47
11-Aug	39	19,153	99	601	176,355	98	206	977	6	178	59,703	98	117	906	54
12-Aug	29 [b]	19,182	99	527 [b]	176,882	98	156 [b]	1,133	7	131 [b]	59,834	98	96 [b]	1,002	60
13-Aug	27 [b]	19,208	99	491 [b]	177,372	98	181 [b]	1,314	8	123 [b]	59,957	99	89 [b]	1,091	65
14-Aug	25 [b]	19,233	99	455 [b]	177,827	98	205 [b]	1,520	9	114 [b]	60,071	99	83 [b]	1,173	70
15-Aug	23 [b]	19,256	99	419 [b]	178,245	99	230 [b]	1,750	10	105 [b]	60,176	99	76 [b]	1,249	75
16-Aug	21 [b]	19,278	99	383 [b]	178,628	99	254 [b]	2,004	12	96 [b]	60,272	99	70 [b]	1,319	79
17-Aug	19 [b]	19,297	99	347 [b]	178,974	99	279 [b]	2,283	13	88 [b]	60,360	99	63 [b]	1,382	82
18-Aug	17 [b]	19,314	99	311 [b]	179,285	99	303 [b]	2,586	15	79 [b]	60,438	99	57 [b]	1,438	86
19-Aug	16 [b]	19,330	100	275 [b]	179,559	99	328 [b]	2,914	17	70 [b]	60,509	100	50 [b]	1,488	89
20-Aug	14 [b]	19,344	100	239 [b]	179,798	100	352 [b]	3,266	19	61 [b]	60,570	100	44 [b]	1,532	91
21-Aug	12 [b]	19,355	100	203 [b]	180,000	100	377 [b]	3,643	21	53 [b]	60,623	100	37 [b]	1,569	94
22-Aug	10 [b]	19,365	100	167 [b]	180,167	100	401 [b]	4,044	24	44 [b]	60,667	100	31 [b]	1,599	95
23-Aug	8 [b]	19,373	100	131 [b]	180,297	100	426 [b]	4,469	26	35 [b]	60,702	100	24 [b]	1,623	97
24-Aug	6 [b]	19,380	100	95 [b]	180,392	100	450 [b]	4,919	29	26 [b]	60,728	100	18 [b]	1,641	98
25-Aug	4 [c]	19,384	100	59 [c]	180,450	100	475 [c]	5,394	32	18 [c]	60,746	100	11 [c]	1,652	99
26-Aug	1	19,385	100	26	180,476	100	548	5,942	35	10	60,756	100	6	1,658	99
27-Aug	4	19,389	100	19	180,495	100	450	6,392	38	8	60,764	100	3	1,661	99
28-Aug	5	19,394	100	12	180,507	100	600	6,992	41	5	60,769	100	5	1,666	99
29-Aug	3	19,397	100	11	180,518	100	752	7,744	46	3	60,772	100	5	1,671	100
30-Aug	1	19,398	100	9	180,527	100	427	8,171	48	4	60,776	100	2	1,673	100
31-Aug	0	19,398	100	11	180,538	100	638	8,809	52	1	60,777	100	0	1,673	100
1-Sep	4	19,402	100	8	180,546	100	635	9,444	56	1	60,778	100	0	1,673	100
2-Sep	1	19,403	100	5	180,551	100	869	10,313	61	2	60,780	100	0	1,673	100

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Appendix A1.–Page 3 of 3.

Date	Chinook Salmon			Chum Salmon			Coho Salmon			Sockeye Salmon			Pink Salmon		
	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage	Daily	Cum.	Percent Passage
3-Sep	1	19,404	100	8	180,559	100	752	11,065	65	2	60,782	100	0	1,673	100
4-Sep	0	19,404	100	3	180,562	100	604	11,669	69	2	60,784	100	0	1,673	100
5-Sep	1	19,405	100	5	180,567	100	753	12,422	73	2	60,786	100	0	1,673	100
6-Sep	3	19,408	100	1	180,568	100	619	13,041	77	3	60,789	100	0	1,673	100
7-Sep	2	19,410	100	3	180,571	100	579	13,620	80	2	60,791	100	0	1,673	100
8-Sep	0	19,410	100	4	180,575	100	922	14,542	85	3	60,794	100	0	1,673	100
9-Sep	1	19,411	100	0	180,575	100	695	15,237	90	1	60,795	100	0	1,673	100
10-Sep	0	19,411	100	5	180,580	100	497	15,734	92	2	60,797	100	2	1,675	100
11-Sep	0	19,411	100	5	180,585	100	412	16,146	95	4	60,801	100	0	1,675	100
12-Sep	0	19,411	100	6	180,591	100	384	16,530	97	3	60,804	100	1	1,676	100
13-Sep	3	19,414	100	0	180,591	100	241	16,771	99	2	60,806	100	0	1,676	100
14-Sep	0	19,414	100	3	180,594	100	240	17,011	100	1	60,807	100	0	1,676	100

[a] Partial day count, passage was not estimated.

[b] Estimated salmon passage (whole day).

[c] Estimated salmon passage (partial day).

APPENDIX B. DAILY CARCASS COUNTS AT THE KOGRUKLUK RIVER WEIR, 2006

Appendix B1.–Daily salmon carcass counts at the Kogrukluk River weir, 2006.

Date	Chinook	Sockeye	Chum	Coho	Pink
6/28	0	0	1	0	0
6/29	0	0	0	0	0
6/30	0	0	1	0	0
7/1	0	0	0	0	0
7/2	0	0	0	0	0
7/3	0	0	16	0	0
7/4	0	0	15	0	0
7/5	0	0	27	0	0
7/6	0	0	76	0	0
7/7	0	0	72	0	0
7/8	0	1	145	0	0
7/9	0	1	177	0	0
7/10	0	0	219	0	0
7/11	0	1	340	0	1
7/12	0	2	352	0	0
7/13	0	0	492	0	0
7/14	0	0	320	0	1
7/15	0	0	539	0	4
7/16	0	0	591	0	0
7/17	1	2	623	0	2
7/18	0	0	644	0	4
7/19	0	0	872	0	2
7/20	0	0	785	0	3
7/21	1	1	978	0	1
7/22	2	0	818	0	0
7/23	9	0	870	0	4
7/24	5	3	791	0	3
7/25	4	3	1,257	0	3
7/26	9	3	1,308	0	6
7/27	6	7	920	0	3
7/28	19	11	1,425	0	3
7/29	31	11	1,307	0	0
7/30	52	18	1,790	0	7
7/31	50	17	1,342	0	5
8/1	91	25	1,416	0	2
8/2	79	41	1,221	0	3
8/3	106	36	1,118	0	4
8/4	95	30	756	0	0
8/5	168	77	1,244	0	0
8/6	178	81	1,139	0	1
8/7	186	113	867	0	4
8/8	150	103	525	0	4
8/9	197	133	697	0	3
8/10	185	143	554	0	1
8/11	217	187	588	0	10
8/12[a]	ND	ND	ND	ND	ND
8/13[a]	ND	ND	ND	ND	ND
8/14[a]	ND	ND	ND	ND	ND
8/15[a]	ND	ND	ND	ND	ND
8/16[a]	ND	ND	ND	ND	ND
8/16[a]	ND	ND	ND	ND	ND
8/17[a]	ND	ND	ND	ND	ND
8/18[a]	ND	ND	ND	ND	ND
8/19[a]	ND	ND	ND	ND	ND
8/20[a]	ND	ND	ND	ND	ND
8/21[a]	ND	ND	ND	ND	ND
8/22[a]	ND	ND	ND	ND	ND
8/23[a]	ND	ND	ND	ND	ND
8/24[a]	ND	ND	ND	ND	ND
8/25[a]	ND	ND	ND	ND	ND
8/26	3	100	5	0	28
8/27	4	78	30	0	32
8/28	1	112	12	0	21
8/29	1	98	21	0	30
8/30	1	98	15	0	13
8/31	2	62	13	1	13
9/1	3	62	8	1	13
9/2	1	78	8	0	11
9/3	1	39	9	0	12
9/4	0	39	7	0	13
9/5	2	36	5	0	5
9/6	1	41	6	0	9
9/7[b]	ND	ND	ND	ND	ND
9/8	0	50	5	5	5
9/9	0	28	9	1	5
9/10	1	16	3	3	3
9/11	2	21	3	2	0
9/12[b]	ND	ND	ND	ND	ND
9/13	0	23	4	4	0
9/14	0	15	2	6	0
Totals	1,864	2,046	29,403	23	297

APPENDIX C. CLIMATE INFORMATION FOR THE KOGRUKLUK RIVER WEIR, 2006

Appendix C1.–Daily climate and water level data collected at the Kogrukluk River weir site.

		Observations by Hour				Daily Totals
		Sky	Temperature		River	Precipitation
Date	Time	Code[a]	Air	Water	Stage (mm)	(mm)[b]
6/20	17:00	2	20.0	ND	3320	ND
6/21	7:30	1	5.0	8.0	3280	0.0
6/22	7:30	1	ND	ND	3180	0.0
	17:00	1	19.0	12.0	3170	
6/23	7:30	1	8.0	10.0	3130	0.0
	17:00	3	19.0	12.0	3120	
6/24	7:30	4	10.0	10.0	3090	0.0
	17:00	2	19.0	12.0	3090	
6/25	10:00	1	12.0	10.0	3070	0.0
	17:00	3	18.0	12.0	3050	
6/26	7:30	3	11.0	10.0	3030	0.0
	17:00	1	23.0	12.0	3030	
6/27	7:30	1	7.0	10.0	3010	0.0
	21:00	1	19.0	13.0	3020	
6/28	7:30	1	9.0	10.0	3010	0.0
	18:00	1	20.0	12.0	2990	
6/29	7:30	4	11.0	11.0	2970	0.0
	17:00	4	14.0	11.0	2970	
6/30	7:30	4	9.0	10.0	2990	12.5
	17:00	2	19.0	11.0	3010	
7/1	10:00	1	12.0	9.0	3020	0.0
	17:00	1	23.0	13.0	2990	
7/2	10:00	3	14.0	11.0	2950	0.0
	17:00	1	19.0	13.0	2940	
7/3	7:30	4	10.0	11.0	2910	0.0
	17:00	1	22.0	14.0	2900	
7/4	10:00	1	15.0	11.0	2880	0.0
	17:00	2	27.0	14.0	2870	
7/5	7:15	2	14.0	13.0	2860	0.0
	17:00	2	25.0	15.0	2850	
7/6	7:15	2	13.0	12.0	2840	3.0
7/7	7:15	4	13.0	12.0	2870	4.0
7/8	10:00	4	14.0	11.0	2990	15.0
	17:30	4	18.0	12.0	3010	
7/9	10:00	3	15.0	11.0	2990	0.5
7/10	7:15	4	13.0	12.0	2970	0.0
	17:00	3	20.0	13.0	2950	
7/11	7:15	3	8.0	11.0	2920	0.0
	17:00	1	21.0	14.0	2920	
7/12	7:30	1	10.0	11.0	2880	0.5
	17:00	2	22.0	14.0	2890	
7/13	7:15	4	10.0	12.0	2890	0.0
	17:00	4	15.0	12.0	2890	
7/14	7:15	4	9.0	10.0	2830	0.0
	17:00	4	11.0	10.0	2850	
7/15	10:00	4	12.0	9.0	2870	7.0
	17:00	4	12.0	11.0	2910	
7/16	10:00	4	11.0	10.0	2860	0.0
	17:00	4	15.0	11.0	2810	
7/17	7:15	4	9.0	9.0	2850	0.0
	17:00	4	14.0	11.0	2870	

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		Observations by Hour				Daily Totals
		Sky	Temperature		River	Precipitation
Date	Time	Code[a]	Air	Water	Stage (cm)	(mm)[b]
7/18	9:00	4	12.0	10.0	2820	0.0
	17:00	4	18.0	11.0	2780	
7/19	7:15	3	9.0	10.0	2830	0.0
	17:00	2	21.0	12.0	2780	
7/20	7:15	2	8.0	10.0	2790	0.0
	17:00	1	24.0	15.0	2750	
7/21	7:15	3	15.0	12.0	2800	0.0
	17:00	2	22.0	14.0	2730	
7/22	10:00	2	13.0	12.0	2760	0.0
	17:00	3	19.0	14.0	2710	
7/23	10:00	1	11.0	11.0	2750	3.5
	17:00	4	18.0	13.0	2710	
7/24	7:15	4	11.0	11.0	2750	2.0
	17:00	4	15.0	11.0	2730	
7/25	7:15	4	10.0	10.0	2850	6.0
	17:00	4	17.0	12.0	2770	
7/26	7:15	3	9.0	11.0	2830	0.0
	17:00	3	19.0	12.0	2760	
7/27	8:00	4	11.0	11.0	2780	0.0
	17:00	4	17.0	12.0	2720	
7/28	7:15	4	11.0	11.0	2830	0.0
	17:00	4	16.0	11.0	2720	
7/29	10:00	4	10.0	10.0	2840	0.0
	17:00	4	14.0	11.0	2710	
7/30	10:00	4	10.0	10.0	2820	0.5
	17:00	4	14.0	11.0	2700	
7/31	7:15	4	11.0	10.0	2740	2.0
	17:00	4	13.0	11.0	2690	
8/1	7:15	4	8.0	10.0	2790	1.0
	17:00	4	11.0	10.0	2690	
8/2	7:15	4	9.0	9.0	2770	5.0
	17:00	4	15.0	11.0	2710	
8/3	7:15	4	11.0	10.0	2770	0.0
	17:00	4	14.0	11.0	2720	
8/4	7:15	4	10.0	10.0	2780	5.0
	17:00	4	15.0	11.0	2730	
8/5	10:00	3	12.0	10.0	2890	5.0
	17:00	2	19.0	13.0	2810	
8/6	10:00	1	7.0	10.0	2900	3.0
8/7	7:15	2	9.0	11.0	2800	0.0
8/8	7:15	4	11.0	12.0	2750	0.0
	17:00	4	17.0	12.0	2710	
8/9	10:00	4	14.0	11.0	2790	0.0
	17:00	4	17.0	12.0	2690	
8/10	7:15	4	11.0	11.0	2730	4.0
	17:00	4	15.0	11.0	2710	
8/11	7:30	4	11.0	10.0	2790	17.5
	17:00	4	15.0	11.0	2820	
8/12	10:00	3	10.0	10.0	3070	12.0
	17:00	3	12.0	11.0	2980	
8/13	10:00	4	10.0	10.0	2930	3.0
	17:00	4	13.0	10.0	2930	

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Appendix C1.–Page 3 of 4.

		Observations by Hour				Daily Totals
		Sky	Temperature		River	Precipitation
Date	Time	Code[a]	Air	Water	Stage (cm)	(mm)[b]
8/14	7:30	4	11.0	10.0	2960	10.0
	17:00	4	14.0	10.0	2970	
8/15	7:30	4	10.0	10.0	3120	15.0
	17:00	4	16.0	11.0	3170	
8/16	7:30	3	10.0	10.0	3330	1.0
	17:00	3	19.0	12.0	3280	
8/17	7:30	2	8.0	10.0	3200	2.0
	17:00	2	18.0	12.0	3190	
8/18	7:00	4	11.0	11.0	3170	5.0
	17:00	3	15.0	11.0	3160	
8/19	10:00	2	5.0	9.0	3260	12.0
	17:00	2	12.0	11.0	3250	
8/20	10:00	3	6.0	8.0	3180	0.0
	17:00	2	15.0	11.0	3140	
8/21	7:30	1	1.0	9.0	3100	0.0
	17:00	4	14.0	9.0	3080	
8/22	7:30	4	9.0	9.0	3080	8.0
	17:00	3	11.0	10.0	3080	
8/23	7:30	4	5.0	8.0	3150	1.0
	17:00	3	16.0	10.0	3120	
8/24	7:30	3	5.0	9.0	3080	0.0
	17:00	2	17.0	10.0	3060	
8/25	7:30	2	2.0	8.0	3030	0.0
	17:00	4	14.0	10.0	3010	
8/26	10:00	4	10.0	9.0	3000	0.0
	17:00	4	14.0	10.0	2980	
8/27	10:00	1	8.0	8.0	2970	0.0
	17:00	3	16.0	11.0	2960	
8/28	7:30	4	8.0	9.0	2950	0.0
	17:00	3	19.0	11.0	2930	
8/29	7:30	4	6.0	9.0	2940	1.0
	17:00	3	17.0	11.0	2920	
8/30	7:30	3	5.0	9.0	2920	0.0
	17:00	4	13.0	9.0	2910	
8/31	7:30	2	4.0	9.0	2910	0.2
	17:00	3	14.0	9.0	2910	
9/1	10:00	2	7.0	8.0	2900	1.8
	17:00	3	14.0	9.0	2880	
9/2	10:00	2	5.0	8.0	2870	0.0
	17:00	1	15.0	11.0	2850	
9/3	10:00	1	2.0	8.0	2840	0.0
	17:00	1	17.0	10.0	2830	
9/4	10:00	1	3.0	8.0	2820	0.0
	17:00	1	19.0	10.0	2810	
9/5	10:00	4	8.0	8.0	2810	0.0
	17:00	2	18.0	10.0	2790	
9/6	10:00	5	4.0	9.0	2790	0.1
	17:00	4	16.0	10.0	2780	
9/7	10:00	4	8.0	8.0	2790	3.2
	17:00	4	11.0	8.0	2800	
9/8	10:00	4	11.0	9.0	2860	7.0
	17:00	4	13.0	11.0	2890	

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Appendix C1.–Page 4 of 4.

		Observations by Hour				Daily Totals
		Sky	Temperature		River	Precipitation
Date	Time	Code[a]	Air	Water	Stage (cm)	(mm)[b]
9/9	10:00	3	10.0	8.0	3110	0.5
	17:00	2	17.0	11.0	3160	
9/10	10:00	1	8.0	9.0	3110	4.0
	17:00	ND	18.0	11.0	3050	
9/11	10:00	1	7.0	9.0	3060	0.0
	17:00	2	19.0	11.0	3020	
9/12	10:00	1	3.0	8.0	2990	0.0
	17:00	2	19.0	10.0	2970	
9/13	10:00	5	3.0	7.0	2940	0.0
	17:00	1	18.0	10.0	2920	
9/14	10:00	4	10.0	9.0	2920	5.0
	17:00	4	12.0	10.0	2920	
9/15	10:00	4	10.0	9.0	3240	7.0
	17:00	4	12.0	9.0	3340	
9/16	10:00	4	10.0	9.0	3520	2.0
	17:00	4	14.0	10.0	3530	
9/17	10:00	4	10.0	8.0	3540	0.0
	17:00	4	14.0	9.0	3470	
9/18	10:00	4	9.0	9.0	3370	0.0
	17:00	4	11.0	9.0	3350	
9/19	10:00	4	8.0	8.0	3300	3.0
	17:00	4	13.0	9.0	3310	
9/20	10:00	4	8.0	8.0	3380	0.8
	17:00	3	15.0	9.0	3370	
9/21	10:00	4	9.0	8.0	3280	1.8
	17:00	4	9.0	8.0	3270	
9/22	10:00	4	8.0	8.0	3260	7.5
	17:00	4	12.0	8.0	3290	
9/23	10:00	4	7.0	8.0	3290	0.5
	17:00	4	9.0	8.0	3220	
9/24	10:00	4	5.0	7.0	3170	0.0
	17:00	4	10.0	8.0	3150	
9/25	10:00	2	-1.0	6.0	3130	0.0
	17:00	1	10.0	8.0	3120	

Note: ND = no data

[a] Sky Codes: 0= no observation
1= clear or mostly clear (<10% cloud cover)
2= cloud cover less than 50% of the sky
3=cloud cover more than 50% of the sky
4= complete overcast.

[b] Represents cumulative precipitation in the previous 24 hours.

APPENDIX D. DAILY STREAM TEMPERATURE FROM DATALOGGER AT THE KOGRUKLUK RIVER WEIR, 2006

Appendix D1.–Daily stream temperature summary from Hobo data logger at Kogrukluk River weir, 2006.

Date	Temperature (°C) Avg.	Min.	Max.
6/28	11.3	10.0	12.7
6/29	10.8	10.0	12.1
6/30	10.2	9.0	12.0
7/1	11.9	10.3	13.8
7/2	12.4	11.3	13.7
7/3	12.7	11.3	14.5
7/4	13.5	11.8	15.3
7/5	13.9	12.7	15.1
7/6	13.7	12.8	14.5
7/7	12.2	11.5	13.2
7/8	11.6	11.2	12.2
7/9	11.7	10.6	13.0
7/10	12.3	11.6	13.0
7/11	12.5	11.2	14.3
7/12	12.8	11.3	14.6
7/13	12.2	11.6	13.5
7/14	10.5	10.1	11.5
7/15	10.1	9.3	11.2
7/16	10.6	10.1	11.1
7/17	10.0	9.5	10.6
7/18	10.4	9.6	11.7
7/19	11.0	10.0	12.5
7/20	12.4	10.6	14.8
7/21	13.3	12.4	14.2
7/22	12.9	11.8	13.9
7/23	12.0	11.3	12.8
7/24	11.3	10.8	11.8
7/25	11.2	10.5	12.0
7/26	11.4	10.4	12.2
7/27	11.5	10.9	12.4
7/28	11.4	10.8	12.3
7/29	11.2	10.4	12.5
7/30	10.8	10.0	11.7
7/31	10.7	10.2	11.3
8/1	10.2	9.9	10.9
8/2	10.0	9.4	10.8
8/3	10.4	10.0	11.0
8/4	10.5	10.0	11.3
8/5	11.3	10.2	12.9
8/6	12.0	10.4	13.7
8/7	12.6	11.3	14.1
8/8	12.4	11.8	13.2
8/9	11.6	11.2	12.2
8/10	11.0	10.7	11.5
8/11	10.7	10.2	11.2
8/12	11.2	10.5	12.0
8/13	10.7	10.3	11.5
8/14	10.0	9.7	10.2
8/15	10.4	9.8	11.3
8/16	11.2	10.4	12.4
8/17	11.3	10.5	11.8
8/18	10.9	10.4	11.4
8/19	10.1	9.3	10.8
8/20	9.9	8.9	11.1

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Date	Temperature (°C) Avg.	Min.	Max.
8/21	9.0	8.4	10.2
8/22	8.9	8.2	9.9
8/23	9.2	8.4	10.3
8/24	9.4	8.4	10.3
8/25	9.0	8.1	9.6
8/26	9.4	8.9	10.1
8/27	9.1	8.1	10.0
8/28	9.8	8.9	11.0
8/29	9.9	9.0	10.7
8/30	9.1	8.7	10.0
8/31	8.6	7.7	9.3
9/1	9.1	8.3	9.8
9/2	9.1	8.1	10.2
9/3	9.2	7.9	10.5
9/4	9.2	7.8	10.5
9/5	9.4	8.5	10.4
9/6	8.9	7.9	9.7
9/7	8.6	8.3	9.0
9/8	8.9	8.3	9.5
9/9	9.4	8.5	10.2
9/10	10.1	9.3	11.0
9/11	10.1	9.3	11.0
9/12	9.3	8.2	10.1
9/13	8.7	7.6	9.5
9/14	9.1	8.8	9.4
9/15	9.0	8.8	9.2
9/16	8.8	8.6	9.0
9/17	8.6	8.2	8.8
9/18	8.3	8.1	8.6
9/19	7.8	7.6	8.0
9/20	7.8	7.3	8.5
9/21	7.8	7.7	8.2
9/22	7.6	7.3	7.8
9/23	7.5	7.2	7.8
9/24	7.4	7.0	7.7
9/25	6.7	6.0	7.3
Average:	10.4	9.6	11.3
Minimum:	6.7	6.0	7.3
Maximum:	13.9	12.8	15.3

APPENDIX E. HISTORICAL PASSAGE OF CHINOOK SALMON AT THE KOGRUKLUK RIVER WEIR

Appendix E1.–Historical daily Chinook salmon passage at the Kogrukluk weir, 1996–2006.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
6/16		0 [a]									
6/17		0 [a]									
6/18		0 [a]									
6/19	0 [a]	1 [a]									
6/20	1 [a]	1 [a]	0 [a]								
6/21	1 [a]	2 [a]	1 [a]			1 [a]		0	0		
6/22	4 [a]	4 [a]	4 [a]			3 [a]		1	0	1	
6/23	12 [a]	9 [a]	2 [a]			7 [a]		0	9	1	
6/24	16 [a]	15 [a]	4 [a]			9 [a]		0	0	0	
6/25	30 [a]	28 [a]	3 [a]			17 [a]		7	47	58	
6/26	36 [a]	34 [a]	9 [a]			27 [a]	15	5	51	58	
6/27	68 [a]	67 [a]	88 [a]			44 [a]	143	24	108	36	
6/28	96 [a]	51	39 [a]			29 [a]	103	40	87	56	0 [b]
6/29	146 [a]	610	118 [a]			124 [a]	279	50	428	81	6
6/30	80	596	79 [a]			54 [a]	89	74	281	71	25
7/1	264	507	198 [a]	6 [a]		139 [a]	187	17	297	379	80
7/2	998	172	157 [a]	2 [a]	1	255 [a]	310	272	350	543	233
7/3	831	927	254 [a]	2 [a]	42	242 [a]	129	344	662	851	195
7/4	397	587	398 [a]	5 [a]	40	543 [a]	618	229	578	117	631
7/5	1,464	1,025	433 [a]	43 [a]	95	160	90	410	856	1,075	511
7/6	1,688	790	516 [a]	17	179	397	1,192	454	699	976	640
7/7	1,788	1,142	145	53	108	386	123	479	1,571	1,219	655
7/8	880	486	817 [a]	41	46	698	726	592	1,324	957	1,040
7/9	683	708	769 [a]	56	189	796	241	858	1,062	1,218	752
7/10	552	219	452 [a]	148	124	336	450	562	1,072	1,309	848
7/11	339	224	719 [a]	199	234	644	804	71	1,169	1,007	409
7/12	418	532	992 [a]	258	282	515	547	602	927	674	759
7/13	715	303	699 [a]	204	149	408	442	357	467	478	517
7/14	515	552	598 [a]	287	152	448	402	761	572 [c]	834	586
7/15	282	398	675 [a]	129	186	221	381	554	550	686	629
7/16	181	324	617 [a]	355	221	444	315	646	342	829	1,233
7/17	237	377	455 [a]	331	150	230	330	459	671	1,136	611
7/18	227	477	229	126	102	111	311 [c]	400	516	868	512
7/19	260	357	329	395	103	316	289	441	485	517	562
7/20	88	392	264	221	51	264 [a]	269 [c]	376	619	551	1,082
7/21	180	346	225	788	77	184 [a]	269 [c]	542	657	893	647
7/22	98	208	215	265	113	208 [a]	249	466	474	634 [c]	585
7/23	56	110	98	230	78	218 [a]	114	223	286	636	883
7/24	77	53	112	235	93	141 [a]	176	257	185	456	547
7/25	99	34	205	429	57	115 [a]	131	248	221	385	823
7/26	31	100	127	81	30	57 [a]	82	116	197	359 [c]	370
7/27	25	13	184	113	53	43 [a]	50	153	485	273	350
7/28	27	81	194	68	25	50	37	106	295	320	445
7/29	52	37	114	93	19	72	32	85 [a]	150	235	418
7/30	99	47	110	88	14	77	31	85 [a]	121	167	274
7/31	19	36	101	52	41	46	8	43	106	132	249
8/1	16 [a]	20	64	54	24	29	23	39	77	81	186
8/2	12 [a]	30	58	41	37	53	12	40	68	131	169
8/3	9	25	31	24	35 [a]	24	11 [a]	31 [a]	44	104	162
8/4	7	13	25	18	29 [a]	17	11 [a]	31 [a]	60	98	127
8/5	2	18	30	23 [a]	26 [a]	9	11 [a]	23	70	64	161
8/6	6	19	17	17 [a]	22 [a]	14	9	20	48	57	63
8/7	8	13	14	7	18 [a]	4	6	27	77	45	62
8/8	10	10	20	10	4	12	11	24	48	51	38
8/9	2	23	15	4	7	1	7	15	23	30	17

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Appendix E1.–Page 2 of 2.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
8/10	14	28	5	2	10	6	1	7	37	32	22
8/11	7 [a]	33	10	2	3	3	5	3	10	14	39
8/12	10 [a]	9 [a]	3	8	3	1	5	14	25	26	29 [a]
8/13	4 [a]	4 [a]	7	5	9	7	3	5	13	33	27 [a]
8/14	3 [a]	4	5	4	6	4	4	6	5	16	25 [a]
8/15	5	13	5	1	5	11	2	5	8	13	23 [a]
8/16	1	6	5	2	1	2	1	8	11	7	21 [a]
8/17	0	5	3	3	0	1	0	7	7	9	19 [a]
8/18	1	1	2	3	0	0	0	3	6	23	17 [a]
8/19	0	5	7	0	1	4 [a]	0	2	4	16	16 [a]
8/20	3	4	4	1	3	0 [a]	0	7	3	9	14 [a]
8/21	2	1	4	0	0	1 [a]	1	7	4	8	12 [a]
8/22	3	2	1	2	1	1	2	2	7	3	10 [a]
8/23	4	1	0	0	2	1	3	0	3	4	8 [a]
8/24	1	0	1	1	0	1	1	7	4	12	6 [a]
8/25	0	2	1	2	1	2	2	2	1	8	4 [a]
8/26	2	4	3	1	0	2	0	3	2	5	1
8/27	1	4	1	2	2	3	1	2 [d]	2	4	4
8/28	1	0	0	0	3	0	3	2 [a]	0	4	5
8/29	2	2	0	0	0	0	1	2 [d]	0	3	3
8/30	0	1	3	13	4	0	2	2	0	2	1
8/31	0	1	4	0	0	0	1	1	0	2	0
9/1	0	0	0	0	0	1	0	3	0	0	4
9/2	0	0	1	0	0	2	2	1	2	0	1
9/3	0	0	2	0	0	0	0	2	2	0	1
9/4	0	0	0	0	0	0	0	2	0	1	0
9/5	0	0	1	0	0	0	0	1	2	1	1
9/6	0	0	0	0	0	0	0	1	0	1	3
9/7	0	0	0	0	0	0	0	1	1	1	2
9/8	0	0	1	0	0	0	0	1	0	0	0
9/9	0	0	0	0	0	0	0	1	0	1	1
9/10	0	0	1	0	0	0	0	0	0	0	0
9/11	0	0	1	0	0	0	0	0	0	0	0
9/12	0	0	1	0	0	1	0	2	0	0	0
9/13	0	0	0	0	0	0	0	0	0 [c]	3	3
9/14	0	0	0	0	0	0	0	0	0 [c]	0	0
9/15	0	0	0	0	0	0	0	0	0 [c]	1	
9/16		1	1	0	0	0	0	0	0	0 [a]	
9/17		0	0	0	0	0	0	0	0	0 [a]	
9/18		0 [a]	0		0	0	0	0	0	0 [a]	
9/19		0	0		0	0	0	0	0	0 [a]	
9/20		0			0	0	0	0	0	0	
9/21		0				0	0		0	0	
9/22						0	0		0	0	
9/23						0	0		0		
9/24						0	0		0		
9/25						0			0		

Note: Operational dates vary from year to year. Please refer to Figure 4 for an explanation of operational dates. Dates without data are days when the weir was not operating and daily passage was not estimated. Also, the sum of daily passages found in this table might differ from the cumulative passages reported elsewhere in this report due to rounding errors associated with estimates.

[a] The weir was not operational; daily passage was estimated.

[b] Partial day count; passage was not estimated.

[c] Passage was estimated due to the occurrence of a hole in the weir.

[d] Partial day count; passage was estimated.

Appendix E2.–Historical daily cumulative Chinook salmon passage at the Kogrukluk River weir, 1996–2006.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
6/16		0									
6/17		0									
6/18		0									
6/19	0	1									
6/20	1	2	0								
6/21	3	4	1			1		0	0		
6/22	7	8	5			4		1	0	1	
6/23	19	17	7			11		1	9	2	
6/24	35	32	11			20		1	9	2	
6/25	65	60	14			36		8	56	60	
6/26	102	94	24			64	15	13	107	118	
6/27	170	161	111			108	158	37	215	154	
6/28	265	212	151			137	261	77	302	210	0
6/29	412	822	268			261	540	127	730	291	6
6/30	492	1,418	348			315	629	201	1,011	362	31
7/1	756	1,925	546	6		454	816	218	1,308	741	111
7/2	1,754	2,097	703	8	1	709	1,126	490	1,658	1,284	344
7/3	2,585	3,024	957	10	43	952	1,255	834	2,320	2,135	539
7/4	2,982	3,611	1,355	15	83	1,495	1,873	1,063	2,898	2,252	1,170
7/5	4,446	4,636	1,789	58	178	1,655	1,963	1,473	3,754	3,327	1,681
7/6	6,134	5,426	2,305	75	357	2,052	3,155	1,927	4,453	4,303	2,321
7/7	7,922	6,568	2,450	128	465	2,438	3,278	2,406	6,024	5,522	2,976
7/8	8,802	7,054	3,267	169	511	3,136	4,004	2,998	7,348	6,479	4,016
7/9	9,485	7,762	4,036	225	700	3,932	4,245	3,856	8,410	7,697	4,768
7/10	10,037	7,981	4,488	373	824	4,268	4,695	4,418	9,482	9,006	5,616
7/11	10,376	8,205	5,207	572	1,058	4,912	5,499	4,489	10,651	10,013	6,025
7/12	10,794	8,737	6,199	830	1,340	5,427	6,046	5,091	11,578	10,687	6,784
7/13	11,509	9,040	6,898	1,034	1,489	5,835	6,488	5,448	12,045	11,165	7,301
7/14	12,024	9,592	7,496	1,321	1,641	6,283	6,890	6,209	12,617	11,999	7,887
7/15	12,306	9,990	8,172	1,450	1,827	6,504	7,271	6,763	13,167	12,685	8,516
7/16	12,487	10,314	8,788	1,805	2,048	6,948	7,586	7,409	13,509	13,514	9,749
7/17	12,724	10,691	9,243	2,136	2,198	7,178	7,916	7,868	14,180	14,650	10,360
7/18	12,951	11,168	9,472	2,262	2,300	7,289	8,227	8,268	14,696	15,518	10,872
7/19	13,211	11,525	9,801	2,657	2,403	7,605	8,516	8,709	15,181	16,035	11,434
7/20	13,299	11,917	10,065	2,878	2,454	7,869	8,785	9,085	15,800	16,586	12,516
7/21	13,479	12,263	10,290	3,666	2,531	8,053	9,054	9,627	16,457	17,479	13,163
7/22	13,577	12,471	10,505	3,931	2,644	8,262	9,303	10,093	16,931	18,113	13,748
7/23	13,633	12,581	10,603	4,161	2,722	8,480	9,417	10,316	17,217	18,749	14,631
7/24	13,710	12,634	10,715	4,396	2,815	8,621	9,593	10,573	17,402	19,205	15,178
7/25	13,809	12,668	10,920	4,825	2,872	8,736	9,724	10,821	17,623	19,590	16,001
7/26	13,840	12,768	11,047	4,906	2,902	8,793	9,806	10,937	17,820	19,949	16,371
7/27	13,865	12,781	11,231	5,019	2,955	8,836	9,856	11,090	18,305	20,222	16,721
7/28	13,892	12,862	11,425	5,087	2,980	8,886	9,893	11,196	18,600	20,542	17,166
7/29	13,944	12,899	11,539	5,180	2,999	8,958	9,925	11,281	18,750	20,777	17,584
7/30	14,043	12,946	11,649	5,268	3,013	9,035	9,956	11,367	18,871	20,944	17,858
7/31	14,062	12,982	11,750	5,320	3,054	9,081	9,964	11,410	18,977	21,076	18,107
8/1	14,078	13,002	11,814	5,374	3,078	9,110	9,987	11,449	19,054	21,157	18,293
8/2	14,090	13,032	11,872	5,415	3,115	9,163	9,999	11,489	19,122	21,288	18,462
8/3	14,099	13,057	11,903	5,439	3,150	9,187	10,010	11,519	19,166	21,392	18,624
8/4	14,106	13,070	11,928	5,457	3,179	9,204	10,020	11,550	19,226	21,490	18,751
8/5	14,108	13,088	11,958	5,480	3,205	9,213	10,031	11,573	19,296	21,554	18,912
8/6	14,114	13,107	11,975	5,497	3,227	9,227	10,040	11,593	19,344	21,611	18,975
8/7	14,122	13,120	11,989	5,504	3,245	9,231	10,046	11,620	19,421	21,656	19,037
8/8	14,132	13,130	12,009	5,514	3,249	9,243	10,057	11,644	19,469	21,707	19,075
8/9	14,134	13,153	12,024	5,518	3,256	9,244	10,064	11,659	19,492	21,737	19,092

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Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
8/10	14,148	13,181	12,029	5,520	3,266	9,250	10,065	11,666	19,529	21,769	19,114
8/11	14,155	13,214	12,039	5,522	3,269	9,253	10,070	11,669	19,539	21,783	19,153
8/12	14,165	13,223	12,042	5,530	3,272	9,254	10,075	11,683	19,564	21,809	19,182
8/13	14,170	13,227	12,049	5,535	3,281	9,261	10,078	11,688	19,577	21,842	19,208
8/14	14,173	13,231	12,054	5,539	3,287	9,265	10,082	11,694	19,582	21,858	19,233
8/15	14,178	13,244	12,059	5,540	3,292	9,276	10,084	11,699	19,590	21,871	19,256
8/16	14,179	13,250	12,064	5,542	3,293	9,278	10,085	11,707	19,601	21,878	19,278
8/17	14,179	13,255	12,067	5,545	3,293	9,279	10,085	11,714	19,608	21,887	19,297
8/18	14,180	13,256	12,069	5,548	3,293	9,279	10,085	11,717	19,614	21,910	19,314
8/19	14,180	13,261	12,076	5,548	3,294	9,283	10,085	11,719	19,618	21,926	19,330
8/20	14,183	13,265	12,080	5,549	3,297	9,283	10,085	11,726	19,621	21,935	19,344
8/21	14,185	13,266	12,084	5,549	3,297	9,284	10,086	11,733	19,625	21,943	19,355
8/22	14,188	13,268	12,085	5,551	3,298	9,285	10,088	11,735	19,632	21,946	19,365
8/23	14,192	13,269	12,085	5,551	3,300	9,286	10,091	11,735	19,635	21,950	19,373
8/24	14,193	13,269	12,086	5,552	3,300	9,287	10,092	11,742	19,639	21,962	19,380
8/25	14,193	13,271	12,087	5,554	3,301	9,289	10,094	11,744	19,640	21,970	19,384
8/26	14,195	13,275	12,090	5,555	3,301	9,291	10,094	11,747	19,642	21,975	19,385
8/27	14,196	13,279	12,091	5,557	3,303	9,294	10,095	11,749	19,644	21,979	19,389
8/28	14,197	13,279	12,091	5,557	3,306	9,294	10,098	11,751	19,644	21,983	19,394
8/29	14,199	13,281	12,091	5,557	3,306	9,294	10,099	11,753	19,644	21,986	19,397
8/30	14,199	13,282	12,094	5,570	3,310	9,294	10,101	11,755	19,644	21,988	19,398
8/31	14,199	13,283	12,098	5,570	3,310	9,294	10,102	11,756	19,644	21,990	19,398
9/1	14,199	13,283	12,098	5,570	3,310	9,295	10,102	11,759	19,644	21,990	19,402
9/2	14,199	13,283	12,099	5,570	3,310	9,297	10,104	11,760	19,646	21,990	19,403
9/3	14,199	13,283	12,101	5,570	3,310	9,297	10,104	11,762	19,648	21,990	19,404
9/4	14,199	13,283	12,101	5,570	3,310	9,297	10,104	11,764	19,648	21,991	19,404
9/5	14,199	13,283	12,102	5,570	3,310	9,297	10,104	11,765	19,650	21,992	19,405
9/6	14,199	13,283	12,102	5,570	3,310	9,297	10,104	11,766	19,650	21,993	19,408
9/7	14,199	13,283	12,102	5,570	3,310	9,297	10,104	11,767	19,651	21,994	19,410
9/8	14,199	13,283	12,103	5,570	3,310	9,297	10,104	11,768	19,651	21,994	19,410
9/9	14,199	13,283	12,103	5,570	3,310	9,297	10,104	11,769	19,651	21,995	19,411
9/10	14,199	13,283	12,104	5,570	3,310	9,297	10,104	11,769	19,651	21,995	19,411
9/11	14,199	13,283	12,105	5,570	3,310	9,297	10,104	11,769	19,651	21,995	19,411
9/12	14,199	13,283	12,106	5,570	3,310	9,298	10,104	11,771	19,651	21,995	19,411
9/13	14,199	13,283	12,106	5,570	3,310	9,298	10,104	11,771	19,651	21,998	19,414
9/14	14,199	13,283	12,106	5,570	3,310	9,298	10,104	11,771	19,651	21,998	19,414
9/15	14,199	13,283	12,106	5,570	3,310	9,298	10,104	11,771	19,651	21,999	
9/16		13,284	12,107	5,570	3,310	9,298	10,104	11,771	19,651	21,999	
9/17		13,284	12,107	5,570	3,310	9,298	10,104	11,771	19,651	21,999	
9/18		13,284	12,107		3,310	9,298	10,104	11,771	19,651	21,999	
9/19		13,284	12,107		3,310	9,298	10,104	11,771	19,651	22,000	
9/20		13,284			3,310	9,298	10,104	11,771	19,651	22,000	
9/21							10,104		19,651	22,000	
9/22							10,104		19,651	22,000	
9/23							10,104		19,651		
9/24							10,104		19,651		
9/25									19,651		

Note: Operational dates vary from year to year. Please refer to Figure 4 for an explanation of operational dates. Dates without data are days when the weir was not operating and daily passage was not estimated. All years include daily passage estimates.

Appendix E3.–Historical cumulative percent passage of Chinook salmon at the Kogrukluk River weir, 1996–2006.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
6/16		0						0			
6/17		0						0			
6/18		0						0			
6/19	0	0						0			
6/20	0	0	0					0			
6/21	0	0	0			0		0	0		
6/22	0	0	0			0		0	0	0	
6/23	0	0	0			0		0	0	0	
6/24	0	0	0			0		0	0	0	
6/25	0	0	0			0		0	0	0	
6/26	1	1	0			1	0	0	1	1	
6/27	1	1	1			1	2	0	1	1	
6/28	2	2	1			1	3	1	2	1	0
6/29	3	6	2			3	5	1	4	1	0
6/30	3	11	3			3	6	2	5	2	0
7/1	5	14	5	0		5	8	2	7	3	1
7/2	12	16	6	0	0	8	11	4	8	6	2
7/3	18	23	8	0	1	10	12	7	12	10	3
7/4	21	27	11	0	3	16	19	9	15	10	6
7/5	31	35	15	1	5	18	19	13	19	15	9
7/6	43	41	19	1	11	22	31	16	23	20	12
7/7	56	49	20	2	14	26	32	20	31	25	15
7/8	62	53	27	3	15	34	40	25	37	29	21
7/9	67	58	33	4	21	42	42	33	43	35	25
7/10	71	60	37	7	25	46	46	38	48	41	29
7/11	73	62	43	10	32	53	54	38	54	46	31
7/12	76	66	51	15	40	58	60	43	59	49	35
7/13	81	68	57	19	45	63	64	46	61	51	38
7/14	85	72	62	24	50	68	68	53	64	55	41
7/15	87	75	67	26	55	70	72	57	67	58	44
7/16	88	78	73	32	62	75	75	63	69	61	50
7/17	90	80	76	38	66	77	78	67	72	67	53
7/18	91	84	78	41	69	78	81	70	75	71	56
7/19	93	87	81	48	73	82	84	74	77	73	59
7/20	94	90	83	52	74	85	87	77	80	75	64
7/21	95	92	85	66	76	87	90	82	84	79	68
7/22	96	94	87	71	80	89	92	86	86	82	71
7/23	96	95	88	75	82	91	93	88	88	85	75
7/24	97	95	89	79	85	93	95	90	89	87	78
7/25	97	95	90	87	87	94	96	92	90	89	82
7/26	97	96	91	88	88	95	97	93	91	91	84
7/27	98	96	93	90	89	95	98	94	93	92	86
7/28	98	97	94	91	90	96	98	95	95	93	88
7/29	98	97	95	93	91	96	98	96	95	94	91
7/30	99	97	96	95	91	97	99	97	96	95	92
7/31	99	98	97	96	92	98	99	97	97	96	93
8/1	99	98	98	96	93	98	99	97	97	96	94
8/2	99	98	98	97	94	99	99	98	97	97	95
8/3	99	98	98	98	95	99	99	98	98	97	96
8/4	99	98	99	98	96	99	99	98	98	98	97
8/5	99	99	99	98	97	99	99	98	98	98	97
8/6	99	99	99	99	97	99	99	98	98	98	98
8/7	99	99	99	99	98	99	99	99	99	98	98
8/8	100	99	99	99	98	99	100	99	99	99	98
8/9	100	99	99	99	98	99	100	99	99	99	98

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Appendix E3.–Page 2 of 2.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
8/10	100	99	99	99	99	99	100	99	99	99	98
8/11	100	99	99	99	99	100	100	99	99	99	99
8/12	100	100	99	99	99	100	100	99	100	99	99
8/13	100	100	100	99	99	100	100	99	100	99	99
8/14	100	100	100	99	99	100	100	99	100	99	99
8/15	100	100	100	99	99	100	100	99	100	99	99
8/16	100	100	100	99	99	100	100	99	100	99	99
8/17	100	100	100	100	99	100	100	100	100	99	99
8/18	100	100	100	100	99	100	100	100	100	100	99
8/19	100	100	100	100	100	100	100	100	100	100	100
8/20	100	100	100	100	100	100	100	100	100	100	100
8/21	100	100	100	100	100	100	100	100	100	100	100
8/22	100	100	100	100	100	100	100	100	100	100	100
8/23	100	100	100	100	100	100	100	100	100	100	100
8/24	100	100	100	100	100	100	100	100	100	100	100
8/25	100	100	100	100	100	100	100	100	100	100	100
8/26	100	100	100	100	100	100	100	100	100	100	100
8/27	100	100	100	100	100	100	100	100	100	100	100
8/28	100	100	100	100	100	100	100	100	100	100	100
8/29	100	100	100	100	100	100	100	100	100	100	100
8/30	100	100	100	100	100	100	100	100	100	100	100
8/31	100	100	100	100	100	100	100	100	100	100	100
9/1	100	100	100	100	100	100	100	100	100	100	100
9/2	100	100	100	100	100	100	100	100	100	100	100
9/3	100	100	100	100	100	100	100	100	100	100	100
9/4	100	100	100	100	100	100	100	100	100	100	100
9/5	100	100	100	100	100	100	100	100	100	100	100
9/6	100	100	100	100	100	100	100	100	100	100	100
9/7	100	100	100	100	100	100	100	100	100	100	100
9/8	100	100	100	100	100	100	100	100	100	100	100
9/9	100	100	100	100	100	100	100	100	100	100	100
9/10	100	100	100	100	100	100	100	100	100	100	100
9/11	100	100	100	100	100	100	100	100	100	100	100
9/12	100	100	100	100	100	100	100	100	100	100	100
9/13	100	100	100	100	100	100	100	100	100	100	100
9/14	100	100	100	100	100	100	100	100	100	100	100
9/15	100	100	100	100	100	100	100	100	100	100	
9/16		100	100	100	100	100	100	100	100	100	
9/17		100	100	100	100	100	100	100	100	100	
9/18		100	100		100	100	100	100	100	100	
9/19		100	100		100	100	100	100	100	100	
9/20		100			100	100	100	100	100	100	
9/21									100	100	
9/22									100	100	
9/23									100		
9/24									100		
9/25									100		

Note: The boxes represent the median passage date and the central 50% of the run. Operational dates vary from year to year. Please refer to Figure 4 for an explanation of operational dates. Dates without data are days when the weir was not operating and daily passage was not estimated. All years include daily passage estimates.

APPENDIX F. HISTORICAL SALMON ESCAPEMENT ESTIMATES AT THE KOGRUKLUK RIVER WEIR

Appendix F1.–Historical factor table for salmon escapement estimates, Kogrukluk River 1976–2006.

	Chinook				Chum				Sockeye				Coho[a]			
Year	T[b]	Count	Percent Missed[c]	Est'd Total	T[b]	Count	Percent Missed[c]	Est'd Total	T[b]	Count	Percent Missed[c]	Est'd Total	T[b]	Count	Percent Missed[c]	Est'd Total
1976	L	5,507	1.7	5,600	N	8,046	0.9	8,117	N	2,302	1.0	2,326				
1977[d]		1,385	n.a.	1,385		10,388	n.a.	10,388		1,112	n.a.	1,112				
1978	N	13,132	3.9	13,667	N	47,099	2.1	48,125	E	1,646	1.4	1,670				
1979	L	10,125	10.7	11,338		13,966	24.9	18,599	N	2,432	7.5	2,628				
1980		843	87.2	843		6,323	84.9	6,323		404	87.4	404				
1981	E	16,070	4.4	16,807	E	56,271	1.9	57,372	E	17,702	2.1	18,076	N	11,450	0.0	11,455
1982		5,325	51.6	10,993		41,204	33.4	61,859		11,729	32.2	17,297	L	35,582	5.9	37,796
1983		1,082	64.2	3,025		3,248	65.5	4,085		375	68.1	375	L	8,327	2.5	8,538
1984	N	4,928	0.0	4,928	N	41,484	0.0	41,484	N	4,133	0.0	4,133	E	25,304	8.3	27,595
1985	L	4,287	7.2	4,619	N	13,843	7.7	15,005	L	4,344	0.3	4,359	N	14,618	11.1	16,441
1986		2,922	42.0	5,038	N	12,041	18.1	14,693		3,255	23.4	4,247		14,717	34.6	22,506
1987[e]		770	81.1	4,063		2,365	86.4	17,422		284	70.8	973	E	19,756	13.4	22,821
1988	N	7,665	10.0	8,520		28,499	27.9	39,543	E	4,240	3.7	4,402	N	11,722	13.3	13,512
1989[f]		4,911	58.9	11,940		15,543	60.7	39,547		2,599	55.3	5,810		1,272	n.a.	1,272
1990	N	10,097	1.2	10,218	E	26,555	0.8	26,765	N	8,383	0.3	8,407		2,736	55.4	6,132
1991		5,868	25.3	7,850	L	22,369	7.5	24,188	L	13,737	16.5	16,455		7,059	29.2	9,964
1992	N	6,397	5.3	6,755	E	31,902	6.5	34,104	E	7,344	2.6	7,539		2,712	89.6	26,231
1993	N	10,516	14.7	12,333	N	26,764	16.1	31,901	N	27,148	7.6	29,366		4,395	78.6	20,517
1994		8,305	45.5	15,227		23,147	50.4	46,635		5,695	59.9	14,192		27,057	22.0	34,695
1995	E	18,877	8.6	20,651	N	28,460	9.0	31,265	N	10,582	3.8	10,996		17,492	37.2	27,862
1996	E	13,764	3.1	14,199	E	47,095	2.9	48,478	N	15,222	1.1	15,386	E	47,011	7.0	50,555
1997	E	13,111	1.3	13,284	N	7,902	0.7	7,958	N	13,059	0.1	13,077	N	11,611	5.1	12,238
1998		3,009	75.1	12,107		13,013	64.3	36,441		5,321	68.3	16,773	N	22,614	7.1	24,348
1999	L	5,472	1.8	5,570	L	13,497	2.3	13,820	L	5,777	1.5	5,864	L	10,094	20.0	12,609
2000	L	3,180	3.9	3,310	N	11,077	3.6	11,491	L	2,776	3.1	2,865	E	32,875	0.8	33,135
2001		6,572	29.3	9,298		22,551	26.2	30,570		6,637	24.4	8,776	E	18,308	5.6	19,387
2002	N	9,590	5.1	10,104	E	49,494	4.0	51,570	E	3,913	3.4	4,050	N	14,501	0.1	14,516
2003	L	11,585	1.6	11,771	L	22,514	3.8	23,413	N	8,986	2.0	9,164	N	68,718	7.9	74,604
2004	N	19,432	1.1	19,651	N	24,174	0.1	24,201	E	6,767	0.1	6,775	N	26,078	3.6	27,041
2005	N	21,731	1.2	22,000	L	191,588	3.1	197,723	N	37,465	1.2	37,939	N	23,102	4.2	24,116
2006	L	19,184	1.2	19,414	N	176,508	2.3	180,594	L	59,773	1.7	60,807		12,811	24.7	17,011

[a] Coho migrations were not monitored prior to 1981.

[b] The timing model used for estimated missed counts depends on the distribution of the mean date of migration (E-early, N-normal, L-late). Since the mean date of migration is a moving average, the run timing assessments (T) are updated each year. Thus, the letter designations in this table do not necessarily match those in previous years' reports.

[c] Only years when the proportion estimated was less than 0.20 were considered for the purposes of calculating mean date of migration. Thus, there is no "E", "N", or "L" designation for years when passage estimates represented a proportion greater than 0.20 of the total escapement.

[d] Estimates were made from counting tower data and are not included in the "Estimated Total".

[e] Chinook, chum, and sockeye escapements were estimated from a ratio of unknown 1987 escapement and known 1987 aerial assessments to known 1988 weir escapement and known 1988 aerial assessment. Coho escapements were estimated using time series techniques.

[f] Heavy rain and high river levels allowed only two days of counts during the coho migration. As a result, total escapement was not estimated.

APPENDIX G. HISTORICAL PASSAGE OF CHUM SALMON AT THE KOGRUKLUK RIVER WEIR

Appendix G1.–Historical daily chum salmon passage at the Kogrukluk River weir, 1996–2006.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
6/16		0 [a]									
6/17		0 [a]									
6/18		0 [a]									
6/19	5 [a]	0 [a]									
6/20	0 [a]	0 [a]	0 [a]								
6/21	10 [a]	0 [a]	0 [a]					2	0		
6/22	24 [a]	1 [a]	5 [a]					2	15	1	
6/23	34 [a]	1 [a]	5 [a]					10	54	2	
6/24	34 [a]	2 [a]	10 [a]					2	30	1	
6/25	49 [a]	6 [a]	29 [a]					2	97	15	
6/26	122 [a]	8 [a]	38 [a]				247	7	93	16	
6/27	161 [a]	7 [a]	33 [a]				630	34	149	25	
6/28	229 [a]	44	54 [a]			6 [a]	474	48	114	45	336 [b]
6/29	428 [a]	216	203 [a]			26 [a]	973	28	460	105	957
6/30	205	157	230 [a]			9 [a]	1,081	81	548	160	1,351
7/1	1,134	156	401 [a]	3 [a]		37 [a]	1,045	67	516	398	2,042
7/2	3,055	165	430 [a]	15 [a]	27	86 [a]	933	272	431	316	2,503
7/3	2,834	251	573 [a]	7 [a]	61	152 [a]	1,111	391	505	655	3,216
7/4	2,212	245	1,146 [a]	21 [a]	121	338 [a]	1,927	365	720	949	4,833
7/5	3,537	499	788 [a]	51 [a]	190	423	1,705	712	809	2,742	6,799
7/6	2,868	346	1,377 [a]	172	290	363	2,389	689	892	5,136	7,720
7/7	2,686	389	836	312	470	620	2,266	626	1,022	5,016	6,412
7/8	3,699	362	2,053 [a]	379	437	771	2,276	580	1,202	6,258	7,435
7/9	1,277	157	1,442 [a]	421	527	918	2,373	658	949	6,746	5,954
7/10	2,470	192	1,652 [a]	590	625	1,044	3,143	567	1,261	5,600	7,137
7/11	1,511	210	2,691 [a]	766	698	1,059	3,402	152	1,126	4,999	5,007
7/12	1,754	272	1,876 [a]	963	649	1,211	3,056	544	450	3,880	6,614
7/13	3,064	334	1,649 [a]	880	429	1,765	2,337	489	221	3,934	5,894
7/14	2,054	329	1,312 [a]	651	402	1,846	2,094	1,137	398 [c]	8,057	5,028
7/15	1,366	391	2,069 [a]	539	530	1,589	2,154	1,070	422	8,145	4,653
7/16	1,391	304	1,274 [a]	590	786	1,811	2,175	1,057	500	10,174	5,891
7/17	1,601	247	2,089 [a]	473	491	780	665	955	630	8,127	4,762
7/18	1,033	313	592	441	538	1,221	1,283 [c]	1,067	635	6,153	5,823
7/19	864	320	1,175	591	504	1,652	1,008	1,422	902	8,734	7,326
7/20	628	174	1,522	556	338	1,207 [a]	1,103 [c]	1,357	872	9,241	7,210
7/21	1,139	263	1,492	577	383	1,285 [a]	1,103 [c]	1,583	817	9,884	7,669
7/22	569	128	1,101	422	340	1,254 [a]	1,198	1,078	663	8,579 [c]	5,947
7/23	814	163	822	481	306	765 [a]	1,152	539	437	7,869	5,582
7/24	483	71	585	458	251	990 [a]	2,913	484	348	7,323	4,496
7/25	265	55	722	365	170	681 [a]	1,138	858	533	6,701	4,246
7/26	182	123	514	320	221	703 [a]	556	535	437	6,711 [c]	3,684
7/27	117	100	670	353	203	459 [a]	468	366	859	5,663	3,549
7/28	355	192	710	269	204	407	260	356	889	7,157	2,916
7/29	597	123	507	288	139	780	252	354 [a]	460	5,436	2,291
7/30	415	77	359	324	161	851	149	354 [a]	360	3,721	2,329
7/31	190	36	290	252	205	539	106	315	382	3,200	2,422
8/1	170 [a]	48	153	245	100	449	73	379	319	2,677	2,203
8/2	151 [a]	50	141	173	85	555	55	292	253	2,549	2,318
8/3	131	56	120	129	107 [a]	318	38 [a]	237 [a]	136	1,823	2,500
8/4	99	38	192	187	91 [a]	256	38 [a]	237 [a]	165	1,739	2,216
8/5	53	33	145	123 [a]	83 [a]	339	38 [a]	125	181	1,410	2,071
8/6	82	42	92	103 [a]	71 [a]	227	21	152	149	1,518	1,362
8/7	51	32	51	34	62 [a]	168	14	177	153	1,195	1,039
8/8	50	21	42	57	9	154	18	113	137	1,269	1,011
8/9	24	28	25	35	26	68	15	137	117	1,138	476

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Appendix G1.–Page 2 of 2.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
8/10	60	27	23	30	29	74	8	88	57	859	524
8/11	15 [a]	68	19	27	15	75	5	34	32	666	601
8/12	20 [a]	15 [a]	10	34	17	74	18	42	52	491	527 [a]
8/13	29 [a]	16 [a]	8	23	34	31	25	37	19	432	491 [a]
8/14	5 [a]	7	11	12	11	24	6	12	27	342	455 [a]
8/15	16	11	11	11	4	18	5	38	24	283	419 [a]
8/16	5	15	3	5	6	28	4	20	39	204	383 [a]
8/17	2	5	11	10	6	13	2	16	26	188	347 [a]
8/18	5	2	3	3	22	11	3	9	7	161	311 [a]
8/19	6	2	4	0	6	8 [a]	1	4	10	151	275 [a]
8/20	4	4	4	4	1	7 [a]	0	4	9	112	239 [a]
8/21	8	1	1	5	1	7 [a]	6	3	3	98	203 [a]
8/22	5	0	3	6	0	2	5	2	8	60	167 [a]
8/23	6	0	1	2	0	5	3	2	9	63	131 [a]
8/24	1	0	3	1	1	3	3	3	1	100	95 [a]
8/25	7	1	1	4	0	2	3	1	6	65	59 [a]
8/26	3	0	5	1	6	1	1	5	7	29	26
8/27	2	0	2	2	0	0	0	4 [d]	7	22	19
8/28	1	2	5	0	0	0	1	2 [a]	3	25	12
8/29	2	0	1	2	0	1	1	2 [d]	3	26	11
8/30	1	1	1	4	0	0	1	1	6	20	9
8/31	1	0	0	3	0	0	1	2	3	12	11
9/1	2	1	0	3	0	0	0	2	3	9	8
9/2	2	0	2	1	0	0	1	1	4	5	5
9/3	1	0	2	1	0	0	2	1	4	5	8
9/4	0	0	4	1	0	0	1	0	0	11	3
9/5	0	0	1	1	0	1	0	3	2	10	5
9/6	0	0	0	0	0	0	0	1	1	9	1
9/7	2	2	1	1	1	0	1	0	2	10	3
9/8	1	0	0	2	0	0	2	2	2	10	4
9/9	1	0	1	1	0	0	0	3	0	4	0
9/10	3	1	3	1	0	0	0	0	1	9	5
9/11	1	0	4	0	0	0	0	1	1	9	5
9/12	2	0	1	0	0	0	1	1	0	4	6
9/13	1	0	1	2	0	0	1	1	2 [c]	0	0
9/14	0	0	2	0	1	0	1	0	0 [c]	3	3
9/15	0	0	1	0	0	1	2	0	0 [c]	7	
9/16		0	0	0	0	0	0	0	0	4 [a]	
9/17		0	1	1	0	1	0	0	0	4 [a]	
9/18		0 [a]	1		0	0	0	0	0	3 [a]	
9/19		0	0		0	0	0	1	0	2 [a]	
9/20		0			0	0	0	0	1	3	
9/21		0				0	0		0	0	
9/22						0	0		0	1	
9/23						0	0		2		
9/24						1	1		0		
9/25						1			0		

Note: Operational dates vary from year to year. Please refer to Figure 4 for an explanation of operational dates. Dates without data are days when the weir was not operating and daily passage was not estimated. Also, the sum of daily passages found in this table might differ from the cumulative passages reported elsewhere in this report due to rounding errors associated with estimates.

[a] The weir was not operational; daily passage was estimated.

[b] Partial day count; passage was not estimated.

[c] Passage was estimated due to the occurrence of a hole in the weir.

[d] Partial day count; passage was estimated.

Appendix G2.–Historical daily cumulative chum salmon passage at the Kogrukluk River weir, 1996–2006.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
6/16		0									
6/17		0									
6/18		0									
6/19	5	0									
6/20	5	0	0								
6/21	15	0	0					2	0		
6/22	39	1	5					4	15	1	
6/23	73	2	10					14	69	3	
6/24	107	4	19					16	99	4	
6/25	156	10	48					18	196	19	
6/26	277	18	86				247	25	289	35	
6/27	438	25	119				877	59	438	60	
6/28	666	69	172			6	1,351	107	552	105	336
6/29	1,095	285	375			31	2,324	135	1,012	210	1,293
6/30	1,300	442	605			40	3,405	216	1,560	370	2,644
7/1	2,434	598	1,007	3		77	4,450	283	2,076	768	4,686
7/2	5,489	763	1,437	18	27	163	5,383	555	2,507	1,084	7,189
7/3	8,323	1,014	2,010	25	88	315	6,494	946	3,012	1,739	10,405
7/4	10,535	1,259	3,156	46	209	653	8,421	1,311	3,732	2,688	15,238
7/5	14,072	1,758	3,945	97	399	1,076	10,126	2,023	4,541	5,430	22,037
7/6	16,940	2,104	5,322	269	689	1,439	12,515	2,712	5,433	10,566	29,757
7/7	19,626	2,493	6,158	581	1,159	2,059	14,781	3,338	6,455	15,582	36,169
7/8	23,325	2,855	8,211	960	1,596	2,830	17,057	3,918	7,657	21,840	43,604
7/9	24,602	3,012	9,652	1,381	2,123	3,748	19,430	4,576	8,606	28,586	49,558
7/10	27,072	3,204	11,304	1,971	2,748	4,792	22,573	5,143	9,867	34,186	56,695
7/11	28,583	3,414	13,995	2,737	3,446	5,851	25,975	5,295	10,993	39,185	61,702
7/12	30,337	3,686	15,871	3,700	4,095	7,062	29,031	5,839	11,443	43,065	68,316
7/13	33,401	4,020	17,520	4,580	4,524	8,827	31,368	6,328	11,664	46,999	74,210
7/14	35,455	4,349	18,832	5,231	4,926	10,673	33,462	7,465	12,062	55,056	79,238
7/15	36,821	4,740	20,902	5,770	5,456	12,262	35,616	8,535	12,484	63,201	83,891
7/16	38,212	5,044	22,175	6,360	6,242	14,073	37,791	9,592	12,984	73,375	89,782
7/17	39,813	5,291	24,264	6,833	6,733	14,853	38,456	10,547	13,614	81,502	94,544
7/18	40,846	5,604	24,856	7,274	7,271	16,074	39,739	11,614	14,249	87,655	100,367
7/19	41,710	5,924	26,031	7,865	7,775	17,726	40,747	13,036	15,151	96,389	107,693
7/20	42,338	6,098	27,553	8,421	8,113	18,933	41,850	14,393	16,023	105,630	114,903
7/21	43,477	6,361	29,045	8,998	8,496	20,218	42,953	15,976	16,840	115,514	122,572
7/22	44,046	6,489	30,146	9,420	8,836	21,472	44,151	17,054	17,503	124,093	128,519
7/23	44,860	6,652	30,968	9,901	9,142	22,237	45,303	17,593	17,940	131,962	134,101
7/24	45,343	6,723	31,553	10,359	9,393	23,227	48,216	18,077	18,288	139,285	138,597
7/25	45,608	6,778	32,275	10,724	9,563	23,909	49,354	18,935	18,821	145,986	142,843
7/26	45,790	6,901	32,789	11,044	9,784	24,611	49,910	19,470	19,258	152,697	146,527
7/27	45,907	7,001	33,459	11,397	9,987	25,070	50,378	19,836	20,117	158,360	150,076
7/28	46,262	7,193	34,169	11,666	10,191	25,477	50,638	20,192	21,006	165,517	152,992
7/29	46,859	7,316	34,676	11,954	10,330	26,257	50,890	20,546	21,466	170,953	155,283
7/30	47,274	7,393	35,035	12,278	10,491	27,108	51,039	20,900	21,826	174,674	157,612
7/31	47,464	7,429	35,325	12,530	10,696	27,647	51,145	21,215	22,208	177,874	160,034
8/1	47,634	7,477	35,478	12,775	10,796	28,096	51,218	21,594	22,527	180,551	162,237
8/2	47,785	7,527	35,619	12,948	10,881	28,651	51,273	21,886	22,780	183,100	164,555
8/3	47,916	7,583	35,739	13,077	10,988	28,969	51,311	22,123	22,916	184,923	167,055
8/4	48,015	7,621	35,931	13,264	11,079	29,225	51,349	22,360	23,081	186,662	169,271
8/5	48,068	7,654	36,076	13,387	11,162	29,564	51,387	22,485	23,262	188,072	171,342
8/6	48,150	7,696	36,168	13,490	11,233	29,791	51,408	22,637	23,411	189,590	172,704
8/7	48,201	7,728	36,219	13,524	11,295	29,959	51,422	22,814	23,564	190,785	173,743
8/8	48,251	7,749	36,261	13,581	11,304	30,113	51,440	22,927	23,701	192,054	174,754
8/9	48,275	7,777	36,286	13,616	11,330	30,181	51,455	23,064	23,818	193,192	175,230

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Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
8/10	48,335	7,804	36,309	13,646	11,359	30,255	51,463	23,152	23,875	194,051	175,754
8/11	48,349	7,872	36,328	13,673	11,374	30,330	51,468	23,186	23,907	194,717	176,355
8/12	48,369	7,887	36,338	13,707	11,391	30,404	51,486	23,228	23,959	195,208	176,882
8/13	48,398	7,903	36,346	13,730	11,425	30,435	51,511	23,265	23,978	195,640	177,372
8/14	48,403	7,910	36,357	13,742	11,436	30,459	51,517	23,277	24,005	195,982	177,827
8/15	48,419	7,921	36,368	13,753	11,440	30,477	51,522	23,315	24,029	196,265	178,245
8/16	48,424	7,936	36,371	13,758	11,446	30,505	51,526	23,335	24,068	196,469	178,628
8/17	48,426	7,941	36,382	13,768	11,452	30,518	51,528	23,351	24,094	196,657	178,974
8/18	48,431	7,943	36,385	13,771	11,474	30,529	51,531	23,360	24,101	196,818	179,285
8/19	48,437	7,945	36,389	13,771	11,480	30,537	51,532	23,364	24,111	196,969	179,559
8/20	48,441	7,949	36,393	13,775	11,481	30,544	51,532	23,368	24,120	197,081	179,798
8/21	48,449	7,950	36,394	13,780	11,482	30,551	51,538	23,371	24,123	197,179	180,000
8/22	48,454	7,950	36,397	13,786	11,482	30,553	51,543	23,373	24,131	197,239	180,167
8/23	48,460	7,950	36,398	13,788	11,482	30,558	51,546	23,375	24,140	197,302	180,297
8/24	48,461	7,950	36,401	13,789	11,483	30,561	51,549	23,378	24,141	197,402	180,392
8/25	48,468	7,951	36,402	13,793	11,483	30,563	51,552	23,379	24,147	197,467	180,450
8/26	48,471	7,951	36,407	13,794	11,489	30,564	51,553	23,384	24,154	197,496	180,476
8/27	48,473	7,951	36,409	13,796	11,489	30,564	51,553	23,388	24,161	197,518	180,495
8/28	48,474	7,953	36,414	13,796	11,489	30,564	51,554	23,390	24,164	197,543	180,507
8/29	48,476	7,953	36,415	13,798	11,489	30,565	51,555	23,393	24,167	197,569	180,518
8/30	48,477	7,954	36,416	13,802	11,489	30,565	51,556	23,394	24,173	197,589	180,527
8/31	48,478	7,954	36,416	13,805	11,489	30,565	51,557	23,396	24,176	197,601	180,538
9/1	48,480	7,955	36,416	13,808	11,489	30,565	51,557	23,398	24,179	197,610	180,546
9/2	48,482	7,955	36,418	13,809	11,489	30,565	51,558	23,399	24,183	197,615	180,551
9/3	48,483	7,955	36,420	13,810	11,489	30,565	51,560	23,400	24,187	197,620	180,559
9/4	48,483	7,955	36,424	13,811	11,489	30,565	51,561	23,400	24,187	197,631	180,562
9/5	48,483	7,955	36,425	13,812	11,489	30,566	51,561	23,403	24,189	197,641	180,567
9/6	48,483	7,955	36,425	13,812	11,489	30,566	51,561	23,404	24,190	197,650	180,568
9/7	48,485	7,957	36,426	13,813	11,490	30,566	51,562	23,404	24,192	197,660	180,571
9/8	48,486	7,957	36,426	13,815	11,490	30,566	51,564	23,406	24,194	197,670	180,575
9/9	48,487	7,957	36,427	13,816	11,490	30,566	51,564	23,409	24,194	197,674	180,575
9/10	48,490	7,958	36,430	13,817	11,490	30,566	51,564	23,409	24,195	197,683	180,580
9/11	48,491	7,958	36,434	13,817	11,490	30,566	51,564	23,410	24,196	197,692	180,585
9/12	48,493	7,958	36,435	13,817	11,490	30,566	51,565	23,411	24,196	197,696	180,591
9/13	48,494	7,958	36,436	13,819	11,490	30,566	51,566	23,412	24,198	197,696	180,591
9/14	48,494	7,958	36,438	13,819	11,491	30,566	51,567	23,412	24,198	197,699	180,594
9/15	48,494	7,958	36,439	13,819	11,491	30,567	51,569	23,412	24,198	197,706	
9/16		7,958	36,439	13,819	11,491	30,567	51,569	23,412	24,198	197,711	
9/17		7,958	36,440	13,820	11,491	30,568	51,569	23,412	24,198	197,714	
9/18		7,958	36,441		11,491	30,568	51,569	23,412	24,198	197,717	
9/19		7,958	36,441		11,491	30,568	51,569	23,413	24,198	197,719	
9/20		7,958			11,491	30,568	51,569	23,413	24,199	197,722	
9/21		7,958				30,568	51,569		24,199	197,722	
9/22						30,568	51,569		24,199	197,723	
9/23						30,568	51,569		24,201		
9/24						30,569	51,570		24,201		
9/25						30,570			24,201		

Note: Operational dates vary from year to year. Please refer to Figure 4 for and explanation of operational dates. Dates without data are days when the weir was not operating and daily passage was not estimated. All years include daily passage estimates.

Appendix G3.–Historical cumulative percent passage of chum salmon at the Kogrukluk River weir, 1996–2006.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
6/16		0									
6/17		0									
6/18		0									
6/19	0	0									
6/20	0	0	0								
6/21	0	0	0					0	0		
6/22	0	0	0					0	0	0	
6/23	0	0	0					0	0	0	
6/24	0	0	0					0	0	0	
6/25	0	0	0					0	1	0	
6/26	1	0	0				0	0	1	0	
6/27	1	0	0				2	0	2	0	
6/28	1	1	0			0	3	0	2	0	0
6/29	2	4	1			0	5	1	4	0	1
6/30	3	6	2			0	7	1	6	0	1
7/1	5	8	3	0		0	9	1	9	0	3
7/2	11	10	4	0	0	1	10	2	10	1	4
7/3	17	13	6	0	1	1	13	4	12	1	6
7/4	22	16	9	0	2	2	16	6	15	1	8
7/5	29	22	11	1	3	4	20	9	19	3	12
7/6	35	26	15	2	6	5	24	12	22	5	16
7/7	40	31	17	4	10	7	29	14	27	8	20
7/8	48	36	23	7	14	9	33	17	32	11	24
7/9	51	38	26	10	18	12	38	20	36	14	27
7/10	56	40	31	14	24	16	44	22	41	17	31
7/11	59	43	38	20	30	19	50	23	45	20	34
7/12	63	46	44	27	36	23	56	25	47	22	38
7/13	69	51	48	33	39	29	61	27	48	24	41
7/14	73	55	52	38	43	35	65	32	50	28	44
7/15	76	60	57	42	47	40	69	36	52	32	46
7/16	79	63	61	46	54	46	73	41	54	37	50
7/17	82	66	67	49	59	49	75	45	56	41	52
7/18	84	70	68	53	63	53	77	50	59	44	56
7/19	86	74	71	57	68	58	79	56	63	49	60
7/20	87	77	76	61	71	62	81	61	66	53	64
7/21	90	80	80	65	74	66	83	68	70	58	68
7/22	91	82	83	68	77	70	86	73	72	63	71
7/23	93	84	85	72	80	73	88	75	74	67	74
7/24	94	84	87	75	82	76	93	77	76	70	77
7/25	94	85	89	78	83	78	96	81	78	74	79
7/26	94	87	90	80	85	81	97	83	80	77	81
7/27	95	88	92	82	87	82	98	85	83	80	83
7/28	95	90	94	84	89	83	98	86	87	84	85
7/29	97	92	95	86	90	86	99	88	89	86	86
7/30	97	93	96	89	91	89	99	89	90	88	87
7/31	98	93	97	91	93	90	99	91	92	90	89
8/1	98	94	97	92	94	92	99	92	93	91	90
8/2	99	95	98	94	95	94	99	93	94	93	91
8/3	99	95	98	95	96	95	99	94	95	94	93
8/4	99	96	99	96	96	96	100	96	95	94	94
8/5	99	96	99	97	97	97	100	96	96	95	95
8/6	99	97	99	98	98	97	100	97	97	96	96
8/7	99	97	99	98	98	98	100	97	97	96	96
8/8	99	97	100	98	98	99	100	98	98	97	97
8/9	100	98	100	99	99	99	100	99	98	98	97

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Appendix G3.–Page 2 of 2.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
8/10	100	98	100	99	99	99	100	99	99	98	97
8/11	100	99	100	99	99	99	100	99	99	98	98
8/12	100	99	100	99	99	99	100	99	99	99	98
8/13	100	99	100	99	99	100	100	99	99	99	98
8/14	100	99	100	99	100	100	100	99	99	99	98
8/15	100	100	100	100	100	100	100	100	99	99	99
8/16	100	100	100	100	100	100	100	100	99	99	99
8/17	100	100	100	100	100	100	100	100	100	99	99
8/18	100	100	100	100	100	100	100	100	100	100	99
8/19	100	100	100	100	100	100	100	100	100	100	99
8/20	100	100	100	100	100	100	100	100	100	100	100
8/21	100	100	100	100	100	100	100	100	100	100	100
8/22	100	100	100	100	100	100	100	100	100	100	100
8/23	100	100	100	100	100	100	100	100	100	100	100
8/24	100	100	100	100	100	100	100	100	100	100	100
8/25	100	100	100	100	100	100	100	100	100	100	100
8/26	100	100	100	100	100	100	100	100	100	100	100
8/27	100	100	100	100	100	100	100	100	100	100	100
8/28	100	100	100	100	100	100	100	100	100	100	100
8/29	100	100	100	100	100	100	100	100	100	100	100
8/30	100	100	100	100	100	100	100	100	100	100	100
8/31	100	100	100	100	100	100	100	100	100	100	100
9/1	100	100	100	100	100	100	100	100	100	100	100
9/2	100	100	100	100	100	100	100	100	100	100	100
9/3	100	100	100	100	100	100	100	100	100	100	100
9/4	100	100	100	100	100	100	100	100	100	100	100
9/5	100	100	100	100	100	100	100	100	100	100	100
9/6	100	100	100	100	100	100	100	100	100	100	100
9/7	100	100	100	100	100	100	100	100	100	100	100
9/8	100	100	100	100	100	100	100	100	100	100	100
9/9	100	100	100	100	100	100	100	100	100	100	100
9/10	100	100	100	100	100	100	100	100	100	100	100
9/11	100	100	100	100	100	100	100	100	100	100	100
9/12	100	100	100	100	100	100	100	100	100	100	100
9/13	100	100	100	100	100	100	100	100	100	100	100
9/14	100	100	100	100	100	100	100	100	100	100	100
9/15	100	100	100	100	100	100	100	100	100	100	
9/16		100	100	100	100	100	100	100	100	100	
9/17		100	100	100	100	100	100	100	100	100	
9/18		100	100		100	100	100	100	100	100	
9/19		100	100		100	100	100	100	100	100	
9/20		100			100	100	100	100	100	100	
9/21		100				100	100		100	100	
9/22						100	100		100	100	
9/23						100	100		100		
9/24						100	100		100		
9/25						100			100		

Note The boxes represent the median passage date and central 50% of the run. Operational dates vary from year to year. Please refer to Figure 4 for and explanation of operational dates. Dates without data are days when the weir was not operating and daily passage was not estimated. All years include daily passage estimates.

APPENDIX H. HISTORICAL PASSAGE OF SOCKEYE SALMON AT THE KOGRUKLUK RIVER WEIR

Appendix H1.–Historical daily sockeye salmon passage at the Kogrukluk River weir, 1996–2006.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
6/16		0 [a]									
6/17		0 [a]									
6/18		0 [a]									
6/19	0 [a]	0 [a]									
6/20	0 [a]	0 [a]	0 [a]								
6/21	0 [a]	0 [a]	0 [a]			0 [a]		0	0		
6/22	1 [a]	0 [a]	0 [a]			1 [a]		0	0	0	
6/23	2 [a]	0 [a]	0 [a]			2 [a]		0	0	0	
6/24	6 [a]	0 [a]	0 [a]			4 [a]		0	0	0	
6/25	9 [a]	0 [a]	0 [a]			4 [a]		0	0	1	
6/26	10 [a]	0 [a]	0 [a]			10 [a]	3	0	0	1	
6/27	17 [a]	0 [a]	0 [a]			5 [a]	5	1	3	6	
6/28	24 [a]	8	8 [a]			10 [a]	1	1	6	9	5 [b]
6/29	62 [a]	83	3 [a]			15 [a]	17	1	13	6	8
6/30	10	30	111 [a]			23 [a]	6	11	42	2	47
7/1	75	104	40 [a]			134 [a]	16	4	42	32	163
7/2	257	91	140 [a]		0	91 [a]	77	20	51	80	260
7/3	385	319	122 [a]		0	143 [a]	145	49	52	133	436
7/4	243	291	428 [a]		0	199 [a]	235	37	142	63	1249
7/5	452	537	391 [a]		10	50	158	49	183	819	842
7/6	536	574	238 [a]	1	14	130	422	271	323	1452	1341
7/7	806	577	13	7	12	245	43	173	601	1707	1095
7/8	646	549	535 [a]	6	17	487	491	466	370	2655	1474
7/9	1105	261	757 [a]	14	41	603	51	662	413	1516	2259
7/10	945	330	397 [a]	41	91	345	190	220	502	2063	2123
7/11	954	377	666 [a]	45	169	634	421	89	507	1531	1344
7/12	908	428	1461 [a]	92	217	748	275	420	362	1458	2319
7/13	1539	421	2069 [a]	143	35	524	127	449	186	1422	1531
7/14	1122	668	1396 [a]	144	22	846	205	758	220 [c]	2159	2388
7/15	821	826	992 [a]	228	103	499	157	705	207	1793	2620
7/16	458	443	1108 [a]	400	285	346	211	502	125	2247	4137
7/17	368	955	589 [a]	318	150	231	222	466	211	2421	2690
7/18	299	851	138	236	169	145	167 [c]	469	184	2109	1834
7/19	385	876	405	348	90	235	67	704	388	1088	2103
7/20	209	611	462	352	94	317 [a]	49 [c]	538	245	1116	4664
7/21	370	566	469	338	223	320 [a]	49 [c]	448	233	2124	3476
7/22	268	274	441	345	218	165 [a]	31	310	167	1314 [c]	3419
7/23	233	511	244	248	147	152 [a]	17	103	82	1239	2720
7/24	251	152	164	440	113	140 [a]	59	175	58	776	1755
7/25	308	129	449	354	22	96 [a]	33	321	138	597	1370
7/26	67	193	334	157	78	126 [a]	24	131	63	645 [c]	1382
7/27	117	161	452	308	103	103 [a]	9	112	143	552	1032
7/28	99	182	424	148	63	77	13	100	178	656	859
7/29	236	127	258	148	45	99	6	75 [a]	53	247	1164
7/30	244	89	228	232	34	92	6	75 [a]	45	278	470
7/31	81	89	189	162	80	61	6	46	45	132	634
8/1	71 [a]	62	130	165	27	73	0	41	46	159	437
8/2	61 [a]	54	99	95	32	52	1	34	22	190	472
8/3	51	37	96	77	25 [a]	37	1 [a]	25 [a]	23	101	647
8/4	32	38	77	75	21 [a]	32	1 [a]	25 [a]	16	107	696
8/5	38	41	74	68 [a]	18 [a]	23	1 [a]	18	19	107	780
8/6	47	16	19	19 [a]	14 [a]	18	1	7	9	73	513
8/7	31	26	25	28	11 [a]	9	2	17	11	51	289
8/8	23	15	18	22	1	16	3	5	12	94	233
8/9	9	14	23	14	10	3	2	5	6	71	143

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Appendix H1.–Page 2 of 2.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
8/10	31	20	17	13	9	8	4	5	7	30	102
8/11	6 [a]	32	16	7	10	4	0	2	1	63	178
8/12	9 [a]	14 [a]	6	5	7	11	3	1	6	32	131 [a]
8/13	4 [a]	5 [a]	6	3	6	7	0	1	1	48	123 [a]
8/14	16 [a]	4	11	6	7	7	0	3	1	32	114 [a]
8/15	7	5	6	3	6	4	2	3	4	26	105 [a]
8/16	1	2	6	3	3	1	1	1	0	29	96 [a]
8/17	2	4	3	3	2	3	0	1	3	30	88 [a]
8/18	5	1	3	0	1	1	2	0	1	49	79 [a]
8/19	0	1	1	2	1	1 [a]	0	0	-2	35	70 [a]
8/20	1	0	2	1	1	0 [a]	0	2	2	19	61 [a]
8/21	0	0	0	0	1	0 [a]	3	0	2	23	53 [a]
8/22	2	1	4	0	1	0	0	0	1	12	44 [a]
8/23	4	0	1	0	1	1	3	1	0	17	35 [a]
8/24	1	0	0	0	1	1	1	2	0	33	26 [a]
8/25	1	0	1	0	1	2	0	1	0	16	18 [a]
8/26	2	1	1	0	0	0	0	0	0	4	10
8/27	0	1	1	0	0	1	0	0 [d]	0	1	8
8/28	0	0	1	0	0	0	3	0 [a]	0	6	5
8/29	0	0	0	0	0	0	0	0 [d]	0	7	3
8/30	0	0	0	0	0	0	0	0	0	5	4
8/31	0	0	0	0	0	0	0	0	0	1	1
9/1	2	0	1	0	0	0	0	1	0	1	1
9/2	0	0	2	0	0	1	0	0	0	0	2
9/3	1	0	0	0	1	0	1	0	0	1	2
9/4	0	0	0	0	0	0	0	1	0	2	2
9/5	0	0	0	0	1	0	0	0	0	2	2
9/6	1	0	0	0	1	0	0	0	0	4	3
9/7	0	0	0	0	0	0	1	0	0	0	2
9/8	0	0	0	0	0	0	0	1	0	2	3
9/9	0	0	0	0	0	0	0	0	1	2	1
9/10	0	0	0	0	0	0	0	0	0	1	2
9/11	0	0	0	0	0	0	0	0	0	2	4
9/12	0	0	1	0	0	0	0	0	0	2	3
9/13	0	0	0	0	0	0	0	0	0 [c]	0	2
9/14	0	0	0	0	0	1	0	0	0 [c]	0	1
9/15	0	0	0	0	0	0	0	0	0 [c]	0	
9/16		0	0	0	0	0	0	0	0	0 [a]	
9/17		0	0	0	0	0	0	0	0	0 [a]	
9/18		0 [a]	0	0	0	0	0	0	0	0 [a]	
9/19		0	0		0	0	0	0	0	0 [a]	
9/20		0			0	0	0	0	0	0	
9/21		1				0	0		0	0	
9/22						0	0		0	0	
9/23						0	0		0		
9/24						0	0		0		
9/25						1			0		

Note: Operational dates vary from year to year. Please refer to Figure 4 for an explanation of operational dates. Dates without data are days when the weir was not operating and daily passage was not estimated. Also, the sum of daily passages found in this table might differ from the cumulative passages reported elsewhere in this report due to rounding errors associated with estimates.

[a] The weir was not operational; daily passage was estimated.

[b] Partial day count; passage was not estimated.

[c] Passage was estimated due to the occurrence of a hole in the weir.

[d] Partial day count; passage was estimated.

Appendix H2.–Historical daily cumulative sockeye salmon passage at the Kogrukluk River weir, 1996–2006.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
6/16		0									
6/17		0									
6/18		0									
6/19	0	0									
6/20	0	0	0								
6/21	0	0	0			0		0	0		
6/22	1	0	0			1		0	0	0	
6/23	3	0	0			2		0	0	0	
6/24	9	0	0			7		0	0	0	
6/25	17	0	0			10		0	0	1	
6/26	27	0	0			20	3	0	0	2	
6/27	44	0	0			25	8	1	3	8	
6/28	68	8	8			35	9	2	9	17	5
6/29	130	91	11			50	26	3	22	23	13
6/30	140	121	122			73	32	14	64	25	60
7/1	215	225	162			207	48	18	106	57	223
7/2	472	316	302		0	298	125	38	157	137	483
7/3	857	635	424		0	441	270	87	209	270	919
7/4	1,100	926	853		0	640	505	124	351	333	2,168
7/5	1,552	1,463	1,243		10	690	663	173	534	1,152	3,010
7/6	2,088	2,037	1,481	1	24	820	1,085	444	857	2,604	4,351
7/7	2,894	2,614	1,494	8	36	1,065	1,128	617	1,458	4,311	5,446
7/8	3,540	3,163	2,029	14	53	1,552	1,619	1,083	1,828	6,966	6,920
7/9	4,645	3,424	2,786	28	94	2,155	1,670	1,745	2,241	8,482	9,179
7/10	5,590	3,754	3,183	69	185	2,500	1,860	1,965	2,743	10,545	11,302
7/11	6,544	4,131	3,850	114	354	3,134	2,281	2,054	3,250	12,076	12,646
7/12	7,452	4,559	5,310	206	571	3,882	2,556	2,474	3,612	13,534	14,965
7/13	8,991	4,980	7,379	349	606	4,406	2,683	2,923	3,798	14,956	16,496
7/14	10,113	5,648	8,776	493	628	5,252	2,888	3,681	4,018	17,115	18,884
7/15	10,934	6,474	9,767	721	731	5,751	3,045	4,386	4,225	18,908	21,504
7/16	11,392	6,917	10,876	1,121	1,016	6,097	3,256	4,888	4,350	21,155	25,641
7/17	11,760	7,872	11,465	1,439	1,166	6,328	3,478	5,354	4,561	23,576	28,331
7/18	12,059	8,723	11,603	1,675	1,335	6,473	3,645	5,823	4,745	25,685	30,165
7/19	12,444	9,599	12,008	2,023	1,425	6,708	3,712	6,527	5,133	26,773	32,268
7/20	12,653	10,210	12,470	2,375	1,519	7,025	3,761	7,065	5,378	27,889	36,932
7/21	13,023	10,776	12,939	2,713	1,742	7,346	3,810	7,513	5,611	30,013	40,408
7/22	13,291	11,050	13,380	3,058	1,960	7,511	3,841	7,823	5,778	31,327	43,827
7/23	13,524	11,561	13,624	3,306	2,107	7,663	3,858	7,926	5,860	32,566	46,547
7/24	13,775	11,713	13,788	3,746	2,220	7,803	3,917	8,101	5,918	33,342	48,302
7/25	14,083	11,842	14,237	4,100	2,242	7,900	3,950	8,422	6,056	33,939	49,672
7/26	14,150	12,035	14,571	4,257	2,320	8,026	3,974	8,553	6,119	34,584	51,054
7/27	14,267	12,196	15,023	4,565	2,423	8,129	3,983	8,665	6,262	35,136	52,086
7/28	14,366	12,378	15,447	4,713	2,486	8,205	3,996	8,765	6,440	35,792	52,945
7/29	14,602	12,505	15,705	4,861	2,531	8,304	4,002	8,840	6,493	36,039	54,109
7/30	14,846	12,594	15,933	5,093	2,565	8,396	4,008	8,915	6,538	36,317	54,579
7/31	14,927	12,683	16,122	5,255	2,645	8,457	4,014	8,961	6,583	36,449	55,213
8/1	14,998	12,745	16,252	5,420	2,672	8,530	4,014	9,002	6,629	36,608	55,650
8/2	15,059	12,799	16,351	5,515	2,704	8,582	4,015	9,036	6,651	36,798	56,122
8/3	15,110	12,836	16,447	5,592	2,729	8,619	4,016	9,061	6,674	36,899	56,769
8/4	15,142	12,874	16,524	5,667	2,750	8,651	4,017	9,086	6,690	37,006	57,465
8/5	15,180	12,915	16,598	5,735	2,768	8,674	4,018	9,104	6,709	37,113	58,245
8/6	15,227	12,931	16,617	5,754	2,782	8,692	4,019	9,111	6,718	37,186	58,758
8/7	15,258	12,957	16,642	5,782	2,793	8,701	4,021	9,128	6,729	37,237	59,047
8/8	15,281	12,972	16,660	5,804	2,794	8,717	4,024	9,133	6,741	37,331	59,280
8/9	15,290	12,986	16,683	5,818	2,804	8,720	4,026	9,138	6,747	37,402	59,423

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Appendix H2.–Page 2 of 2.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
8/10	15,321	13,006	16,700	5,831	2,813	8,728	4,030	9,143	6,754	37,432	59,525
8/11	15,327	13,038	16,716	5,838	2,823	8,732	4,030	9,145	6,755	37,495	59,703
8/12	15,336	13,052	16,722	5,843	2,830	8,743	4,033	9,146	6,761	37,527	59,834
8/13	15,340	13,057	16,728	5,846	2,836	8,750	4,033	9,147	6,762	37,575	59,957
8/14	15,356	13,061	16,739	5,852	2,843	8,757	4,033	9,150	6,763	37,607	60,071
8/15	15,363	13,066	16,745	5,855	2,849	8,761	4,035	9,153	6,767	37,633	60,176
8/16	15,364	13,068	16,751	5,858	2,852	8,762	4,036	9,154	6,767	37,662	60,272
8/17	15,366	13,072	16,754	5,861	2,854	8,765	4,036	9,155	6,770	37,692	60,360
8/18	15,371	13,073	16,757	5,861	2,855	8,766	4,038	9,155	6,771	37,741	60,438
8/19	15,371	13,074	16,758	5,863	2,856	8,767	4,038	9,155	6,769	37,776	60,509
8/20	15,372	13,074	16,760	5,864	2,857	8,768	4,038	9,157	6,771	37,795	60,570
8/21	15,372	13,074	16,760	5,864	2,858	8,768	4,041	9,157	6,773	37,818	60,623
8/22	15,374	13,075	16,764	5,864	2,859	8,768	4,041	9,157	6,774	37,830	60,667
8/23	15,378	13,075	16,765	5,864	2,860	8,769	4,044	9,158	6,774	37,847	60,702
8/24	15,379	13,075	16,765	5,864	2,861	8,770	4,045	9,160	6,774	37,880	60,728
8/25	15,380	13,075	16,766	5,864	2,862	8,772	4,045	9,161	6,774	37,896	60,746
8/26	15,382	13,076	16,767	5,864	2,862	8,772	4,045	9,161	6,774	37,900	60,756
8/27	15,382	13,077	16,768	5,864	2,862	8,773	4,045	9,161	6,774	37,901	60,764
8/28	15,382	13,077	16,769	5,864	2,862	8,773	4,048	9,161	6,774	37,907	60,769
8/29	15,382	13,077	16,769	5,864	2,862	8,773	4,048	9,161	6,774	37,914	60,772
8/30	15,382	13,077	16,769	5,864	2,862	8,773	4,048	9,161	6,774	37,919	60,776
8/31	15,382	13,077	16,769	5,864	2,862	8,773	4,048	9,161	6,774	37,920	60,777
9/1	15,384	13,077	16,770	5,864	2,862	8,773	4,048	9,162	6,774	37,921	60,778
9/2	15,384	13,077	16,772	5,864	2,862	8,774	4,048	9,162	6,774	37,921	60,780
9/3	15,385	13,077	16,772	5,864	2,863	8,774	4,049	9,162	6,774	37,922	60,782
9/4	15,385	13,077	16,772	5,864	2,863	8,774	4,049	9,163	6,774	37,924	60,784
9/5	15,385	13,077	16,772	5,864	2,864	8,774	4,049	9,163	6,774	37,926	60,786
9/6	15,386	13,077	16,772	5,864	2,865	8,774	4,049	9,163	6,774	37,930	60,789
9/7	15,386	13,077	16,772	5,864	2,865	8,774	4,050	9,163	6,774	37,930	60,791
9/8	15,386	13,077	16,772	5,864	2,865	8,774	4,050	9,164	6,774	37,932	60,794
9/9	15,386	13,077	16,772	5,864	2,865	8,774	4,050	9,164	6,775	37,934	60,795
9/10	15,386	13,077	16,772	5,864	2,865	8,774	4,050	9,164	6,775	37,935	60,797
9/11	15,386	13,077	16,772	5,864	2,865	8,774	4,050	9,164	6,775	37,937	60,801
9/12	15,386	13,077	16,773	5,864	2,865	8,774	4,050	9,164	6,775	37,939	60,804
9/13	15,386	13,077	16,773	5,864	2,865	8,774	4,050	9,164	6,775	37,939	60,806
9/14	15,386	13,077	16,773	5,864	2,865	8,775	4,050	9,164	6,775	37,939	60,807
9/15	15,386	13,077	16,773	5,864	2,865	8,775	4,050	9,164	6,775	37,939	
9/16		13,077	16,773	5,864	2,865	8,775	4,050	9,164	6,775	37,939	
9/17		13,077	16,773	5,864	2,865	8,775	4,050	9,164	6,775	37,939	
9/18		13,077	16,773	5,864	2,865	8,775	4,050	9,164	6,775	37,939	
9/19		13,077	16,773		2,865	8,775	4,050	9,164	6,775	37,939	
9/20		13,077			2,865	8,775	4,050	9,164	6,775	37,939	
9/21		13,078				8,775	4,050		6,775	37,939	
9/22						8,775	4,050		6,775	37,939	
9/23						8,775	4,050		6,775		
9/24						8,775	4,050		6,775		
9/25						8,776			6,775		

Note: Operational dates vary from year to year. Please refer to Figure 4 for and explanation of operational dates. Dates without data are days when the weir was not operating and daily passage was not estimated. All years include daily passage estimates.

Appendix H3.–Historical cumulative percent passage of sockeye salmon at the Kogrukluk River weir, 1996–2006.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
6/16		0									
6/17		0									
6/18		0									
6/19	0	0									
6/20	0	0	0								
6/21	0	0	0			0		0	0		
6/22	0	0	0			0		0	0	0	
6/23	0	0	0			0		0	0	0	
6/24	0	0	0			0		0	0	0	
6/25	0	0	0			0		0	0	0	
6/26	0	0	0			0	0	0	0	0	
6/27	0	0	0			0	0	0	0	0	
6/28	0	0	0			0	0	0	0	0	0
6/29	1	1	0			1	1	0	0	0	0
6/30	1	1	1			1	1	0	1	0	0
7/1	1	2	1			2	1	0	2	0	0
7/2	3	2	2		0	3	3	0	2	0	1
7/3	6	5	3		0	5	7	1	3	1	2
7/4	7	7	5		0	7	12	1	5	1	4
7/5	10	11	7		0	8	16	2	8	3	5
7/6	14	16	9	0	1	9	27	5	13	7	7
7/7	19	20	9	0	1	12	28	7	22	11	9
7/8	23	24	12	0	2	18	40	12	27	18	11
7/9	30	26	17	0	3	25	41	19	33	22	15
7/10	36	29	19	1	6	28	46	21	40	28	19
7/11	43	32	23	2	12	36	56	22	48	32	21
7/12	48	35	32	4	20	44	63	27	53	36	25
7/13	58	38	44	6	21	50	66	32	56	39	27
7/14	66	43	52	8	22	60	71	40	59	45	31
7/15	71	50	58	12	26	66	75	48	62	50	35
7/16	74	53	65	19	35	69	80	53	64	56	42
7/17	76	60	68	25	41	72	86	58	67	62	47
7/18	78	67	69	29	47	74	90	64	70	68	50
7/19	81	73	72	34	50	76	92	71	76	71	53
7/20	82	78	74	41	53	80	93	77	79	74	61
7/21	85	82	77	46	61	84	94	82	83	79	66
7/22	86	84	80	52	68	86	95	85	85	83	72
7/23	88	88	81	56	74	87	95	86	86	86	77
7/24	90	90	82	64	77	89	97	88	87	88	79
7/25	92	91	85	70	78	90	98	92	89	89	82
7/26	92	92	87	73	81	91	98	93	90	91	84
7/27	93	93	90	78	85	93	98	95	92	93	86
7/28	93	95	92	80	87	93	99	96	95	94	87
7/29	95	96	94	83	88	95	99	96	96	95	89
7/30	96	96	95	87	90	96	99	97	97	96	90
7/31	97	97	96	90	92	96	99	98	97	96	91
8/1	97	97	97	92	93	97	99	98	98	96	92
8/2	98	98	97	94	94	98	99	99	98	97	92
8/3	98	98	98	95	95	98	99	99	99	97	93
8/4	98	98	99	97	96	99	99	99	99	98	95
8/5	99	99	99	98	97	99	99	99	99	98	96
8/6	99	99	99	98	97	99	99	99	99	98	97
8/7	99	99	99	99	97	99	99	100	99	98	97
8/8	99	99	99	99	98	99	99	100	99	98	97
8/9	99	99	99	99	98	99	99	100	100	99	98

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Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
8/10	100	99	100	99	98	99	100	100	100	99	98
8/11	100	100	100	100	99	100	100	100	100	99	98
8/12	100	100	100	100	99	100	100	100	100	99	98
8/13	100	100	100	100	99	100	100	100	100	99	99
8/14	100	100	100	100	99	100	100	100	100	99	99
8/15	100	100	100	100	99	100	100	100	100	99	99
8/16	100	100	100	100	100	100	100	100	100	99	99
8/17	100	100	100	100	100	100	100	100	100	99	99
8/18	100	100	100	100	100	100	100	100	100	99	99
8/19	100	100	100	100	100	100	100	100	100	100	100
8/20	100	100	100	100	100	100	100	100	100	100	100
8/21	100	100	100	100	100	100	100	100	100	100	100
8/22	100	100	100	100	100	100	100	100	100	100	100
8/23	100	100	100	100	100	100	100	100	100	100	100
8/24	100	100	100	100	100	100	100	100	100	100	100
8/25	100	100	100	100	100	100	100	100	100	100	100
8/26	100	100	100	100	100	100	100	100	100	100	100
8/27	100	100	100	100	100	100	100	100	100	100	100
8/28	100	100	100	100	100	100	100	100	100	100	100
8/29	100	100	100	100	100	100	100	100	100	100	100
8/30	100	100	100	100	100	100	100	100	100	100	100
8/31	100	100	100	100	100	100	100	100	100	100	100
9/1	100	100	100	100	100	100	100	100	100	100	100
9/2	100	100	100	100	100	100	100	100	100	100	100
9/3	100	100	100	100	100	100	100	100	100	100	100
9/4	100	100	100	100	100	100	100	100	100	100	100
9/5	100	100	100	100	100	100	100	100	100	100	100
9/6	100	100	100	100	100	100	100	100	100	100	100
9/7	100	100	100	100	100	100	100	100	100	100	100
9/8	100	100	100	100	100	100	100	100	100	100	100
9/9	100	100	100	100	100	100	100	100	100	100	100
9/10	100	100	100	100	100	100	100	100	100	100	100
9/11	100	100	100	100	100	100	100	100	100	100	100
9/12	100	100	100	100	100	100	100	100	100	100	100
9/13	100	100	100	100	100	100	100	100	100	100	100
9/14	100	100	100	100	100	100	100	100	100	100	100
9/15	100	100	100	100	100	100	100	100	100	100	
9/16		100	100	100	100	100	100	100	100	100	
9/17		100	100	100	100	100	100	100	100	100	
9/18		100	100	100	100	100	100	100	100	100	
9/19		100	100		100	100	100	100	100	100	
9/20		100			100	100	100	100	100	100	
9/21		100				100	100		100	100	
9/22						100	100		100	100	
9/23						100	100		100		
9/24						100	100		100		
9/25						100			100		

Note: The boxes represent the median passage date and central 50% of the run. Operational dates vary from year to year. Please refer to Figure 4 for and explanation of operational dates. Dates without data are days when the weir was not operating and daily passage was not estimated. All years include daily passage estimates.

APPENDIX I. HISTORICAL PASSAGE OF COHO SALMON AT THE KOGRUKLUK RIVER WEIR

Appendix I1.–Historical daily coho salmon passage at the Kogrukluk River weir, 1996–2006.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
6/26							0	0	0	0	
6/27							0	0	0	0	
6/28		0					0	0	0	0	0 [a]
6/29	0	0					0	0	0	0	0
6/30	0	0					0	0	0	0	0
7/1	0	0					0	0	0	0	0
7/2	0	0			0		0	0	0	0	0
7/3	0	0			0		0	0	0	0	0
7/4	0	0			0		0	0	0	0	0
7/5	0	0			0	0	0	0	0	0	0
7/6	0	0		0	0	0	0	0	0	0	0
7/7	0	0	0	0	0	0	0	0	0	0	0
7/8	0	0		0	0	0	0	0	0	0	0
7/9	0	0		0	0	0	0	0	0	0	0
7/10	0	0		0	0	0	0	0	0	0	0
7/11	0	0		0	0	0	0	0	0	0	0
7/12	0	0		0	0	0	0	0	0	0	0
7/13	0	0		0	0	0	0	0	0	0	0
7/14	0	0		0	0	0	0	0	0 [b]	0	0
7/15	0	0		0	0	0	0	0	0	0	0
7/16	0	0		0	0	0	0	0	0	0	0
7/17	0	0		0	0	0	0	0	0	0	0
7/18	0	0	0	0	0	0	0 [b]	0	0	0	0
7/19	0	0	0	0	0	0	0	0	0	0	0
7/20	1	0	0	0	0		1 [b]	6	0	0	0
7/21	2	0	0	0	0		1 [b]	8	0	0	0
7/22	3	0	0	0	0		1	12	3	1 [b]	0
7/23	0	0	0	0	0		0	3	3	3	2
7/24	2	0	0	1	0		5	3	3	2	29
7/25	6	0	0	0	3		8	14	3	0	42
7/26	3	0	2	0	2		2	4	3	2 [b]	10
7/27	3	0	2	0	3		5	8	17	0	10
7/28	15	0	0	0	1	0	3	27	14	7	7
7/29	25	2	0	0	1	0	0	27 [c]	15	21	9
7/30	83	0	1	1	4	0	0	27 [c]	20	17	11
7/31	26	1	2	0	10	2	0	25	15	8	18
8/1	54 [c]	4	2	0	1	2	0	47	33	21	12
8/2	82 [c]	5	3	0	9	9	3	67	22	29	25
8/3	110	3	10	0	33 [c]	5	6 [c]	51 [c]	11	43	43
8/4	41	4	7	0	32 [c]	12	6 [c]	51 [c]	46	34	65
8/5	36	23	14	0 [c]	51 [c]	4	6 [c]	37	73	17	103
8/6	215	22	6	0 [c]	65 [c]	20	8	53	76	30	67
8/7	151	47	7	1	79 [c]	7	6	135	111	37	106
8/8	140	11	5	1	94	32	20	67	95	78	89
8/9	245	26	17	1	192	16	12	269	113	47	65
8/10	606	65	6	6	325	9	8	324	217	65	58
8/11	613 [c]	89	27	4	233	44	5	27	85	70	206
8/12	901 [c]	57 [c]	17	4	650	190	50	955	240	166	156 [c]
8/13	869 [c]	73 [c]	35	11	872	104	59	547	92	207	181 [c]
8/14	1,025 [c]	21	127	5	967	242	31	1,006	289	219	205 [c]
8/15	1,123	64	91	24	803	237	56	1,200	761	210	230 [c]
8/16	1,384	123	244	62	345	767	89	845	638	248	254 [c]
8/17	1,473	84	225	49	99	386	73	633	660	116	279 [c]
8/18	1,107	93	54	15	559	815	48	237	676	960	303 [c]
8/19	1,035	117	24	6	1,151	576 [c]	17	442	748	718	328 [c]

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Appendix I1.–Page 2 of 2.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
8/20	2,142	238	128	238	1,099	312 [c]	125	1,145	369	334	352 [c]
8/21	2,510	449	747	69	1,243	623 [c]	743	2,186	708	646	377 [c]
8/22	2,547	428	298	188	1,143	1,067	825	1,430	839	23	401 [c]
8/23	2,665	479	260	191	1,051	557	958	1,011	999	947	426 [c]
8/24	2,418	425	940	175	1,065	1,006	814	1,593	689	2,070	450 [c]
8/25	2,727	611	470	171	592	714	1,080	1,765	1,391	834	475 [c]
8/26	2,346	585	1,331	77	408	631	243	3,171	841	89	548
8/27	1,953	401	438	261	1,881	906	301	3,269 [d]	282	23	450
8/28	2,430	350	481	103	2,673	718	341	3,551 [c]	172	663	600
8/29	1,375	300	590	206	3,066	1,441	308	3,551 [d]	451	794	752
8/30	2,056	707	903	265	2,564	769	602	4,100	1,365	877	427
8/31	2,098	908	1,441	208	1,416	867	1,350	3,662	388	710	638
9/1	2,004	564	1,405	349	1,105	629	1,005	3,701	1,294	188	635
9/2	1,948	251	1,574	482	864	783	509	2,790	1,408	24	869
9/3	1,492	431	1,395	501	727	322	351	2,101	934	648	752
9/4	990	69	1,982	876	426	452	500	4,501	780	2,122	604
9/5	890	540	1,189	1,001	552	401	860	4,661	919	1,364	753
9/6	907	234	642	424	1,296	106	747	2,873	1,029	1,029	619
9/7	1,035	722	242	530	796	200	595	1,687	835	1,607	579
9/8	775	597	483	529	602	573	373	1,907	814	704	922
9/9	517	415	424	406	445	288	147	2,957	157	419	695
9/10	460	342	767	413	280	364	154	2,002	573	866	497
9/11	345	195	722	258	458	84	93	1,309	656	569	412
9/12	230	102	553	346	270	172	233	1,857	709	637	384
9/13	128	80	427	225	190	177	208	1,720	572 [b]	401	241
9/14	116	62	270	609	102	137	97	687	461 [b]	331	240
9/15	72	52	356	442	70	92	110	501	350 [b]	464	
9/16		89	363	128	33	572	71	356	271	340 [c]	
9/17		89	435	232	39	258	53	333	207	282 [c]	
9/18		64 [c]	229	571 [c]	43	167	35	552	142	224 [c]	
9/19		38	201	380 [c]	24	107	42	181	277	166 [c]	
9/20		28	330 [c]	267 [c]	28	62	29	338	226	122	
9/21		26	222 [c]	176 [c]		136	23		172	95	
9/22		140 [c]	273 [c]	363 [c]		62	16		191	127	
9/23		62 [c]	196 [c]	161 [c]		67	13		134		
9/24		73 [c]	182 [c]	190 [c]		37	35		132		
9/25		26 [c]	87 [c]	66 [c]		49			223		
9/26		24 [c]	114 [c]	63 [c]							
9/27		14 [c]	59 [c]	61 [c]							
9/28		24 [c]	46 [c]	41 [c]							
9/29		17 [c]	37 [c]	37 [c]							
9/30		6 [c]	32 [c]	18 [c]							
10/1		8 [c]	25 [c]	20 [c]							
10/2		11 [c]	36 [c]	28 [c]							
10/3		10 [c]	34 [c]	27 [c]							
10/4		10 [c]	38 [c]	25 [c]							
10/5		8 [c]	21 [c]	21 [c]							

Note: Operational dates vary from year to year. Please refer to Figure 4 for an explanation of operational dates. Dates without data are days when the weir was not operating and daily passage was not estimated. Also, the sum of daily passages found in this table might differ from the cumulative passages reported elsewhere in this report due to rounding errors associated with estimates.

[a] Partial day count; passage was not estimated.

[b] Passage was estimated due to the occurrence of a hole in the weir.

[c] The weir was not operational; daily passage was estimated.

[d] Partial day count; passage was estimated.

Appendix I2.–Historical daily cumulative coho salmon passage at the Kogrukluk River weir, 1996–2006.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
6/26							0	0	0	0	
6/27							0	0	0	0	
6/28		0					0	0	0	0	0
6/29	0	0					0	0	0	0	0
6/30	0	0					0	0	0	0	0
7/1	0	0					0	0	0	0	0
7/2	0	0			0		0	0	0	0	0
7/3	0	0			0		0	0	0	0	0
7/4	0	0			0		0	0	0	0	0
7/5	0	0		0	0	0	0	0	0	0	0
7/6	0	0		0	0	0	0	0	0	0	0
7/7	0	0	0	0	0	0	0	0	0	0	0
7/8	0	0	0	0	0	0	0	0	0	0	0
7/9	0	0	0	0	0	0	0	0	0	0	0
7/10	0	0	0	0	0	0	0	0	0	0	0
7/11	0	0	0	0	0	0	0	0	0	0	0
7/12	0	0	0	0	0	0	0	0	0	0	0
7/13	0	0	0	0	0	0	0	0	0	0	0
7/14	0	0	0	0	0	0	0	0	0	0	0
7/15	0	0	0	0	0	0	0	0	0	0	0
7/16	0	0	0	0	0	0	0	0	0	0	0
7/17	0	0	0	0	0	0	0	0	0	0	0
7/18	0	0	0	0	0	0	0	0	0	0	0
7/19	0	0	0	0	0	0	0	0	0	0	0
7/20	1	0	0	0	0	0	1	6	0	0	0
7/21	3	0	0	0	0	0	1	14	0	0	0
7/22	6	0	0	0	0	0	2	26	3	1	0
7/23	6	0	0	0	0	0	2	29	6	4	2
7/24	8	0	0	1	0	0	7	32	9	6	31
7/25	14	0	0	1	3	0	15	46	12	6	73
7/26	17	0	2	1	5	0	17	50	15	9	83
7/27	20	0	4	1	8	0	22	58	32	9	93
7/28	35	0	4	1	9	0	25	85	46	16	100
7/29	60	2	4	1	10	0	25	112	61	37	109
7/30	143	2	5	2	14	0	25	139	81	54	120
7/31	169	3	7	2	24	2	25	164	96	62	138
8/1	223	7	9	2	25	4	25	211	129	83	150
8/2	305	12	12	2	34	13	28	278	151	112	175
8/3	415	15	22	2	67	18	34	329	162	155	218
8/4	456	19	29	2	99	30	39	380	208	189	283
8/5	492	42	43	2	150	34	45	417	281	206	386
8/6	707	64	49	2	215	54	53	470	357	236	453
8/7	858	111	56	3	294	61	59	605	468	273	559
8/8	998	122	61	4	388	93	79	672	563	351	648
8/9	1,243	148	78	5	580	109	91	941	676	398	713
8/10	1,849	213	84	11	905	118	99	1,265	893	463	771
8/11	2,462	302	111	15	1,138	162	104	1,292	978	533	977
8/12	3,363	359	128	19	1,788	352	154	2,247	1,218	699	1,133
8/13	4,232	432	163	30	2,660	456	213	2,794	1,310	906	1,314
8/14	5,257	453	290	35	3,627	698	244	3,800	1,599	1,125	1,520
8/15	6,380	517	381	59	4,430	935	300	5,000	2,360	1,335	1,750
8/16	7,764	640	625	121	4,775	1,702	389	5,845	2,998	1,583	2,004
8/17	9,237	724	850	170	4,874	2,088	462	6,478	3,658	1,699	2,283
8/18	10,344	817	904	185	5,433	2,903	510	6,715	4,334	2,659	2,586
8/19	11,379	934	928	191	6,584	3,479	527	7,157	5,082	3,377	2,914

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Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
8/20	13,521	1,172	1,056	429	7,683	3,791	652	8,302	5,451	3,711	3,266
8/21	16,031	1,621	1,803	498	8,926	4,414	1,395	10,488	6,159	4,357	3,643
8/22	18,578	2,049	2,101	686	10,069	5,481	2,220	11,918	6,998	4,380	4,044
8/23	21,243	2,528	2,361	877	11,120	6,038	3,178	12,929	7,997	5,327	4,469
8/24	23,661	2,953	3,301	1,052	12,185	7,044	3,992	14,522	8,686	7,397	4,919
8/25	26,388	3,564	3,771	1,223	12,777	7,758	5,072	16,287	10,077	8,231	5,394
8/26	28,734	4,149	5,102	1,300	13,185	8,389	5,315	19,458	10,918	8,320	5,942
8/27	30,687	4,550	5,540	1,561	15,066	9,295	5,616	22,727	11,200	8,343	6,392
8/28	33,117	4,900	6,021	1,664	17,739	10,013	5,957	26,277	11,372	9,006	6,992
8/29	34,492	5,200	6,611	1,870	20,805	11,454	6,265	29,828	11,823	9,800	7,744
8/30	36,548	5,907	7,514	2,135	23,369	12,223	6,867	33,928	13,188	10,677	8,171
8/31	38,646	6,815	8,955	2,343	24,785	13,090	8,217	37,590	13,576	11,387	8,809
9/1	40,650	7,379	10,360	2,692	25,890	13,719	9,222	41,291	14,870	11,575	9,444
9/2	42,598	7,630	11,934	3,174	26,754	14,502	9,731	44,081	16,278	11,599	10,313
9/3	44,090	8,061	13,329	3,675	27,481	14,824	10,082	46,182	17,212	12,247	11,065
9/4	45,080	8,130	15,311	4,551	27,907	15,276	10,582	50,683	17,992	14,369	11,669
9/5	45,970	8,670	16,500	5,552	28,459	15,677	11,442	55,344	18,911	15,733	12,422
9/6	46,877	8,904	17,142	5,976	29,755	15,783	12,189	58,217	19,940	16,762	13,041
9/7	47,912	9,626	17,384	6,506	30,551	15,983	12,784	59,904	20,775	18,369	13,620
9/8	48,687	10,223	17,867	7,035	31,153	16,556	13,157	61,811	21,589	19,073	14,542
9/9	49,204	10,638	18,291	7,441	31,598	16,844	13,304	64,768	21,746	19,492	15,237
9/10	49,664	10,980	19,058	7,854	31,878	17,208	13,458	66,770	22,319	20,358	15,734
9/11	50,009	11,175	19,780	8,112	32,336	17,292	13,551	68,079	22,975	20,927	16,146
9/12	50,239	11,277	20,333	8,458	32,606	17,464	13,784	69,936	23,684	21,564	16,530
9/13	50,367	11,357	20,760	8,683	32,796	17,641	13,992	71,656	24,256	21,965	16,771
9/14	50,483	11,419	21,030	9,292	32,898	17,778	14,089	72,343	24,716	22,296	17,011
9/15	50,555	11,471	21,386	9,734	32,968	17,870	14,199	72,844	25,066	22,760	
9/16		11,560	21,749	9,862	33,001	18,442	14,270	73,200	25,337	23,099	
9/17		11,649	22,184	10,094	33,040	18,700	14,323	73,533	25,544	23,381	
9/18		11,713	22,413	10,665	33,083	18,867	14,358	74,085	25,686	23,605	
9/19		11,751	22,614	11,045	33,107	18,974	14,400	74,266	25,963	23,772	
9/20		11,779	22,944	11,312	33,135	19,036	14,429	74,604	26,189	23,894	
9/21		11,805	23,167	11,488		19,172	14,452		26,361	23,989	
9/22		11,945	23,440	11,850		19,234	14,468		26,552	24,116	
9/23		12,007	23,636	12,011		19,301	14,481		26,686		
9/24		12,080	23,818	12,202		19,338	14,516		26,818		
9/25		12,106	23,905	12,268		19,387			27,041		
9/26		12,130	24,019	12,332							
9/27		12,144	24,078	12,392							
9/28		12,168	24,124	12,433							
9/29		12,185	24,161	12,470							
9/30		12,191	24,193	12,488							
10/1		12,199	24,218	12,508							
10/2		12,210	24,254	12,536							
10/3		12,220	24,288	12,563							
10/4		12,230	24,326	12,588							
10/5		12,238	24,348	12,609							

Note: Operational dates vary from year to year. Please refer to Figure 4 for and explanation of operational dates. Dates without data are days when the weir was not operating and daily passage was not estimated. All years include daily passage estimates.

Appendix I3.–Historical cumulative percent passage of coho salmon at the Kogrukluk River weir, 1996–2006.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
6/26							0	0	0	0	
6/27							0	0	0	0	
6/28		0					0	0	0	0	0
6/29	0	0					0	0	0	0	0
6/30	0	0					0	0	0	0	0
7/1	0	0					0	0	0	0	0
7/2	0	0			0		0	0	0	0	0
7/3	0	0			0		0	0	0	0	0
7/4	0	0			0		0	0	0	0	0
7/5	0	0		0	0	0	0	0	0	0	0
7/6	0	0		0	0	0	0	0	0	0	0
7/7	0	0	0	0	0	0	0	0	0	0	0
7/8	0	0	0	0	0	0	0	0	0	0	0
7/9	0	0	0	0	0	0	0	0	0	0	0
7/10	0	0	0	0	0	0	0	0	0	0	0
7/11	0	0	0	0	0	0	0	0	0	0	0
7/12	0	0	0	0	0	0	0	0	0	0	0
7/13	0	0	0	0	0	0	0	0	0	0	0
7/14	0	0	0	0	0	0	0	0	0	0	0
7/15	0	0	0	0	0	0	0	0	0	0	0
7/16	0	0	0	0	0	0	0	0	0	0	0
7/17	0	0	0	0	0	0	0	0	0	0	0
7/18	0	0	0	0	0	0	0	0	0	0	0
7/19	0	0	0	0	0	0	0	0	0	0	0
7/20	0	0	0	0	0	0	0	0	0	0	0
7/21	0	0	0	0	0	0	0	0	0	0	0
7/22	0	0	0	0	0	0	0	0	0	0	0
7/23	0	0	0	0	0	0	0	0	0	0	0
7/24	0	0	0	0	0	0	0	0	0	0	0
7/25	0	0	0	0	0	0	0	0	0	0	0
7/26	0	0	0	0	0	0	0	0	0	0	0
7/27	0	0	0	0	0	0	0	0	0	0	1
7/28	0	0	0	0	0	0	0	0	0	0	1
7/29	0	0	0	0	0	0	0	0	0	0	1
7/30	0	0	0	0	0	0	0	0	0	0	1
7/31	0	0	0	0	0	0	0	0	0	0	1
8/1	0	0	0	0	0	0	0	0	0	0	1
8/2	1	0	0	0	0	0	0	0	1	0	1
8/3	1	0	0	0	0	0	0	0	1	1	1
8/4	1	0	0	0	0	0	0	1	1	1	2
8/5	1	0	0	0	0	0	0	1	1	1	2
8/6	1	1	0	0	1	0	0	1	1	1	3
8/7	2	1	0	0	1	0	0	1	2	1	3
8/8	2	1	0	0	1	0	1	1	2	1	4
8/9	2	1	0	0	2	1	1	1	2	2	4
8/10	4	2	0	0	3	1	1	2	3	2	5
8/11	5	2	0	0	3	1	1	2	4	2	6
8/12	7	3	1	0	5	2	1	3	5	3	7
8/13	8	4	1	0	8	2	1	4	5	4	8
8/14	10	4	1	0	11	4	2	5	6	5	9
8/15	13	4	2	0	13	5	2	7	9	6	10
8/16	15	5	3	1	14	9	3	8	11	7	12
8/17	18	6	3	1	15	11	3	9	14	7	13
8/18	20	7	4	1	16	15	4	9	16	11	15
8/19	23	8	4	2	20	18	4	10	19	14	17

-continued-

Appendix I3.–Page 2 of 2.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
8/20	27	10	4	3	23	20	4	11	20	15	19
8/21	32	13	7	4	27	23	10	14	23	18	21
8/22	37	17	9	5	30	28	15	16	26	18	24
8/23	42	21	10	7	34	31	22	17	30	22	26
8/24	47	24	14	8	37	36	27	19	32	31	29
8/25	52	29	15	10	39	40	35	22	37	34	32
8/26	57	34	21	10	40	43	37	26	40	34	35
8/27	61	37	23	12	45	48	39	30	41	35	38
8/28	66	40	25	13	54	52	41	35	42	37	41
8/29	68	42	27	15	63	59	43	40	44	41	46
8/30	72	48	31	17	71	63	47	45	49	44	48
8/31	76	56	37	19	75	68	57	50	50	47	52
9/1	80	60	43	21	78	71	64	55	55	48	56
9/2	84	62	49	25	81	75	67	59	60	48	61
9/3	87	66	55	29	83	76	69	62	64	51	65
9/4	89	66	63	36	84	79	73	68	67	60	69
9/5	91	71	68	44	86	81	79	74	70	65	73
9/6	93	73	70	47	90	81	84	78	74	70	77
9/7	95	79	71	52	92	82	88	80	77	76	80
9/8	96	84	73	56	94	85	91	83	80	79	85
9/9	97	87	75	59	95	87	92	87	80	81	90
9/10	98	90	78	62	96	89	93	89	83	84	92
9/11	99	91	81	64	98	89	93	91	85	87	95
9/12	99	92	84	67	98	90	95	94	88	89	97
9/13	100	93	85	69	99	91	96	96	90	91	99
9/14	100	93	86	74	99	92	97	97	91	92	100
9/15	100	94	88	77	99	92	98	98	93	94	
9/16		94	89	78	100	95	98	98	94	96	
9/17		95	91	80	100	96	99	99	94	97	
9/18		96	92	85	100	97	99	99	95	98	
9/19		96	93	88	100	98	99	100	96	99	
9/20		96	94	90	100	98	99	100	97	99	
9/21		96	95	91		99	100		97	99	
9/22		98	96	94		99	100		98	100	
9/23		98	97	95		100	100		99		
9/24		99	98	97		100	100		99		
9/25		99	98	97		100			100		
9/26		99	99	98							
9/27		99	99	98							
9/28		99	99	99							
9/29		100	99	99							
9/30		100	99	99							
10/1		100	99	99							
10/2		100	100	99							
10/3		100	100	100							
10/4		100	100	100							
10/5		100	100	100							

Note: The boxes represent the median passage date and central 50% of the run. Operational dates vary from year to year. Please refer to Figure 4 for and explanation of operational dates. Dates without data are days when the weir was not operating and daily passage was not estimated. All years include daily passage estimates.

APPENDIX J. HISTORICAL CUMULATIVE CARCASS COUNTS AT THE KOGRUKLUK RIVER WEIR

Appendix J1.–Historical cumulative carcass counts and percent carcasses return at the Kogrukluk River weir.

	Chinook					**Chum**					**Sockeye**				
Year	Male Carcasses	Female Carcasses	Total Cumulative Carcasses	Observed Upstream Passage	Percent Carcasses	Male Carcasses	Female Carcasses	Total Cumulative Carcasses	Observed Upstream Passage	Percent Carcasses	Male Carcasses	Female Carcasses	Total Cumulative Carcasses	Observed Upstream Passage	Percent Carcasses
1976	52	12	64	5,507	1	892	167	1,059	8,046	13	2	1	3	2,302	0
1977	6	6	12	1,385	1	514	57	571	10,388	5	0	2	2	1,112	0
1978	423	228	651	13,132	5	4,750	1,387	6,137	47,099	13	5	1	6	1,646	0
1979	14	8	22	10,125	0	1,187	227	1,414	13,966	10	1	1	2	2,432	0
1980[a]			ND	843				ND	6,323				ND	404	
1981	345	393	738	16,071	5	1,891	507	2,398	56,271	4	1,697	189	1,886	17,702	11
1982			ND	5,325				ND	41,204				ND	11,729	
1983[a]	40	14	54	1,082	5	162	123	285	3,257	9	215	13	228	375	61
1984	757	95	852	4,928	17	6,928	2,297	9,225	41,484	22	361	74	435	4,133	11
1985			ND	4,293				ND	13,843				ND	4,344	
1986	5	3	8	2,922	0	248	87	335	12,041		136	54	190	3,255	6
1987[a]			ND	770				ND	2,365				ND	284	
1988[b]	1,336	457	1,793	7,665	23	6,638	1,345	7,983	28,499	28	282	44	325	4,240	8
1989	0	1	1	4,911	0	323	69	392	15,543	3	2	1	3	2,599	0
1990			684	10,093	7			6,004	26,555	23			556	8,383	7
1991			852	5,868	15			6,453	22,369	29			547	13,737	4
1992			533	6,397	8			7,580	31,902	24			1,356	7,344	18
1993			1,117	10,516	11			7,112	26,764	27			1,313	27,148	5
1994			1,199	8,305	14			3,938	23,147	17			1,216	5,695	21
1995			3,450	18,877	18			11,051	28,460	39			2,448	10,582	23
1996			3,134	13,764	23			11,870	47,111	25			2,791	15,222	18
1997			749	13,111	6			2,621	7,902	33			470	13,059	4
1998			948	3,009	32			5,588	13,013	43			623	5,321	12
1999			507	5,472	9			3,286	13,497	24			446	5,777	8
2000			379	3,180	12			2,570	11,077	23			238	2,776	9
2001			978	6,572	15			6,191	22,551	27			822	6,637	12
2002			1,634	9,590	17			17,462	49,494	35			611	3,913	16
2003			1,352	11,585	12			8,111	22,514	36			934	8,986	10
2004	2,548	245	2,793	19,432	14	11,577	1,018	12,595	24,174	52	731	180	911	6,767	13
2005			2,797	21,731	13			36,745	191,588	19			3,005	37,465	8
2006			1,864	19,184	10			29,403	176,508	17			2,046	59,773	3
Average % of observed escapement returned to the weir as carcasses**:**					11					23					11

[a] Partial day count; passage was not estimated.

[b] In 1988 estimates were made for carcass accumulation. Percentages derived from estimated carcasses/ estimated escapement. Values for all other years were generated from observed carcasses/observed escapement.