Fishery Data Series No. 06-26

Takotna River Salmon Studies, 2005

Annual Report for Study 05-304
USFWS Office of Subsistence Management
Fisheries Information Services Division and
Bering Sea Fishermen's Association

by

Daniel J. Costello,

Douglas B. Molyneaux,

and

Clinton Goods

May 2006

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

Symbols and Abbreviations

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

Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

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

FISHERY DATA SERIES NO. 06-26

TAKOTNA RIVER SALMON STUDIES, 2005

by

Daniel J. Costello,

Douglas B. Molyneaux,

and

Clinton Goods

Division of Commercial Fisheries, Anchorage

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1565

May 2006

Development and publication of this manuscript was partially financed by the USFWS Office of Subsistence Management (Project 05-304) Fisheries Resource Monitoring Program under Cooperative Agreement 701815J587 and a grant from the U.S. Bureau of Indian Affairs administered by the Bering Sea Fishermen's Association (#E00441023).

The Division of Sport Fish Fishery Data Series was established in 1987 for the publication of technically oriented results for a single project or group of closely related projects. Since 2004, the Division of Commercial Fisheries has also used the Fishery Data Series. Fishery Data Series reports are intended for fishery and other technical professionals. Fishery Data Series reports are available through the Alaska State Library and on the Internet: http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm This publication has undergone editorial and peer review.

Daniel J. Costello,
daniel_costello@fishgame.state.ak.us

Douglas B. Molyneaux,
doug_molyneaux@fishgame.state.ak.us

and

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

This document should be cited as:
Costello, D. J., D. B. Molyneaux, and C. Goods. 2006. Takotna River salmon studies, 2005. Alaska Department of Fish and Game, Fishery Data Series No. 06-26, Anchorage.

TABLE OF CONTENTS

Page

LIST OF TABLES....................iv
LIST OF FIGURES....................iv
LIST OF APPENDICES....................vi
ABSTRACT....................1
INTRODUCTION....................1
Background....................3
Objectives....................4
METHODS....................5
Study Area....................5
Weir Design....................5
Installation Site....................5
Construction....................6
Maintenance....................6
Escapement Monitoring....................7
Passage Counts....................7
Estimating Missed Passage....................8
Carcasses....................9
Age, Sex, and Length Composition....................9
Sample Collection....................9
Estimating Age, Sex, and Length Composition of Escapement....................10
Weather and Stream Observations....................11
Juvenile Salmon Investigations....................11
Study Area....................11
Sampling Efforts....................11
Capture Methods....................11
Distribution....................12
Length Patterns....................12
Related Fisheries Projects....................13
Inriver Abundance of Chinook Salmon in the Kuskokwim River....................13
Kuskokwim River Sockeye Salmon Radiotelemetry Feasibility Study....................13
Kuskokwim River Salmon Mark–Recapture Project....................13
Genetic Diversity of Chinook Salmon from the Kuskokwim River....................14
Kuskokwim River Chum Salmon Fry Body Condition and Feeding Ecology Project....................14
RESULTS....................14
Escapement Monitoring....................14

TABLE OF CONTENTS (Continued)

Page

- Chinook Salmon 14
- Chum Salmon 15
- Coho Salmon 15
- Other Species 15
- Carcasses 15

Age, Sex, and Length Composition 15
- Chinook Salmon 15
- Chum Salmon 16
- Coho Salmon 16

Weather and Stream Observations 16
Juvenile Salmon Investigations 17
- Sampling Efforts 17
- Capture Methods 17
- Distribution 17
  - Juvenile Chinook Salmon 17
  - Juvenile Coho Salmon 17
  - Other Species 18
- Length Patterns 18
  - Juvenile Chinook Salmon 18
  - Juvenile Coho Salmon 18

Related Fisheries Projects 18
- Inriver Abundance of Chinook Salmon in the Kuskokwim River 18
- Kuskokwim River Sockeye Salmon Radiotelemetry Feasibility Study 18
- Kuskokwim River Salmon Mark–Recapture Project 18
- Genetic Diversity of Chinook Salmon from the Kuskokwim River 19
- Kuskokwim River Chum Salmon Fry Body Condition and Feeding Ecology Project 19

DISCUSSION 19

Escapement Monitoring 19
- Chinook Salmon 20
  - Abundance 20
  - Spawning Locations 21
  - Run Timing at Weir 21
  - Index Value 21
- Chum Salmon 22
  - Abundance 22
  - Run Timing at Weir 23
- Coho Salmon 23
  - Abundance 23
  - Run Timing at Weir 24
- Other Species 24

TABLE OF CONTENTS (Continued)

Page

Sockeye Salmon ... 24
Resident Species ... 25
Carcasses ... 25
Age, Sex, and Length Composition ... 26
Chinook Salmon ... 26
Chum Salmon ... 28
Coho Salmon ... 29
Weather and Stream Observations ... 30
Juvenile Salmon Investigations ... 31
Sampling Efforts ... 31
Distribution ... 31
Juvenile Chinook Salmon ... 31
Coho Salmon ... 31
Length Patterns ... 31
Chinook Salmon ... 31
Coho Salmon ... 32
Related Fisheries Projects ... 33
Inriver Abundance of Chinook Salmon in the Kuskokwim River ... 33
Kuskokwim River Sockeye Salmon Radiotelemetry Feasibility Study ... 33
Kuskokwim River Salmon Mark–Recapture Project ... 34
Chinook Salmon ... 34
Chum Salmon ... 34
Coho Salmon ... 35
Sockeye Salmon ... 36
Genetic Diversity of Chinook Salmon from the Kuskokwim River ... 37
Kuskokwim River Chum Salmon Fry Body Condition and Feeding Ecology Project ... 37
CONCLUSIONS ... 38
Escapement Monitoring ... 38
Age, Sex, and Length Composition ... 38
Weather and Stream Observations ... 38
Juvenile Salmon Investigations ... 38
Related Fisheries Projects ... 39
RECOMMENDATIONS ... 39
Escapement Monitoring ... 39
Age, Sex, and Length Composition ... 40
Weather and Stream Observations ... 40
Juvenile Salmon Investigations ... 40
Related Fisheries Projects ... 40
ACKNOWLEDGMENTS ... 41
REFERENCES CITED ... 41
TABLES AND FIGURES ... 47
APPENDIX A. HISTORICAL SALMON PASSAGE AT THE TAKOTNA RIVER WEIR ... 109

TABLE OF CONTENTS (Continued)

Page

APPENDIX B. DAILY CARCASS COUNTS, 2005 123

APPENDIX C. WEATHER AND STREAM OBSERVATIONS, 2005........ 127

APPENDIX D. JUVENILE SAMPLING EVENTS, 2005 135

APPENDIX E. LENGTH DATA FOR JUVENILE SALMON IN THE TAKOTNA RIVER DRAINAGE, 2005 . 139

APPENDIX F. HISTORICAL CUMULATIVE PERCENT SALMON PASSAGE 145

LIST OF TABLES

Table **Page**

1. Actual daily and estimated counts of Chinook, chum, sockeye, coho salmon and longnose suckers at the Takotna River weir, 2005. 48
2. Age and sex composition of Chinook salmon sampled at the Takotna River weir in 2005 using escapement samples collected with a live trap. 51
3. Mean length (mm) of Chinook salmon sampled at the Takotna River weir in 2005 using escapement samples collected with a live trap. 52
4. Age and sex composition of chum salmon at the Takotna River weir in 2005 based on escapement samples collected with a live trap. 53
5. Mean length (mm) of chum salmon at the Takotna River weir in 2005 based on escapement samples collected with a live trap. 54
6. Age and sex composition of coho salmon at the Takotna River weir in 2005 based on escapement samples collected with a live trap. 56
7. Mean length (mm) of coho salmon at the Takotna River weir in 2005 based on escapement samples collected with a live trap. 57
8. Historical number caught and CPUE for juvenile Chinook salmon caught using minnow traps. 59
9. Historical number caught and CPUE for juvenile coho salmon caught using minnow traps. 60

LIST OF FIGURES

Figure **Page**

1. Map depicting the location of Kuskokwim Area salmon management districts and escapement monitoring projects. 61
2. Average timing of the Chinook salmon subsistence harvest in District 1 compared to the average run timing observed in the Bethel Test Fishery, 1984–1999. 62
3. Map depicting the Takotna River drainage and the location of historic native communities and fish weirs. 63
4. Index areas used for juvenile salmon investigation in the Takotna River drainage. 64
5. Historical annual run timing of Chinook, chum, and coho salmon based on cumulative percent passage at the Takotna River tower (1996–1997) and weir (2000–2005). 65
6. Average length by date for juvenile salmon captured in the Takotna River drainage in 2005. 66
7. Cumulative passage of Chinook, chum, and coho salmon in 2005 compared to the respective historical average, minimum, and maximum from 1996–1997 (tower) and 2000–2004 (weir). 67
8. Historical annual Chinook salmon escapement into six Kuskokwim River tributaries, and the Kuskokwim River Chinook salmon aerial survey indices, 1991–2005. 68
9. Locations and results of aerial stream surveys conducted in the Takotna River drainage, July 2005. 69
10. Reference map of the upper Kuskokwim River for Figures 11 and 12. 70
11. Locations of aerial steam surveys conducted in the Salmon River (Pitka Fork), July 2005. 71
12. Salmon River index areas used for aerial stream surveys. 72

LIST OF FIGURES (Continued)

Figure **Page**

13. Comparison of Salmon River aerial survey counts and Takotna River escapement counts for Chinook salmon, 2000–2005. 73
14. Historical annual chum salmon escapement into seven Kuskokwim River tributaries, 1991–2005. 74
15. Historical annual coho salmon escapement into six Kuskokwim River tributaries, 1991–2005. 75
16. Historical annual sockeye salmon escapement into six Kuskokwim River tributaries, 1991–2005. 76
17. Historical annual Chinook and chum salmon escapement compared to annual carcass deposition at the Takotna River weir, 2000–2005. 77
18. Historical age composition by sample date for Chinook salmon at Takotna River weir. 78
19. Historical Chinook and chum salmon age distribution at Takotna River weir. 79
20. Historical percentage of female Chinook, chum, and coho salmon by sample date at the Takotna River weir. 80
21. Percentage of females per strata as determined by ASL sampling compared to visual identification at Takotna River weir, 2005. 81
22. Historical average annual length for Chinook salmon sampled at Takotna River weir. 82
23. Historical age composition by sample date for chum salmon at Takotna River weir. 83
24. Historical average annual length of male and female chum and coho salmon at the Takotna River weir. 84
25. Historical average annual length for chum salmon at Takotna River weir, with 95% confidence intervals. 85
26. Historical average annual length for coho salmon at Takotna River weir, with 95% confidence intervals. 86
27. Historical average, minimum, and maximum daily river stage and water temperature at the Takotna River weir from 2000–2004, compared to daily average river stage and water temperature in 2005. 87
28. Daily Chinook, chum, and coho salmon passage at the Takotna River weir relative to average river stage height, 2005. 88
29. Daily Chinook, chum, and coho salmon passage at the Takotna River weir relative to average water temperature, 2005. 89
30. Lengths of juvenile Chinook salmon caught using minnow traps in Index Areas 1–14 of the Takotna River drainage, 2005, with speculation of represented age class. 90
31. Lengths of juvenile coho salmon caught using minnow traps in Index Areas 1–14 of the Takotna River drainage, 2005, with speculation of represented age class. 91
32. Dates when individual Chinook salmon stocks pass through the Kalskag tagging sites (rkm 271) based on radiotelemetry, 2002–2003. 92
33. Dates when individual Chinook salmon stocks pass through the Kalskag tagging sites (rkm 271) based on radiotelemetry, 2004–2005. 93
34. Chinook and chum salmon captured at the lower Kalskag tagging site, by date, compared to Chinook and chum salmon recovered at the Takotna River weir, by date tagged, 2005. 94
35. Daily passage of tagged Chinook salmon compared to overall daily Chinook salmon passage at the Takotna River weir in 2005. 95
36. Dates when individual Chinook salmon stocks passed through the Kalskag tagging sites (rkm 271) based on a tagging study, 2005. 96
37. Daily and cumulative percent passage of overall chum salmon passage compared to tagged chum salmon passage at the Takotna River weir in 2005. 97
38. Dates when individual chum salmon stocks passed through the Kalskag tagging sites (rkm 271) based on a tagging study, 2002–2003. 98
39. Dates when individual chum salmon stocks passed through the Kalskag tagging sites (rkm 271) based on a tagging study, 2004–2005. 99
40. Daily and cumulative percent passage of overall coho salmon passage compared to tagged coho salmon passage at the Takotna River weir in 2005. 100
41. Dates when individual coho salmon stocks passed through the Kalskag tagging sites (rkm 271) based on a tagging study, 2002–2003. 101
42. Dates when individual coho salmon stocks passed through the Kalskag tagging sites (rkm 271) based on a tagging study, 2004–2005. 102

LIST OF FIGURES (Continued)

Figure **Page**

43. Sockeye and coho salmon captured at the Kalskag tagging site, by date, compared to Sockeye and coho salmon recovered at the Takotna River weir, by date tagged, 2005. ... 103
44. Dates when individual sockeye salmon stocks passed through the Kalskag tagging sites (rkm 271) based on a tagging study, 2003–2005. ... 104
45. Daily overall sockeye salmon passage compared to tagged sockeye salmon passage at the Takotna River weir in 2005. ... 105
46. Lengths of juvenile chum salmon caught in Index Areas 1–14 of the Takotna River drainage, 10 May–4 June 2005. ... 106
47. Lengths of juvenile chum salmon caught in Index Areas 1–14 of the Takotna River drainage, 14 June–2 July 2005. ... 107

LIST OF APPENDICES

Appendix **Page**

A1. Historical daily and daily cumulative Chinook salmon passage at the Takotna River weir. ... 110
A2. Historical daily and daily cumulative chum salmon passage at the Takotna River weir. ... 113
A3. Historical daily and daily cumulative coho salmon passage at the Takotna River weir. ... 116
A4. Historical daily and daily cumulative longnose sucker passage at the Takotna River weir. ... 119
B1. Daily carcass counts for Chinook, sockeye, chum, coho salmon, and longnose suckers at the Takotna River weir, 2005. ... 124
C1. Daily weather and stream observations at the Takotna River weir, 2005. ... 128
D1. Summary of juvenile sampling events, 2005. ... 136
E1. Trap-caught juvenile Chinook salmon lengths by date, Index Area, and number caught, 2005. ... 140
E2. Trap-caught juvenile coho salmon lengths by date, Index Area, and number caught, 2005. ... 141
E3. Trap-caught juvenile chum salmon lengths by date and number caught, 2005. ... 143
F1. Historical daily cumulative percent passage of Chinook and chum salmon at the Takotna River weir. ... 146
F2. Historical daily cumulative percent passage of coho and sockeye salmon at the Takotna River weir. ... 149

ABSTRACT

The Takotna River is a major tributary of the Kuskokwim River that currently supports modest runs of Pacific salmon *Oncorhynchus spp.* compared to other tributaries in the drainage. The Takotna 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 is a tool to ensure appropriate geographic and temporal distribution of spawners, and provide a means to assess trends in escapement that should be monitored and considered in harvest management decisions. Towards this end, Takotna River weir has been operated annually since 2000 to determine daily and total salmon escapements for the target operational period of 24 June through 20 September; to estimate age, sex, and length compositions of Chinook *O. tshawytscha*, chum *O. keta*, and coho *O. kisutch* salmon escapement; to monitor environmental variables that influence salmon productivity; to investigate geographic distribution and length patterns of juvenile Chinook and coho salmon in the Takotna River drainage; and to provide part of an integrated platform in support of other Kuskokwim Area fisheries projects.

In 1995, the Alaska Department of Fish and Game (ADF&G) established an escapement monitoring program on the Takotna River approximately 835 river kilometers (rkm) from the mouth of the Kuskokwim River. A counting tower was used to enumerate fish from 1995 to 1999 with limited success, and the project transitioned to a resistance board weir in 2000. Since its inception, the weir has been jointly operated by ADF&G Division of Commercial Fisheries and the Takotna Tribal Council (TTC). In 2005, the weir was operational for the entire target operational period of 24 June to 20 September. Total annual escapement for the 2005 target operational period included 499 Chinook, 6,458 chum, 2,216 coho, and 34 sockeye salmon *O. nerka*. Age, sex, and length (ASL) samples were taken from 34.1% of the Chinook escapement, 12.9% of the chum escapement, and 24.6% of the coho escapement. Though the number of Chinook samples was insufficient to estimate the ASL composition of the total escapement, the Chinook sample composition included 55.9% age-1.3 fish, 24.2% age-1.4 fish, 19.4% age-1.2 fish, and 29.4% females. The chum salmon escapement was comprised of 89.9% age-0.3 fish, 8.6% age-0.4 fish, 1.5% age-0.2 fish, and 51.3% females. The coho salmon escapement was comprised of 87.7% age-2.1 fish, 12.0% of age-3.1 fish, and 48.1% females. Juvenile fish were captured using beach seines, dip nets, minnow traps, and a stationary net deployed in the Takotna River during January through December. Captures included 509 juvenile Chinook, 119 juvenile chum, and 159 juvenile coho salmon. Most juvenile Chinook and coho salmon were captured using minnow traps in Gold Creek and in Big Creek (lower), respectively. Most juvenile chum salmon captures were in Fourth of July Creek using a beach seine. In addition to enumerating escapement, estimating ASL composition, and investigating juvenile salmon distribution, the weir served as a platform for several other projects including *Inriver Abundance of Chinook Salmon in the Kuskokwim River* (FIS 02-015), *Kuskokwim River Sockeye Salmon Radiotelemetry Feasibility Study*, *Kuskokwim River Salmon Mark–Recapture Project* (FIS 04-308), *Genetic diversity of Chinook salmon from the Kuskokwim River* (FIS 01-070)*, and Body Condition and Feeding Ecology of Kuskokwim River Chum Salmon Fry during Freshwater Outmigration.*

Key words: Kuskokwim River, Takotna River, escapement, Chinook salmon, *Oncorhynchus tshawytscha*, chum salmon, *O. keta*, coho salmon, *O. kisutch*, juvenile salmon, resistance board weir, upper Kuskokwim, age-sex-length, ASL, radiotelemetry, mark–recapture, genetic stock identification, stock specific run timing.

INTRODUCTION

The Kuskokwim River is the second largest river in Alaska, draining an area approximately 130,000 km^2 (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 commercial harvest of over 1 million salmon (Whitmore et al. 2005). The subsistence salmon fishery in the Kuskokwim Area is one of the largest and most important in the state (ADF&G 2003; Coffing 1991, *Unpublished* a, b; Coffing et al. 2001; Ward et al. 2003; Whitmore et al. 2005) and remains a fundamental component of local culture. 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).

Managing for sustainable salmon fisheries in the Kuskokwim River is challenging due in part to the lack of abundance and run-timing information, both for the total run and constituent stocks. Salmon that contribute to these fisheries spawn and rear in nearly every tributary of the Kuskokwim River basin; however, few spawning streams receive rigorous salmon escapement monitoring. Historically, only two long-term, ground-based escapement monitoring projects have operated in the Kuskokwim River basin: the Kogrukluk River weir and the Aniak River sonar (Whitmore et al. 2005). These tributaries constitute a modest fraction of the total Kuskokwim River basin, and salmon populations in them are not representative of the diversity of salmon populations that contribute to subsistence, commercial, and sport harvests, or do not take into account the overall ecosystem function in the Kuskokwim drainage. Other ground-based escapement monitoring projects have been developed within the Kuskokwim River basin, but these initiatives were short-lived (Whitmore et al. 2005). Aerial stream surveys are periodically conducted on many tributaries using fixed-wing aircraft, but these 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 (Whitmore et al. 2005). The inception of the Takotna River weir in 2000, coupled with other initiatives begun in the late 1990s and beyond (Kerkvliet et al. 2003; Schwanke et al. 2001; Stroka and Brase 2004; Stuby 2003) provides some of the additional escapement monitoring and abundance estimates required for management authorities to assess the adequacy of escapements and the effectiveness of management decisions (Holmes and Burkett 1996; Mundy 1998).

The goal of salmon management is to provide for long-term sustainable fisheries by ensuring adequate numbers of salmon escape onto the spawning grounds each year. Since 1960, management of Kuskokwim River subsistence, commercial and sport fisheries have 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, tribal groups such as the McGrath Native Village Council (MNVC) are charged by their constituency to actively promote a healthy and sustainable subsistence salmon fishery. These and other groups have combined their resources to develop projects such as the Takotna River weir to better achieve the common goal of providing for long-term sustainability of salmon fisheries in the Kuskokwim River.

In September 2000, the Alaska Board of Fisheries (BOF) classified both Kuskokwim River Chinook *O. tshawytscha* and chum *O. keta* salmon as “yield concerns” (5 AAC 39.222, 2001) due to the chronic inability of managers to maintain expected harvest levels (Burkey et al. 2000a, 2000b; Ward et al. 2003). This designation was upheld during the January 2004 BOF meeting (Bergstrom and Whitmore 2004). The yield concern designation bolstered escapement-monitoring efforts and gave rise to several main-river and regional projects that depend on the weir infrastructure for data collection. The weir platforms serve as tag recovery locations for projects intended to estimate stock-specific run timing and abundance through marked-to-unmarked ratios (Pawluk et al. *In prep* b; Stuby *In prep*), and serve as collection sites for stock-specific baseline samples for genetic stock identification studies (Templin et al. 2004, *In prep*).

Although salmon production is modest, the Takotna River contributes to sustainable fisheries both by adding to the annual production and by adding to genetic diversity similar to what Hilborn et al. (2003) described for Bristol Bay. Since fishers tend to harvest fish from the early part of the salmon runs (Figure 2) and the early part of the runs may be dominated by upper river salmon stocks, salmon production from the upper Kuskokwim River may support a disproportionately high fraction of the subsistence harvest, particularly for Chinook salmon. This latter point makes monitoring upper Kuskokwim River salmon escapements, such as on the Takotna River, a particularly important tool for maintaining long-term sustainability of the downriver fisheries (Burkey et al. 2000a; Kerkvliet et al. 2003, 2004; Pawluk et al. *In prep* a, b; Stuby *In prep*).

BACKGROUND

The Takotna River currently supports modest runs of Chinook, chum, and coho *O. kisutch* salmon, which are thought to be vestiges of much stronger runs. Small escapements of sockeye salmon *O. nerka* have also been observed in the Takotna River in recent years. Takotna River salmon populations appear to be in a state of recovery following near extirpation in the early twentieth century (Molyneaux et al. 2000; Stokes 1985). Prior to the early 1900s, native Athabaskans in the area harvested salmon from the Takotna River. This included residents of Tagholjitdochak', a village located on the Takotna River near the confluence of Fourth of July Creek (Figure 3; Anderson 1977; BLM 1984; Hosley 1966; Stokes 1985). Hosley (1966) and Stokes (1983) reported that people from the Vinasale and Tatlawiksuk Athabaskan bands also fished in the Takotna River. The numbers of salmon these groups harvested is unknown, but interviews with Nikolai elders recall the existence of fairly strong Chinook and chum salmon runs in the Takotna River until the early 1900s (Stokes 1985).

Historically, native Athabaskans commonly harvested salmon using weirs fitted with fish traps. At least four historical weir sites have been documented on the Takotna River; the last of these was abandoned no later than the mid 1920s, according to oral history and firsthand knowledge of Nikolai elders (Figure 3; Stokes 1983). One of the weir sites was located on the Nixon Fork of the Takotna River, near the confluence of the West Fork River. The other locations included a site on the main river a short distance above the community of Takotna, one near Big Creek (lower), and another near or within Fourth of July Creek. According to an elder who fished the Nixon Fork weir, these sites were abandoned as a result of the booming mining industry, which inspired a general migration to major village sites, and rapid population decline during several epidemics that ravaged area Native populations in the late nineteenth and early twentieth centuries. In many cases, residents that survived the wave of epidemics, primarily diphtheria, were forced to abandon traditional village sites such as at Tagholjitdochak' between 1908 and 1910 (BLM 1984).

Gold was discovered in the Innoko mining district in 1906 and the Takotna River became a major access route to the gold fields (Brown 1983). The community of Takotna developed as a supply point and staging area for miners. Dog teams were the primary means of winter transportation and the dried salmon they were fed were likely harvested from the Takotna River and other local streams. Steamboats loaded with tons of mining supplies navigated the Takotna River as far upstream as the current town of Takotna. In the early 1920s, small temporary dams were built on the river to facilitate steamboat passage (Kusko Times 1921). At some point, salmon populations became depleted. The timing and cause of the decline are unclear (Stokes 1985), but was likely caused by a combination of overfishing and habitat alteration associated with mining development.

Area residents and local biologists described the Takotna River as being nearly void of salmon during the 1960s and 1970s (Molyneaux et al. 2000). By the 1980s, Takotna residents began to notice adult salmon in the river again. During an aerial survey in 1994, an experienced ADF&G fishery biologist observed several thousand chum salmon and some Chinook salmon in Fourth of July Creek, a clear water tributary of the Takotna River, but few salmon were observed elsewhere in the Takotna drainage (Burkey and Salomone 1999). By about the 1990s, rod and reel fishers began to catch coho salmon while fishing for northern pike *Esox lucius* (D. Newton, local resident, Takotna; personal communication).

Due to its location, size, and a perceived increase in salmon abundance, an escapement monitoring program was implemented on the Takotna River in 1995. A counting tower was used to enumerate fish from 1995 to 1999, but success was limited because of poor water clarity, periodic high water levels, and organizational difficulties (Molyneaux et al. 2000). As one of several initiatives that were started in the late 1990s to help address the information gaps in the management program, the escapement monitoring program on the Takotna River transitioned from a counting tower to a resistance board weir in 2000 (Clark and Molyneaux 2003; Costello et al. 2005; Gilk and Molyneaux 2004; Schwanke et al. 2001; Schwanke and Molyneaux 2002). The Takotna River weir is currently the farthest upstream ground-based salmon escapement-monitoring project in the Kuskokwim River drainage. The use of the weir greatly enhanced the success of the program.

The ADF&G Division of Commercial Fisheries and the Takotna Tribal Council (TTC) jointly operate the weir. ADF&G staff help oversee inseason operations and serve as the principal agent for data management, data analysis, and report writing. The TTC provides most of the field crew and coordinates much of the preseason preparations and inseason operations.

OBJECTIVES

The objectives of the Takotna River escapement monitoring project in 2005 were to:

1. Determine daily and total annual escapements of Chinook, chum, and coho salmon in the Takotna River upstream of the community of Takotna during the target operational period of 24 June to 20 September;
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, one 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;
4. Investigate the distribution and length patterns of juvenile Chinook and coho salmon in Takotna River tributaries; and
5. 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* (FIS 02-015);

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

c. Serving as a recovery location for tagged Chinook, chum, sockeye, and coho salmon in support of *Kuskokwim River Mark–Recapture Project* (FIS 04-308);

d. Serving as a collection site for salmon tissue samples for *Genetic Diversity of Chinook Salmon from the Kuskokwim River* (FIS 01-070); and

e. Providing personnel and equipment support for *Body Condition and Feeding Ecology of Kuskokwim River Chum Salmon Fry during Freshwater Outmigration.*

METHODS

STUDY AREA

The Takotna River originates in the central Kuskokwim Mountains of the upper Kuskokwim River basin (Figure 1). Formed by the confluence of Moore Creek and Little Waldren Fork, the river flows northeasterly, passing the community of Takotna at river kilometer (rkm) 80, before turning southeasterly near the confluence of the Nixon Fork at rkm 24 (Figure 3; Brown 1983). The Tatalina River joins at rkm 4.8, and then the Takotna River empties into the Kuskokwim River across from McGrath at rkm 752 of the Kuskokwim River.

The Takotna River is about 160 km in length and drains an area of 5,646 sq km (Brown 1983). The river is shallow with many meanders from its headwaters to the community of Takotna, but gradually becomes deeper downstream of that point, especially after the confluence of the Nixon Fork. In the lower reaches, the current is sluggish and the channel width averages 122 to 152 m. The river’s average slope is about 89 cm per km (Brown 1983).

At normal flow the Takotna River has a nominal load of suspended materials, but the water is stained due to organic leaching. The Nixon Fork and Tatalina rivers drain extensive bog flats and swampy lowlands, but the remainder of the basin is primarily upland spruce-hardwood forest (Brown 1983; Selkregg 1976). White spruce, birch, and aspen are common on moderate south-facing slopes, while black spruce is more characteristic of northern exposures and poorly drained flat areas. The understory consists of spongy moss and low brush on the cool, moist slopes, grasses on the dry slopes, and willow and alder in the higher open forest near the timberline.

WEIR DESIGN

Installation Site

The weir was installed in 2005 at the same location used in previous years, which is approximately 185 m upstream of the Takotna River Bridge (Costello et al. 2005). The site was about 3 rkm upstream of the village of Takotna and 83 rkm from the confluence with the Kuskokwim River (Figure 3). The weir is located downstream from most known spawning areas, so the project provides a nearly complete census of salmon escapement in the Takotna River excluding the Nixon Fork and Tatalina Rivers.

At the weir site, the Takotna River is approximately 85 m wide and 4 m deep from bank level to the bottom of the channel. During normal summer operations, river depth is about 1 m in the deepest section. The weir is positioned in the center of a 1 km stretch of relatively straight channel, with a large floodplain to the south. Vegetation on the floodplain is mostly grasses with interspersed patches of alder and willow, which suggests the floodplain is in an intermediate stage of succession.

Construction

The design and materials used in the Takotna River weir in 2005 were the same as those used in 2000 (Schwanke et al. 2001), and included modifications incorporated into the design in 2001 (Schwanke and Molyneaux 2002). The weir was installed across the entire 85-m (280-ft) channel following the techniques described by Stewart (2003). The substrate rail and resistance board panels covered the middle 79-m (260-ft) portion of the channel, and fixed weir materials extended the weir 3 m (10 ft) to each bank. The pickets were 1-5/16 in (3.33 cm) in diameter and spaced at intervals of 3 in (7.62 cm) to leave a gap of 1-11/16 in (4.29 cm) between each picket. Stewart (2002, 2003) describes details of panel construction and installation.

A live trap was installed within the deeper portion of the channel. Designed as the primary means of upstream fish passage, the trap could be easily configured to pass fish freely upstream, capture individual fish for tag recovery, or trap numerous fish for collection of ASL or genetic samples. Schwanke et al. (2001) describes the details of trap construction and installation.

Installation of two skiff gates allowed boats to pass with little or no involvement from the weir crew. Both skiff gates consisted of the same modified weir panels described by Schwanke et al. (2001), but one gate was modified to accommodate propeller-driven boats. Boats with jet-drive engines were the most common and could pass up or downstream over the primary skiff gate after reducing their speed to 5 miles per hr (8 km per hr) or less. Operators of propeller-driven boats could pass upstream and downstream over the modified boat gate described by Costello et al. (2005).

To accommodate downstream migration of longnose suckers *Catastomas catostomas* and other resident species, downstream passage chutes were incorporated into the weir once resident species were observed congregating just upstream. At locations where downstream migrants were most concentrated, chutes were created by releasing the resistance boards on one or two adjacent weir panels so the distal ends dipped slightly below the stream surface. The chute's shallow profile guided downstream migrants while preventing upstream salmon passage. The chutes were monitored and adjusted to ensure salmon were not passing upstream over them. Downstream passage was not enumerated, however, few salmon have typically been observed passing downstream over these chutes, and these numbers are not considered significant.

Maintenance

The weir was cleaned twice each day, typically at the end of the morning and evening counting shifts. A technician walked across the weir partially submerging each panel, thereby allowing the current to wash any debris downstream. Algal growth and debris that accumulated around stringers was periodically removed either with a rake or by hand. Each time the weir was cleaned, the weir panels, substrate rail, fish trap, and fixed weir sections were inspected for signs of substrate scouring, broken pickets, or other conditions that could allow fish to pass without detection. Periodically, the crew conducted a more thorough inspection by snorkeling along the substrate rail. Any points along the substrate rail showing signs of substrate scouring were immediately addressed with sandbags. Damaged weir pickets were repaired using wooden dowels as described by Stewart (2002).

ESCAPEMENT MONITORING

The target operational period for the weir is 24 June to 20 September, although actual operational periods may vary from year to year. Total annual escapement is defined as the number of fish that passes within this period. In years when the operational period falls short of the target operational period, or when there are inoperable periods during the season, estimates of the daily salmon passage are made for missed days in order to provide consistent comparisons of escapements among years. Total annual escapement is determined from the total observed and estimated fish passage.

Passage Counts

In 2005, all fish passing upstream of the weir through the passage gates were counted and recorded by species and sex, excluding fish that were small enough to pass freely between the weir pickets. Standard daily operations consisted of four 2-hour counting periods, but this schedule was adjusted as needed to accommodate the migratory behavior and abundance of fish, or operational constraints such as reduced visibility in evening hours late in the season. Substantial delays in fish passage occurred only at night or during ASL sampling. Crew members recorded the total upstream fish count, plus any additional information such as weather observations, tags, and carcass counts, on a designated form and zeroed the tally counter after each counting session. At the end of each day, total daily and cumulative seasonal counts were copied to logbook forms. These counts were reported each morning to ADF&G staff in Bethel via single side band radio or satellite telephone.

The live trap was used as the primary means of upstream fish passage so crew members could capture and recover information from fish tagged in the mainstem Kuskokwim River. A Plexiglas®[1] viewing window was placed on the stream surface to improve visual identification of fish entering the trap. This allowed passage counts to be conducted from the downstream entrance of the trap, and enabled crew members to observe and capture tagged fish. A secondary passage gate could be employed if fish were hesitant to enter the live trap. Using the trap as a counting platform, a connecting picket would be removed between two neighboring panels. By folding the panels to stand on edge, an opening 6 feet wide would be created. A rigid aluminum weir panel would be lashed to the upstream ends of the panels to serve as an easily removable gate. When removed for counting, the gate would be placed on the river bottom, in front of the opening, to act as a flash panel for the identification of passing fish. Alternatively, a weir panel could be removed from anywhere along the weir, and a crew member could wade next to the opening to conduct a passage count.

Visual determination of sex was possible due to advanced sexual dimorphism. For example, females became 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 streamline and muscular in appearance, and swam with short, powerful strokes. Though some variation exists, these differences were applicable to all salmon species observed.

---

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

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.

Estimating Missed Passage

Although not necessary in 2005, passage estimates are necessary in years when the weir is not operational for 1 or more days during the target operational period. The passage estimate for a single day is calculated as the average of the observed passage for 2 days before and 2 days after the inoperable day, minus any observed passage from the inoperable day. Daily passage estimates for inoperable periods lasting 2 or more days are derived by one of two methods, depending on the situation.

A "linear method" is used to interpolate daily estimates from average observed passage 2 days before an inoperable period to average observed passage 2 days after the inoperable period. This method results in a linear increase or decrease in daily estimates over the duration of the inoperable period. Daily estimates from this method are calculated using the formula:

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

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

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

for (d_1, 2, …, d_i, …d_I)

where

$\hat{n}_{d_i}$ = passage estimate for the i^{th} day of the period (d_1, 2, …, d_i, …d_I) when the weir was inoperative;

n_{d_I+1} = observed passage the first day after the weir was reinstalled;

n_{d_I+2} = observed passage the second day after the weir was reinstalled;

n_{d_1-1} = observed passage of 1 day before the weir was washed out;

n_{d_1-2} = observed passage of the second day before the weir was washed out; and

I = number of inoperative days.

A "proportion method" is used if similar fish passage characteristics were observed between Takotna River weir and model data sets. A model data set could be from a different year at Takotna River, or from the same year at 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.

Carcasses

Spawned out and dead salmon (hereafter referred to as carcasses) that washed up on the weir were counted by species and sex, and passed downstream. The daily carcass count was tallied by species and recorded into the camp log.

AGE, SEX, AND LENGTH COMPOSITION

Age, sex, and length 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 (DuBois and Molyneaux 2000).

Sample Collection

The crew at the Takotna River weir employed standard 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 to 7 days followed by a few days without sampling. In an attempt to achieve the sampling goal for Chinook salmon, moderate sampling was conducted on a continual basis, for periods lasting from 4 to 13 days. The goal of each pulse was to collect samples from 210 Chinook, 200 chum, and 170 coho salmon. These 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 (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. Sample sizes for coho salmon were increased from 70 to 170 fish per pulse in 2005, which allowed the characterization of each third of the run. Sample sizes for all species 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 pulse samples was 3 per species, one pulse sample from each third of the run, to account for temporal dynamics in the ASL composition.

Salmon were sampled from a fish trap installed in the weir as described by Schwanke et al. (2001). The trap structure included an entrance gate, holding box, and exit gate. On days when sampling was conducted, the entrance gate was opened while the exit gate remained closed, allowing fish to accumulate inside the 5 by 8-ft (1.5 by 2.4-m) holding box. The holding box was allowed to fill with fish between counting shifts and sampling was conducted during the next scheduled counting period. Every fish of the target species was measured for length to the nearest millimeter from mideye to tail fork (METF) and identified as male or female through visual examination of the external morphology. Three scales were removed from the preferred area of the fish (INPFC 1963), placed on gum cards, and later used to determine age. Detailed sampling methods were similar to those described by Costello et al. (2005).

Additional samples were collected through active sampling. Active sampling required a technician to be positioned at the downstream end of the trap to observe fish entering the holding pen. When a salmon entered the holding pen, the technician would immediately close both the entrance and exit gates, thereby actively trapping the salmon inside the holding box for sampling. Active sampling was used mostly for Chinook salmon and for tag recoveries.

After sampling was completed, relevant information such as sex, length, date, and location was copied from hardcopy forms to computer mark-sense forms. Further details of sampling procedures can be found in DuBois and Molyneaux (2000) and Costello et al. (2005). The completed gum cards and data forms were sent to the Bethel and Anchorage ADF&G offices for processing, and archived at the ADF&G office in Anchorage. The computer files were archived by ADF&G staff in the Anchorage and Bethel offices, and data were loaded into the Arctic-Yukon-Kuskokwim (AYK) salmon database management system (Brannian et al. 2005).

Estimating Age, Sex, and Length Composition of Escapement

ADF&G staff in Bethel and Anchorage aged scales, processed the ASL data, and generated data summaries. DuBois and Molyneaux (2000) describe details of the processing and summarizing procedures. These procedures generated two types of summary tables for each species: one described the age and sex composition and the other described length statistics. These summaries account for changes in the ASL composition throughout the season by first partitioning the season into temporal strata based on pulse sample dates, then applying the ASL composition of individual pulse samples to the corresponding temporal strata, and finally summing the strata to generate the estimated ASL composition for the season. This procedure ensures that the ASL composition of the total annual escapement is weighted by the abundance of fish in the escapement rather than by the abundance of fish in the samples. For example, if samples of coho salmon were collected in 6 pulses, then the season would be partitioned into 6 temporal strata with one pulse sample occurring in each stratum. A sample of 140 coho salmon collected from 3 to 6 September would be used to estimate the ASL composition of the 400 coho salmon that passed the weir during the temporal strata that extended from 2 to 7 September. This procedure would be repeated for each stratum, and the estimated age and sex composition for the total annual escapement would be calculated as the sum of coho 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 stratum by the escapement of coho salmon that passed the weir during that stratum. Confidence intervals were constructed for the estimated mean lengths according to Thompson (1992, page 105).

Ages are reported using European notation. European notation is composed of 2 numerals separated by a decimal; the first numeral indicates the number of winters the juvenile spent in fresh water 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 both numerals, plus 1 year to account for the winter when the egg was incubating in gravel. For example, a Chinook salmon described as an age-1.4 fish is actually 6 years of age.

Weather and Stream Observations

Water and air temperatures were measured at the Takotna River weir each day at approximately 0800 and 1700 hours. These times varied slightly with counting schedules. Temperatures were measured using a calibrated thermometer. Water temperature was determined by submerging the thermometer below the water surface until the temperature reading stabilized and air temperature was obtained from a thermometer placed in a shaded location near the weir site. Temperature readings were recorded in the logbook, along with notations about wind direction, estimated wind speed, cloud cover, and precipitation. Daily precipitation was measured using a rain gauge.

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 above an established datum plane. The staff gauge was calibrated to the datum plane by a semi-permanent benchmark located about 6 m from the river bank and consisted of a nail driven into a tree. The height of the nail corresponded to stage measurements of 300 mm relative to the datum plane. River stage was measured at approximately 0800 and 1700 hours.

Juvenile Salmon Investigations

Study Area

Investigators have been interested in the distribution of juvenile salmon in the Takotna River drainage since 2000. To address this objective, the drainage was divided into 13 geographic zones, referred to as Index Areas (Figure 4). Efforts were made to investigate each area for the presence of juvenile salmon at least once per season, but the remoteness of many of the Index Areas and low water conditions made that task nearly impossible in recent years. In 2004, one minor tributary, Gold Creek, was added as an Index Area due to its proximity to the community of Takotna and its accessibility for year around sampling. In 2005, specific sites were selected in each Index Area based on accessibility and distance from neighboring Index Areas. Each site was considered representative of the entire Index Area and allowed for consistent repeat sampling. Selected sites were considered sufficiently far from neighboring Index Areas that juvenile salmon caught at each site were assumed to be rearing in that location.

Sampling Efforts

Beginning in mid-June, the crew began investigating Index Areas (Figure 4) for the presence of Chinook and coho salmon using minnow traps and occasionally beach seines, sometimes concurrently with efforts to capture chum salmon. Index Areas near the weir site (Index Areas 1, 2, and 14) were to be surveyed using minnow traps in weekly intervals, those more distant (Index Areas 3, 4, 5, and 13) were to be surveyed in 2-week intervals, and those most remote (Index Area 6, 7, 8, 9, and 12) were to be surveyed once a month. The two Index Areas requiring the longest commute and least accessible during low water conditions, Index Areas 10 and 11, were to be surveyed once during the season. Sampling efforts relaxed after 27 September, and sampling in 2005 was last conducted on 4 December. Sampling that was conducted in January and December was mostly volunteer effort, with minor contribution from TTC.

Capture Methods

Capture methods have varied over the years, but minnow trapping remains the primary means for the capture of juvenile Chinook and coho salmon. Occasionally, juvenile salmon are captured using a simple dip-net or beach seine. These methods are effective for bolstering the length data, but are poor tools for determining distribution.

Minnow traps had 1/4-in mesh (6.4 mm) and were baited with salmon roe hung in perforated bags inside the trap. Traps were set along both banks of the chosen site in about 100-ft (30-m) intervals to minimize bias associated with trap placement, and were allowed to soak for about 24 hours. The number of traps set at each location and exact soak time were recorded and added to the database.

The beach seine used most often measured 30 ft (9.1 m) in length by 4 ft (1.2 m) in depth with a 1/4-in (6.4-mm) mesh size. On rare occasions, a seine net with 1/8-in (3.2-mm) web was used. A 5-ft (1.5-m) section of PVC pipe was attached to each end, which allowed the seine to be pulled through the water. A typical sampling event included several seine hauls in a given segment of stream with each haul moving progressively downstream. The number of seine hauls per event was recorded and archived in the database.

Distribution

Regardless of capture method, the number of each species captured was recorded along with a brief habitat description, and later archived in a database kept at the ADF&G office in Anchorage. Catch per unit effort (CPUE) was calculated for minnow trapping events as a means for describing juvenile salmon distribution in the drainage. CPUE was calculated following the guidelines set forth by Murphy and Willis (1996) using the following formula:

$$\hat{R}_2 = \frac{\sum_{i=1}^{n} c_i}{\sum_{i=1}^{n} e_i} \quad (3)$$

where

$\sum_{i=1}^{n} c_i$ = sum fish captured per trap (c_i) over all traps (n),

$\sum_{i=1}^{n} e_i$ = sum hours fished per trap (e_i) over all traps (n), and

$\hat{R}_2$ = catch per unit effort (CPUE).

This method of calculating CPUE is different from that used prior to 2004; thus, any discrepancies between CPUE values in this report and those of previous reports are attributed to the new methodology.

Length Patterns

All captured salmon were measured for fork length (FL) to the nearest millimeter using a straight edged ruler. Lengths were recorded onto field forms and later archived in a database kept at the ADF&G office in Anchorage. Lengths obtained from trap-caught Chinook and coho salmon were compared by sample date.

RELATED FISHERIES PROJECTS

Inriver Abundance of Chinook Salmon in the Kuskokwim River

The Takotna River weir was part of a radiotelemetry project entitled *Invriver Abundance of Chinook Salmon in the Kuskokwim River* intended to estimate the total abundance of Chinook salmon in the Kuskokwim River (Stuby 2003, 2004, 2005, *In prep*). Radio transmitters were inserted into Chinook salmon caught near upper Kalskag (rkm 270) following methods described by Stuby (*In prep*; Figure 1). The Takotna River had one of several radio receiver stations intended to monitor passage of radio-equipped fish into tributary streams. The Takotna River receiver station was placed approximately 300 m downstream from the weir. Though Chinook salmon were also fitted with a spaghetti tag that allowed the weir crew to recognize a radio tagged Chinook, no attempt was made to capture these fish since they were monitored by the receiver station and later noted by aerial surveys. The known Chinook salmon passage at the weir, coupled with data collected from the receiver station, were used with similar data collected at other weir projects to develop estimates of the total Chinook salmon abundance upstream from the Lower Kalskag tagging site. Stuby (*In prep*) provides details of tagging methods and analysis.

Kuskokwim River Sockeye Salmon Radiotelemetry Feasibility Study

A pilot sockeye salmon radiotelemetry project entitled *Kuskokwim River Sockeye Salmon Radiotelemetry Feasibility Study* was conducted in 2005 to assess the feasibility of conducting a large-scale study in future years. The sockeye salmon radiotelemetry study operated using infrastructure already in place from the Kuskokwim River tagging study and the Chinook salmon radiotelemetry project. Three additional stations were strategically placed to assess the relative contribution of the Stony River drainage. Tag frequencies were selected to ensure compatibility with the existing receiver stations, one of which was located at the Takotna River weir site. In June and July 2005, at a tagging site near Kalskag, a total of 100 sockeye salmon were equipped with radio tags as a primary mark and white spaghetti tags as a secondary mark. The goal of the project in 2005 was to assess the effectiveness of the tags and the tracking methods. Gilk (*Unpublished*) provides details of tagging methods and analysis.

Kuskokwim River Salmon Mark–Recapture Project

The Takotna River weir was part of a tagging project entitled *Kuskokwim River Salmon Mark–Recapture Project* intended to estimate stock specific run timing, travel speed, and total abundance of Chinook, chum, coho, and sockeye salmon in the Kuskokwim River (Pawluk et al. *In prep* b). Chinook, chum, coho, and sockeye salmon were equipped with Floy® anchor tags at fish wheels located near upper Kalskag. The Takotna River weir served as one of several tag recovery locations for collecting information on tagged fish.

The weir crew captured tagged fish in the fish trap and recorded the date of capture, species, and tag number (when recovered). Tagged fish were captured using the active sampling technique described earlier. Visibility was enhanced through the use of clear-bottom viewing boxes that reduced glare and water turbulence. Once the information was collected from the tag, the fish was released upstream of the weir. If a tagged fish passed the weir without being recaptured, the crew recorded the color of the tag and it was added to the daily tallies. Fish were examined for a secondary mark, in this case a severed adipose fin, through the ASL sampling process and in separate trapping events, in order to assess the incidence of tag loss. Pawluk et al. (*In prep* b) provides details of tagging methods and analysis.

Genetic Diversity of Chinook Salmon from the Kuskokwim River

Crew members obtained tissue samples from 100 Chinook salmon at Takotna River weir as part of a Kuskokwim River Chinook genetics project entitled *Genetic Diversity of Chinook Salmon from the Kuskokwim River* (Templin et al. *In prep*). Genetic samples were gathered during each of the 3 ASL sampling pulses to better approximate the genetic composition of Takotna River Chinook salmon. After ASL sampling, a piece of an axillary process was cut from the fish, wiped clean, and placed in a vial of isopropyl alcohol. Sampling instruments were cleaned after each fish to prevent cross contamination. Vials were numbered, and the corresponding sex, location, and sampling date were recorded. The tissue samples were sent to the ADF&G Division of Commercial Fisheries Gene Conservation Laboratory for analysis. Templin et al. (*In prep*) provides details of sample analysis.

Kuskokwim River Chum Salmon Fry Body Condition and Feeding Ecology Project

The juvenile salmon component of the Takotna River weir project was pursued in conjunction with a separate project entitled *Body Condition and Feeding Ecology of Kuskokwim River Chum Salmon Fry during Freshwater Outmigration* focused on the capture of juvenile chum salmon for energy content analysis (C. E. Zimmerman, USGS, Anchorage; personal communication) (http://www.aykssi.org/prod/index.htm). Because the study was not intended to investigate distribution, the capture method was not important and the crew often devised unique and creative methods to maximize their sample size. One of these methods involved positioning a beach seine perpendicular to the current that inflated like a windsock in the stream channel. Juvenile fish would drift or swim downstream into the net, and become trapped by the current. Lengths (FL) were determined for most juvenile chum salmon, and some Chinook and coho salmon captured incidentally when time allowed. Length data collected using this method, referred to as the "stationary net", was recorded and archived, along with the corresponding Index Area as developed for the weir project, but was not used to assess distribution or to study length patterns over time.

RESULTS

Escapement Monitoring

Installation of the Takotna River weir began on 8 June and was complete at 1300 hours on 10 June, 14 days before the target operational date of 24 June. Disassembly began on 21 September, but the weir components were not fully removed until early October due to inclement river conditions. Despite continual high river levels in September, the weir remained fully operational throughout the target operational period.

Chinook Salmon

A total of 506 Chinook salmon were observed passing the weir between 10 June and 20 September (Table 1; Appendix A1). Of those, 499 passed during the target operational period that began on 24 June. The central 50% of passage occurred between 6 and 16 July, and the last Chinook salmon was reported on 13 September (Table 1; Figure 5). Peak daily passage of 56 Chinook salmon occurred on 13 July, and the median passage date was 12 July (Table 1;

Figure 5). Daily passage estimates were not necessary because the weir was fully operational for the duration of the Chinook salmon run.

Chum Salmon

A total of 6,472 chum salmon were observed passing the weir between 10 June and 20 September (Table 1; Appendix A2). Of those, 6,467 passed during the target operational period that began on 24 June. The central 50% of passage occurred between 9 and 21 July, and the last chum salmon was reported on 16 September (Table 1; Figure 5). Peak daily passage of 414 chum salmon occurred on 17 July, and the median passage date was 16 July (Table 1; Figure 5). Since the weir was fully operational for the duration of the chum salmon run, daily passage estimates were not necessary.

Coho Salmon

A total of 2,216 coho salmon were observed passing the weir during the 2005 target operational period (Table 1; Appendix A3). Coho salmon were observed passing from 25 July to 20 September, the last day of operations. The central 50% of passage occurred between 24 August and 4 September (Table 1; Figure 5). Peak daily passage of 258 coho salmon occurred on 24 August, and the median passage date was 27 August (Table 1; Figure 5). Since the weir was fully operational for the duration of the coho salmon run, daily passage estimates were not necessary.

Other Species

Sockeye and pink *O. gorbuscha* salmon are uncommon in the Takotna River. In 2005, a total of 34 sockeye salmon were observed passing upstream of the weir between 17 July and 14 September (Table 1). The central 50% of passage occurred between 24 August and 4 September. Peak daily passage of 3 sockeye salmon occurred on 24, 25, and 31 August, and the median passage date was 17 August. No pink salmon were observed in 2005.

Three resident fish species were observed passing upstream of the weir in 2005. Longnose suckers were the most abundant, with 2,392 fish passing the weir between 10 June and 20 September, and 231 passing during the target operational period (Table 1; Appendix A4). Other species that passed upstream included 29 northern pike and 3 whitefish *Coregonus spp*.

Carcasses

A total of 3 Chinook, 44 chum, and 4 coho salmon carcasses were recovered at the Takotna River weir in 2005 (Appendix B1). Chinook carcasses were recovered between 9 July and 18 September. Chum carcasses were recovered between 16 July and 18 September, with 50% cumulative recovery on 27 July. Females accounted for 23% of the recovered chum salmon carcasses. Coho carcasses were first recovered 7 September. Other species recovered included 1 whitefish and 4 northern pike.

AGE, SEX, AND LENGTH COMPOSITION

Chinook Salmon

Sampling goals for Chinook salmon were not achieved in 2005. The samples were collected in 3 pulses with sample sizes of 118, 63, and 17 fish, respectively, for a total of 198 fish. Age, sex, and length were determined for 170 Chinook salmon (86% of the total sample), or 34.1% of the total Chinook escapement in 2005 (Tables 2 and 3). The Chinook run was partitioned into

2 temporal strata based on sampling dates, with sample sizes of 96 and 74 fish (Table 2), but the overall sample size was insufficient to estimate the ASL composition of the total annual escapement. Age 1.3 was the most abundant age class and comprised over 50% of the escapement in both strata (Table 2). During the first stratum from 24 June to 13 July age 1.2 was the second most abundant age class (25.0%) followed by age 1.4 (18.8%) and age 2.3 (1.0%; Table 2). However, during the second stratum from 14 July and 20 September age 1.4 was the second most abundant age class (31.1%) followed by age 1.2 (12.2%; Table 2).

The average length of the sampled fish showed partitioning by age class (Table 3). Age-1.2, -1.3, and -1.4 male Chinook salmon had average lengths of 541, 687, and 736 mm, respectively. Age-1.3 and -1.4 female Chinook salmon had average lengths of 718, and 816 mm. One age-2.3 male Chinook salmon was sampled, with a length of 692 mm. Male Chinook salmon lengths ranged from 382 to 914 mm, while female lengths ranged from 456 to 957 mm.

Chum Salmon

Sampling goals for chum salmon were achieved in 2005. The samples were collected in 5 pulses with sample sizes of 161, 200, 210, 210, and 216 fish, respectively, for a total of 997 fish. Age, sex, and length were determined for 836 chum salmon (84% of the total sample), or 12.9% of the total annual chum salmon escapement in 2005 (Tables 4 and 5). The chum run was partitioned into 5 temporal strata based on sampling dates, with sample sizes of 138, 166, 186, 159, and 187 fish, respectively (Table 4). As applied to the total annual chum escapement, age 0.3 was the most abundant age class (89.9%), followed by age 0.2 (8.6%), and age 0.4 (1.5%; Table 4). Female chum salmon comprised 51.3% of the total annual escapement, or 3,320 fish.

The length of female chum salmon ranged from 408 to 610 mm, and males ranged from 450 to 650 mm (Table 5). Average lengths for female age-0.2, -0.3, and -0.4 fish were 517, 538, and 557 mm, respectively. Average lengths for male age-0.2, -0.3, and -0.4 fish were 530, 567, and 566 mm, respectively.

Coho Salmon

Sampling goals for coho salmon were achieved in 2005. The samples were collected in 4 pulses with sample sizes of 175, 171, 170, and 156 fish, respectively, for a total of 672 fish. Age, sex, and length were determined for 546 coho salmon (81% of the total sample), or 24.6% of the total annual coho salmon escapement in 2005 (Tables 6 and 7). The coho salmon run was partitioned into 4 temporal strata based on sampling dates, with sample sizes of 149, 133, 140, and 124 fish, respectively (Table 6). Age-2.1 fish accounted for 87.7% of the total annual escapement, and age-3.1 and -1.1 fish accounted for 12.0% and 0.2% of the escapement, respectively (Table 6). Female coho salmon comprised 48.1% of the total annual escapement, or 1,066 fish (Table 6).

Age 2.1 male coho salmon ranged in length from 396 to 652 mm with a mean of 543 mm, and age 3.1 males ranged in length from 446 to 625 mm with a mean of 557 mm (Table 7). Age-2.1 female coho salmon ranged in length from 443 to 620 mm with a mean of 556 mm, and age-3.1 females ranged in length from 446 to 599 mm with a mean of 549.

WEATHER AND STREAM OBSERVATIONS

Water temperature in the Takotna River ranged from 5.4 to 22.9°C, with an average water temperature of 14.1°C (Appendix C1). River stages ranged from 30.0 to 104.0 cm, with an average of 49.6 cm for the overall operational period. Air temperature at the weir ranged from -2.5 to 30.0°C, with an average air temperature of 15.4°C for the operational period.

JUVENILE SALMON INVESTIGATIONS

Sampling Efforts

This was the sixth consecutive year of juvenile salmon investigations in the Takotna River basin. Juvenile Chinook and coho salmon surveys began with two minnow trapping events in January, but otherwise were not conducted intensively until mid-July, after the crew had ceased targeting juvenile chum salmon for *Body Condition and Feeding Ecology of Kuskokwim River Chum Salmon Fry during Freshwater Outmigration.* Juvenile investigations in 2005 were limited by crew availability and river conditions, and, as a result, were conducted only a few times during the year. Nine of the 14 Index Areas were surveyed at least once in 2005, including three that were not surveyed in 2004 (Index Areas 7, 8, and 12; Figure 4).

Capture Methods

Minnow trapping provides the most useful data, and was conducted more often than any other capture method. In 2005, minnow trapping was conducted once in Index Areas 3, 5, 8, and 12, twice in Index Areas 1, 7, and 11, and 6 times in Index Area 14 (Figure 4; Appendix D1). A total of 421 juvenile Chinook and 137 juvenile coho salmon were captured using minnow traps in 2005.

On occasion, a beach seine was used to supplement the minnow traps. Often the traps would be set overnight, allowing time for the crew to beach seine in the same or a neighboring Index Area. When the traps were soaking in Index Areas 7, 8, and 12 on 19 and 20 July, the crew beach seined in Index Area 5, and when the traps were soaking in Index Areas 5 and 7 on 3 and 4 September, the crew beach seined in Index Areas 8 and 9 (Figure 4; Appendix D1). Fish were enumerated and lengths were taken, but data collected from beach seining were not used in calculating CPUE or for investigating length patterns. No juvenile Chinook or coho salmon were captured using beach seines in 2005.

Distribution

Juvenile Chinook Salmon

For Chinook salmon, CPUE was highest in Gold Creek (0.63 fish per trap-hour; Index Area 14), followed by the mainstem downstream from the weir site (0.03 fish per trap-hour; Index Area 1), and Moore Creek (0.01 fish per trap-hour; Index Area 11) (Table 8). One juvenile Chinook salmon was captured in Minnie Creek (Index Area 7), for a CPUE of < 0.00 fish per trap hour. Disregarding Gold Creek because its disproportionately high CPUE is not comparable to other locations in the drainage, total CPUE for the entire season was 0.01 fish per trap-hour (Table 8).

Juvenile Coho Salmon

For coho salmon, CPUE was highest in Big Creek (lower) (0.35 fish per trap-hour; Index Area 3), followed by Moore Creek (0.04 fish per trap-hour; Index Area 11), Gold Creek (0.03 fish per trap-hour; Index Area 14), and the mainstem downstream from the weir site (0.01 fish per trap-hour; Index Area 1) (Table 9). Disregarding Gold Creek because it's disproportionately high CPUE is not comparable to other locations in the drainage, total CPUE for the entire season was 0.04 fish per trap-hour (Table 9).

Other Species

No chum salmon were captured while sampling for juvenile Chinook and coho salmon (Appendix D1). However, several resident species were captured, including about 430 juvenile longnose suckers, 373 Arctic grayling *Thymallus articus*, 339 slimy sculpin *Cottus cognatus*, 48 Dolly Varden *Salvelinus malma*, 34 whitefish, and 7 burbot *Lota lota*.

Length Patterns

Lengths were obtained from 314 trap-caught juvenile Chinook and 132 trap-caught juvenile coho salmon (Appendix D1). Due to time constraints, not every captured juvenile salmon was measured for length.

Juvenile Chinook Salmon

Juvenile Chinook salmon lengths averaged 71.1 mm on 16 January (n = 15), 78.9 mm on 24 January (n = 22), 74.4 mm on 1 August (n = 55), 74.4 mm on 15 August (n = 105), 76.3 mm on 31 August (n = 89), 89.1 mm on 18 September (n = 8), and 85.1 mm on 27 September (n = 18; Figure 6). One juvenile Chinook salmon was captured on 19 July with a length of 69 mm, and one was captured on 4 December with a length of 83 mm (Appendix E1).

Juvenile Coho Salmon

Lengths were obtained from 132 trap-caught juvenile coho salmon (Appendix D1). Due to time constraints, not every captured juvenile salmon was measured for length. Lengths averaged 90.7 mm on 16 January (n = 3), 60.5 mm on 3 August (n = 84), 55.8 mm on 31 August (n = 5), 68.4 mm on 18 September (n = 33), and 65.2 mm on 4 December (n = 6; Figure 6). One juvenile coho salmon was captured on 27 September with a length of 52 mm (Appendix E2).

RELATED FISHERIES PROJECTS

Inriver Abundance of Chinook Salmon in the Kuskokwim River

One Chinook salmon with a radio transmitter was detected by the tracking station located about 300 m downstream from the weir. Records were not kept regarding when the fish actually past the weir, but it was first detected by the tracking station on 29 June and moved past the tracking station on 9 July (Stuby *In prep*). Results from the Chinook salmon radiotelemetry studies will be reported in Stuby (*In prep*).

Kuskokwim River Sockeye Salmon Radiotelemetry Feasibility Study

No radio tagged sockeye salmon were observed or detected passing the Takotna River weir or nearby receiver station in 2005. Detailed results for the sockeye salmon radiotelemetry pilot project are reported by Gilk (*Unpublished*).

Kuskokwim River Salmon Mark–Recapture Project

Tag recovery efforts at the Takotna River weir were successful in 2005. The weir remained operational for the entire Chinook, chum, and sockeye salmon runs, so few tagged fish of these species were likely to have passed the weir without detection. In addition, nearly all passage was successfully conducted through the live trap despite very low water conditions, enabling crew to recover nearly every tag observed (i.e. fish captured and unique tag number recorded). Occasionally, tagged salmon escaped upstream before they could be captured in the live trap, resulting in missed tag recoveries. Tag recovery efforts at the Takotna River weir included recovery of both the Chinook salmon observed with Floy® anchor tags, of both the sockeye salmon observed with tags, of all 6 chum salmon observed with tags, and 14 of 15 coho salmon observed with tags, resulting in a 96% overall recovery rate. No secondary tag marks indicating potential tag loss were found among 213 Chinook, 1,107 chum, and 1,059 coho salmon examined without tags. The recovery of tag numbers offered an opportunity to study migration characteristics of Takotna River chum and coho salmon in 2005. Results for the sockeye, chum, and coho salmon tagging study in 2005 will be reported in detail by Pawluk et al. (*In prep* b).

Genetic Diversity of Chinook Salmon from the Kuskokwim River

Tissue samples were collected from 100 Chinook salmon throughout the run for genetic analysis of population structure and genetic stock identification. Results of this study will be reported in Templin et al. (*In prep*).

Kuskokwim River Chum Salmon Fry Body Condition and Feeding Ecology Project

This was the second year of cooperative efforts between ADF&G and U. S. Geological Survey (USGS). Attempts to collect juvenile chum salmon began on 29 April and continued until 7 July (Appendix D1). After 7 July investigative efforts transitioned to the capture of Chinook and coho salmon, but chum salmon captured during these surveys would have been collected for analysis if any had been captured. Based on past experience, the stationary net was favored early in the season and was often supplemented with the dip net. Later in June, however, the beach seine was often used instead of the stationary net after beach seining efforts proved successful. The stationary net was deployed a total of 15 times from April through June, and the dip net was used on eight separate occasions, mostly in June (Appendix D1). Since the objective was to collect as many juvenile chum salmon as possible, efforts were focused in Fourth of July Creek, where juvenile chum salmon were found in high concentrations in 2004 (Costello et al. 2005).

Combining the beach seine, dip net, and stationary net, a total of 119 juvenile chum salmon were captured in 2005 (Appendix D1). None were captured in trapping events. All of these were captured in Fourth of July Creek (Index Area 4; Figure 4), but this location received a disproportionate amount of effort in April, May, and June.

Every juvenile chum salmon captured was measured for length (Appendix D1). Lengths averaged 33.0 mm on 10 May (n = 4), 37.7 mm on 14 May (n = 3), 37.5 mm on 21 May (n = 2), 35.9 mm on 24 May (n = 9), 36.5 mm on 27 May (n = 2), 41.3 mm on 4 June (n = 3), 37.0 mm on 14 June (n = 4), 41.5 mm on 18 June (n = 11), 38.8 mm on 25 June (n = 17), 49.8 mm on 28 June (n = 48), and 53.8 mm on 2 July (n = 12; Figure 6). One juvenile chum salmon was captured on 21 June with a length of 50 mm (Appendix E3).

While in pursuit of juvenile chum salmon, a total of 88 juvenile Chinook and 22 juvenile coho salmon were captured in Fourth of July Creek, mostly using the dip net (Appendix D1). Of these, 11 Chinook salmon were measured for length, which were archived in the database.

DISCUSSION

ESCAPEMENT MONITORING

The reported Chinook, chum, sockeye, and coho escapements in 2005 are considered accurate representations of annual escapements to the Takotna River. The weir was successfully operated throughout the target operational period of 24 June and 20 September, and Chinook, chum, and coho salmon escapements were determined without reliance on passage estimates. Daily passage trends indicated few salmon passed the weir site before or after the operational period (Table 1; Appendices A1–A3).

Chinook Salmon

Abundance

Reported escapement of 499 Chinook salmon past the Takotna River weir during the target operational period of 24 June through 20 September is considered a reliable estimate of the 2005 total annual escapement upstream of the weir (Table 1). Only 7 Chinook salmon were observed passing the weir during the 14 days before the scheduled operational date, and no Chinook salmon were observed after 13 September.

Chinook salmon escapement in 2005 was higher than escapements in 1996, 2000, 2002, 2003, and 2004, but less than in 1997 and 2001, although escapement in 1997 was enumerated using counting towers and passage may have been overestimated (Figures 7 and 8; Appendix A1). No formal escapement goal has been determined for the Takotna River, which precludes assessment of the adequacy of the escapement. However, in tributaries where escapement goals have been established (ADF&G 2004), escapement goals were met or exceeded in 2005 and have improved in recent years from below-average levels in 1998–2000 (Figure 8; Bergstrom and Whitmore 2004; Linderman et al. *In prep*).

The overall Kuskokwim River Chinook salmon escapement was considered above average in 2005 (Figure 8; Linderman et al. *In prep*). Kuskokwim River Chinook aerial survey index was only slightly lower than in 2004, which was the highest year on record. Takotna River Chinook salmon escapements have been similar to most other escapement monitoring projects in the Kuskokwim River drainage in recent years, having low escapement in 2000 and much higher escapements in 2004 and 2005 (Costello et al. *In prep*; Jasper and Molyneaux *In prep*; Zabkar et al. *In prep*). All projects reported an increase from 2004 to 2005 except the George River weir (Stewart et al. *In prep*). Only in 2001 did Chinook salmon escapement to the Takotna River weir deviate from the trend observed at most other monitored locations (Figure 8; Schwanke and Molyneaux 2002).

Implemented since 2001 as a response to the BOF classification of Kuskokwim River Chinook salmon as a stock of concern, the subsistence fishing schedule observes a 3-day weekly closure to allow large pulses of salmon passage through the river, likely contributing to higher escapements in recent years (Bergstrom and Whitmore 2004). In response to adequate run strength indicators for Chinook and chum salmon in 2005, the subsistence schedule was lifted for the season on 19 June before it had gone into effect for the entire drainage (Linderman et al. *In prep*). However, Takotna River Chinook salmon likely benefited from the schedule because June closures provided windows when fish could pass through the more intense lower Kuskokwim River subsistence fisheries.

For the second time since 2000, ADF&G permitted commercial fishing in District W-1 during four periods between 24 June and 1 July (Linderman et al. *In prep*). Additional commercial fishing periods were conducted during the coho salmon run. Only 4,784 Chinook salmon were reported in 2005 commercial salmon harvests compared with a recent 10-year average of 7,059 fish and a pre-2001 10-year average of 18,081 fish. The recent lack of a commercial market for

Kuskokwim River chum salmon has likely influenced Chinook salmon commercial harvests, since Chinook salmon are harvested incidentally with chum salmon. Considering the small commercial harvest, the impact of the subsistence fishery is likely much greater. An estimate is not yet available for the 2005 subsistence harvest, but the 1994–2003 average subsistence Chinook salmon harvest was 81,854 fish (Linderman et al. *In prep*). These harvests are in comparison to the 145,373 estimated to have migrated past the Aniak River in 2005 (Stuby *In prep*).

Spawning Locations

Aerial surveys of the Takotna River drainage on 21 July revealed that most of the Chinook salmon escapement likely spawned in Fourth of July Creek (Figure 9). A total of 104 Chinook salmon were observed in Fourth of July Creek in 2005. Counts in Fourth of July Creek have ranged from 15 Chinook salmon in 2002 to 106 Chinook salmon in 2001 (Clark and Molyneaux 2003; Costello et al. 2005; Gilk and Molyneaux 2004; Schwanke et al. 2001; Schwanke and Molyneaux 2002). There appears to be a correlation between escapement and the number of Chinook salmon observed in Fourth of July Creek; when escapements were low (2000 and 2002), only 29 and 15 Chinook salmon were seen, but when escapements were higher (2001, 2004, and 2005), 106, 73, and 104 Chinook salmon were seen, respectively. Big Creek (lower), Big Creek (upper), Big Waldren Fork, Little Waldren Fork, and Moore Creek were also surveyed in 2005, but no Chinook salmon were observed in these tributaries. Historically, no Chinook salmon have ever been observed in these tributaries, even though Big Creek (lower), Big Waldren Fork, Little Waldren Fork, and Moore Creek have been surveyed 4 times since 2000. By the time of the aerial surveys, about 75% of the total annual escapement of Chinook and chum salmon had passed upstream of the Takotna River weir, so the timing of the survey corresponded well to the period of peak spawning ground abundance. Still, the fish observed during the survey only accounted for 20.6% of the cumulative Chinook salmon escapement through that date. Historical aerial surveys suggest Fourth of July Creek is the dominant spawning area for salmon in the Takotna River drainage (Clark and Molyneaux 2003; Costello et al. 2005; Gilk and Molyneaux 2004; Schwanke et al. 2001; Schwanke and Molyneaux 2002) although many Chinook salmon may spawn in the mainstem Takotna River.

Run Timing at Weir

Chinook salmon run timing at the weir in 2005 was similar to previous years (Figure 5; Appendix F1). The median passage date in 2005 was 6 days earlier than in 2003 and 2000, and 1 day earlier than in 2001, but 1 day later than in 2002, 3 days later than in 2004 and 1997, and 8 days later than in 1996. At other Kuskokwim River escapement projects, the run timing of Chinook salmon was variable in 2005; for example, at Kogrukluk (rkm 710), Tatlawiksuk (rkm 568), and George (rkm 453) river weirs the Chinook salmon run timings were similar to past years (Costello et al. *In prep*; Jasper and Molyneaux *In prep*; Stewart et al. *In prep*), whereas at Tuluksak River weir (rkm 222) it was among the earliest on record (Zabkar et al. *In prep*).

Index Value

One of the arguments supporting operation of the Takotna River weir is that it provides a measure of escapement that can be applied as an index for the upper Kuskokwim River drainage. The only other escapement monitoring regularly conducted in the upper Kuskokwim River is aerial surveys of the Salmon River (Pitka Fork drainage), a formal escapement index stream (Burkey et al. 2002; Figures 10–12). The Salmon River surveys, however, focus only on

Chinook salmon and are not conducted every year. To date, there are 6 years of paired Chinook escapement measures for both the Takotna and the Salmon River, but they do not correlate well (R^2 = 0.0169; Figure 13). Both abundance measures showed an increase from 2000 to 2001, but the increase observed at the Salmon River was disproportionate to the increase observed at the Takotna River. In 2002, 2003, and 2005 more Chinook salmon were seen in the Salmon River survey than would have been suggested based on the Takotna River weir escapement data. In 2000, 2001, and 2004 fewer Chinook salmon were seen in the Salmon River survey than would have been predicted based on the observed escapement to the Takotna River weir. The discrepancy observed in 2004 may be the result of poor aerial survey conditions in one portion of the Salmon River (Index Area 101; Figure 12), but the aerial survey count in 2005 is likely biased low for the same reason. The authors recommend that managers continue to expand this paired data set so that the relationship can be better assessed.

Chum Salmon

Abundance

Reported escapement of 6,467 chum salmon past the Takotna River weir during the target operational period of 24 June through 20 September is considered a reliable estimate of the 2005 total annual escapement upstream of the weir (Table 1). Only 5 chum salmon were observed passing the weir during the 14 days before the scheduled operational date, and no chum salmon were observed after 16 September.

Escapements have been determined for chum salmon in all 6 years the project has operated. The 2005 chum salmon escapement to Takotna River was the highest on record, 3 times that of 2004, and over 5 times that of 2000, which was one of the years that contributed to the "stock of concern" designation by the BOF (Burkey et al. 2000b; Figure 14; Appendix A2). No formal escapement goals have been established for Takotna River chum salmon, which precludes assessment of the adequacy of the escapement. However, in tributaries where escapement goals have been established (Aniak River sonar and Kogrukluk River weir; ADF&G 2004), escapement goals were met or exceeded in 2005 and have improved in recent years from below-average levels in 1998–2000 (Figure 14; Bergstrom and Whitmore 2004; Linderman et al. *In prep*).

The dramatic increase in chum salmon escapement at the Takotna River weir in 2005 was observed at nearly every other escapement monitoring project in the Kuskokwim River (Figure 14; Costello et al. *In prep*; Jasper and Molyneaux *In prep*; McEwen *In prep*; Zabkar et al. *In prep*). In fact, chum salmon escapement in 2005 was the highest on record for every escapement monitoring project in the drainage except for the George River weir, where chum salmon escapement was only slightly higher than in 2004 and half that reported for 2003 (Figure 14; Stewart et al. *In prep*). At most other monitored locations in the drainage, chum salmon escapements have recovered from below-average levels in 1999 and 2000 to intermediate levels in recent years, and to record high levels in 2005 based on historical escapement estimates (Costello et al. *In prep*; Jasper and Molyneaux *In prep*; McEwen *In prep*; Roettiger et al. 2005; Stewart et al. *In prep*; Bergstrom and Whitmore 2004). However, unlike other weir projects in the Kuskokwim River, escapement at the Takotna River weir declined steadily between 2001 and 2004 (Figure 14; Appendix A2).

Implemented since 2001 as a response to the BOF classification of Kuskokwim River chum salmon as a stock of concern, the subsistence fishing schedule observes a 3-day weekly closure to allow large pulses of salmon passage through the river, likely contributing to higher escapements in recent years (Bergstrom and Whitmore 2004). In response to adequate run strength indicators for Chinook and chum salmon in 2005, the subsistence schedule was lifted for the season on 19 June before it had gone into effect for the entire drainage (Linderman et al. *In prep*). Nonetheless, Takotna River chum salmon may have still benefited from the schedule because June closures provided windows when fish could pass through the more intense lower Kuskokwim River subsistence fisheries. Evidence from tagging studies suggests that chum salmon bound for the Takotna River pass through the lower river in late June and early July; thus conservation measures implemented during this time may benefit Takotna River stocks (Kerkvliet et al. 2003, 2004; Pawluk et al. *In prep* a, *In prep* b).

For the second time since 2000, ADF&G permitted commercial fishing in District W-1 during four periods between 24 June and 1 July (Linderman et al. *In prep*). Additional commercial fishing periods were conducted during the coho salmon run. Though the chum salmon commercial harvest in 2005 was about 3 times that reported in 2004, the reported harvest of 69,000 chum salmon was well below the recent 10-year average of 107,572 fish and the pre-2001 10-year average of 286,134 fish. The recent lack of a commercial market for Kuskokwim River chum salmon has likely influenced commercial harvests. An estimate is not yet available for the 2005 subsistence harvest, but the 1994–2003 average subsistence chum salmon harvest estimate was 61,441 fish (Linderman et al. *In prep*). The effect of these fisheries on Takotna River chum salmon escapements is likely modest, given the low harvests and the record chum escapements reported throughout the drainage (Figure 14; Costello et al. *In prep*; Jasper and Molyneaux *In prep*; McEwen *In prep*; Zabkar et al. *In prep*).

Run Timing at Weir

Chum salmon run timing at the weir in 2005 was slightly later than usual (Figure 5; Appendix F1). The median passage date was 1 day earlier than in 2001 and 2 days earlier than in 2003 but 6 days later than in 2002 and 2004, 2 days later than in 2000, 3 days later than in 1997, and 10 days later than in 1996. Timing of the chum salmon run was slightly late or about average at most Kuskokwim River escapement-monitoring projects in 2005 (e.g. Costello et al. *In prep*; Jasper and Molyneaux *In prep*; Stewart et al. *In prep*). Only the Tuluksak River weir reported an early chum salmon run timing in 2005 (Zabkar et al. *In prep*).

Coho Salmon

Abundance

The reported escapement of 2,216 coho salmon past the Takotna River weir during the target operational period of 24 June through 20 September is considered a reliable estimate of the 2005 total annual escapement (Table 1). No coho salmon were observed passing the weir before the scheduled operational data, and only 6 coho salmon were observed after 16 September.

Escapements have been determined in all 6 years the project has operated. The 2005 coho salmon escapement at Takotna River weir was the lowest on record, and less than half that reported for 2003 (Figures 7, 15; Appendix A3). Coho salmon escapements are monitored at five other weir projects in the Kuskokwim River drainage, and a formal escapement goal exists only at Kogrukluk River weir (Figure 15; Linderman et al. *In prep*). The escapement goal was achieved at Kogrukluk River weir, but escapements were below most other years at every project (Costello et al. *In prep*; Jasper and Molyneaux *In prep*; Stewart et al. *In prep*; Zabkar et al. *In prep*).

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). Run abundance remained depressed until 2003, when record escapements were recorded (Figure 15). After several years of depressed runs, the commercial market was not positioned to fully exploit the unexpectedly strong coho salmon run in 2003. This problem was counteracted in 2004 and 2005 when processing capacity was increased. Despite these changes, commercial harvest in 2005 was 142,319 coho salmon, which was well below the recent 10-year average of 302,383 fish and the pre-2001 10-year average of 453,755 fish (Linderman et al. *In prep*). Although lower than recent years, the 2005 commercial harvest may represent a higher exploitation rate considering the relatively low escapement observed at most projects in 2005 (Linderman et al. *In prep*).

Run Timing at Weir

Coho salmon run timing at the weir in 2005 was similar to previous years (Figure 5; Appendix F2). Annual median passage dates have varied little, ranging between 25 and 27 August. Unlike in previous years, the central 50% passage occurred over a period of 12 days in 2005 compared to 10, 9, 10, 14, and 14 days in 2000, 2001, 2002, 2003, and 2004, respectively. The overall pattern of daily passage was markedly similar among the 6 years of enumeration data, and much less variable than at other weir projects (e.g. Costello et al. *In prep*; Jasper and Molyneaux *In prep*; Roettiger et al. 2005; Stewart et al. *In prep*; Zabkar et al. *In prep*). As reported, median passage dates have occurred within 4 days during the last 6 years at Takotna River weir, but at other projects with comparable escapement data, median passage dates have been much more variable, ranging from 7 days at Tatlawiksuk and Kogrukluk river weirs to 14 days at George River weir (Costello et al. *In prep*; Jasper and Molyneaux *In prep*; Stewart et al. *In prep*; Zabkar et al. *In prep*). Run timing at other Kuskokwim River escapement projects was also average or slightly later than average, except at Tuluksak River weir, which reported the second earliest run timing on record in 2005 (Zabkar et al. *In prep*).

Other Species

Sockeye Salmon

Reported escapement of 34 sockeye salmon past the Takotna River weir during the target operational period of 24 June through 20 September is considered a reliable estimate of the 2005 total annual escapement (Table 1). No sockeye salmon were observed before 17 July or after 14 September. Few sockeye salmon are observed in the Takotna River, making the reported escapement of 34 sockeye salmon in 2005 the highest on record (Table 1; Figure 16). Historically, annual sockeye salmon escapement at the Takotna River weir has ranged from 1 fish in 2001 and 2002 to 17 fish in 2004, which is not surprising since the Takotna River is not a primary spawning tributary for sockeye salmon. Overall, record high sockeye salmon escapements were reported at all other Kuskokwim River projects in 2005 (Figure 16; Linderman et al. *In prep*).

Sockeye salmon are not abundant in the Kuskokwim River, and sockeye salmon are not prominent in subsistence or commercial harvests. The 2005 sockeye salmon commercial harvest of 27,645 sockeye salmon was greater than the recent 10-year average of 23,763 fish (Linderman et al. *In prep*). Compared to other species in the drainage, little is known about sockeye salmon in the Kuskokwim River. As a result, escapement goals do not exist, and they have not been considered a stock of concern by the BOF.

Since sockeye salmon are rare in the Takotna River, few years exist with adequate data to compare run timing. Though the escapements from 2004 and 2005 are barely adequate to describe run timing of Takotna River sockeye salmon, the median passage date was 17 August both years (Appendix F2; Costello et al. 2005). However, the central 50% passage occurred over a period of 27 days in 2005, but only 11 days in 2004. Median passage dates relative to other locations and years were variable at other projects in the drainage. For example, at Kogrukluk and Tuluksak river weirs, the median passage dates were similar to other years and to each other; the median passage date at Tuluksak River weir was 18 July, compared to 15 July at Kogrukluk River weir (Jasper and Molyneaux *In prep*; Zabkar et al. *In prep*). In addition, the central 50% occurred over similar time periods at both projects, ranging from 12 days at Tuluksak River weir to 14 days at Kogrukluk River weir. In contrast, the median passage date at George River weir was 13 August, the second latest on record, and similar to the 17 August median passage date observed at Takotna River weir (Stewart et al. *In prep*). At both locations, the central 50% of the run occurred over a period of 27 days in 2005.

Resident Species

Other species commonly observed at Takotna River weir include longnose suckers, whitefish, Arctic grayling, and northern pike (Appendix A4). Longnose suckers are historically the most abundant resident species counted at the Takotna River weir (Appendix A4). The highest recorded passage of this species was 13,458 fish in 2001. A total of 231 longnose suckers were counted upstream through the weir in 2005, and most of these were observed in the first 2 weeks of operations in June (Table 1). Large numbers of longnose suckers were observed migrating downstream along with whitefish species in August and September, suggesting these fish migrated upstream prior to operations in 2005. With the exception of 2004, longnose sucker passage in 2005 was lower than in all previous years (Appendix A4). Longnose suckers were a prominent species at only two other monitored tributaries in 2005, but the relative strength of the longnose sucker migration varied between the two. At George River weir, longnose sucker passage was the lowest on record for years with comparable operational dates, but reported longnose sucker passage at Tatlawiksuk River weir was the highest since 2001 (Costello et al. *In prep*). In the case of all 3 weirs, a significant number of longnose suckers may have passed upstream before operations began. Migratory timing of longnose suckers is highly variable at the Takotna River weir, as it is in other monitored tributaries in the Kuskokwim River drainage. The median passage date for Takotna River longnose suckers has ranged from 26 June to 23 July even though the weir was installed by 24 June nearly every year. Variable median passage dates have also been observed at both George and Tatlawiksuk river weirs. Information on longnose sucker passage is likely incomplete because much of their upstream migration probably occurs before the beginning of weir operations (Morrow 1980) and smaller individuals may be able to pass freely between the pickets.

Carcasses

In 2005, less than 1% of the Chinook and chum salmon escapements were later found as carcasses at the weir (Figure 17). The remainders of the spawned-out fish were likely 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 injection of marine derived nutrients as described by Cederholm et al. (1999, 2000). Retention of spawned-out salmon carcasses within the Takotna River is particularly important given that salmon runs appear to be in recovery following decades of near absence. Nutrient retention within a system is essential for reestablishment of strong salmon runs (Cederholm et al. 1999, 2000). No conclusions have been made about the occurrence or retention of coho carcasses because the weir was removed before the majority of the fish had completed spawning.

Females comprised 22.7% of the chum salmon carcass count, compared to 48.2% of the upstream migrants. This indicates that sex composition derived from weir carcass counts is biased low for females (DuBois and Molyneaux 2000).

AGE, SEX, AND LENGTH COMPOSITION

Chinook Salmon

Despite active sampling efforts, Chinook ASL samples were below the objective sample size. The need for achieving the target sample size for each ASL pulse sample was weighed against the need for collecting the samples over a brief period of time, the abundance of the species at the time the samples were collected, and the need to avoid undue delay to the salmon migration. As in 2001, 2003, and 2004, the ASL data collected from Chinook salmon in 2005 were not adequate for describing the age composition for the total annual escapement because of insufficient samples; therefore, only general comparisons can be made from fish sampled during the same time frames in previous years (Clark and Molyneaux 2003; Costello et al. 2005; Gilk and Molyneaux 2004).

Though the ASL data were insufficient in 2005 for determining trends over the Chinook run, information in 2000 and 2002 indicated that the percentage of age-1.3 fish tends to decrease while the percentage of age-1.4 fish tends to increase as the season progresses (Figure 18; Molyneaux et al. *In prep*). This is consistent with Takotna River Chinook salmon data combined over all years (Figure 18) and with trends observed at other locations in the drainage (Costello et al. *In prep*; Jasper and Molyneaux *In prep*; Stewart et al. *In prep*; Zabkar et al. *In prep*). Generally, for all escapement projects the contribution of age-1.3 Chinook salmon to overall escapement tends to decrease throughout the run (Molyneaux et al. *In prep*). Notably, in 2005 this trend was not apparent at George and Tuluksak river weirs, emphasizing the high variability among weir projects. The percentage of age-1.4 Chinook salmon tends to increase during the run at most escapement projects, but this pattern is less prevalent and is often masked by the abundance of less common age classes (e.g. age-1.1, -1.2, and -1.5 fish).

Age compositions in 2005 at the Takotna River weir were comparable with most other escapement monitoring projects in the Kuskokwim River drainage. Similar to the Takotna River weir, Kogrukluk and Tuluksak river weirs had near average proportions of age-1.2 Chinook salmon in 2005. The proportion of age-1.3 Chinook in 2005 was higher than usual at all other weir projects in the drainage, with the most extreme disparities at George and Tatlawiksuk river weirs. Similar to Takotna River weir, most other projects reported lower than average proportions of age-1.4 Chinook in 2005 (Costello et al. *In prep*; Jasper and Molyneaux *In prep*; Stewart et al. *In prep*; Zabkar et al. *In prep*). As in past years, the proportions of other age classes of Chinook salmon were low at all locations in 2005, and the relative contribution varied among projects (Table 2; Molyneaux et al. *In prep*).

The unusually high numbers of age-1.2 Chinook salmon in 2004 and age-1.3 Chinook salmon in 2005 at most Kuskokwim River projects is an indication of strong sibling relationships in Kuskokwim River Chinook salmon (Costello et al. *In prep*; Jasper and Molyneaux *In prep*; Stewart et al. *In prep*; Zabkar et al. *In prep*), but the large runs were unexpected because escapements in the 2000 parent year were generally low (Figure 19; Harper and Watry 2001; Linderman et al. 2002; 2003; Schwanke et al. 2001; Ward et al. 2003). Since few smolt studies are currently conducted on the Kuskokwim River, it is impossible to determine whether the strong returns resulted from favorable ocean conditions or favorable river conditions. However, the wide range of the phenomenon in the Kuskokwim River drainage indicates that favorable ocean conditions were probably the driving force. Furthermore, results from juvenile surveys conducted in the Takotna River drainage in 2001 do not suggest high survivability among juveniles during the 2000–2001 winter because juvenile Chinook salmon were found in low concentrations relative to 2002 and 2003 (Schwanke and Molyneaux 2002; Costello et al. *In prep*). The high abundance of both age-1.2 Chinook salmon in 2004 and age-1.3 Chinook salmon in 2005 at Takotna River weir and other tributaries in the drainage may foretell strong returns of age-1.3 and -1.4 Chinook salmon in 2006. Since age-1.4 is typically a prominent age class in the Takotna River (Figure 19), a large run of Chinook salmon to the Takotna River is expected for 2006.

At 31.3% of the sample, the percentage of females at Takotna River weir in 2005 was lower than in most previous years and similar to 2000 (Molyneaux et al. *In prep*). Based on historical data, the percentage of females tends to increase as the season progresses (Table 2; Figure 20; Molyneaux and Folletti 2005). This finding was expected since male salmon are reported to migrate earlier than female salmon (Molyneaux and Folletti 2005). Still, the low Chinook escapement at Takotna coupled with the low percentage of females suggests low numbers of spawning females and thus a low effective population size (Hartl and Clark 1997, page 292). The percentage of female Chinook salmon was average or slightly below average at most other locations where samples were taken in 2005 (Costello et al. *In prep*; Jasper and Molyneaux *In prep*; Stewart et al. *In prep*; Zabkar et al. *In prep*).

The 31.3% female Chinook salmon estimated from weighted ASL samples was comparable to the 32.7% visual estimate of the field crew during daily fish passage in 2005 (Figure 21). When considering strata, however, the percentage of females determined through ASL sampling was considerably lower than the visual estimate in the earlier strata, but considerably higher in the second. ASL sampling between 24 June and 13 July revealed a female sex ratio of 16.7%, whereas the percent female determined through visual examination was 26.4%. Between 14 July and 20 September, the estimate derived from ASL sampling was 38.9%, considerably lower than the 45.9% derived visually. The greater difference in the earlier stratum may be due to the inexperience of the crew; this was the first season they identified the sex of all migrating salmon (Table 1). The authors recommend that the crew continue to visually sex fish passing through the weir to better evaluate discrepancies between the two methods.

Sample sizes were insufficient to estimate length composition of the entire Chinook salmon run in 2005 and in most previous years, but general comparisons can be made looking at only the samples. Mean length for male age-1.3 Chinook salmon sampled in 2005 was similar to previous years given the small sample size, but the mean length for female age-1.3 Chinook salmon in 2005 was less than in 2004 (Figure 22). Small sample sizes for female age-1.3 Chinook salmon in 2001 and 2002 masked the significance of the length differences for those years (Figure 22). Mean length for age-1.4 male Chinook salmon was similar to all previous years except in 2001 when mean length tended to be greater (Figure 22). The mean length for female age-1.4 Chinook salmon was similar to 2000 and 2004, given the small sample sizes, but less than in 2001, 2002, and 2003 when mean length tended to be greater (Figure 22).

Chum Salmon

The ASL data collected from chum salmon in 2005 were adequate for describing the age composition for the total annual escapement. Sampling occurred throughout the run and total sample size met or exceeded the minimum goal. ASL composition has been estimated in all 6 years that the project has operated.

The most striking finding in 2005 was the proportion and abundance of age-0.3 fish (Table 4). Although age-0.3 chum salmon are typically the dominant age class in the Takotna River, they have never comprised nearly 90% of annual escapement. Historically, the proportion of age-0.3 chum salmon in the Takotna River has ranged from 45.6% in 2002 to 83.6% in 2003. In 2004, age-0.3 chum salmon comprised only 47.5% of the escapement, but 2004 was characterized by an unusually high abundance of age-0.2 chum salmon. The high abundance of age-0.3 chum salmon were expected given the unusually high abundance of age-0.2 fish in 2004, and both phenomena were expected given the high escapement in the 2001 parent year (Figure 19). Unusually high abundances and proportions of age-0.3 chum salmon were observed at all other Kuskokwim River locations in 2005 (Costello et al. *In prep*; Jasper and Molyneaux *In prep*; Stewart et al. *In prep*; Zabkar et al. *In prep*). Though the predictive value of sibling relationships for chum salmon is not as reliable as with Chinook salmon (Figure 19), sibling relationship was a reliable predictive tool for 2005, and the high abundances of age-0.3 chum salmon in 2005 may foretell a strong return of age-0.4 chum salmon in 2006.

The proportion of age-0.4 fish was unusually low throughout the chum salmon run in 2005, and their relative contribution remained consistent (Figure 23; Table 4). Usually at Takotna River weir and at other Kuskokwim River projects, the proportion of age-0.3 chum salmon increases as the run progresses, while the proportion of age-0.4 fish inversely diminishes (Table 4; Figure 23; DuBois and Molyneaux 2000). The unusual abundance of age-0.2 chum salmon has masked that trend in recent years, especially for age-0.3 fish. In fact, the percentage of age-0.4 chum salmon has decreased during 4 of the 6 seasons the Takotna River weir has operated and during nearly ever year at other projects in the drainage where chum salmon samples are collected. The proportion of age-0.2 chum salmon to total escapement tends to increase throughout the run, thereby masking the trend normally seen in age-0.3 fish.

Slightly over half of the total annual chum salmon escapement at Takotna River was female in 2005, which is similar to past years (Table 4; Costello et al. 2005). These percentages are also similar to what has been found historically at most other escapement projects (DuBois and Molyneaux 2000). DuBois and Molyneaux (2000) reported that within-season percentage of females generally increases over the duration of the run; however, in 2005 the percentage of females at Takotna River weir remained relatively consistent, similar to what was observed in 2000 and 2002 (Figure 23; Costello et al. 2005). The reason for the inconsistency among years is unknown, but similar and more exaggerated inconsistencies have been observed at Kogrukluk River weir, where the pattern is attributed to the influence of extensive spawning areas downstream of the weir (Jasper and Molyneaux *In prep*; DuBois and Molyneaux 2000). Very limited chum salmon spawning, however, is known to occur downstream of the Takotna River weir.

The 51.3% female chum salmon estimated from weighted ASL samples was comparable to the 48.2% visual estimate of the field crew during daily fish passage in 2005 (Figure 21). There were slight discrepancies in the first strata, but they were not consistent and probably not significant. The greatest difference was in the second strata, which lasted from 7 to 12 July. The 56.6% female determined through ASL sampling was considerably higher than the 48.3% visual estimate (Figure 21). Combining all strata, however, there was no apparent difference. The authors recommend that the crew continue to visually sex fish passing through the weir to better evaluate discrepancies between the two methods.

Length partitioning occurs between sex and age class at Takotna River weir (Table 5; Figure 24). Males tended to be longer than females, and mean lengths increased with age, most noticeably among males (Figure 24). Mean lengths for male age-0.3 chum salmon in 2005 was similar to those observed in most past years, except for in 2001 and 2002 when mean length tended to be greater (Figure 25). The mean length of female age-0.3 chum salmon in 2005 was similar to those observed in 2000 and 2004, but considerably less than in 2001, 2002, and 2003. Mean lengths for male and female age-0.4 chum salmon were similar to past years, considering the small sample sizes and large 95% confidence intervals (Figure 25). In 2005, male age-0.3 and -0.4 chum salmon were similar in length, but female age-0.3 chum salmon tended to be larger than age-0.2 fish (Table 5; Figure 24).

Coho Salmon

The ASL data collected from coho salmon in 2005 were adequate for describing the composition of the total annual escapement. As in past years, age-2.1 coho salmon dominated the 2005 coho salmon run (Table 7), which is typical of Kuskokwim Area coho runs (DuBois and Molyneaux 2000). The proportions of age-1.1, -2.1, and -3.1 coho salmon were near historical average of 0.4%, 91.6%, and 7.9%, respectively (Table 6). Age composition remained fairly consistent over the 2005 season, similar to previous years at Takotna River weir, and to other locations in the Kuskokwim River drainage (Table 6).

The percentage of female coho salmon in the total annual escapement at Takotna River was 48.1%, which is near the upper end of the historic range, and similar to other projects in the drainage (Costello et al. 2005). Historically, the percentage of females has ranged from a low of 39.5% in 2002 to 52.1% in 2003. Similar to previous years, seasonal trends indicate the ratio of female fish increased slightly over the run in 2005 (Figure 20). The percentage of females is typically around 40–50% in Kuskokwim River tributaries where samples are routinely collected, and the percentages typically increase slightly throughout the run in most locations (Costello et al. *In prep*; Stewart et al. *In prep*; Zabkar et al. *In prep*). One chronic exception is in the Kogrukluk River where the percentage of females is typically lower than other areas (30–40%) and the intra-seasonal sex composition is highly variable between years (Jasper and Molyneaux *In prep*). In past years, there have been questions about the crew misidentifying the sex of fish. DuBois and Molyneaux (2000) identified erroneous sex identification as being a persistent problem with coho salmon, and this necessitates continued diligence in sexing fish at the Takotna River weir project; otherwise, no irregularities were observed in the estimated coho salmon ASL composition.

The 48.1% female coho salmon estimated from weighted ASL samples was comparable to the 49.0% visual estimate of the field crew during daily fish passage in 2005 (Figure 21). The sex ratio determined by both methods was similar in all of the strata (Table 1; Figure 21). The authors recommend that the crew continue to visually sex fish passing through the weir to better evaluate discrepancies between the two methods.

Length varied little among age classes in 2005, which is similar to past years and to other locations in the drainage (Molyneaux et al. *In prep*). The mean length of male age-2.1 coho salmon in 2005 was similar to that in past years with the exception of 2004 when mean length tended to be smaller and 2001 when the mean length tended to be larger (Figure 26). The mean length of female age-2.1 coho salmon in 2005 was similar to 2000 and 2003, less than in 2001 and 2002, and considerably greater than in 2004 (Figure 26). Similar to past years, average length-at-age varied little between sexes (Figure 24).

WEATHER AND STREAM OBSERVATIONS

Water levels in the Takotna River were below average for nearly the entire operational period and the mean water level was the second lowest on record (Figure 27). The mean water level for June through August was below the historical average, but water levels in September averaged higher than most other years, except for 2000 which had similar water level patterns in September (Schwanke et al. 2001). Water levels dropped fairly steadily from 10 June through 21 August, but then rose steadily until the end of the target operational period on 20 September. The reported range in water level in 2005 was near the historical minimum for most of July, but remained well below past years from 25 July to 21 August. After 21 August, water levels rose rapidly, exceeding the historical maximum by 17 September. The observed pattern in 2005 was much different from that observed in 2000, 2001, and 2003 in which water levels fluctuated dramatically throughout the season (Gilk and Molyneaux 2004; Schanke et al. 2001; Schwanke and Molyneaux 2002). There did not appear to be a strong correlation between daily water level and salmon passage (Figure 28). However, given that fish passage methods changed during the season, and that sampling events interfere with daily fish passage, it is uncertain whether daily water level influenced fish migration through the weir in 2005.

Water temperature at the Takotna River weir was well above average for the entire season, exceeding the historical daily maximum for about 3 weeks in late July and early August (Figure 27). Mean daily water temperatures dropped to near average for a 2 week period in September, which coincides with a period of heavy precipitation and a rapid and continual water level increase (Figure 27; Appendix C1). Any relationship between stream temperature and passage strength or timing is not easily discernable by the available data (Figure 29). The effect of migration timing does change in relation to long term changes in freshwater water temperatures (Quinn 2005).

Knowledge of environmental conditions and a commitment to long-term monitoring may be valuable in understanding migration and survival. Quinn (2005) notes that migration in salmon is likely controlled by genetic factors as an adaptation to long-term average environmental conditions. Keefer et al. (2004) found a positive correlation between river discharge and run timing of Columbia River Chinook salmon stocks, and that Columbia River sockeye salmon have started their inriver migration 2 weeks earlier in response to warmer water conditions resulting from dam construction. We cannot begin to assess the affects of changing environmental conditions on Kuskokwim River salmon without the relatively complete weather and stream observations collected by weir crews such as at the Takotna River. These measurements can easily be neglected in field camps, and may seem a low priority among project objectives, but incorporating weather and stream observations into the daily morning and afternoon radio schedules with ADF&G staff in Bethel helps ensure the data are gathered consistently throughout the season.

Juvenile Salmon Investigations

Sampling Efforts

Juvenile sampling in 2005 was limited. Unusually strong Chinook and chum salmon runs necessitated crew attention, and extremely low water conditions prevented travel to the upper reaches of the drainage. Juvenile studies remain a secondary objective for the Takotna River weir, and the primary objectives often required the crew to remain near the weir.

Distribution

Juvenile Chinook Salmon

The most significant finding of juvenile investigations in 2005 was the discovery of juvenile Chinook salmon in Minnie and Moore creeks, where Chinook salmon have not been found before (Index Areas 7 and 11; Table 8; Appendix D1). No juvenile Chinook salmon were found in Minnie Creek when it was surveyed in 2001, and none were found in Moore Creek during surveys in 2003 and 2004 (Costello et al. 2005; Gilk and Molyneaux 2004; Schwanke and Molyneaux 2002). Both locations received more survey effort in 2005 than in past years; however, the capture of just a few juveniles in Minnie and Moore creeks confirm that juvenile Chinook salmon were using these tributaries to rear in 2005. The only other surprising finding was the apparent absence of juvenile Chinook salmon in Big Creek (lower). Although less effort than in previous years, 240 hours of trapping in Big Creek (lower) yielded no juvenile Chinook salmon in 2005 despite their presence in 4 of the 5 previous years (Table 8; Appendix D1).

Coho Salmon

An important finding of juvenile investigations in 2005 was the discovery of large numbers of coho salmon in Moore Creek, where previously only one coho salmon had been found (Index Area 11; Table 9; Appendix D1). This finding confirms that coho salmon are using Moore Creek as a rearing location (Costello et al. 2005). Another significant finding in 2005 was the apparent decrease in abundance of juvenile coho salmon in mainstem Takotna River from 2004 to 2005 (Index Areas 1 and 2; Table 9). CPUE in this location dropped from 0.28 fish per trap-hour in 2004 to just 0.01 fish per trap-hour in 2005 (Table 9). However, trapping in Index Area 1 was only conducted once in January and once in June in 2005, compared to the more frequent summer sampling in 2004, and Index Area 2 was never surveyed in 2005 (Appendix D1). As a result, the low CPUE in 2005 is probably misleading. Otherwise, juvenile salmon investigations conducted in 2005 provided no new information about the distribution of juvenile coho salmon in the Takotna River drainage.

Length Patterns

Chinook Salmon

Sampling for length data was limited in 2005. Adequate numbers of juvenile Chinook salmon for length distribution analysis were only captured twice in January, 3 times in August, and twice in September (Appendix D1). Length distribution varied greatly in 2005. For example, two sampling events less than 10 days apart in January revealed significant differences in length distribution between two locations (Figure 6). Juvenile Chinook salmon captured in Gold Creek (Index Area 14) on 16 January averaged 71.1 mm in length while fish captured in the mainstem Takotna River near the confluence of Gold Creek averaged 78.9 mm just 8 days later (Figure 6). Length frequency histograms reveal virtually normal distribution patterns both dates, suggesting size segregation between the two locations (Figure 30). The difference in average length for the two locations is too small to suggest segregation based on age class. In addition, mean lengths of juvenile Chinook salmon captured during three sampling events in August (separated by 2-week intervals) were similar, suggesting either (1) little growth occurred during this period, or (2) the length overlap of different age classes masked the growth patterns of an individual age class. However, length frequency histograms were fairly normally distributed, suggesting the presence of only one age class (Figure 30). Furthermore, scale samples collected from juvenile Chinook salmon in the upper Yukon River drainage in 1993 confirm that age-0 Chinook salmon captured in July and August can range in length from about 50 to 90 mm and that age-1 fish tend to exceed 100 mm in August (Moodie et al. 2000). Mean lengths of juvenile Chinook salmon peaked at 89.1 mm on 18 September in Moore Creek, a considerable increase from the average length of the fish captured on 31 August in Gold Creek (76.3 mm; Figure 6). The reason for the rapid size increase between 31 August and 18 September is not known, but considering the samples were obtained from two very distant locations in the drainage, it may be a result of size segregation; larger fish may remain higher in the drainage than smaller fish, or in faster flowing streams. Again, the pattern does not appear to be age dependent because the shift in length frequency histograms is too small to suggest the presence of age-1 Chinook salmon (Figure 30). Fish sampled from Gold Creek 10 days later had a similar mean length (Figure 6).

Based on a juvenile Chinook salmon study conducted in the upper Yukon drainage in 1993, only age-0 Chinook salmon were captured in the minnow traps from August through September, and age-1 fish in January (Figure 30; Moodie et al. 2000). Though data from the Kuskokwim River drainage are lacking, age-1 Chinook salmon in the upper Yukon River usually outmigrate in May and June (Moodie et al. 2000), suggesting that by the time intensive minnow trapping was conducted in 2005, age-1 fish had already left the system. Scale samples taken from Croucher Creek of the upper Yukon River drainage in 1993 revealed that age-0 Chinook salmon ranged in length from 35 to 75 mm in June, 50 to 90 mm in July and August, and 55 to 95 mm in September and October, similar to the lengths of the Chinook salmon captured in the Takotna River system in August and September (Figure 30; Appendix E1; Moodie et al. 2000). Chinook salmon captured in January are assumed to be age-1 fish from the age-0 population the previous fall because Chinook salmon rarely remain for two winters in the Takotna River.

Coho Salmon

Sampling was limited in 2005 and adequate numbers of juvenile coho salmon for length distribution analysis were only captured once in July, August, September, and December (Appendix D1). Mean length of juvenile coho salmon did not change significantly over the course of the year, but sample sizes were small (Figure 6). Age-2 coho salmon were easily discernible in the sample, but age-0 and -1 fish were difficult to distinguish based on length frequency histograms (Figure 31). Sample sizes were sufficiently large on 3 August and 18 September to show a difference in mean length between those dates (Figure 6). Juvenile coho salmon captured in Moore Creek on September 18 were, on average, larger than those captured in Big Creek (lower) on 3 August (Figure 6). Since Takotna River coho salmon tend to remain in the system two winters (Molyneaux et al. *In prep*), the increase in size from August to September is most likely the result of growth, and not presence or absence of an age class. The one extraordinarily large juvenile coho salmon captured in December was probably an age-2 fish based on its size and will probably outmigrate the following spring as an age-3, an age class occasionally found in the Takotna River drainage (Figure 31; Appendix E2).

RELATED FISHERIES PROJECTS

Inriver Abundance of Chinook Salmon in the Kuskokwim River

The Takotna River weir project contributed successfully to *Inriver Abundance of Chinook Salmon in the Kuskokwim River*. Though only one radio tagged Chinook salmon was recorded at the tracking station near the Takotna River weir, the tracking station remained operational throughout the season, and no other tagged Chinook salmon were detected upstream of the weir during aerial over flights in July and August (L. Stuby, Sport Fish Biologist, ADF&G, Fairbanks; personal communication). Therefore, no other radio tagged Chinook salmon are suspected to have passed the tracking station without detection. Details of the 2005 Kuskokwim River Chinook radiotelemetry project are described by Stuby (*In prep*).

Results from the Chinook salmon radiotelemetry study offered an opportunity to investigate stock-specific run timing past the tagging sites and migratory behavior of discrete spawning aggregates. Four years of data indicate that Chinook salmon bound for the Takotna River and other upper river tributaries are among the first captured and tagged at the tagging sites, which have been located approximately 42 to 91 km upriver from the upstream boundary of District W-1 (Figures 32–34; Stuby 2003, 2004, 2005, *In prep*). Based on radiotelemetry tracking, Takotna River Chinook salmon typically travel between 20 and 40 km per day, which is similar to fish bound for tributaries further downriver (L. Stuby, Sport Fish Biologist, ADF&G, Fairbanks; personal communication). In 2005, the run timing of discreet Chinook salmon spawning aggregates past the tagging sites was more protracted than in 2004 and similar to what was observed in 2002. Overall, run timing of discreet Chinook salmon spawning aggregates past the tagging sites was earlier than in previous years.

The Chinook salmon radiotelemetry project provides valuable data 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 evident through the tagging and tracking of Chinook salmon. In 2005, the date of the first commercial opening in District W-1 of 24 June probably occurred after the bulk of the fish bound for the Takotna River and other upper river tributaries had moved through the lower portions of the Kuskokwim River drainage. Takotna River Chinook salmon captured at the tagging sites likely exited the commercial fishing district 2–3 days before their capture at the tagging sites, assuming their travel speed remained constant along their migration path from the lower river to the upper river (Figures 32 and 33; L. Stuby, Sport Fish Biologist, ADF&G, Fairbanks; personal communication). The timing of Takotna River Chinook salmon through the lower river, coupled with the modest Chinook salmon harvest in 2005, made it unlikely that many Takotna River Chinook salmon were harvested in the commercial fishery. Additionally, the subsistence fishing schedule likely benefited Takotna River Chinook salmon stocks; radiotelemetry data suggest that by the time the subsistence fishing schedule was rescinded on 19 June, most of the Chinook salmon bound for upper river tributaries (such as the Takotna River) had migrated past the lower river where subsistence fishing is most intense (Figures 32 and 33).

Kuskokwim River Sockeye Salmon Radiotelemetry Feasibility Study

Details about the Kuskokwim River sockeye radiotelemetry pilot project will be discussed by Gilk (*Unpublished*). Preliminary results suggest that few Kuskokwim River sockeye salmon are found upstream of the Stony River drainage based on passage data from a receiver station located at Sinka's Landing (178 rkm downstream of the Takotna River). This project was a pilot study, however, and a more extensive project in 2006 will yield more solid conclusions.

Kuskokwim River Salmon Mark–Recapture Project

The Takotna River weir project contributed successfully to *Kuskokwim River Salmon Mark–Recapture Project*. Tag numbers were recovered from 95% of the anchor-tagged fish observed at the Takotna River weir in 2005. The weir remained operational throughout the season, and no tagged salmon are suspected to have passed upstream of the weir without detection. Tagged fish are comparatively rare at the Takotna River weir, and the crew understands the value of every tag number recovered. Details of the 2005 Kuskokwim River Salmon Tagging Project are described by Pawluk et al. (*In prep*).

Chinook Salmon

Tag numbers were recovered from both anchor-tagged Chinook salmon observed passing the Takotna River weir in 2005. The percentage of tagged fish in the total annual Chinook salmon escapement past the Takotna River weir (0.4%) was similar to that reported for George River weir (0.2%), Kogrukluk River weir (0.3%), and Tatlawiksuk River weir (0.3%; Pawluk et al. *In prep* b). The distribution of tags detected relative to passage at the weir indicates that the Takotna River Chinook salmon run was well represented in the tagging sample, despite the few number of tags observed (Figure 35; Pawluk et al. *In prep* b; Stuby *In prep*).

Anchor-tagged Chinook salmon bound for the Takotna River exhibited travel speeds of 13.8 and 28.3 km per day, both considerably slower than the travel speed exhibited by the radio tagged Chinook salmon (Pawluk et al. *In prep*). This is expected, however, because the travel time for the radio tagged Chinook salmon is calculated from tagging to initial detection at the receiver station, while the travel time for anchor-tagged fish is calculated from tagging to weir passage. Large aggregates of Chinook salmon are commonly observed in the deeper pools downstream from the weir, suggesting that radio tagged Chinook salmon can be within the range for detection long before they pass through the weir. This delay can be quite variable, ranging from an average of 1.9 days at Kogrukluk River weir to 6.7 days at Tatlawiksuk River weir (Costello et al. *In prep*; Jasper and Molyneaux *In prep*), and may account for the appearance of a slower travel speed among anchor-tagged Chinook salmon compared to those radio tagged.

Data from the *Kuskokwim River Salmon Mark–Recapture Project* supplements the findings from the Kuskokwim River Chinook Radiotelemetry Project, and is equally useful for management purposes. Run timing of discrete Chinook salmon stocks past the Kalskag tagging sites in 2005 based on anchor-tag deployment mirrored the timing determined from the radio tagging study, and supports the idea that conservation measures, especially in June, benefit Takotna River Chinook salmon stocks (Figure 36).

Chum Salmon

Tag numbers were recovered from all 6 of the tagged chum salmon observed passing the weir in 2005. The percentage of tagged fish in the total annual chum salmon escapement past the Takotna River weir (0.1%) was much lower than that reported for George River weir (2.2%), and slightly lower than that reported for Tatlawiksuk River weir (0.3%), but similar to that reported for Kogrukluk River weir (0.1%; Pawluk et al. *In prep* b). Still, the distribution of tags detected relative to passage at the weir indicates that the Takotna River chum salmon run was well represented in the tagging sample, despite the small sample size (Figure 37; Pawluk et al. *In prep* b).

Results from the tagging study offered an opportunity to investigate stock-specific run timing past the tagging sites and migratory behavior of discrete chum salmon spawning aggregates. Based on tagging data, the median passage date of Takotna River chum salmon past the tagging sites was 3 July in 2005, which was similar to 2003 but considerably later than in 2002 (Figures 38 and 39). Still, in every year of the tagging study, tagging data indicate that Takotna River chum salmon migrate past the tagging sites earlier than any other stock investigated (Figures 38 and 39). The transit time from tagging to weir passage ranged from 13 to 17 days in 2005, with an average of 14.7 days. Considering the distance from the tagging sites, anchor-tagged chum salmon averaged 38.8 km per day, which is similar to past years. The travel speed of Takotna River-bound chum salmon was considerably faster than the observed speeds of 32.2, 33.8, and 35.7 km per day at George, Kogrukluk, and Tatlawiksuk river weirs, respectively, suggesting that travel speed is greatest among the stocks with the longest migration distances.

The Kuskokwim River Salmon Tagging Project provides valuable data for the management of chum salmon by providing managers a better understanding of the run timing of discrete chum salmon stocks through the lower river. When considering opening the commercial fishery or terminating the subsistence fishing schedule for the season, managers look to historic run timing indicators and evidence from the Kuskokwim River tagging study. In 2005, the commercial fishery was first opened on 24 June, after most run assessment tools indicated strong returns to the Kuskokwim River. Historic tagging data indicate that the four commercial fishing periods between 24 June and 1 July occurred while the bulk of the chum salmon bound for the Takotna River were migrating through the lower river (Figures 38 and 39). In fact, in each year of the Kuskokwim River tagging study, tag numbers recovered from chum salmon at the Takotna River weir reveal that the bulk of chum salmon bound for the Takotna River pass the Kalskag/Aniak tagging sites during the last 2 weeks of June and first week of July (Figures 34, 38, and 39). The additional time required to transcend the distance between District W-1 and the tagging sites is not enough to ensure that Takotna River chum salmon had migrated beyond the commercial fishing area by the time of the first opening; it would take only about 3 days for chum salmon to travel this distance assuming that travel speed remains relatively constant along the chum salmon migration path from the lower river to the upper river (Costello et al. 2005). However, the effect of the commercial openings on Kuskokwim River chum salmon stocks was likely negligible in 2005 because the harvest was only a small fraction of the total run to the Kuskokwim River, as evidenced by the record escapement observed at most monitored locations in 2005 (Figure 14; Linderman et al. *In prep*).

The subsistence fishing schedule probably provided little benefit to Kuskokwim River chum salmon stocks in 2005. Tagging data suggest that the schedule was rescinded well before the bulk of the overall chum salmon run had entered the area of greatest subsistence fishing effort, especially considering the late run timing of Takotna River chum salmon in 2005 (Figures 5, 38, and 39; Pawluk et al. *In prep* b).

Coho Salmon

Tag information was collected from 14 of the 15 tagged coho salmon observed passing the weir in 2005 (Pawluk et al. *In prep* b). The percentage of tagged fish in the total annual coho salmon escapement past the Takotna River weir (0.7%) was lower than that reported for George and

Kogrukluk River weirs (1.0% and 0.9%, respectively), but higher than that reported for Tatlawiksuk River weir (0.5%; Pawluk et al. *In prep* b). The distribution of tags detected relative to passage at the weir indicates that the Takotna River coho salmon run was well represented in the tagging sample, despite the small sample size (Figure 40; Pawluk et al. *In prep* b).

Results from the tagging study offered an opportunity to investigate stock-specific run timing past the tagging sites and migratory behavior of discrete coho salmon spawning aggregates. Based on tagging data, the median passage date of Takotna River coho salmon past the tagging sites was 7 August in 2005, considerably later than in 2004, but earlier than in 2002 and 2003 (Figures 41 and 42). Still, in every year of the tagging study, tagging data indicate that Takotna River coho salmon are among the earliest to migrate past the tagging sites, though the timing between coho salmon stocks tends to be more compacted compared to other species (Figures 41 and 42). The transit time from tagging to weir passage ranged from 14 to 32 days in 2005, with an average of 23 days. Considering the distance from the tagging sites, anchor-tagged coho salmon averaged 26.1 km per day, which is similar to past years. The travel speed of Takotna River-bound coho salmon was considerably faster than the observed speeds of 19.8, 23.7, and 22.3 km per day at George, Kogrukluk, and Tatlawiksuk river weirs, respectively, suggesting that travel speed is greatest among the stocks with the longest migration distance.

The *Kuskokwim River Salmon Mark–Recapture Project* provides valuable data for the management of coho salmon by providing managers a better understanding of the run timing of discrete coho salmon stocks through the lower river. In 2005, 11 commercial fishing periods were conducted between 2 August and 1 September. Based on evidence from the tagging study, these periods occurred during the time that most of the coho salmon bound for the Takotna River may have been migrating through the lower portion of the Kuskokwim River (Figures 41–43; Pawluk et al. *In prep* b). The additional time required to transcend the distance between District W-1 and the tagging sites is not enough to ensure that Takotna River coho salmon had migrated beyond the commercial fishing area by the time of the first coho salmon-directed opening; it would take only about 3 days for coho salmon to travel this distance assuming that travel speed remains relatively constant along the chum salmon migration path from the lower river to the upper river (Costello et al. 2005; Pawluk et al. *In prep* b). However, the effect of the commercial openings on Takotna River coho salmon stocks is unknown, but was probably minimal given the relatively small harvest in 2005 and the widespread distribution of coho salmon in the Kuskokwim River (Linderman et al. *In prep*). Though harvest was moderate, there is a greater possibility of overharvesting smaller or weaker stocks such as the Takotna River stock, which may lead to depression or elimination of some populations and a decrease in biodiversity (e.g. Saunders 1981).

Sockeye Salmon

Tag numbers were recovered from both anchor-tagged sockeye salmon observed passing the Takotna River weir in 2005. The percentage of tagged fish in the total annual sockeye salmon escapement past the Takotna River weir (5.7%) was similar to that reported for George River weir (6.3%), and Tatlawiksuk River weir (4.1%), but much higher than that reported for Kogrukluk River weir (0.6%; Pawluk et al. *In prep* b). .

The tagging data offered an opportunity to study migration characteristics of the unusual escapement of sockeye salmon at the Takotna River in 2005. The transit time between tagging and passage at the weir was 12 and 17 days, corresponding to travel speeds of 33.2 and 47.1 km per day. The travel speeds of the 2 tagged sockeye salmon in 2005 were much faster than the single tagged sockeye salmon captured in 2004, with a travel speed of 23.4 km per day, and the observed speeds of 24.0, 26.2, and 24.7 km per day at George, Kogrukluk, and Tatlawiksuk river weirs (Pawluk et al. *In prep* b).

Results from the tagging study suggest that Takotna River sockeye salmon passed through the lower river towards the end of the overall sockeye salmon run in 2004 to 2005, though sample sizes are limited (Figures 44 and 45). Comparatively little is known about sockeye salmon in the Kuskokwim River and escapement goals have not been established, even though their importance for commercial and subsistence fisheries may be increasing.

Genetic Diversity of Chinook Salmon from the Kuskokwim River

Crew at the Tatlawiksuk River weir succeeded in collecting 100 Chinook salmon genetics samples to be added to the study of genetic diversity in the Kuskokwim River drainage. Based on microsatellite DNA and allozymes markers, past evaluations found evidence of genetic distinctions between upper, middle, and lower Kuskokwim River Chinook salmon populations (Templin et al. 2004).

Kuskokwim River Chum Salmon Fry Body Condition and Feeding Ecology Project

Juvenile salmon investigations conducted in 2005 provided no new information about the distribution of juvenile chum salmon in the Takotna River drainage. Of the four methods employed in 2005, only the beach seine, dip net, and stationary net are effective for the capture of juvenile chum salmon, but these were heavily utilized only in Fourth of July Creek (Index Area 4) in 2005 (Appendix D1). Juvenile salmon surveys in 2004 yielded similar results (Costello et al. 2005).

Chum salmon typically emigrate shortly following their emergence in the spring, and typically feed little during their downstream migration (Groot and Margolis 1991). Both in 2004 and 2005, however, chum salmon were found in low numbers in early July (Costello et al. 2005), much later than suspected, and the large sizes of these fish indicate that they were most likely feeding (Figures 46 and 47; Appendix E3). Groot and Margolis (1991) report that chum fry migration in the Yukon River is from early spring until autumn and that the seasonal migration of chum fry is progressively earlier from north to south in North America. Thus, there is little doubt that juvenile chum salmon remain in the Takotna River drainage into July.

Juvenile chum salmon exhibited very little growth from May through most of June (Figures 6, 46, and 47). This was probably the result of variability in time of emergence; the small size of emerging alevins counteracted the growth of already emerged fry (Groot and Margolis 1991). Sample sizes tended to be small throughout May and early June, masking any trend in temporal length distribution. Mean length varied greatly in June. For example, two sampling events 4 days apart revealed differences in length distribution (Figure 6). Juvenile chum salmon captured on 18 June were significantly larger than those captured on 14 June (Figure 6). The juvenile chum salmon captured in July were much larger, on average, than those captured earlier in the season (Figure 6). Though their large sizes suggest feeding, they also coincide with a shift in gear type. A similar result occurred in 2004; the shift from the dip net in June to the beach seine in July corresponded with a dramatic increase in length (Costello et al. 2005). Regardless of size, all captured chum salmon are assumed to be age-0 fish. Except in very rare cases, chum salmon migrate seaward during their first summer following emergence and are obligatory ocean dwellers for most of their lives (Groot and Margolis 1991).

CONCLUSIONS

ESCAPEMENT MONITORING

- The weir was installed by 10 June and was operational until 20 September.
- Total annual Chinook salmon escapement in 2005 showed a modest increase over 2000, 2002, and 2003, but the increase is proportionately lower than the increases seen in most other Kuskokwim River tributaries.
- Total annual chum salmon escapement in 2005 was the highest on record and the increase from 2004 was proportionally higher than the increases seen in most other Kuskokwim River tributaries.
- Total annual coho salmon escapement in 2005 was the lowest on record, which is similar to other Kuskokwim River tributaries with comparable data sets.

AGE, SEX, AND LENGTH COMPOSITION

- Sampling for Chinook salmon was limited in 2005, but the exceptionally high abundance of age-1.3 fish is consistent with findings at most other Kuskokwim Area projects and suggests a strong return of age-1.4 cohort to the Kuskokwim River in 2005.
- The number of age-0.2 chum salmon in the Takotna River escapement diminished in 2005, but an unusually high abundance of age-0.3 chum salmon was observed at Takotna River weir and most other Kuskokwim River projects, and may foretell an abundant return of the age-0.4 cohort to the Kuskokwim River in 2006.
- Despite relatively low parent year escapements, the abundance of the dominant age classes in both Chinook and chum salmon in 2005 suggests continued favorable ocean survivability over the conditions that led to the low runs to the Kuskokwim River in 1998, 1999, and 2000.
- Coho salmon escapement in 2005 was dominated by age-2.1 fish, which is normal for Kuskokwim River tributaries. Coho salmon generally return as age-2.1 fish, so the predictive value of sibling relationships is limited.

WEATHER AND STREAM OBSERVATIONS

- For most of the 2005 season, daily water levels were at or near the lowest levels yet recorded at Takotna River weir, except for one flood event in late August and September when water levels rose.
- Daily water temperatures at Takotna River weir in 2005 were generally well above average, and the highest on record for a 3 week period in late July and early September.

JUVENILE SALMON INVESTIGATIONS

- The most significant finding in 2005 was the discovery of juvenile Chinook salmon in Minnie Creek and juvenile Chinook and coho salmon in Moore Creek.

- The mean length of juvenile Chinook changed little throughout August, but increased dramatically in September, and mean lengths of juvenile coho remained relatively constant throughout the sampling season given the small sample sizes.

RELATED FISHERIES PROJECTS

- One radio tagged Chinook salmon was detected from the tracking station located near the Takotna River weir, which provided valuable information about the run timing of upper Kuskokwim River Chinook salmon when combined with the tags detected upriver of McGrath.
- Only one radio tagged sockeye salmon was detected upstream from the Stony River, which suggests that few sockeye spawn in tributaries further upriver and corroborates the lack of prominent sockeye salmon runs in the Takotna and Tatlawiksuk rivers.
- A total of 2 Chinook, 6 chum, 15 coho, and 2 sockeye salmon equipped with anchor tags were observed passing the Takotna River weir, which provided valuable information as to the run timing and migratory behavior of Takotna River salmon.
- Juvenile chum salmon collection efforts in 2005 yielded similar results as in 2004; the entire sample was collected in Fourth of July Creek, and mean lengths changed little over time considering the effects of different capture methods.

RECOMMENDATIONS

ESCAPEMENT MONITORING

- Annual operation of the Takotna River weir should continue indefinitely because this project provides the only monitoring of chum and coho salmon escapements in the upper Kuskokwim River basin, and it is the only ground-based monitoring for Chinook salmon in the upper Kuskokwim River basin. Further, salmon from Takotna River weir have consistently had the earliest run timing through the subsistence and commercial fisheries of the lower Kuskokwim River (Kalskag and Aniak) as determined through drainage-wide tagging programs. The timing of Takotna River salmon appears to apply more broadly to upper Kuskokwim River Chinook, summer chum, and coho salmon spawning populations. These early running populations are subject to intensive harvest in lower Kuskokwim River subsistence and commercial fisheries at a time when fisheries managers have the least information to assess run abundance; consequently, these early running populations are at greatest risk of management error. The Takotna River weir provides the only basis for assessing the impacts of harvest patterns and the adequacy of upper Kuskokwim River escapements.
- The Takotna River weir should continue to be operated jointly by the TTC and ADF&G. The TTC crew is fully capable at operating the weir with the guidance of an ADF&G crew leader, but TTC lacks capacity for conducting postseason data analysis and report writing. The mutually dependent partnership has created a level of dialogue and synergy that benefits both organizations, as well as the public. Formal and informal discussions that have arisen through the presence of ADF&G staff at Takotna and McGrath have created a level of public awareness about salmon management and stock status that did

not previously exist. The interaction has also created a heightened level of trust between the public and ADF&G that should be recognized and encouraged.

- As opportunity allows, crew members should consider installing the substrate railing late in the spring to take advantage of low water levels in the Takotna River, thereby hopefully avoiding the delay in operation experienced in 2003. All members of the TTC crew are resident at Takotna, making the likelihood of effective timing of an early installation highly plausible.

AGE, SEX, AND LENGTH COMPOSITION

- Sample size objectives for Chinook salmon ASL sampling should be re-evaluated for the Takotna River weir because the target sample size of three 210-fish samples typically exceeds the annual escapement at the weir.

WEATHER AND STREAM OBSERVATIONS

- Investigators should install a water temperature data logger in the river channel in order to accurately determine high, low, and mean daily measurements, which would provide more complete temperature documentation and enable more reliable comparisons among years.
- Conduct additional stream discharge surveys to reestablish a link between flows and river stage.

JUVENILE SALMON INVESTIGATIONS

- Continue to survey for juvenile salmon in the upper Takotna River basin to document occurrence, especially during the spring prior to any possible downstream emigration.
- The effectiveness of beach seines, traps, stationary nets, and dip nets vary by species, so future surveys should incorporate all 4 of these methods, especially when sampling in the upper Takotna River basin.
- Considering the abundance of juvenile Chinook salmon found in Gold Creek, future surveys should give additional attention to sampling in small tributaries.
- Currently the primary objective of the juvenile salmon investigations is to document geographic distribution. If incorporation of additional objectives is desired, such as documenting relative abundance or condition factor, then a more rigorous sampling design will be required that standardizes variables such as sampling location, timing, and methodology.

RELATED FISHERIES PROJECTS

- Investigate the use of findings from the main river Chinook salmon radio telemetry project to estimate the numbers of Takotna River Chinook salmon spawning downstream of the weir by comparing the ratio of tagged to untagged Chinook above the weir to the number of radio tagged Chinook salmon found only downstream of the weir. If tag recovery numbers for a given year are too low, consider pooling results from multiple years.
- Continue the periodic inspection of the nearby radio tracking station to ensure that it remains operational throughout the season.

- Continue collecting tissue samples as requested to determine a genetic baseline for Takotna River salmon stocks, which would eventually allow for the genetic identification of Takotna River salmon captured in mixed stock fisheries in the lower Kuskokwim River and Kuskokwim Bay.
- Continue providing personnel support for the collection of juvenile chum salmon since data from these surveys can be used to investigate juvenile Chinook and coho salmon distribution and length patterns.

ACKNOWLEDGMENTS

Takotna River salmon escapement monitor program is a cooperative project operated jointly by TTC and ADF&G Division of Commercial Fisheries. The USFWS Office of Subsistence Management (OSM) provided $71,979 in funding support for this project, in combination with the George River weir project, through the Fisheries Resource Monitoring Program under Cooperative agreement 701815J587. Since inception of the project in 1995, operational funds have been provided to TTC from a grant from the U.S. Bureau of Indian Affairs that is administered by the Bering Sea Fishermen's Association (#E00441023). USFWS OSM Resource Monitoring Program under Cooperative Agreement 701814J568 funded project FIS 04-307 which supported salmon age, sex, and length aging and data analysis for this project among others.

Many individuals have contributed to the development and operation of the Takotna River weir. Lynn Goods and Jan Newton assisted with administrative needs and we thank them for their support and participation. We would also like to thank McGrath Native Village Council for providing assistance during weir installation and dismantling, and for participating in the orientation with selected McGrath leaders that helped promote a better understanding of the project in the community. Our greatest appreciation goes to assistant crew leader Allen Mwarey, and student interns Amanda Goods and Misty Wachter for their continued diligence and dedication to the project, and to Alfred Perkins and Richie Wachter for their assistance throughout the 2005 field season.

REFERENCES CITED

ADF&G (Alaska Department of Fish and Game). 2003. Alaska Subsistence Fisheries, 2002 annual report. Alaska Department of Fish and Game, Division of Subsistence, Juneau.

ADF&G (Alaska Department of Fish and Game). 2004. Escapement goal review of select AYK Region salmon stocks. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A04-01, Anchorage.

Anderson, E. F. 1977. Report on the cultural resources of the Doyon Region, central Alaska, volume 1. Anthropology and Historic Preservation Cooperative Park Studies Unit, University of Alaska Fairbanks, Occasional Paper No. 5. Fairbanks.

Bergstrom, D. J. and C. Whitmore. 2004. Kuskokwim River Chinook and chum salmon stock status and action plan, a report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A04-02, Anchorage.

REFERENCES CITED (Continued)

Brannian, L. K., S. Darr, H. A. Krenz, S. StClair, and C. Lawn. 2005. Development of the Arctic-Yukon-Kuskokwim salmon database management system through June 30, 2005. Alaska Department of Fish and Game, Special Publication No. 05-10, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/sp05-10.pdf

Bromaghin, J. F. 1993. Sample size determination for interval estimation of multinomial probabilities. The American Statistician. 47(3): 203-206.

Brown, C. M. 1983. Alaska's Kuskokwim River region: a history (draft). Bureau of Land Management, Anchorage.

Buklis, L. S. 1999. A description of economic changes in commercial salmon fisheries in a region of mixed subsistence and market economies. Arctic. 52 (1): 40-48.

(BLM) Bureau of Land Management. 1984. Mouth of Fourth of July Creek, Doyon, Limited. BLM#AA-12368. (site selection for registry as a historical place).

Burkey, C. Jr., and P. Salomone. 1999. Kuskokwim Area salmon escapement observation catalog, 1984 through 1998. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A99-11, Anchorage.

Burkey, C. Jr., M. Coffing, D. B. Molyneaux, and P. Salomone. 2000a. Kuskokwim River Chinook salmon stock status and development of management/action plan options, report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A00-40, Anchorage.

Burkey, C. Jr., M. Coffing, D. B. Molyneaux, and P. Salomone. 2000b. Kuskokwim River chum salmon stock status and development of management/action plan options, report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A00-41, Anchorage.

Burkey, C. Jr., M. Coffing, J. Estensen, R. L. Fisher, and D. B. Molyneaux. 2002. Annual management report for the subsistence and commercial fisheries of the Kuskokwim area, 2001. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A02-53, Anchorage.

Cederholm, C. J., M. D. Kunze, T. Murota, and A. Sibatani. 1999. Pacific salmon carcasses: essential contributions of nutrients and energy for aquatic and terrestrial ecosystems. Fisheries 24: 6-15.

Cederholm, C. J., D. H. Johnson, R. E. Bilby, L. G. Dominguez, A. M. Garrett, W. H. Graeber, E. L. Greda, M. D. Kunze, B. G. Marcot, J. F. Palmisano, W. G. Pearcy, C. A. Simenstad, and P. C. Trotter. 2000. Pacific salmon and wildlife–ecological contexts, relationships, and implications for management. Special Edition Technical Report, Prepared for D. H. Johnson and T. A. O'Neil (Mang. Dirs.). Wildlife-Habitat Relationships in Oregon and Washington. Washington Department of Fish and Wildlife, Olympia.

Clark, K. J. and D. B. Molyneaux. 2003. Takotna River salmon studies and upper Kuskokwim River aerial surveys, 2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A03-10, Anchorage.

Coffing, M. 1991. Kwethluk subsistence: contemporary land use patterns, wild resource harvest and use, and the subsistence economy of a lower Kuskokwim River area community. Alaska Department of Fish and Game, Division of Subsistence, Technical Paper No. 157, Juneau.

Coffing, M. *Unpublished* a. Kuskokwim area subsistence salmon harvest summary, 1996; prepared for the Alaska Board of Fisheries, Fairbanks, Alaska, December 2, 1997. Alaska Department of Fish and Game, Division of Subsistence, Bethel.

Coffing, M. *Unpublished* b. Kuskokwim area subsistence salmon fishery; prepared for the Alaska Board of Fisheries, Fairbanks, Alaska, December 2, 1997. Alaska Department of Fish and Game, Division of Subsistence, Bethel.

Coffing, M., L. Brown, G. Jennings, and C. Utermohle. 2001. The subsistence harvest and use of wild resources in Akiachak, Alaska, 1998. Alaska Department of Fish and Game, Division of Subsistence, Final Project Report to USFWS, Office of Subsistence Management, FIS 00-009, Juneau.

Costello, D. J., S. E. Gilk, and D. B. Molyneaux. 2005. Takotna River salmon studies, 2004. Alaska Department of Fish and Game, Fishery Data Series No. 05-71, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds05-71.pdf

Costello, D. J., R. Stewart, D. B. Molyneaux, and D. E. Orabutt. *In prep*. Tatlawiksuk River salmon studies, 2005. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

DuBois, L. and D. B. Molyneaux. 2000. Salmon age, sex and length catalog for the Kuskokwim area, 1999 Progress Report. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Informational Report No. 3A00-18, Anchorage.

Gilk, S. E. and D. B. Molyneaux. 2004. Takotna river salmon studies and upper Kuskokwim River aerial surveys, 2003. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A04-25, Anchorage.

Gilk, S. E. *Unpublished*. Kuskokwim River sockeye salmon radiotelemetry feasibility study, 2005. Located at: Alaska Department of Fish and Game, 333 Raspberry Road, Anchorage, Alaska.

Groot, C. and L. Margolis, editors. 1991. Pacific salmon life histories. University of British Columbia Press, Vancouver, British Columbia.

Harper, K. C. and C. B. Watry. 2001. Abundance and run timing of adult salmon in the Kwethluk River, Yukon Delta National Wildlife Refuge, Alaska, 2000. U. S. Fish and Wildlife Service, Kenai Fishery Resource Office, Alaska Fisheries Data Series Number 2001-4, Kenai, Alaska.

Hartl, D. L. and A. G. Clark. 1997. Principles of Population Genetics, 3rd edition. Sinauer Associates, Sunderland, MA.

Hilborn, R., T. P. Quinn, D. E. Schindler, and D. E. Rogers. 2003. Biocomplexity and fisheries sustainability. Proceedings of the National Academy of Sciences. 100 (11): 6564–6568.

Holmes, R. A. and R. D. Burkett. 1996. Salmon stewardship: Alaska's perspective. Fisheries 21 (10): 36-38.

Hosley, E. 1966. The Kolchan: Athabaskans of the Upper Kuskokwim. Manuscript. University of Alaska, Fairbanks.

INPFC (International North Pacific Fisheries Commission). 1963. Annual report, 1961. International North Pacific Fisheries Commission, Vancouver, British Columbia.

Jasper, J. R. and D. B. Molyneaux. *In prep*. Kogrukluk River salmon studies, 2005. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

Keefer, M. L., C. A. Peery, M. A. Jepson, K. R. Tolotti, and T. C. Bjornn. 2004. Stock-specific migration timing of adult spring-summer Chinook salmon in the Columbia River basin. North American Journal of Fisheries Management 24:1145-1162.

Kerkvliet, C. M., T. Hamazaki, K. E. Hyer, and D. Cannon. 2003. A mark–recapture experiment to estimate the abundance of Kuskokwim River sockeye, chum, and coho salmon, 2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A03-25, Anchorage.

Kerkvliet, C. M., J. Pawluk, T. Hamazaki, K. E. Hyer, and D. Cannon. 2004. A mark–recapture experiment to estimate the abundance of Kuskokwim River sockeye, chum and coho salmon, 2003. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A04-14, Anchorage.

Kusko Times. 1921. (no title) August 13, 1921, volume 1, No. 58.

REFERENCES CITED (Continued)

Linderman, J. C., D. B. Molyneaux, L. DuBois, and D. J. Cannon. 2003. George River Salmon Studies, 1996-2002. Alaska Department of Fish and Game, Regional Information Report No. 3A03-17, Anchorage.

Linderman, J. C., D. B. Molyneaux, L. DuBois, and W. Morgan. 2002. Tatlawiksuk River weir salmon studies, 1998-2001. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A02-11, Anchorage.

Linderman, J. C., M. M. Martz, and D. G. Bue. *In prep*. Annual management report for the subsistence and commercial fisheries of the Kuskokwim Area, 2005. Alaska Department of Fish and Game, Fisheries Management Report, Anchorage.

McEwen, M. S. *In prep*. Sonar estimation of chum salmon passage in the Aniak River, 2005. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

Molyneaux, D. B., L. DuBois, B. Mwarey, and J. Newton. 2000. Takotna River counting tower, project summary, 1995-1999. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A00-13, Anchorage.

Molyneaux, D. B. and D. Folletti. 2005. Salmon age, sex, and length catalog for the Kuskokwim Area, 2004. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A05-03, Anchorage.

Molyneaux, D. B., C. A. Shelden, and D. Folletti. *In prep*. Salmon age, sex, and length catalog for the Kuskokwim Area, 2005. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report, Anchorage.

Moodie, S., J. A. Grout, and A. von Finster. 2000. Juvenile Chinook salmon (*Oncorhynchus tshawytscha*) utilization of Croucher Creek, a small non-natal tributary of the upper Yukon River during 1993. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2531: 66 pp.

Morrow, J. E. 1980. The freshwater fishes of Alaska. Alaska Northwest Publishing Company, Anchorage.

Mundy, P. R. 1998. Principles and criteria for sustainable salmon management, a contribution to the development of a salmon fishery evaluation framework for the State of Alaska. Alaska Department of Fish and Game, Contract No. IHP-98-045, Anchorage.

Murphy, B. R. and D. W. Willis, editors. 1996. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Pawluk, J., T. Hamazaki, K. E. Hyer, and D. Cannon. *In prep* a. A mark–recapture experiment of Kuskokwim River sockeye, chum, and coho salmon, 2004. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

Pawluk, J., T. Hamazaki, K. E. Hyer, and D. Cannon. *In prep* b. A mark–recapture experiment of Kuskokwim River Chinook, sockeye, chum, and coho salmon, 2005. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

Quinn, T. P. 2005. The behavior and ecology of Pacific salmon and trout. University of Washington Press, Seattle.

Roettiger, T., F. Harris, and K. C. Harper. 2005. Abundance and run timing of adult Pacific salmon in the Kwethluk River, Yukon Delta National Wildlife Refuge, Alaska, 2004. U. S. Fish and Wildlife Service, Kenai Fish and Wildlife Field Office. Alaska Fisheries Data Series No. 2005-7, Kenai, Alaska.

Saunders, R. L. 1981. Atlantic salmon (*Salmo salar*) stocks and management implications in the Canadian Atlantic provinces and New England, USA. Canadian Journal of Fisheries and Aquatic Sciences 38: 1612-1625.

Schwanke, C. J., D. B. Molyneaux, L. DuBois, and C. Goods. 2001. Takotna River salmon studies and upper Kuskokwim River aerial surveys, 2000. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A01-02, Anchorage.

REFERENCES CITED (Continued)

Schwanke, C. J., and D. B. Molyneaux. 2002. Takotna River salmon studies and upper Kuskokwim River aerial surveys, 2001. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A02-09, Anchorage.

Selkregg, L. L., editor. 1976. Alaska regional profiles: southwest region. University of Alaska, Arctic Environmental Information and Data Center, Anchorage, Alaska.

Stewart, R. 2002. Resistance board weir panel construction manual, 2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A02-21, Anchorage.

Stewart, R. 2003. Techniques for installing a resistance board weir. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A03-26, Anchorage.

Stewart, R., D. B. Molyneaux, D. J. Costello, and D. E. Orabutt. *In prep*. George River salmon studies, 2005. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

Stokes, J. 1983. Subsistence salmon fishing in the upper Kuskokwim River system, 1981 and 1982. Alaska Department of Fish and Game, Division of Subsistence, Technical Paper No. 23, Juneau.

Stokes, J. 1985. Natural resource utilization of four upper Kuskokwim communities. Alaska Department of Fish and Game, Division of Subsistence, Technical Paper No. 86, Juneau.

Stroka, S. M. and A. L. J. Brase. 2004. Assessment of Chinook, chum, and coho salmon escapements in the Holitna River drainage using radiotelemetry, 2001-2003. Alaska Department of Fish and Game, Fishery Data Series No. 04-07, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds04-07.pdf

Stuby, L. 2003. Inriver abundance of Chinook salmon in the Kuskokwim River, 2002. Annual Report for Study 02-015, USFWS Office of Subsistence Management, Fishery Information Service Division. Alaska Department of Fish and Game, Fishery Data Series No. 03-22, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds03-22.pdf

Stuby, L. 2004. Inriver abundance of Chinook salmon in the Kuskokwim River, 2003. Alaska Department of Fish and Game, Fishery Data Series No. 04-30, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fds04-30.pdf

Stuby, L. 2005. Inriver abundance of Chinook salmon in the Kuskokwim River, 2002-2004. Alaska Department of Fish and Game, Fishery Data Series No. 05-39, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/Fds05-39.pdf

Stuby, L. *In prep*. Inriver abundance of Chinook salmon in the Kuskokwim River, 2002-2005. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

Templin, W., C. Smith, D. Molyneaux, and L. Seeb. 2004. Genetic diversity of Chinook salmon from the Kuskokwim River. USFWS, Office of Subsistence Management, Fisheries Resource Monitoring Program, Final Report No. 01-070, Anchorage.

Templin, W. D., C.T. Smith, D.B. Molyneaux, and L.W. Seeb. *In prep*. Genetic stock identification of Kuskokwim River Chinook salmon. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report, Anchorage.

Thompson, S. K. 1992. Sampling. John Wiley and Sons, New York.

Ward, T. C., M. Coffing, J. L. Estensen, R. L. Fisher, and D. B. Molyneaux. 2003. Annual management report for the subsistence and commercial fisheries of the Kuskokwim Area, 2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A03-27, Anchorage.

Whitmore, C., M. M. Martz, D. G. Bue, J. C. Linderman, and R. L. Fisher. 2005. Annual management report for the subsistence and commercial fisheries of the Kuskokwim Area, 2003. Alaska Department of Fish and Game, Fishery Management Report No. 05-72, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/fmr05-72.pdf

Zabkar, L. M., F. G. Harris, and K. C. Harper. *In prep*. Abundance and run timing of adult Pacific salmon in the Tuluksak River, Yukon Delta National Wildlife Refuge, Alaska, 2005. U.S. Fish and Wildlife Service, Kenai Fish and Wildlife Field Office, Alaska Fisheries Data Series, Kenai, Alaska.

TABLES AND FIGURES

Table 1.–Actual daily and estimated counts of Chinook, chum, sockeye, coho salmon and longnose suckers at the Takotna River weir, 2005.

	Chinook			Chum			Sockeye			Coho			Longnose Suckers
Date	**Male**	**Female**	**Totals**	**Male**	**Female**	**Totals**	**Male**	**Female**	**Totals**	**Male**	**Female**	**Totals**	**Totals**
6/10[a]	0	0	0	0	0	0	0	0	0	0	0	0	404
6/11[a]	0	0	0	0	0	0	0	0	0	0	0	0	414
6/12[a]	0	0	0	0	0	0	0	0	0	0	0	0	149
6/13[a]	0	0	0	0	0	0	0	0	0	0	0	0	271
6/14[a]	0	0	0	0	0	0	0	0	0	0	0	0	320
6/15[a]	1	0	1	0	0	0	0	0	0	0	0	0	162
6/16[a]	1	0	1	0	1	1	0	0	0	0	0	0	113
6/17[a]	1	1	2	2	0	2	0	0	0	0	0	0	108
6/18[a]	0	0	0	0	0	0	0	0	0	0	0	0	4
6/19[a]	0	0	0	0	0	0	0	0	0	0	0	0	43
6/20[a]	0	1	1	0	0	0	0	0	0	0	0	0	86
6/21[a]	0	0	0	0	1	1	0	0	0	0	0	0	17
6/22[a]	1	0	1	1	0	1	0	0	0	0	0	0	42
6/23[a]	1	0	1	0	0	0	0	0	0	0	0	0	28
6/24	1	0	1	2	0	2	0	0	0	0	0	0	17
6/25	0	0	0	2	2	4	0	0	0	0	0	0	40
6/26	2	2	4	5	4	9	0	0	0	0	0	0	31
6/27	3	0	3	6	3	9	0	0	0	0	0	0	27
6/28	14	9	23	8	6	14	0	0	0	0	0	0	24
6/29	5	9	14	7	9	16	0	0	0	0	0	0	24
6/30	32	18	50	16	24	40	0	0	0	0	0	0	23
7/1	1	0	1	13	11	24	0	0	0	0	0	0	1
7/2	1	0	1	31	10	41	0	0	0	0	0	0	1
7/3	1	0	1	30	17	47	0	0	0	0	0	0	5
7/4	10	0	10	36	50	86	0	0	0	0	0	0	5
7/5	12	1	13	117	105	222	0	0	0	0	0	0	9
7/6	18	3	21	125	80	205	0	0	0	0	0	0	9
7/7	14	1	15	170	131	301	0	0	0	0	0	0	2
7/8	15	6	21	219	179	398	0	0	0	0	0	0	0
7/9	10	1	11	102	98	200	0	0	0	0	0	0	4
7/10	32	6	38	149	178	327	0	0	0	0	0	0	1
7/11	18	4	22	106	87	193	0	0	0	0	0	0	0
7/12	13	4	17	103	120	223	0	0	0	0	0	0	0
7/13	35	21	56	116	104	220	0	0	0	0	0	0	1
7/14	14	3	17	110	79	189	0	0	0	0	0	0	0
7/15	3	0	3	132	109	241	0	0	0	0	0	0	7

-continued-

Table 1.–Page 2 of 3.

	Chinook			Chum			Sockeye			Coho			Longnose Suckers
Date	Male	Female	Totals	Male	Female	Totals	Male	Female	Totals	Male	Female	Totals	Totals
7/16	27	16	43	161	130	291	0	0	0	0	0	0	0
7/17	8	7	15	190	224	414	0	2	2	0	0	0	0
7/18	4	2	6	143	158	301	0	0	0	0	0	0	0
7/19	8	10	18	169	204	373	0	0	0	0	0	0	0
7/20	4	3	7	141	172	313	0	0	0	0	0	0	0
7/21	0	1	1	76	66	142	0	0	0	0	0	0	0
7/22	2	1	3	126	114	240	0	1	1	0	0	0	0
7/23	4	3	7	77	76	153	0	1	1	0	0	0	0
7/24	1	3	4	77	45	122	0	0	0	0	0	0	0
7/25	3	4	7	67	60	127	0	1	1	0	2	2	0
7/26	0	0	0	67	74	141	0	1	1	1	1	2	0
7/27	0	3	3	51	42	93	0	0	0	0	0	0	0
7/28	6	3	9	86	74	160	0	1	1	2	1	3	0
7/29	3	3	6	70	51	121	0	1	1	0	3	3	0
7/30	0	0	0	30	26	56	0	1	1	1	0	1	0
7/31	0	2	2	33	22	55	0	1	1	0	0	0	0
8/1	1	0	1	18	15	33	0	0	0	2	0	2	0
8/2	0	0	0	20	17	37	0	0	0	1	1	2	0
8/3	1	0	1	15	19	34	0	0	0	0	1	1	0
8/4	0	1	1	20	24	44	0	0	0	4	4	8	0
8/5	2	1	3	14	10	24	0	0	0	4	3	7	0
8/6	2	1	3	19	18	37	0	0	0	5	0	5	0
8/7	1	0	1	14	10	24	0	0	0	2	0	2	0
8/8	0	0	0	13	10	23	1	0	1	4	6	10	0
8/9	1	0	1	5	0	5	0	0	0	4	2	6	0
8/10	0	1	1	3	7	10	0	0	0	4	2	6	0
8/11	0	1	1	6	4	10	0	0	0	9	3	12	0
8/12	0	0	0	3	5	8	0	1	1	4	6	10	0
8/13	1	0	1	5	3	8	1	0	1	12	7	19	0
8/14	0	0	0	3	2	5	1	1	2	11	9	20	0
8/15	0	0	0	1	4	5	0	1	1	14	8	22	0
8/16	2	0	2	2	1	3	0	1	1	7	7	14	0
8/17	0	0	0	0	2	2	2	0	2	10	8	18	0
8/18	0	0	0	1	2	3	0	0	0	32	25	57	0
8/19	0	0	0	3	2	5	0	0	0	15	7	22	0
8/20	0	0	0	0	0	0	1	0	1	9	16	25	0
8/21	0	0	0	2	5	7	0	1	1	14	12	26	0

-continued-

Table 1.–Page 3 of 3.

Date	Chinook Male	Chinook Female	Chinook Totals	Chum Male	Chum Female	Chum Totals	Sockeye Male	Sockeye Female	Sockeye Totals	Coho Male	Coho Female	Coho Totals	Longnose Suckers Totals
8/22	0	0	0	0	0	0	1	0	1	14	13	27	0
8/23	0	0	0	0	0	0	1	0	1	58	53	111	0
8/24	2	0	2	3	3	6	3	0	3	131	127	258	0
8/25	1	0	1	0	0	0	1	2	3	107	97	204	0
8/26	0	1	1	0	0	0	0	0	0	66	48	114	0
8/27	0	1	1	1	1	2	0	0	0	45	39	84	0
8/28	1	0	1	1	1	2	0	0	0	35	34	69	0
8/29	1	0	1	0	0	0	0	0	0	58	44	102	0
8/30	0	0	0	0	1	1	0	0	0	81	82	163	0
8/31	0	0	0	1	0	1	2	1	3	34	21	55	0
9/1	0	0	0	1	0	1	0	0	0	33	47	80	0
9/2	0	0	0	0	0	0	0	0	0	7	14	21	0
9/3	0	0	0	0	0	0	0	0	0	28	19	47	0
9/4	1	0	1	1	0	1	0	0	0	44	62	106	0
9/5	0	0	0	2	0	2	0	1	1	55	30	85	0
9/6	0	0	0	2	0	2	0	0	0	37	45	82	0
9/7	0	0	0	2	0	2	0	0	0	28	31	59	0
9/8	0	0	0	1	0	1	0	0	0	19	26	45	0
9/9	0	0	0	0	1	1	0	0	0	11	26	37	0
9/10	1	0	1	0	0	0	0	0	0	17	23	40	0
9/11	0	0	0	0	0	0	0	0	0	16	15	31	0
9/12	0	0	0	0	0	0	0	0	0	12	14	26	0
9/13	1	0	1	0	0	0	0	0	0	2	14	16	0
9/14	0	0	0	2	0	2	0	1	1	8	9	17	0
9/15	0	0	0	1	1	2	0	0	0	4	9	13	0
9/16	0	0	0	1	0	1	0	0	0	5	8	13	0
9/17	0	0	0	0	0	0	0	0	0	3	1	4	0
9/18	0	0	0	0	0	0	0	0	0	0	0	0	0
9/19	0	0	0	0	0	0	0	0	0	0	0	0	0
9/20	0	0	0	0	0	0	0	0	0	1	1	2	0
Total Estimated Escapement	343	156	499	3,355	3,112	6,467	14	20	34	1,130	1,086	2,216	231

[a] Daily passage for this date is not included in cumulative escapement; the date is outside of the target operational period.

Table 2.–Age and sex composition of Chinook salmon sampled at the Takotna River weir in 2005 using escapement samples collected with a live trap.

				Age Class															
	Sample	Sample		1.1		1.2		1.3		2.2		1.4		2.3		1.5		Total	
Year	**Dates**	**Size**	**Sex**	**Esc.**	**%**	**Esc.**	**%**	**Esc.**	**%**	**Esc.**	**%**	**Esc.**	**%**	**Esc.**	**%**	**Esc.**	**%**	**Esc.**	**%**
2005 [a]	7/1- 12	96	M		0.0		25.0		47.9		0.0		9.4		1.0		0.0		83.3
	(6/24- 7/13)		F		0.0		0.0		7.3		0.0		9.4		0.0		0.0		16.7
			Subtotal		0.0		25.0		55.2		0.0		18.8		1.0		0.0		100.0
	7/14- 25	74	M		0.0		12.2		37.9		0.0		4.1		0.0		0.0		54.1
	(7/14- 9/20)		F		0.0		0.0		18.9		0.0		27.0		0.0		0.0		45.9
			Subtotal		0.0		12.2		56.8		0.0		31.1		0.0		0.0		100.0
	Total Sample [b]	170	M		0.0		19.4		43.5		0.0		7.1		0.6		0.0		70.6
			F		0.0		0.0		12.3		0.0		17.1		0.0		0.0		29.4
			Total		0.0		19.4		55.9		0.0		24.2		0.6		0.0	499	100.0

[a] Sampling dates do not meet criteria for estimating escapement percentages for all of the strata.
[b] Does not represent the entire escapement.

Table 3.–Mean length (mm) of Chinook salmon sampled at the Takotna River weir in 2005 using escapement samples collected with a live trap.

				Age Class						
Year	**Sample Dates**	**Sex**		**1.1**	**1.2**	**1.3**	**2.2**	**1.4**	**2.3**	**1.5**
2005[a]	7/1- 12	M	Mean Length		536	686		725	692	
	(6/24- 7/13)		SE		11	7		27	-	
			Range		382- 624	581- 788		598- 823	692- 692	
			Sample Size	0	24	46	0	9	1	0
		F	Mean Length			708		813		
			SE			24		17		
			Range			597- 795		718- 884		
			Sample Size	0	0	7	0	9	0	0
	7/14- 25	M	Mean Length		558	691		800		
	(7/14- 9/20)		SE		23	11		59		
			Range		446- 634	564- 816		715- 914		
			Sample Size	0	9	28	0	3	0	0
		F	Mean Length			727		819		
			SE			22		13		
			Range			456- 790		671- 957		
			Sample Size	0	0	14	0	19	0	0
	Season	M	Mean Length		541	687		736	692	
			Range		382- 634	564- 816		598- 914	692- 692	
			Sample Size	0	33	74	0	12	1	0
		F	Mean Length			718		816		
			Range			456- 795		671- 957		
			Sample Size	0	0	21	0	29	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] Sampling dates do not meet criteria for estimating escapement percentages for all of the strata.

Table 4.–Age and sex composition of chum salmon at the Takotna River weir in 2005 based on escapement samples collected with a live trap.

				Age Class									
	Sample Dates	Sample		0.2		0.3		0.4		0.5		Total	
Year	(Stratum Dates)	Size	Sex	Esc.	%	Esc.	%	Esc.	%	Esc.	%	Esc.	%
2005	7/1- 5	138	M	0	0.0	422	58.7	10	1.4	0	0.0	432	60.1
	(6/24- 7/6)		F	16	2.2	250	34.8	21	2.9	0	0.0	287	39.9
			Subtotal[a]	16	2.2	672	93.5	31	4.3	0	0.0	719	100.0
	7/8- 10	166	M	10	0.6	683	41.6	20	1.2	0	0.0	712	43.4
	(7/7- 12)		F	138	8.4	791	48.2	0	0.0	0	0.0	930	56.6
			Subtotal[a]	148	9.0	1,474	89.8	20	1.2	0	0.0	1,642	100.0
	7/15- 17	186	M	22	1.1	895	44.1	0	0.0	0	0.0	916	45.2
	(7-13- 19)		F	174	8.6	927	45.7	11	0.5	0	0.0	1,113	54.8
			Subtotal[a]	196	9.7	1,822	89.8	11	0.5	0	0.0	2,029	100.0
	7/22- 24	159	M	8	0.6	670	50.3	17	1.3	0	0.0	695	52.2
	(7/20- 27)		F	84	6.3	552	41.5	0	0.0	0	0.0	636	47.8
			Subtotal[a]	92	6.9	1,222	91.8	17	1.3	0	0.0	1,331	100.0
	7/30- 8/4	187	M	16	2.1	359	48.1	16	2.1	0	0.0	391	52.4
	(7/28- 9/20)		F	88	11.8	267	35.9	0	0.0	0	0.0	355	47.6
			Subtotal[a]	104	13.9	626	84.0	16	2.1	0	0.0	746	100.0
	Season[b]	836	M	56	0.9	3,028	46.8	63	1.0	0	0.0	3,147	48.7
			F	500	7.7	2,788	43.1	32	0.5	0	0.0	3,320	51.3
			Total	556	8.6	5,816	89.9	95	1.5	0	0.0	6,467	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 5.–Mean length (mm) of chum salmon at the Takotna River weir in 2005 based on escapement samples collected with a live trap.

Year	Sample Dates (Stratum Dates)	Sex		Age Class 0.2	0.3	0.4	0.5
2005	7/1- 5	M	Mean Length		576	544	
	(6/24- 7/6)		SE		4	7	
			Range		450- 650	537- 550	
			Sample Size	0	81	2	0
		F	Mean Length	543	550	582	
			SE	16	5	15	
			Range	522- 575	478- 610	537- 604	
			Sample Size	3	48	4	0
	7/8- 10	M	Mean Length	547	570	561	
	(7/7- 12)		SE	-	4	8	
			Range	547- 547	496- 640	553- 568	
			Sample Size	1	69	2	0
		F	Mean Length	526	543		
			SE	7	3		
			Range	483- 557	485- 597		
			Sample Size	14	80	0	0
	7/15- 17	M	Mean Length	537	865		
	(7-13- 19)		SE	3	3		
			Range	534- 540	480- 624		
			Sample Size	2	82	0	0
		F	Mean Length	514	537	510	
			SE	6	3	-	
			Range	448- 546	440- 594	510- 510	
			Sample Size	16	85	1	0
	7/22- 24	M	Mean Length	500	563	622	
	(7/20- 27)		SE	-	3	18	
			Range	500- 500	502- 626	604- 640	
			Sample Size	1	80	2	0
		F	Mean Length	518	534		
			SE	6	4		
			Range	488- 549	468- 610		
			Sample Size	10	66	0	0
	7/30- 8/4	M	Mean Length	524	564	529	
	(7/28- 9/20)		SE	11	3	21	
			Range	505- 555	486- 620	472- 564	
			Sample Size	4	90	4	0
		F	Mean Length	500	529		
			SE	8	4		
			Range	408- 565	454- 596		
			Sample Size	22	67	0	0

-continued-

Table 5.–Page 2 of 2.

Year	Sample Dates (Stratum Dates)	Sex		Age Class 0.2	0.3	0.4	0.5
	Season[a]	M	Mean Length	530	567	566	
			Range	500- 555	450- 650	472- 640	
			Sample Size	8	402	10	0
		F	Mean Length	517	538	557	
			Range	408- 575	440- 610	510- 604	
			Sample Size	65	346	5	0

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 at the Takotna River weir in 2005 based on escapement samples collected with a live trap.

				Age Class							
				1.1		2.1		3.1		Total	
Year	Sample Dates (Stratum Dates)	Sample Size	Sex	Esc.	%	Esc.	%	Esc.	%	Esc.	%
2005	8/21- 24	149	M	0	0.0	353	50.3	9	1.3	362	51.7
	(6/24- 8/24)		F	0	0.0	282	40.3	57	8.1	339	48.3
			Subtotal[a]	0	0.0	635	90.6	66	9.4	701	100.0
	8/29- 31	133	M	0	0.0	412	47.4	59	6.8	472	54.1
	(8/25- 9/1)		F	0	0.0	380	43.6	20	2.2	399	45.9
			Subtotal[a]	0	0.0	792	91.0	79	9.0	871	100.0
	9/3- 6	140	M	0	0.0	183	45.7	31	7.9	214	53.6
	(9/2- 7)		F	3	0.7	137	34.3	46	11.4	186	46.4
			Subtotal[a]	3	0.7	320	80.0	77	19.3	400	100.0
	9/10- 16	124	M	2	0.8	87	35.5	14	5.6	102	41.9
	(9/8- 20)		F	0	0.0	110	45.1	31	12.9	142	58.1
			Subtotal[a]	2	0.8	197	80.6	45	18.5	244	100.0
	Season[b]	546	M	2	0.1	1,035	46.7	114	5.1	1,150	51.9
			F	3	0.1	909	41.0	153	6.9	1,066	48.1
			Total	5	0.2	1,944	87.7	267	12.0	2,216	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 7.–Mean length (mm) of coho salmon at the Takotna River weir in 2005 based on escapement samples collected with a live trap.

Year	Sample Dates (Stratum Dates)	Sex		Age Class 1.1	2.1	3.1
2005	8/21- 24	M	Mean Length		531	552
	(6/24- 8/24)		SE		4	37
			Range		460- 630	515- 588
			Sample Size	0	75	2
		F	Mean Length		548	543
			SE		4	10
			Range		480- 610	465- 590
			Sample Size	0	60	12
	8/29- 31	M	Mean Length		545	549
	(8/25- 9/1)		SE		6	10
			Range		409- 628	495- 580
			Sample Size	0	63	9
		F	Mean Length		564	587
			SE		4	7
			Range		470- 615	574- 599
			Sample Size	0	58	3
	9/3- 6	M	Mean Length		556	576
	(9/2- 7)		SE		7	16
			Range		412- 602	446- 625
			Sample Size	0	37	11
		F	Mean Length	522	555	540
			SE	-	5	10
			Range	522- 522	443- 620	446- 590
			Sample Size	1	48	16
	9/10- 16	M	Mean Length	566	558	554
	(9/8- 20)		SE	-	6	21
			Range	566- 566	433- 652	472- 617
			Sample Size	1	44	7
		F	Mean Length		551	548
			SE		4	6
			Range		466- 620	518- 583
			Sample Size	0	56	16

-continued-

Table 7.–Page 2 of 2.

Year	Sample Dates (Stratum Dates)	Sex		Age Class 1.1	2.1	3.1
	Season[a]	M	Mean Length	566	543	557
			Range	566- 566	396- 652	446- 625
			Sample Size	1	246	29
		F	Mean Length	522	556	549
			Range	522- 522	443- 620	446- 599
			Sample Size	1	222	47

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.–Historical number caught and CPUE for juvenile Chinook salmon caught using minnow traps.

Index	Number Caught						CPUE[b]					
Area[a]	2000	2001	2002	2003	2004	2005	2000	2001	2002	2003	2004	2005
1	0	0	ND	ND	1	15	0.00	0.00	ND	ND	0.04	0.03
2	15	0	4	3	0	ND	0.01	0.00	0.01	0.01	0.00	ND
3	58	17	29	0	7	0	0.07	0.04	0.02	0.00	0.02	0.00
4	26	98	132	50	24	ND	0.07	0.09	0.13	0.21	0.06	ND
5	0	ND	4	ND	0	0	0.00	ND	0.01	ND	0.00	0.00
6	0	0	ND	ND	0	ND	0.00	0.00	ND	ND	0.00	ND
7	ND	0	ND	ND	ND	1	ND	0.00	ND	ND	ND	0.00
8	ND	ND	0	ND	ND	0	ND	ND	0.00	ND	ND	0.00
9	ND	0	ND	ND	2	ND	ND	0.00	ND	ND	0.00	ND
10	ND	0	ND	ND	0	ND	ND	0.00	ND	ND	0.00	ND
11	ND	ND	ND	0	0	8	ND	ND	ND	0.00	0.00	0.01
12	ND	0	ND	ND	ND	0	ND	0.00	ND	ND	ND	0.00
13	ND	0	ND	ND	ND	ND	ND	0.00	ND	ND	ND	ND
14[c]	ND	ND	ND	ND	230	397	ND	ND	ND	ND	0.51	0.63
Totals:	99	115	169	53	264	421	0.03	0.03	0.04	0.05	0.01[d]	0.01[d]

Note: ND means "no data."

[a] See Figure 4 for description of Index Areas.

[b] CPUE is defined as the number of salmon captured per trap-hour.

[c] Added as an Index Area in 2004.

[d] To allow comparisons among years, total CPUE does not include Gold Creek.

Table 9.–Historical number caught and CPUE for juvenile coho salmon caught using minnow traps.

Index	Number Caught						CPUE[b]					
Area[a]	2000	2001	2002	2003	2004	2005	2000	2001	2002	2003	2004	2005
1	0	0	ND	ND	7	3	0.00	0.00	ND	ND	0.28	0.01
2	0	0	21	2	0	ND	0.00	0.00	0.03	0.01	0.00	ND
3	10	116	26	26	246	84	0.01	0.27	0.02	0.11	0.62	0.35
4	3	129	23	1	16	ND	0.01	0.12	0.02	0.00	0.04	ND
5	0	ND	23	ND	0	0	0.00	ND	0.06	ND	0.00	0.00
6	0	0	ND	ND	0	ND	0.00	0.00	ND	ND	0.00	ND
7	ND	0	ND	ND	ND	0	ND	0.00	ND	ND	ND	0.00
8	ND	ND	16	ND	ND	0	ND	ND	0.20	ND	ND	0.00
9	ND	0	ND	ND	0	ND	ND	0.00	ND	ND	0.00	ND
10	ND	0	ND	ND	0	ND	ND	0.00	ND	ND	0.00	ND
11	ND	ND	ND	0	1	33	ND	ND	ND	0.00	0.01	0.04
12	ND	0	ND	ND	ND	0	ND	0.00	ND	ND	ND	0.00
13	ND	0	ND	ND	ND	ND	ND	0.00	ND	ND	ND	ND
14[c]	ND	ND	ND	ND	12	17	ND	ND	ND	ND	0.03	0.03
Totals:	13	245	109	29	282	137	0.00	0.06	0.03	0.03	0.09[d]	0.04[d]

Note: ND means "no data."

[a] See Figure 4 for description of Index Areas.

[b] CPUE is defined as the number of salmon captured per trap-hour.

[c] Added as an Index Area in 2004.

[d] To allow comparisons among years, total CPUE does not include Gold Creek.

Figure 1.–Map depicting the location of Kuskokwim Area salmon management districts and escapement monitoring projects.

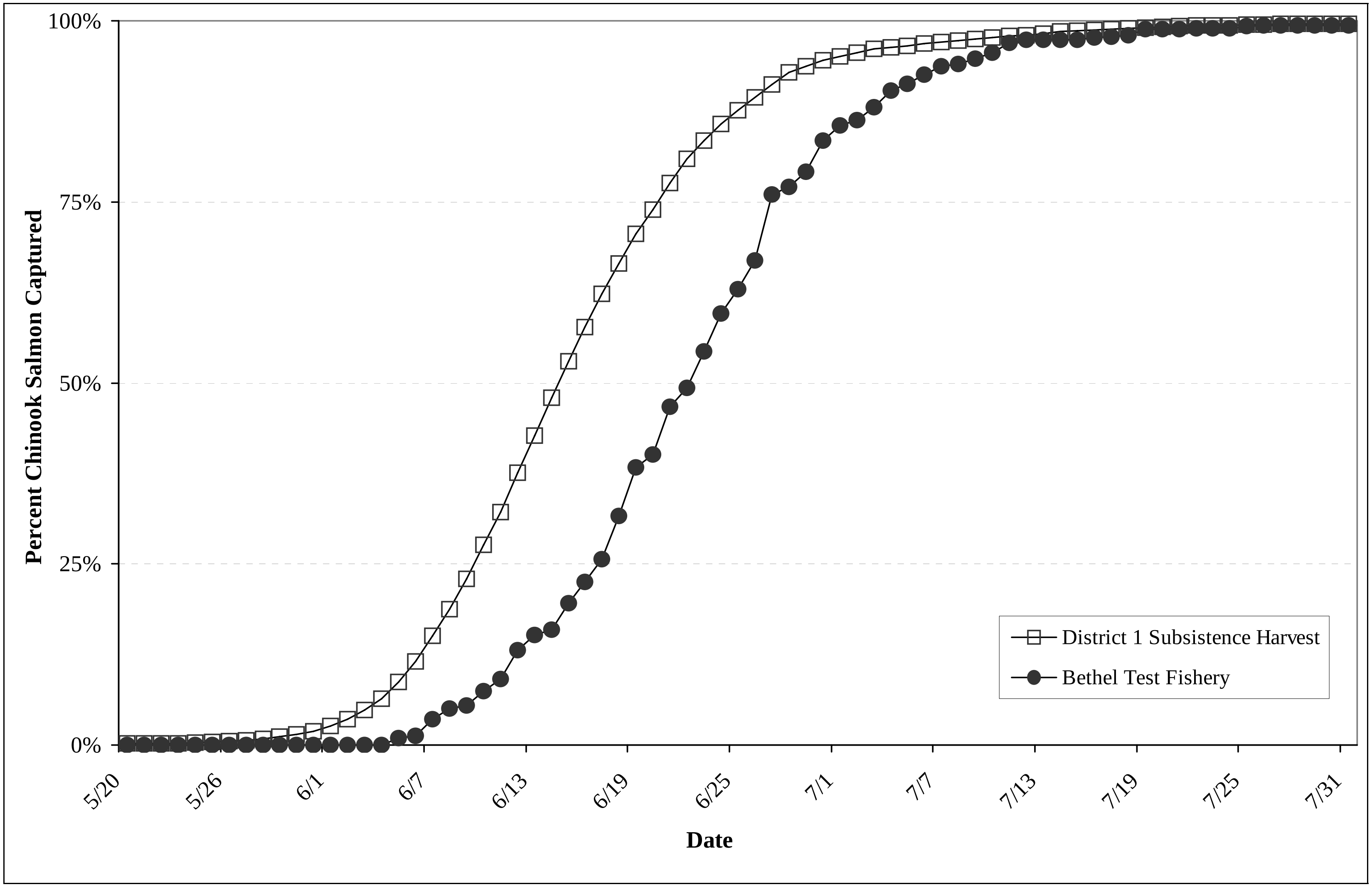


Figure 2.–Average timing of the Chinook salmon subsistence harvest in District 1 compared to the average run timing observed in the Bethel Test Fishery, 1984–1999.

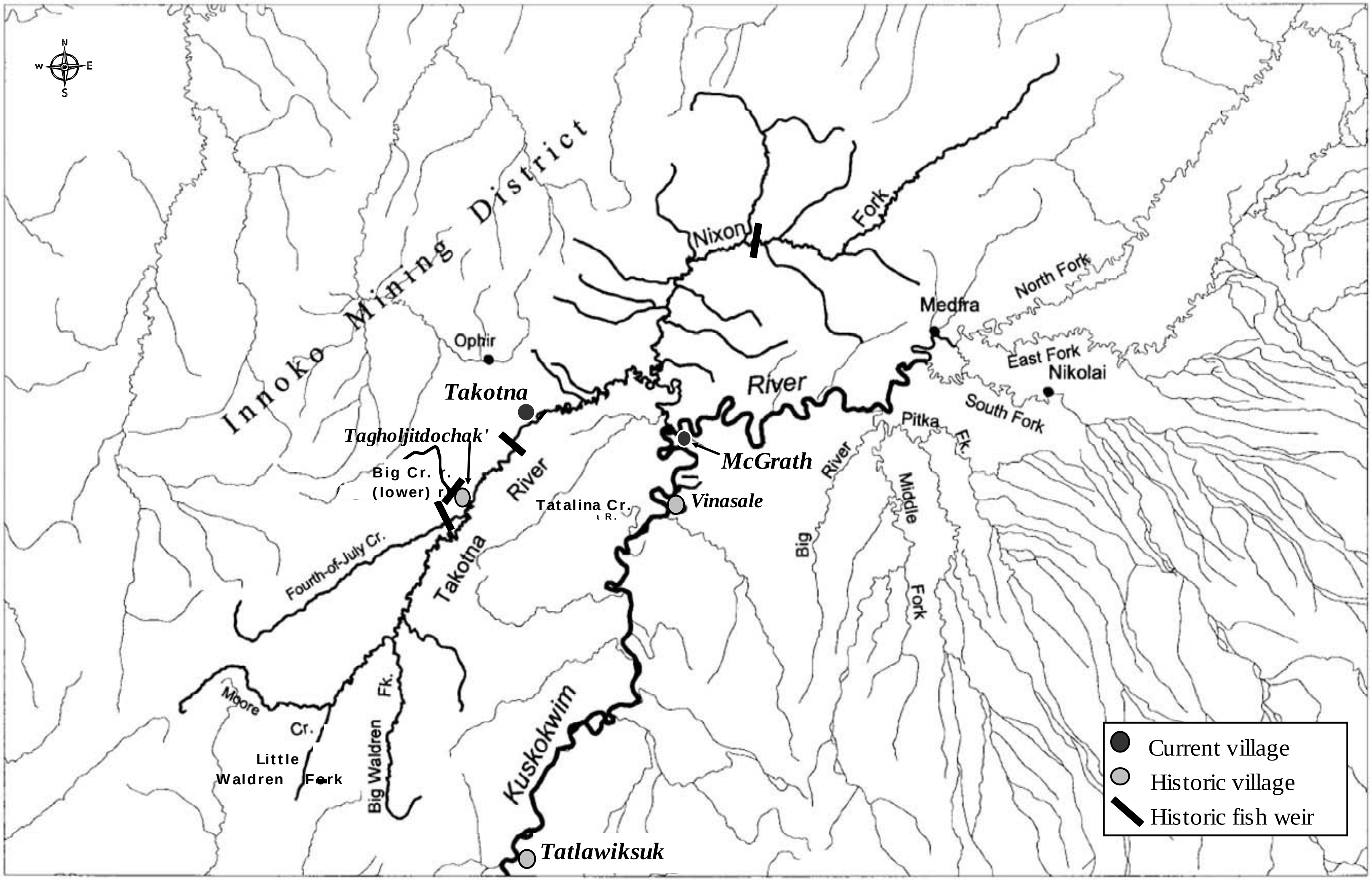


Figure 3.–Map depicting the Takotna River drainage and the location of historic native communities and fish weirs.

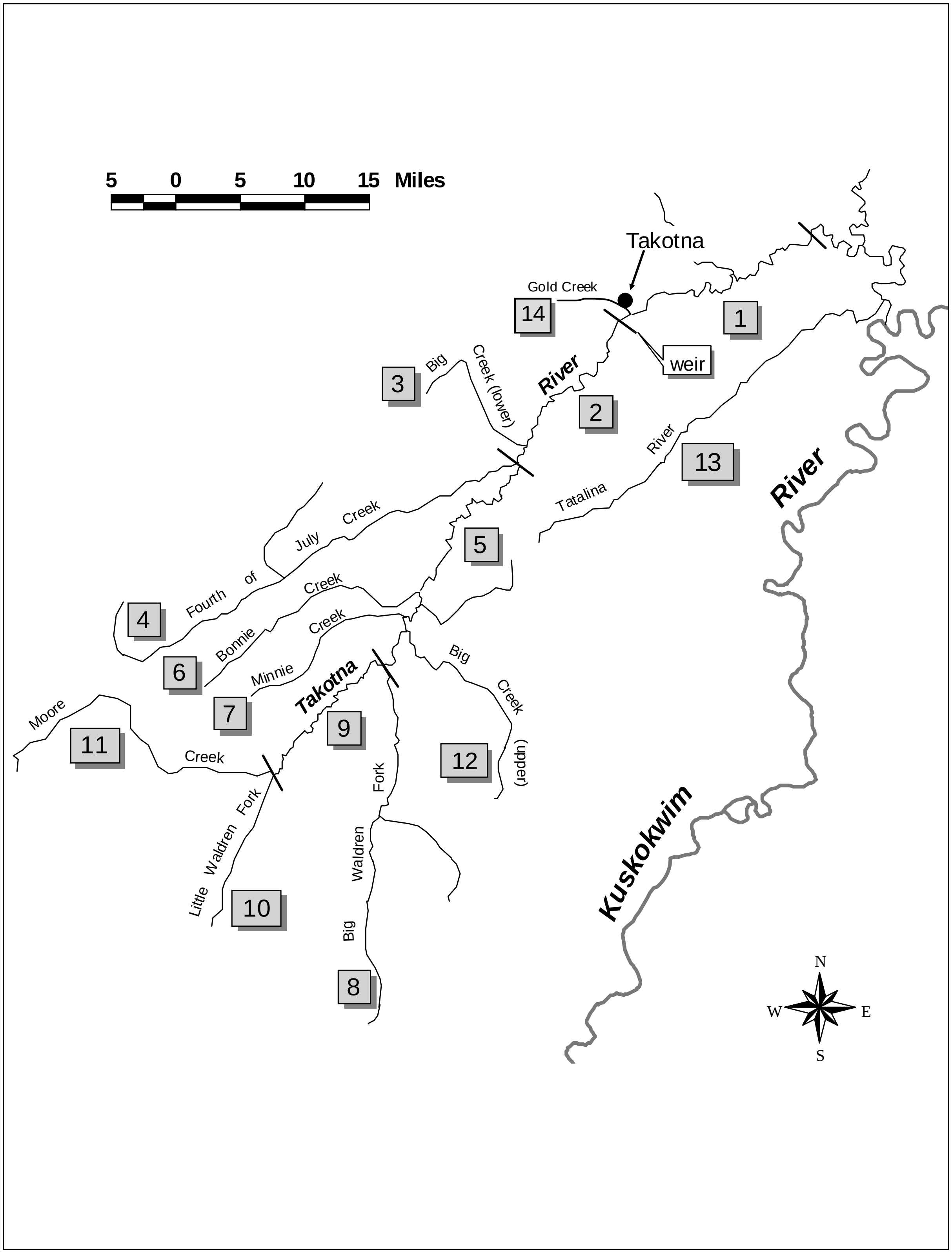
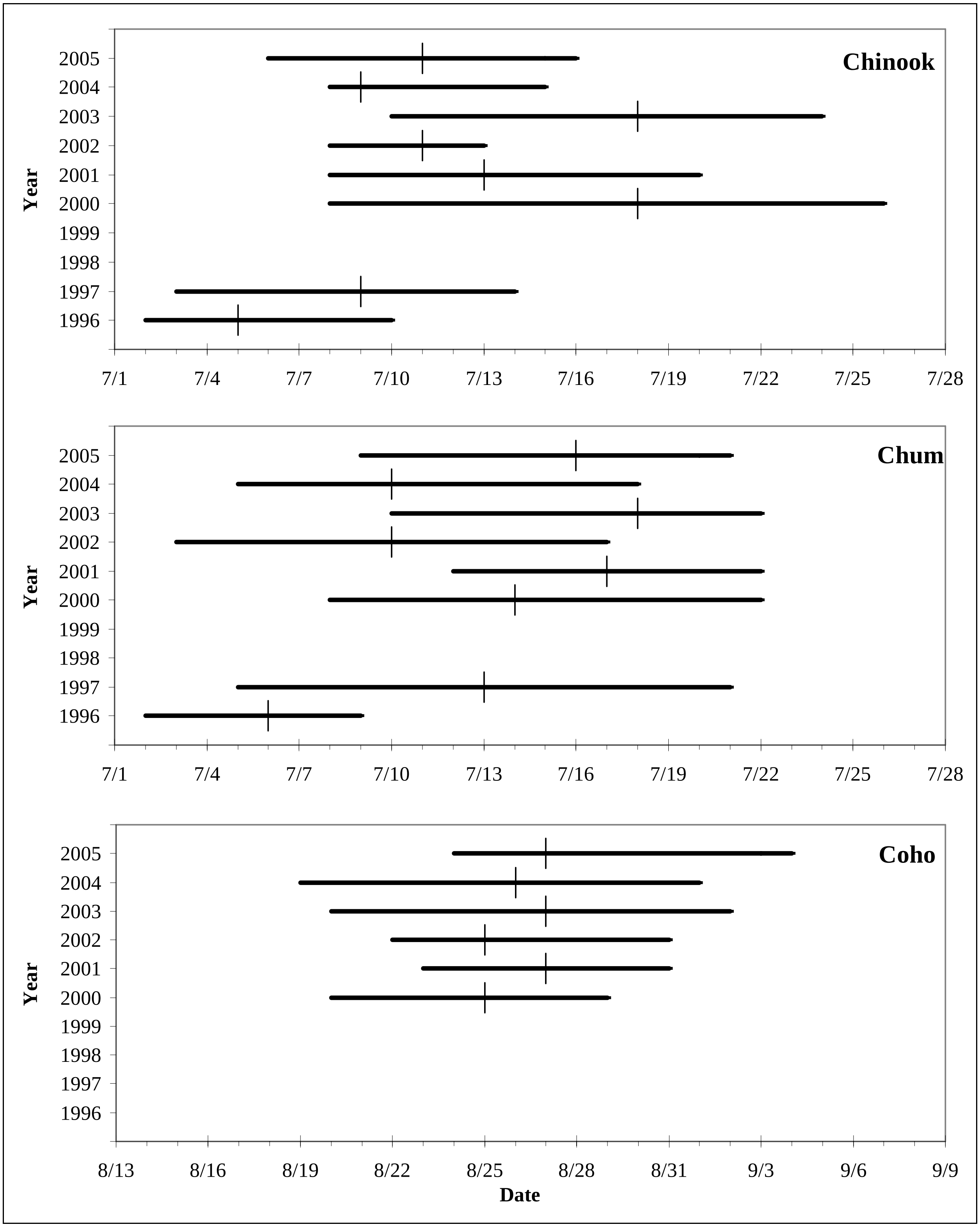


Figure 4.–Index areas used for juvenile salmon investigation in the Takotna River drainage.



Note: Horizontal black lines represent dates when the central fifty percent of the run passed and cross-bars represent median passage dates.

Figure 5.–Historical annual run timing of Chinook, chum, and coho salmon based on cumulative percent passage at the Takotna River tower (1996–1997) and weir (2000–2005).

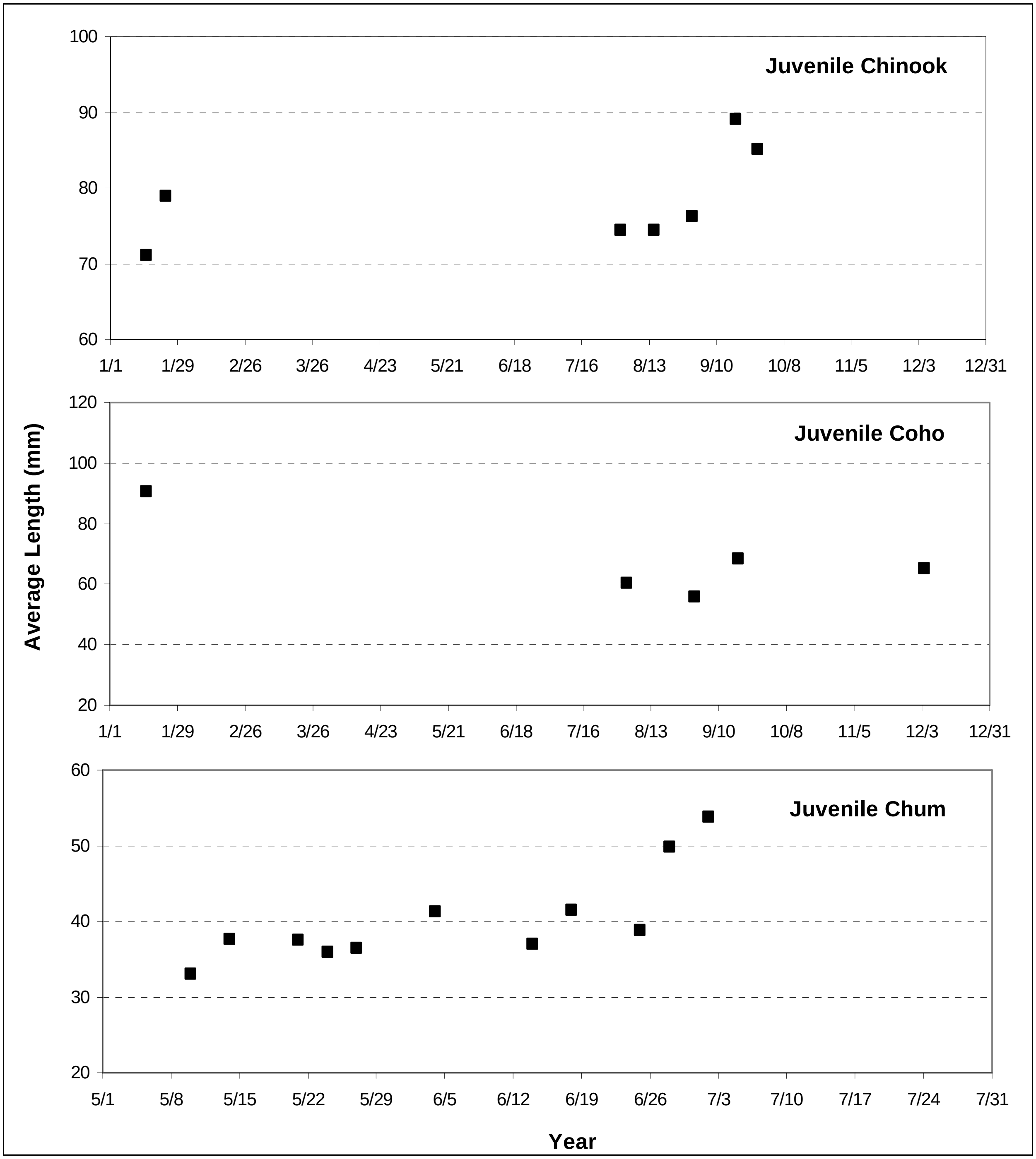


Figure 6.–Average length by date for juvenile salmon captured in the Takotna River drainage in 2005.

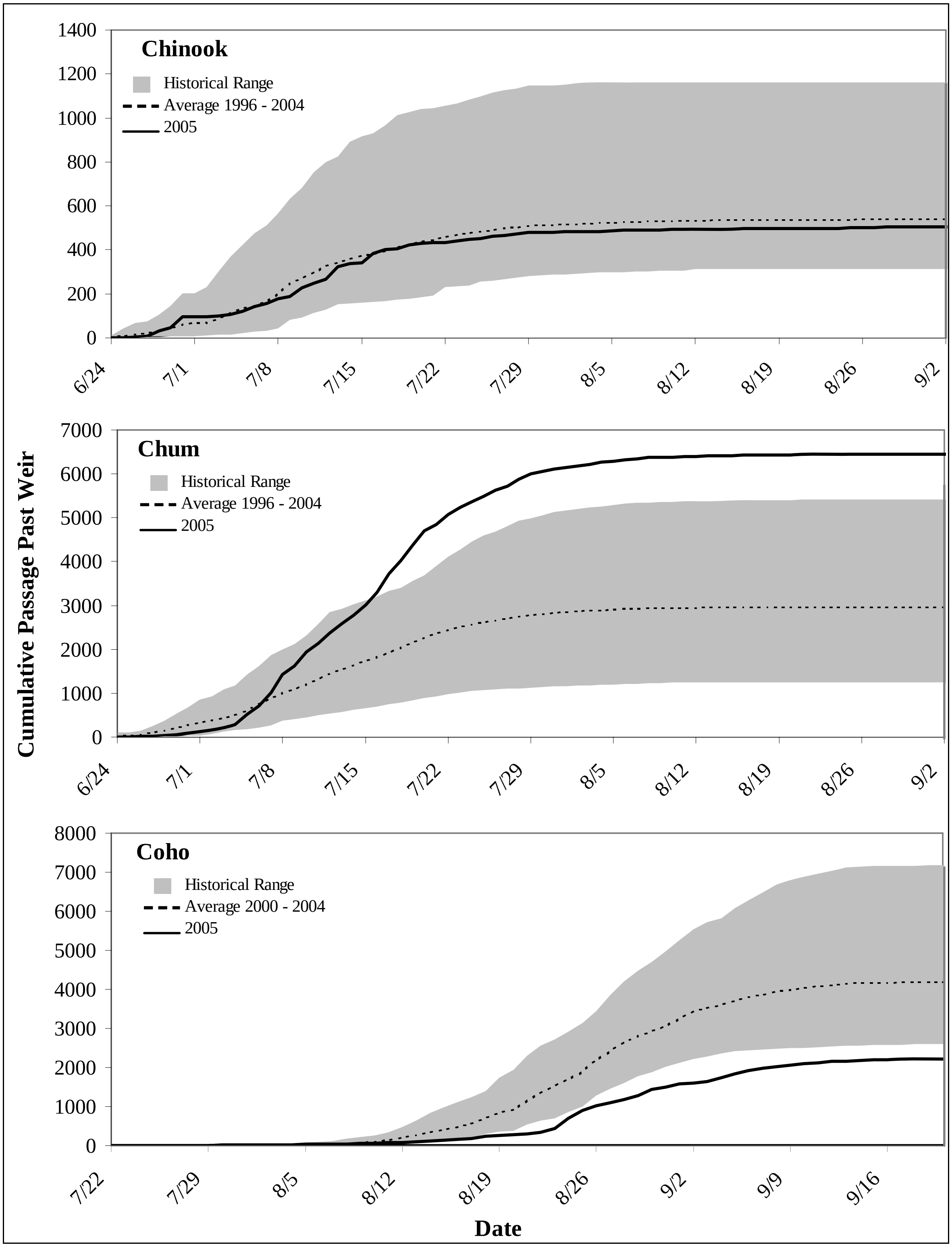


Figure 7.–Cumulative passage of Chinook, chum, and coho salmon in 2005 compared to the respective historical average, minimum, and maximum from 1996–1997 (tower) and 2000–2004 (weir).

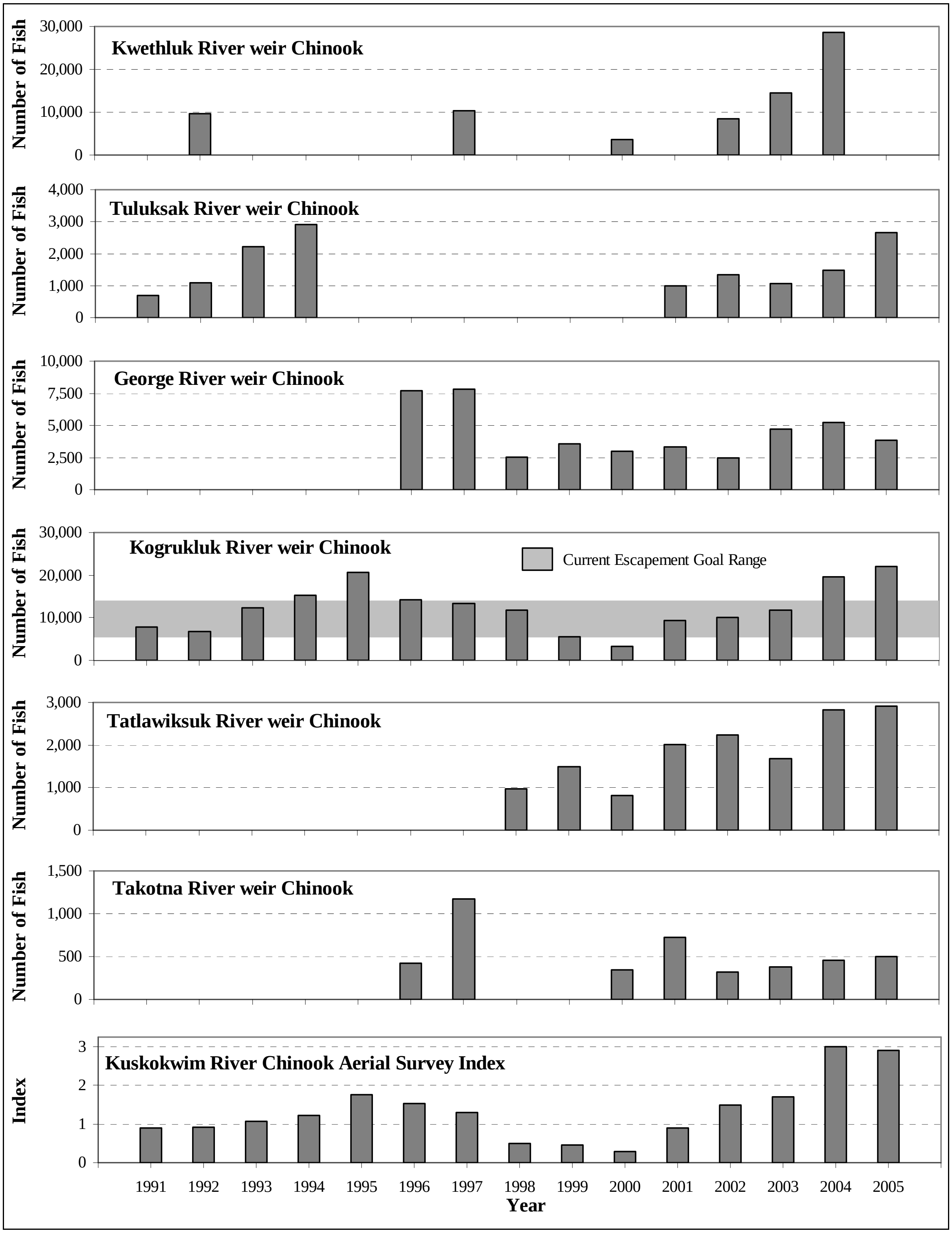


Figure 8.–Historical annual Chinook salmon escapement into six Kuskokwim River tributaries, and the Kuskokwim River Chinook salmon aerial survey indices, 1991–2005.

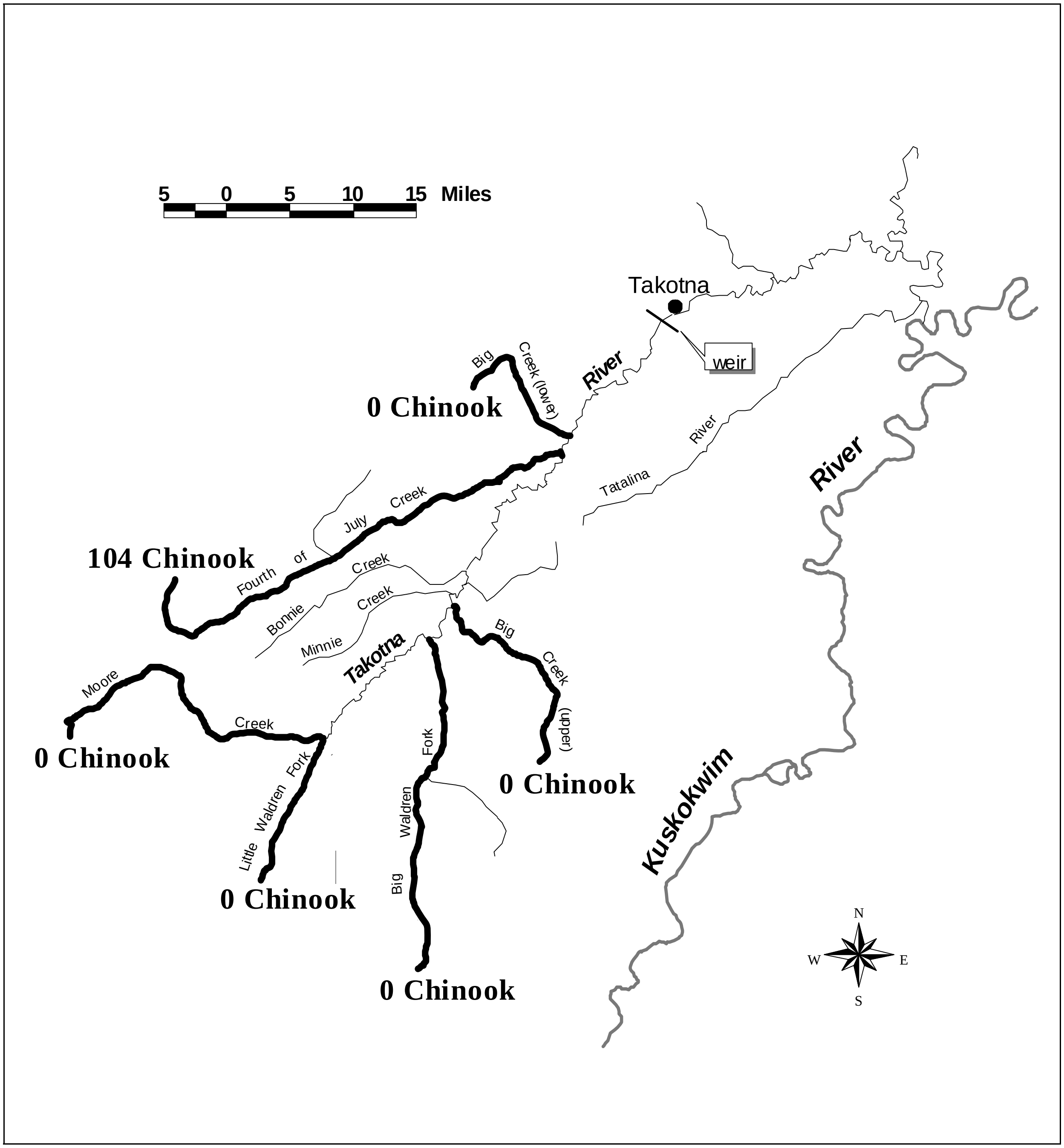


Figure 9.–Locations and results of aerial stream surveys conducted in the Takotna River drainage, July 2005.

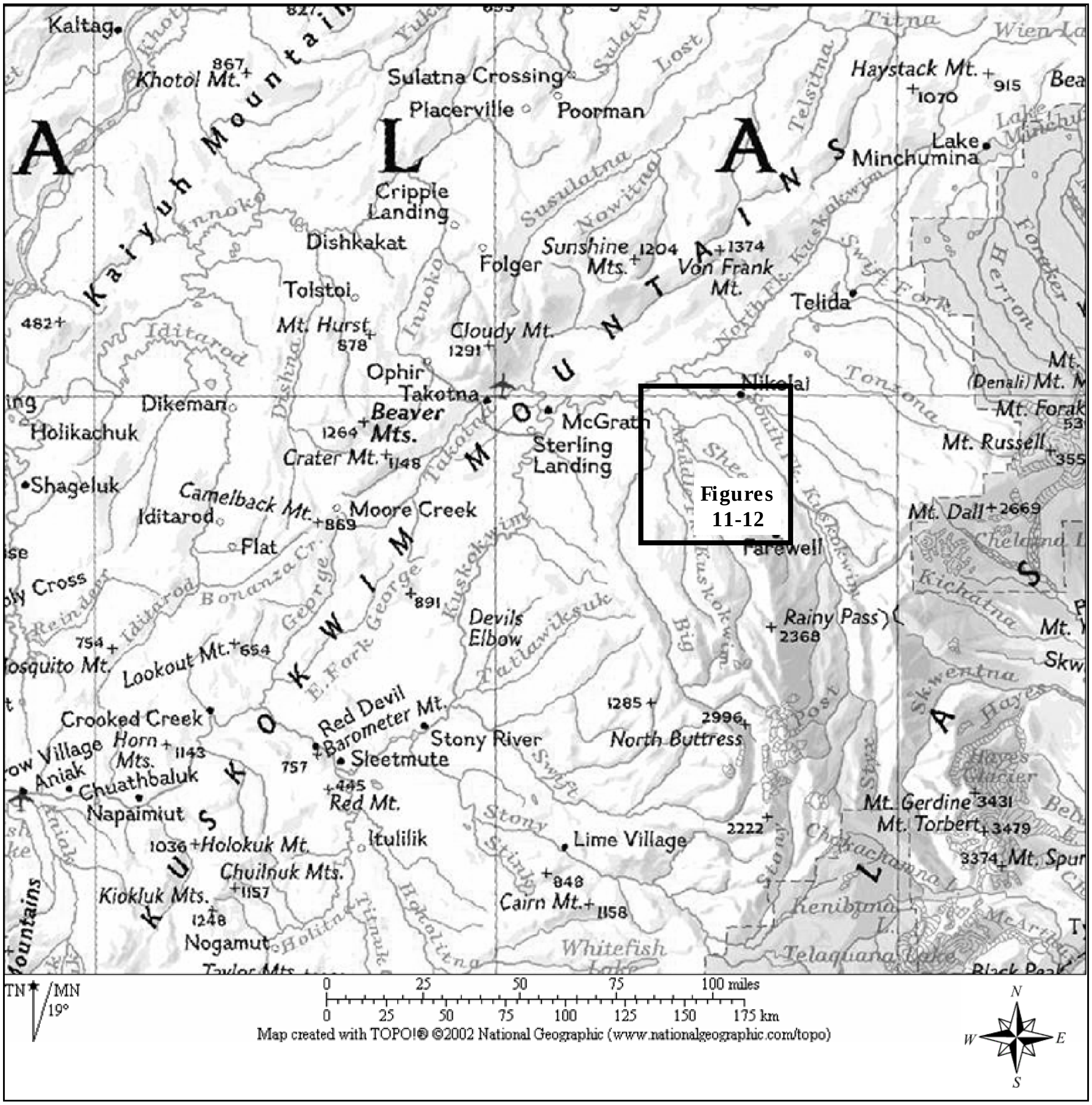


Figure 10.–Reference map of the upper Kuskokwim River for Figures 11 and 12.

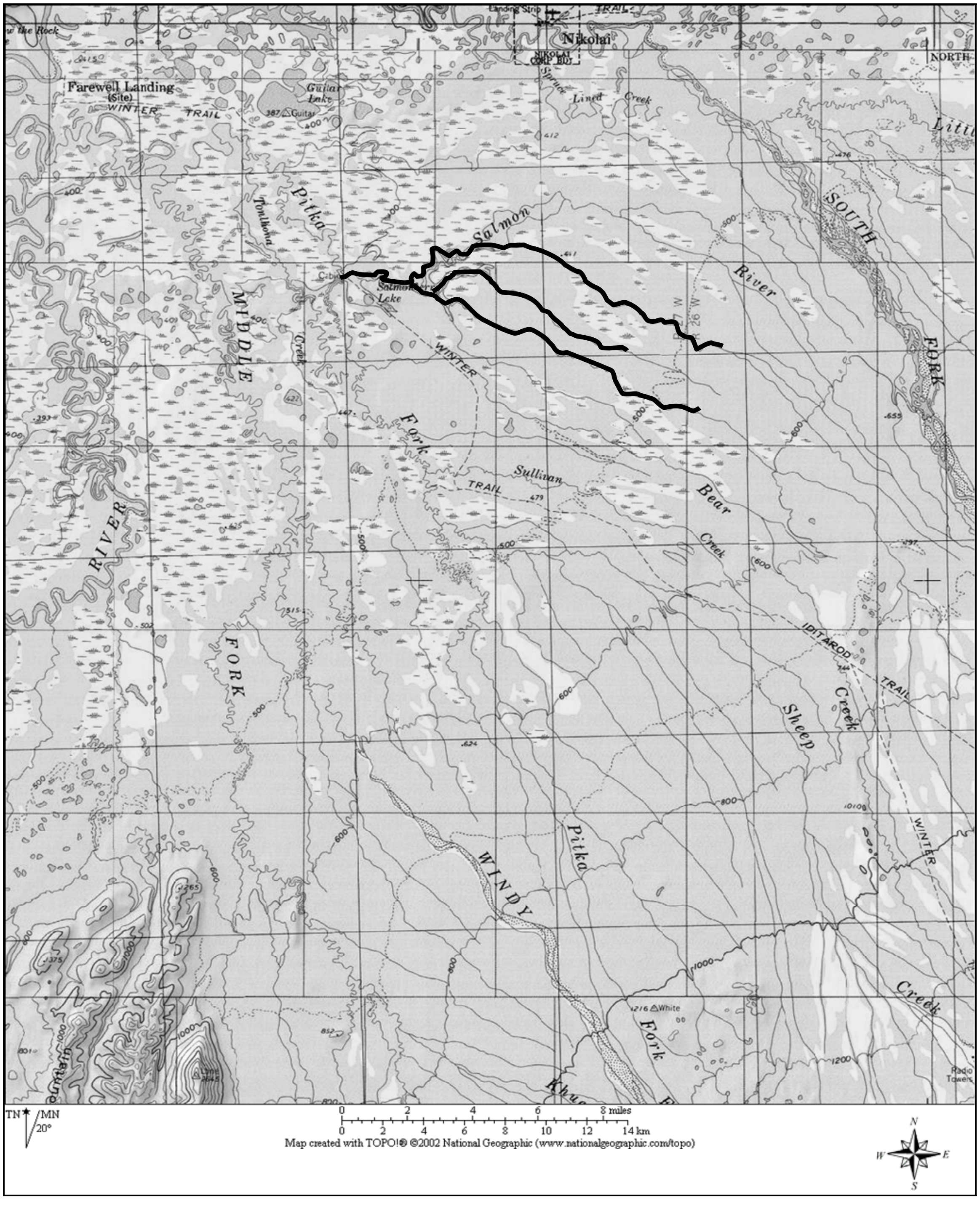


Figure 11.–Locations of aerial steam surveys conducted in the Salmon River (Pitka Fork), July 2005.

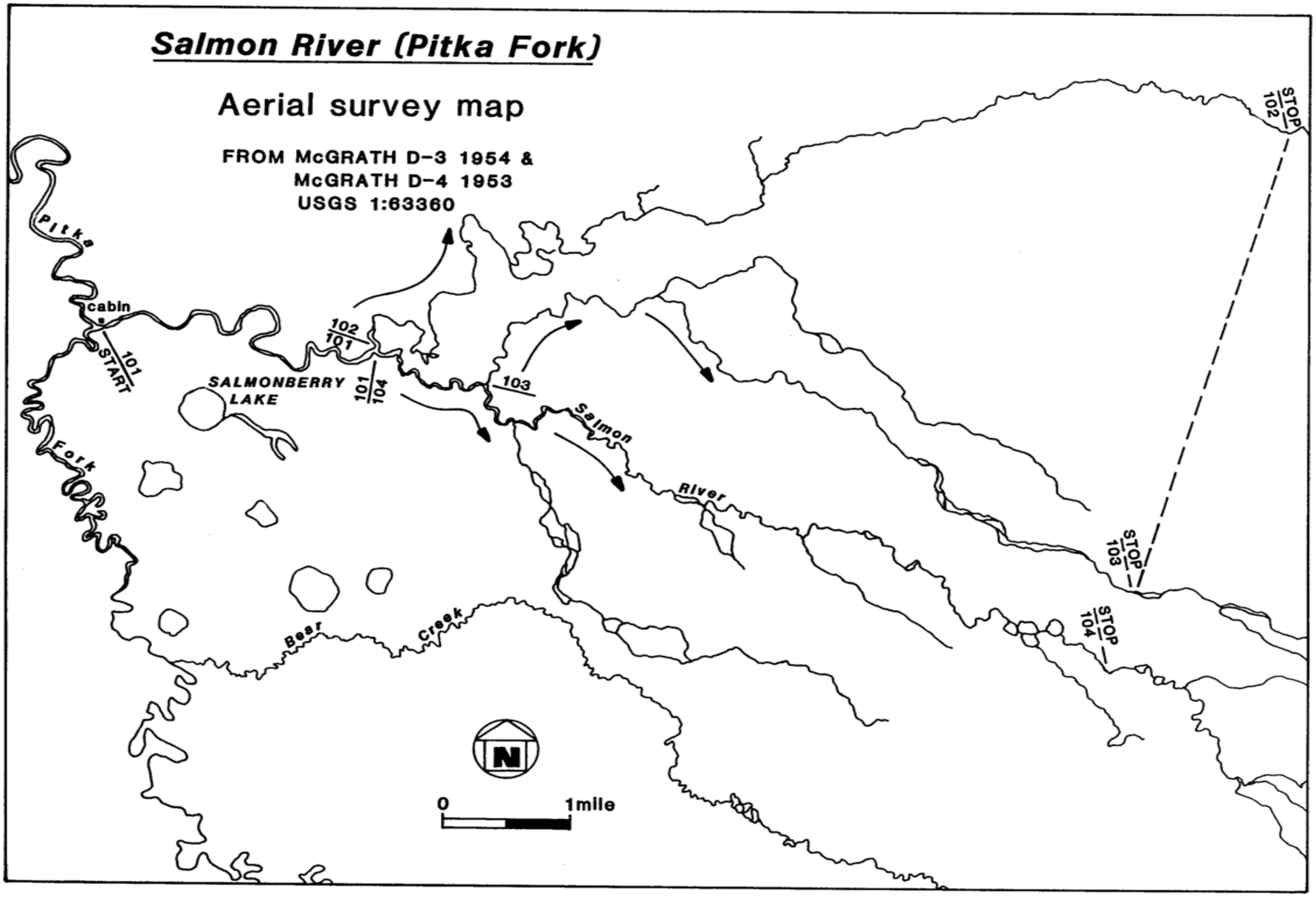
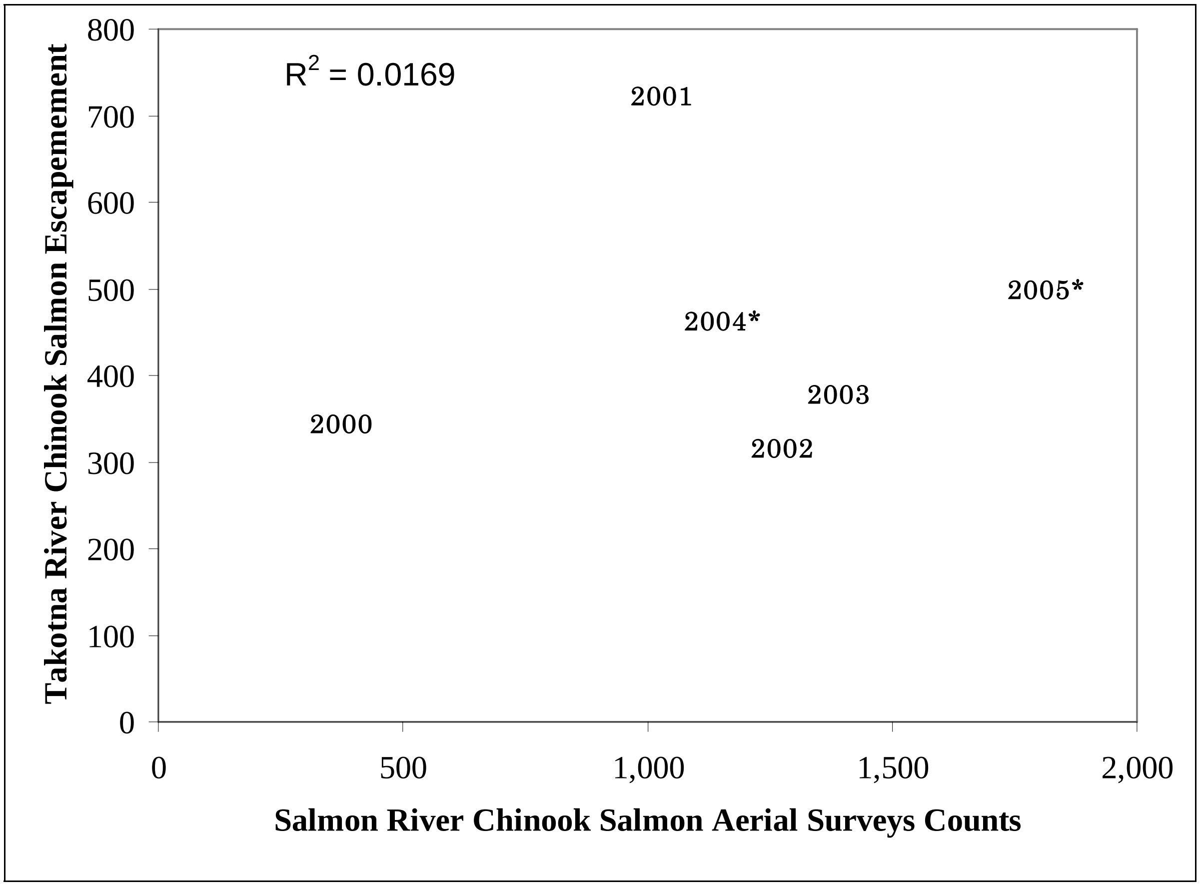


Figure 12.–Salmon River index areas used for aerial stream surveys.



Note: An asterisk (*) denotes an incomplete survey.

Figure 13.–Comparison of Salmon River aerial survey counts and Takotna River escapement counts for Chinook salmon, 2000–2005.

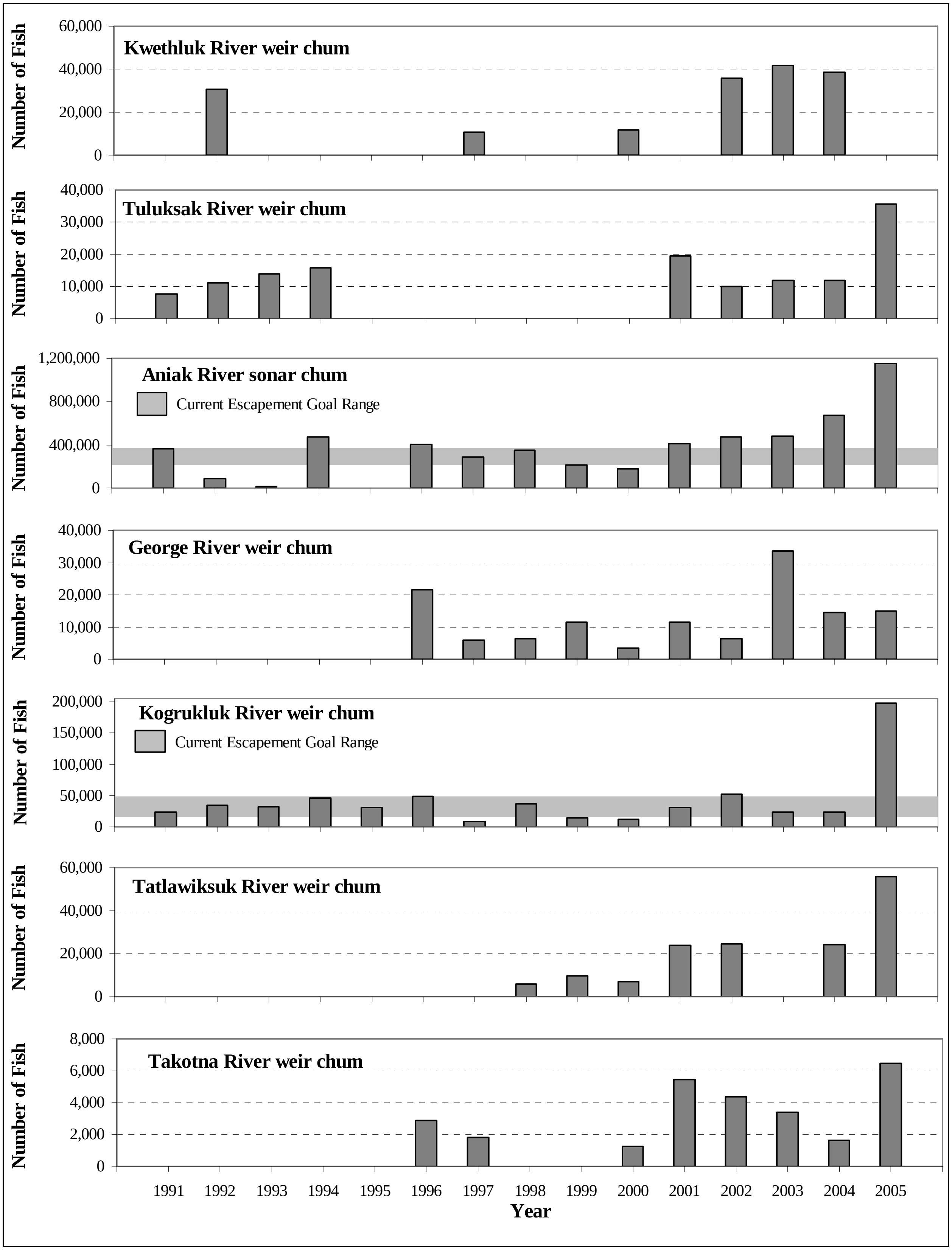


Figure 14.–Historical annual chum salmon escapement into seven Kuskokwim River tributaries, 1991–2005.

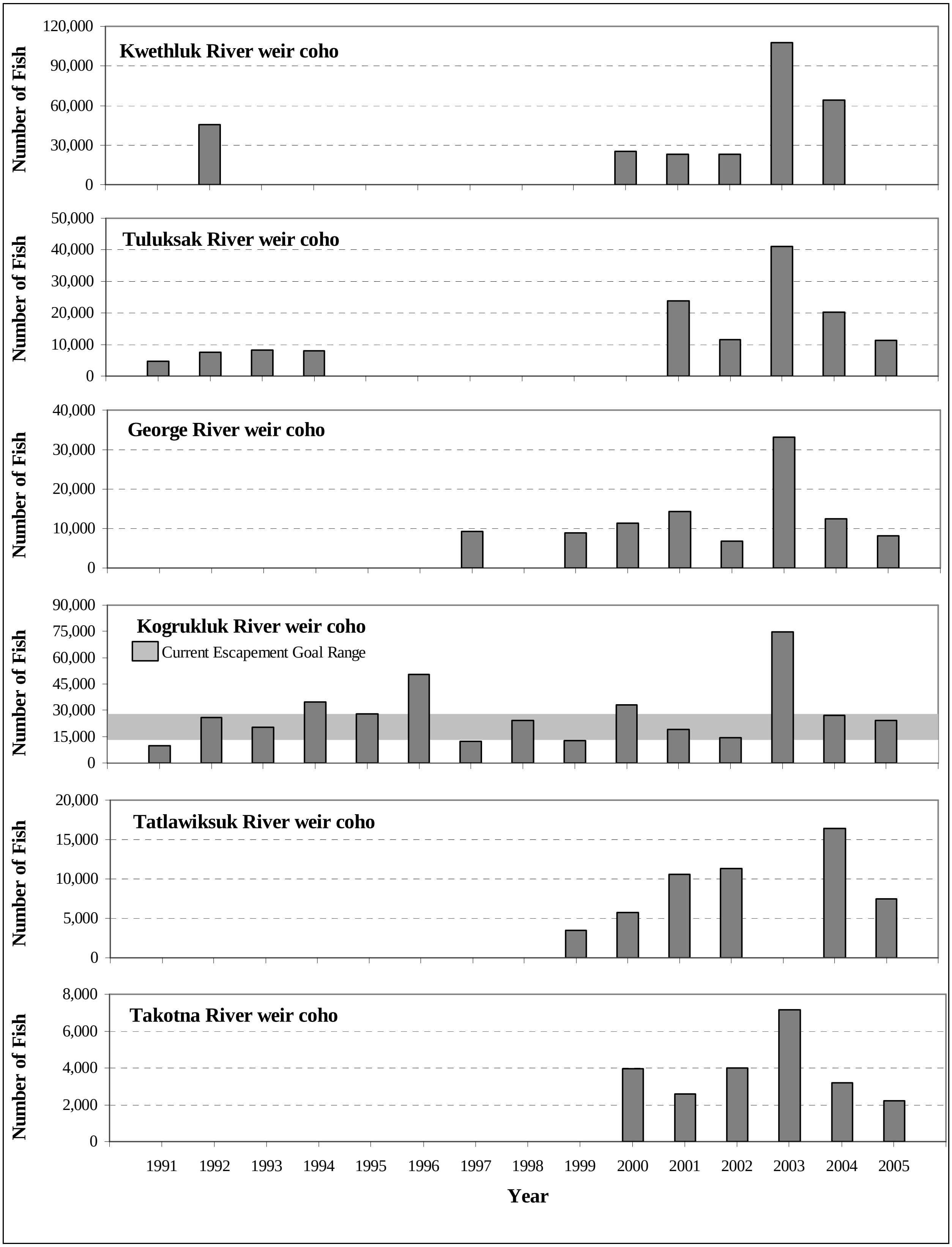


Figure 15.–Historical annual coho salmon escapement into six Kuskokwim River tributaries, 1991–2005.

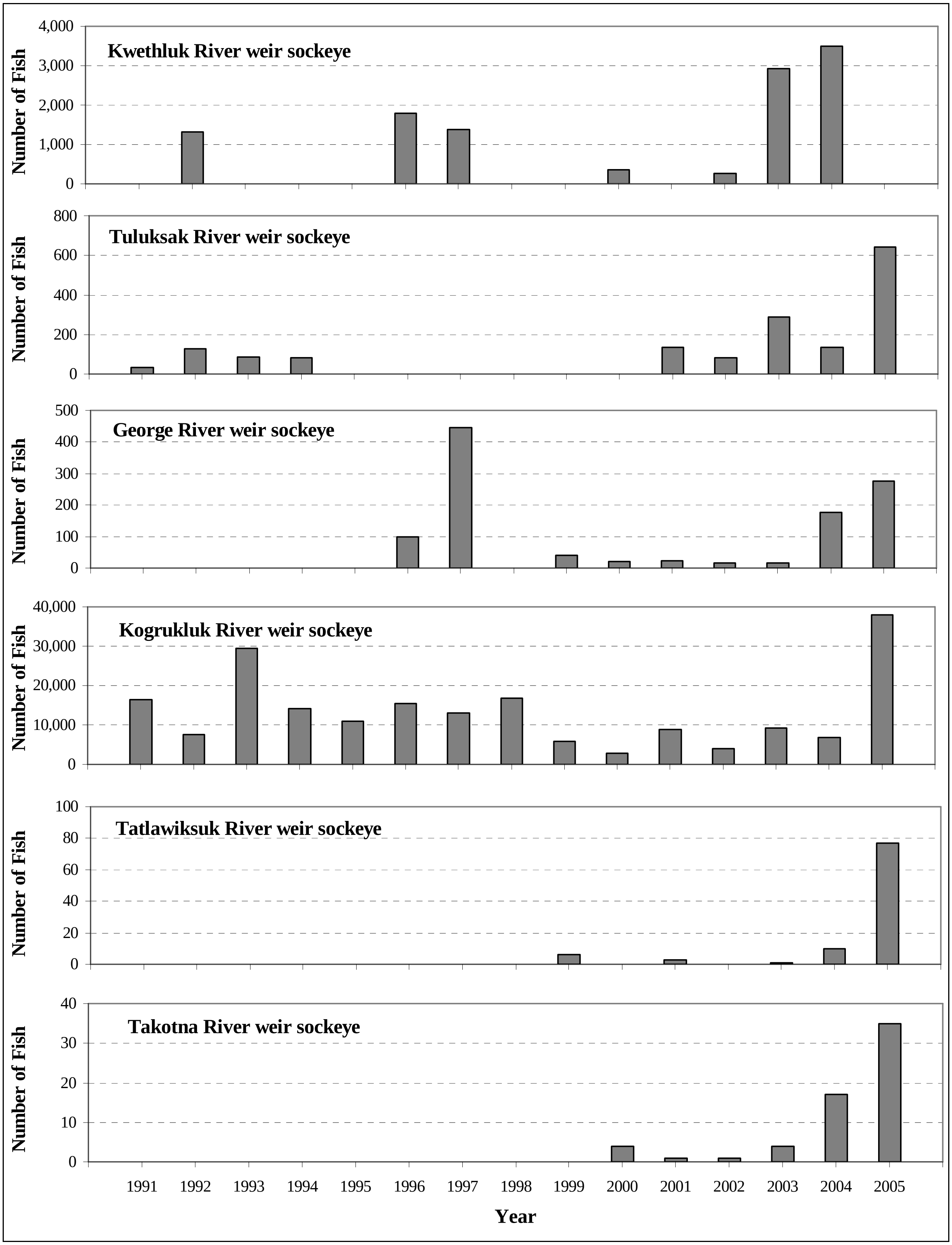


Figure 16.–Historical annual sockeye salmon escapement into six Kuskokwim River tributaries, 1991–2005.

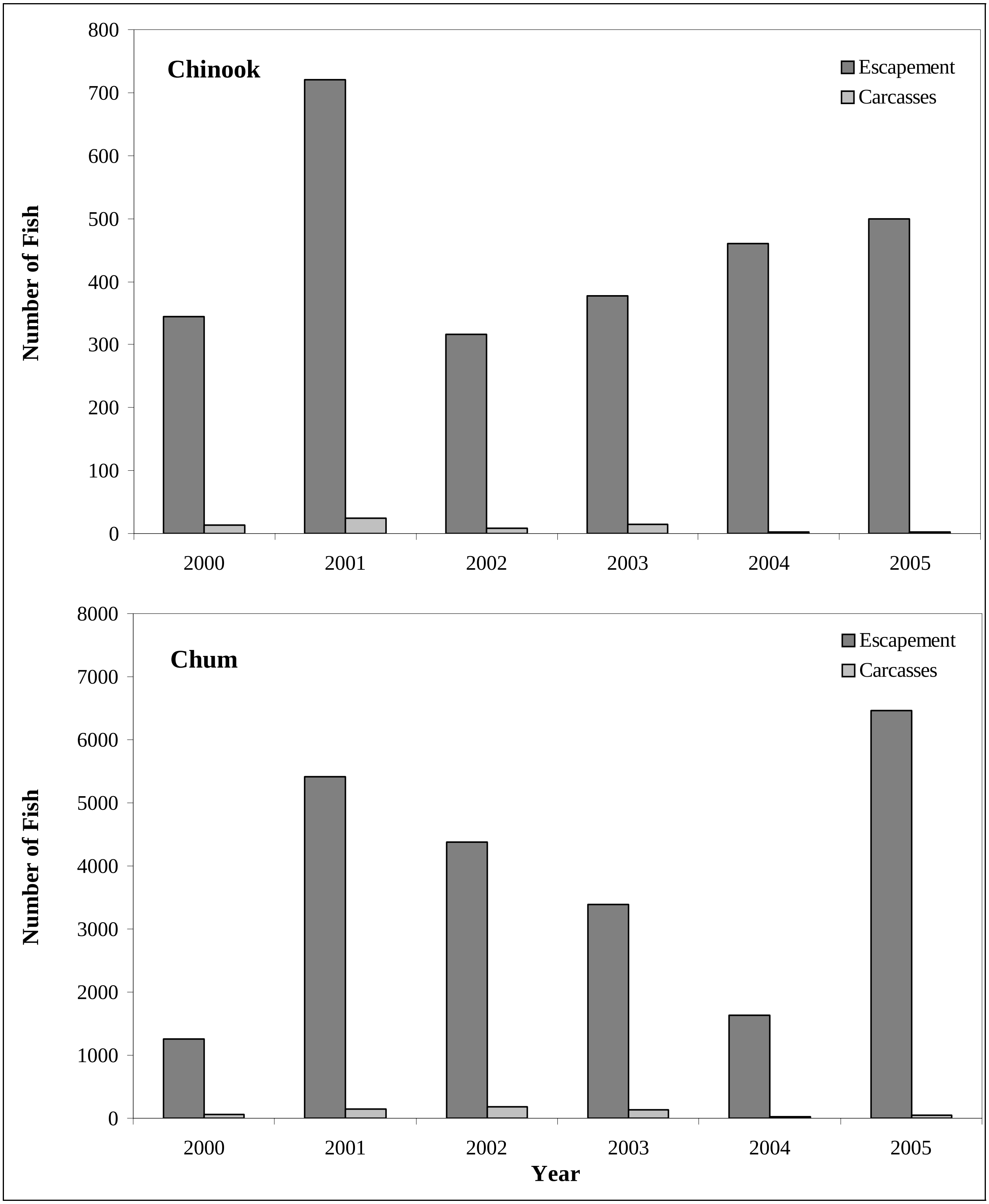


Figure 17.–Historical annual Chinook and chum salmon escapement compared to annual carcass deposition at the Takotna River weir, 2000–2005.

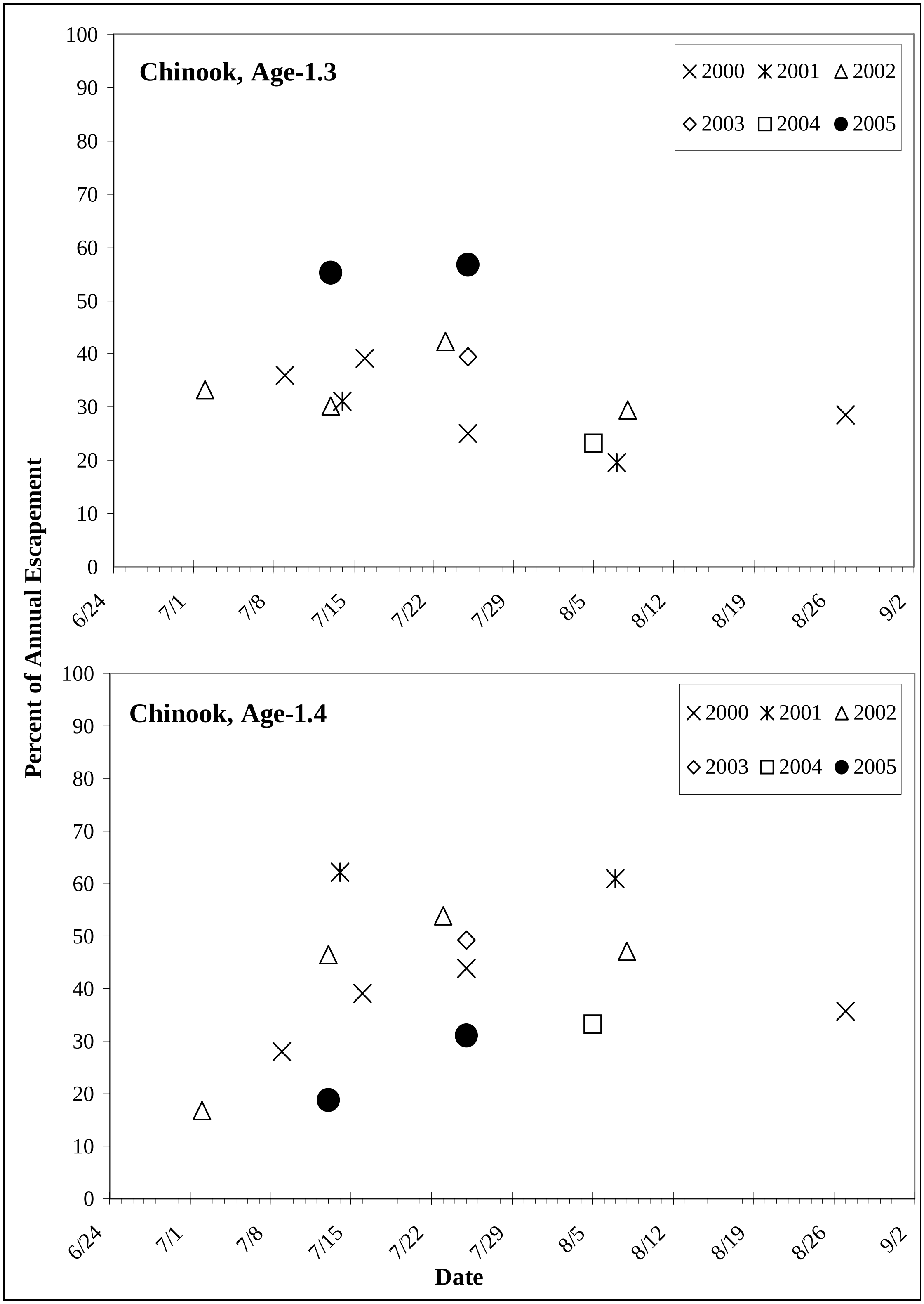
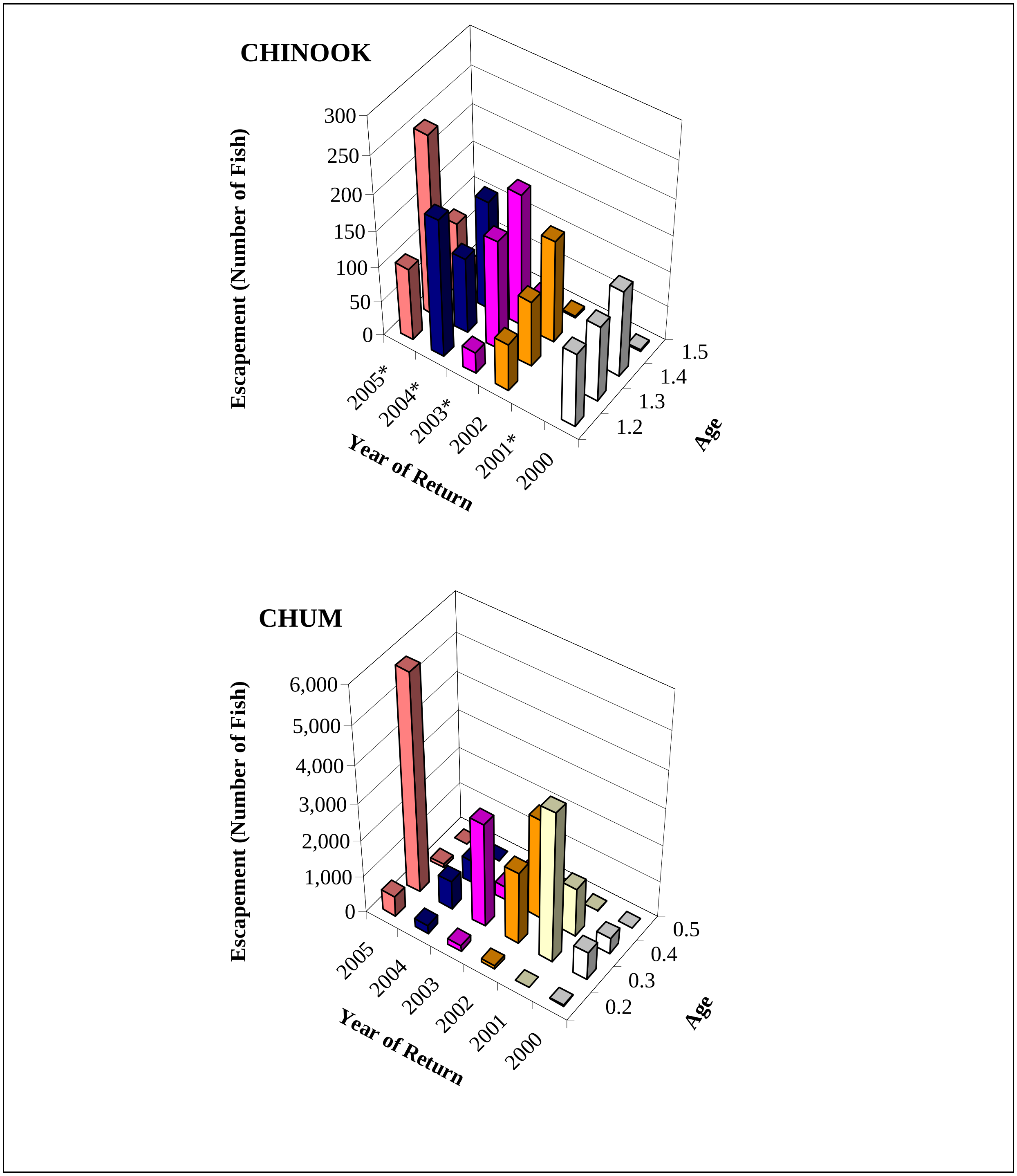


Figure 18.–Historical age composition by sample date for Chinook salmon at Takotna River weir.



Source: D. Folletti, ADF&G; personal communication.

Note: An asterisk (*) denotes incomplete sampling or escapement estimates.

Figure 19.–Historical Chinook and chum salmon age distribution at Takotna River weir.

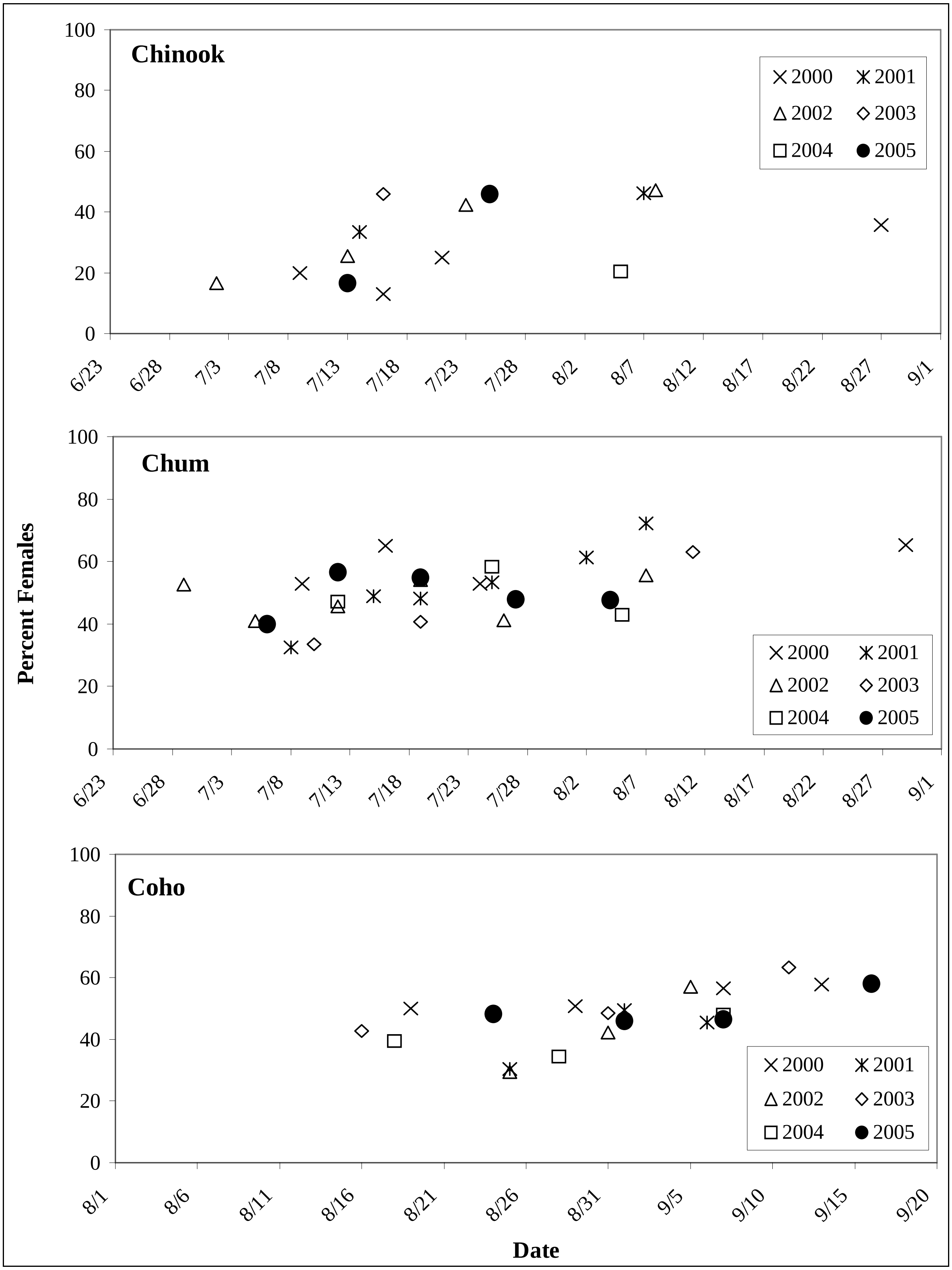


Figure 20.–Historical percentage of female Chinook, chum, and coho salmon by sample date at the Takotna River weir.

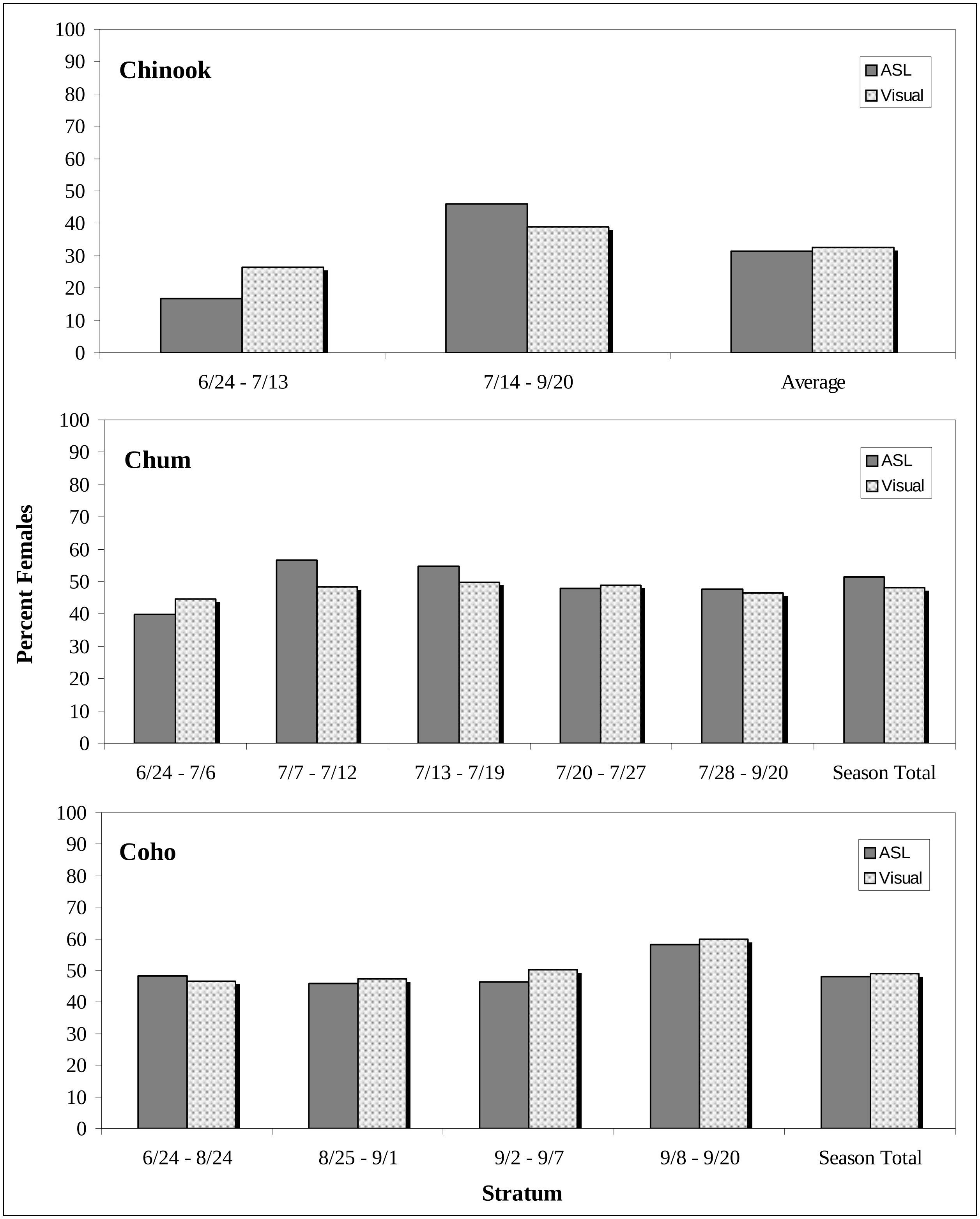
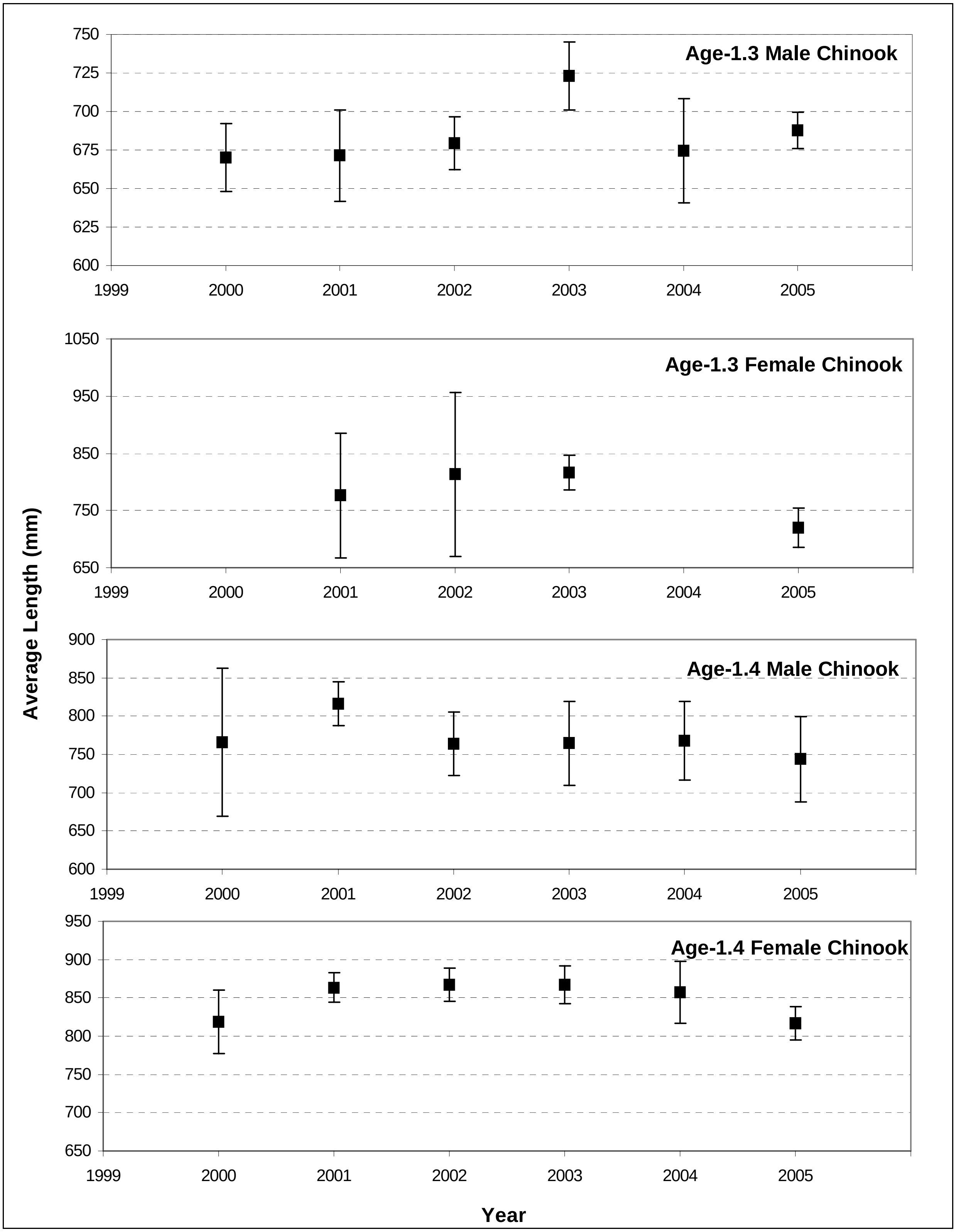


Figure 21.–Percentage of females per strata as determined by ASL sampling compared to visual identification at Takotna River weir, 2005.



Note: Plots represent samples only and are not reflective of the entire Chinook salmon run.

Figure 22.–Historical average annual length for Chinook salmon sampled at Takotna River weir.

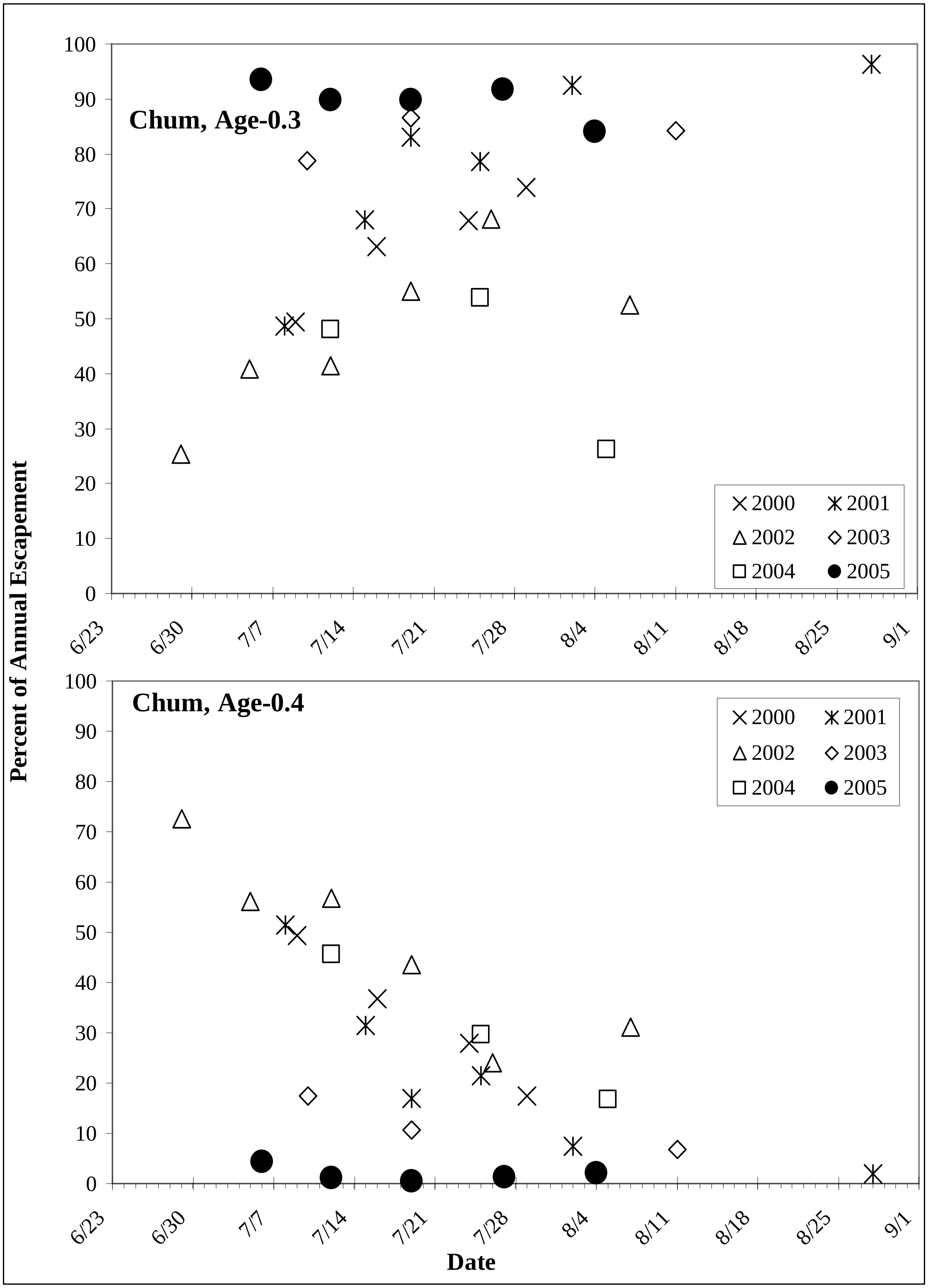


Figure 23.–Historical age composition by sample date for chum salmon at Takotna River weir.

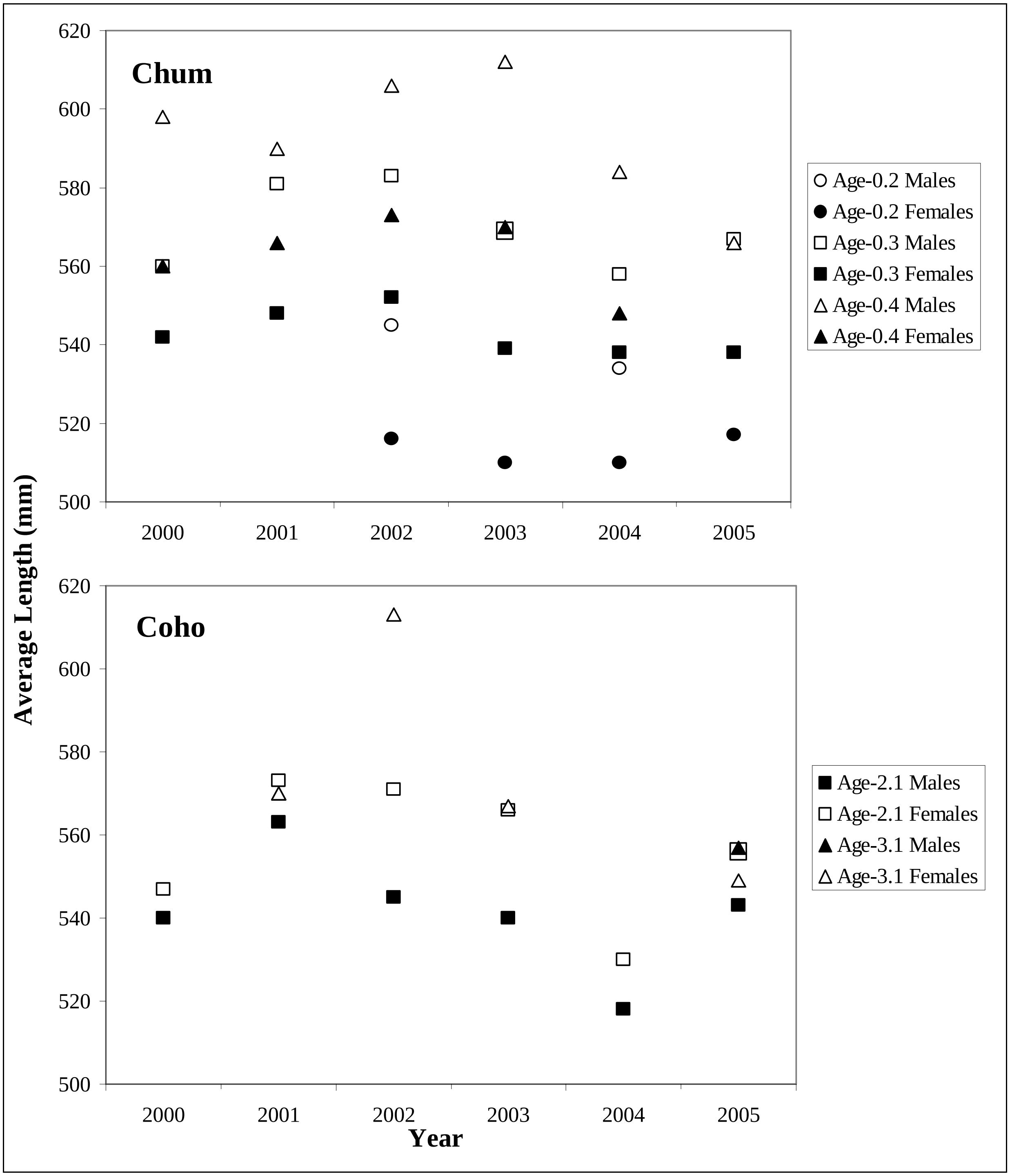


Figure 24.–Historical average annual length of male and female chum and coho salmon at the Takotna River weir.

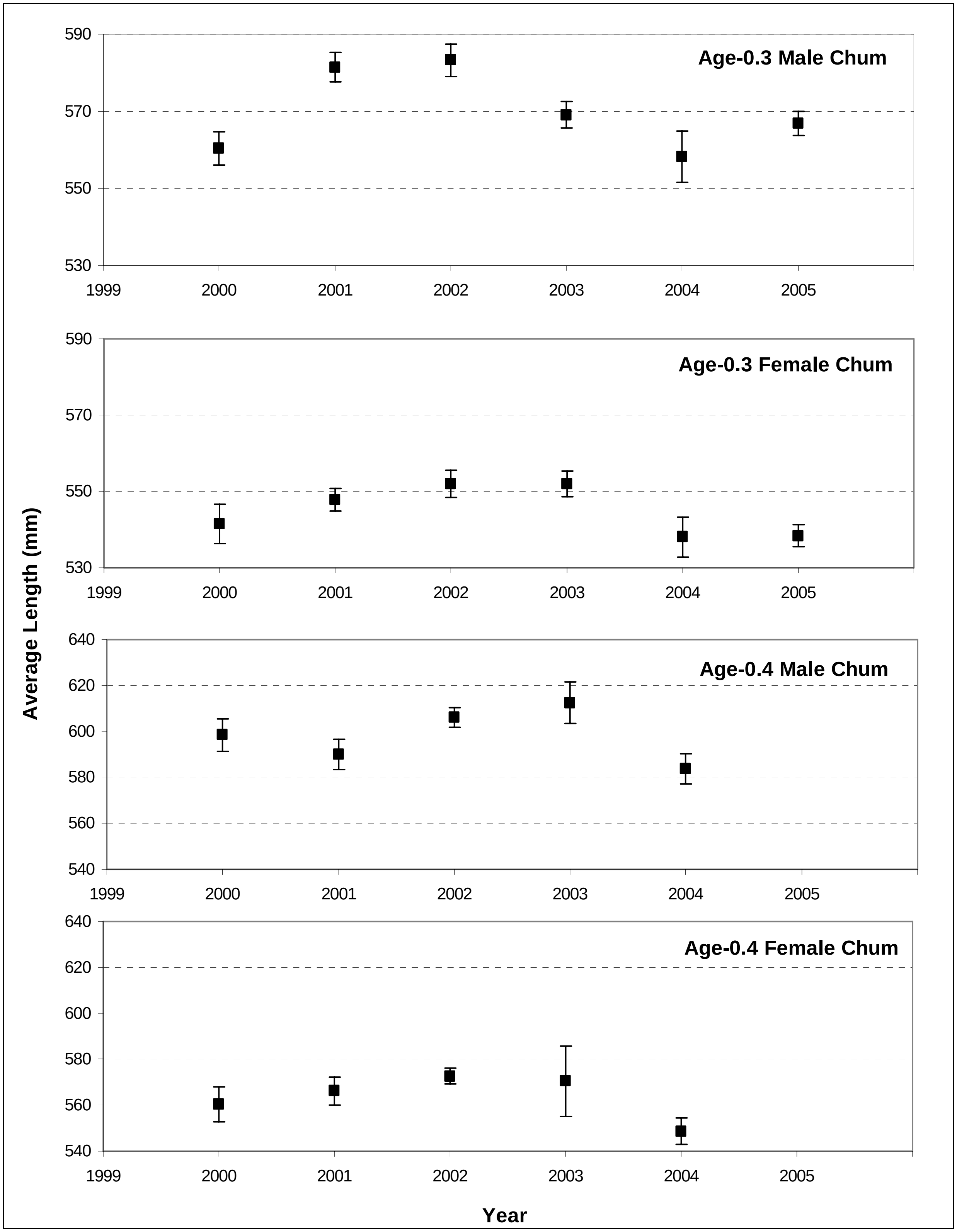


Figure 25.–Historical average annual length for chum salmon at Takotna River weir, with 95% confidence intervals.

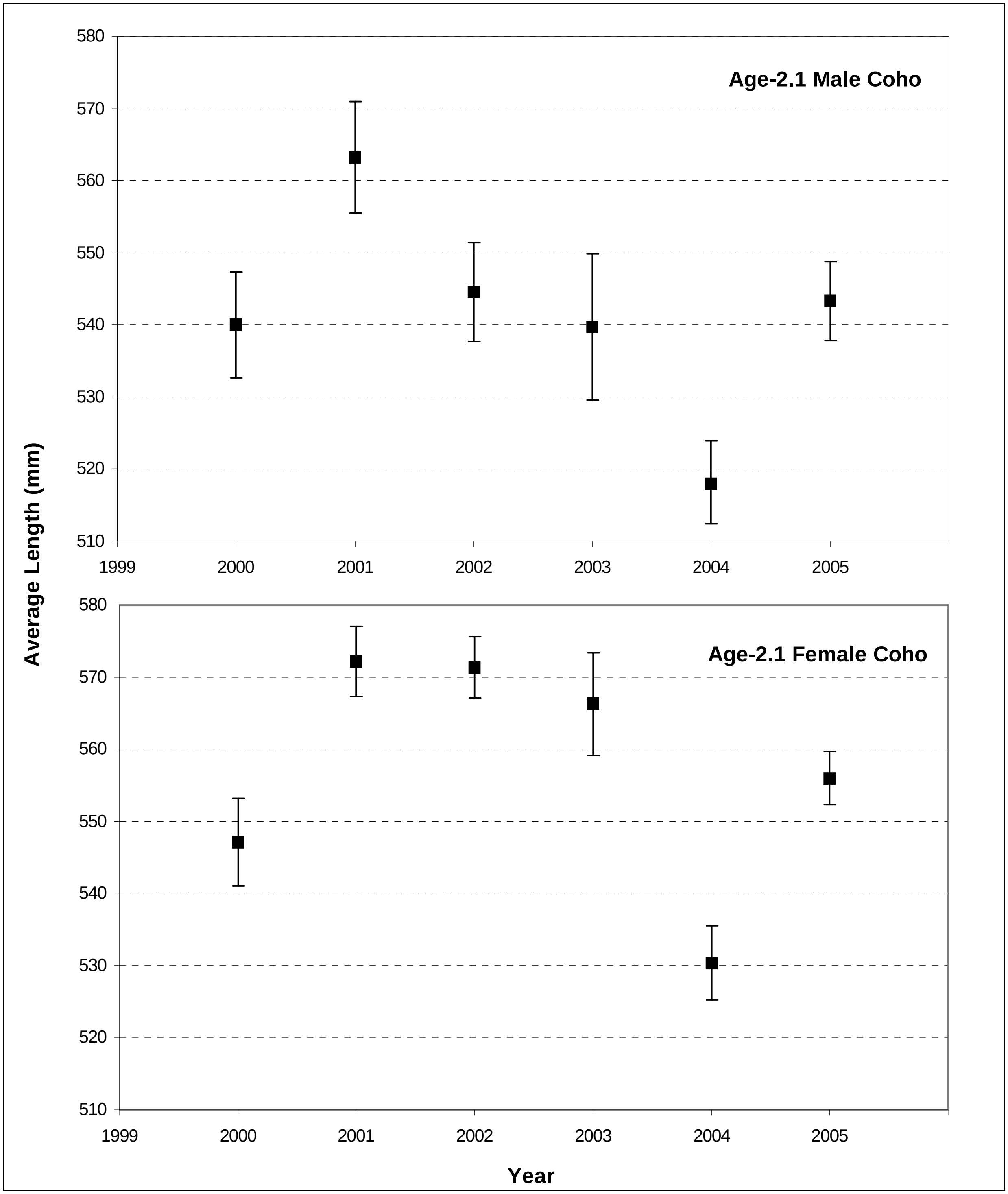


Figure 26.–Historical average annual length for coho salmon at Takotna River weir, with 95% confidence intervals.

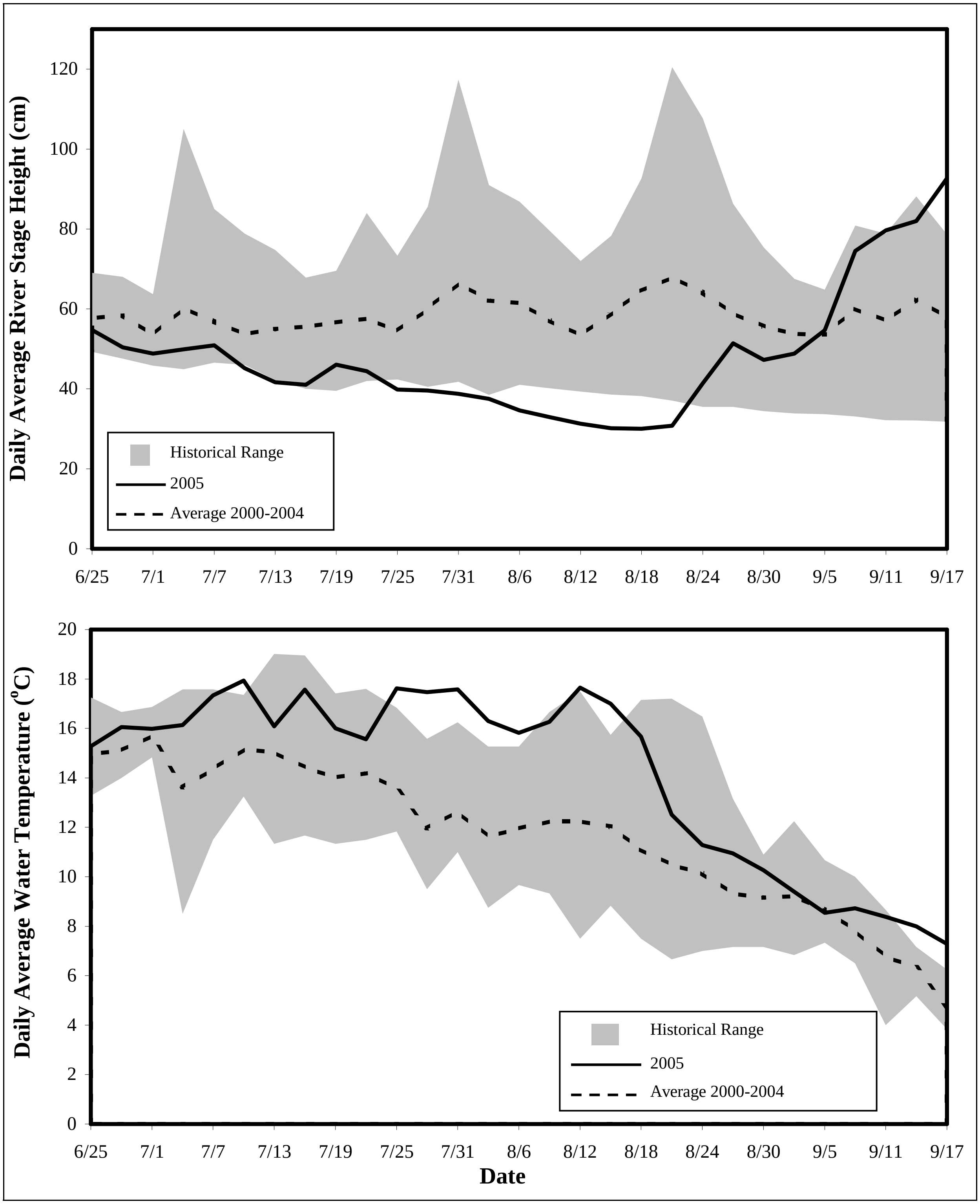


Figure 27.–Historical average, minimum, and maximum daily river stage and water temperature at the Takotna River weir from 2000–2004, compared to daily average river stage and water temperature in 2005.

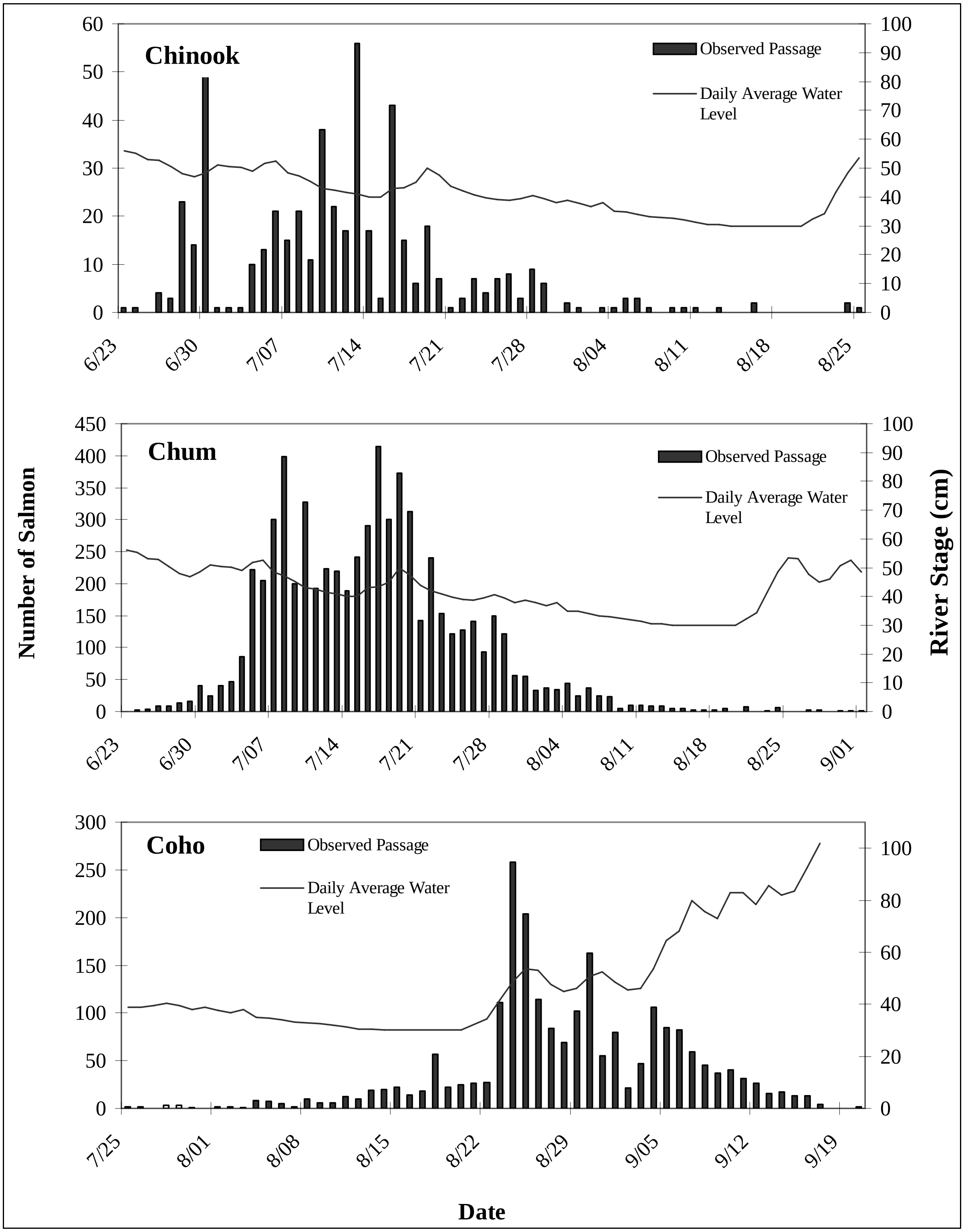


Figure 28.–Daily Chinook, chum, and coho salmon passage at the Takotna River weir relative to average river stage height, 2005.

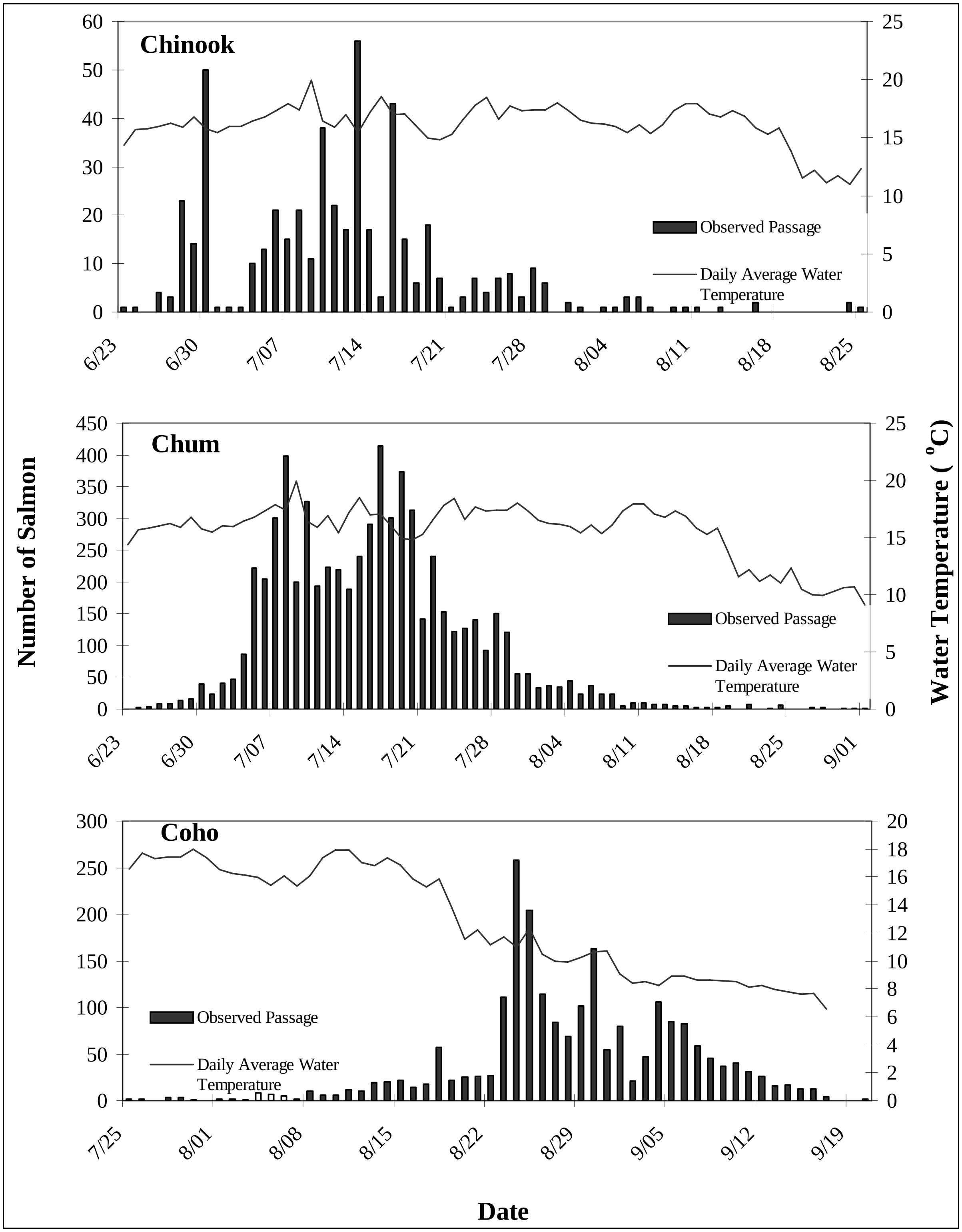


Figure 29.–Daily Chinook, chum, and coho salmon passage at the Takotna River weir relative to average water temperature, 2005.

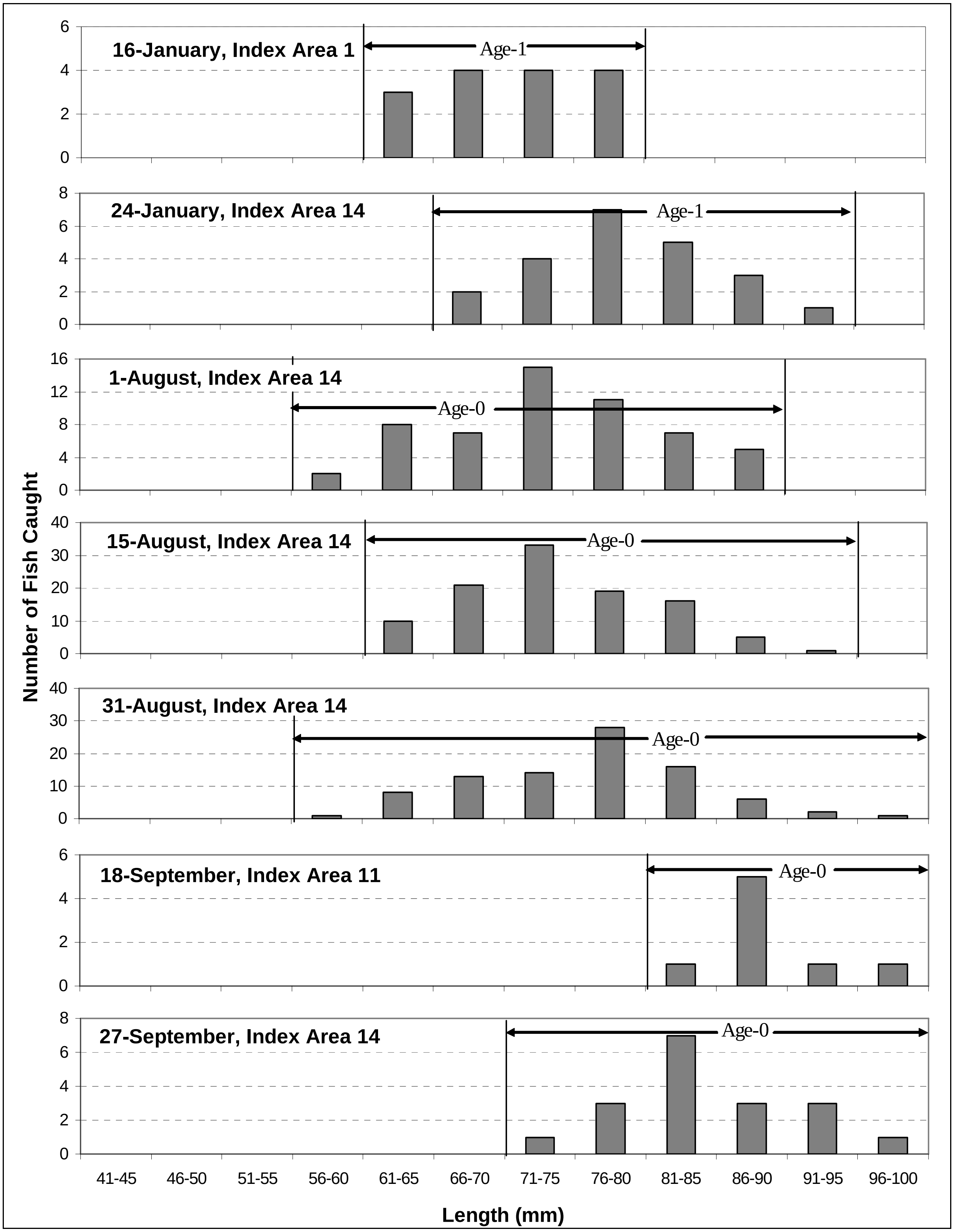


Figure 30.–Lengths of juvenile Chinook salmon caught using minnow traps in Index Areas 1–14 of the Takotna River drainage, 2005, with speculation of represented age class.

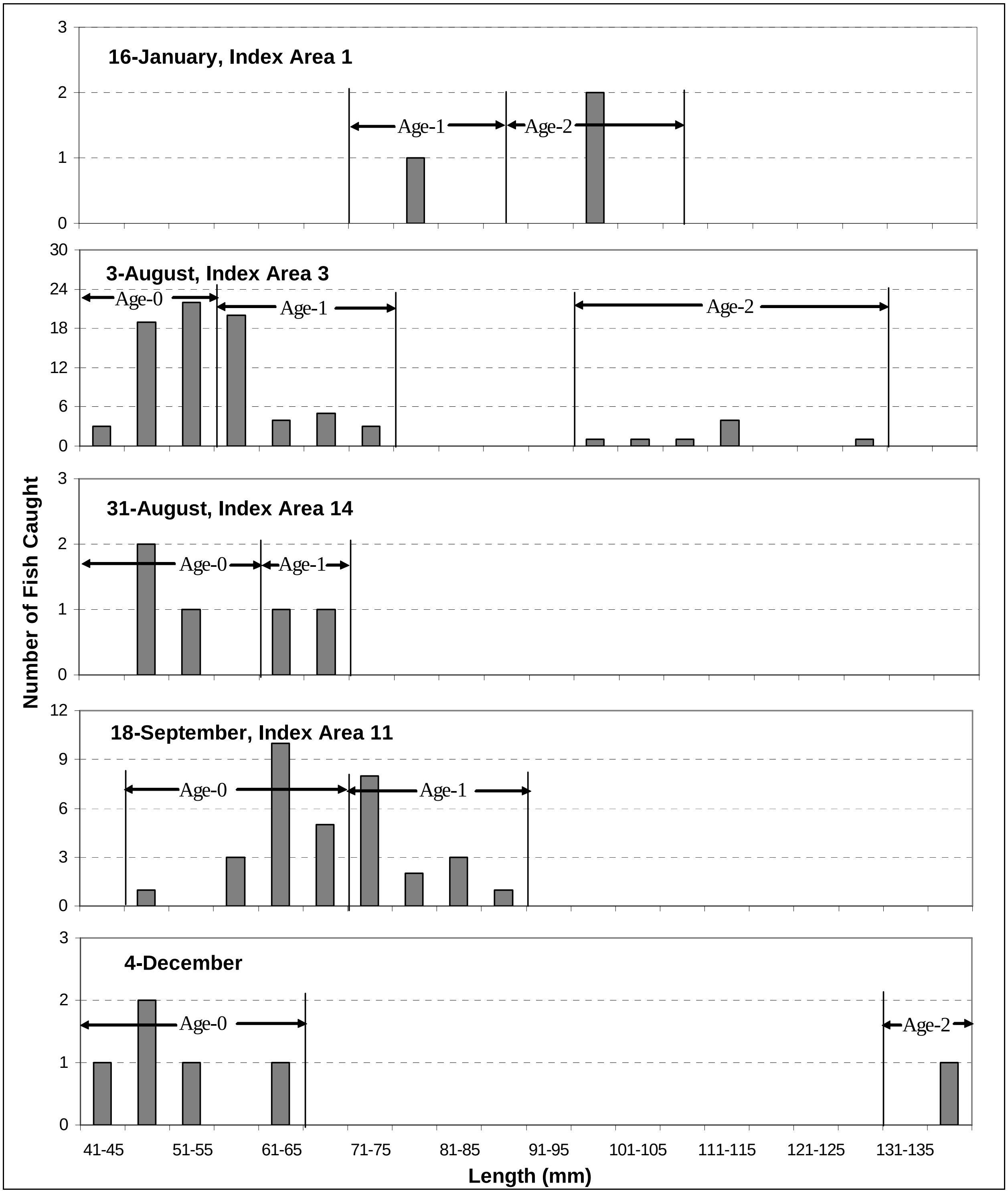
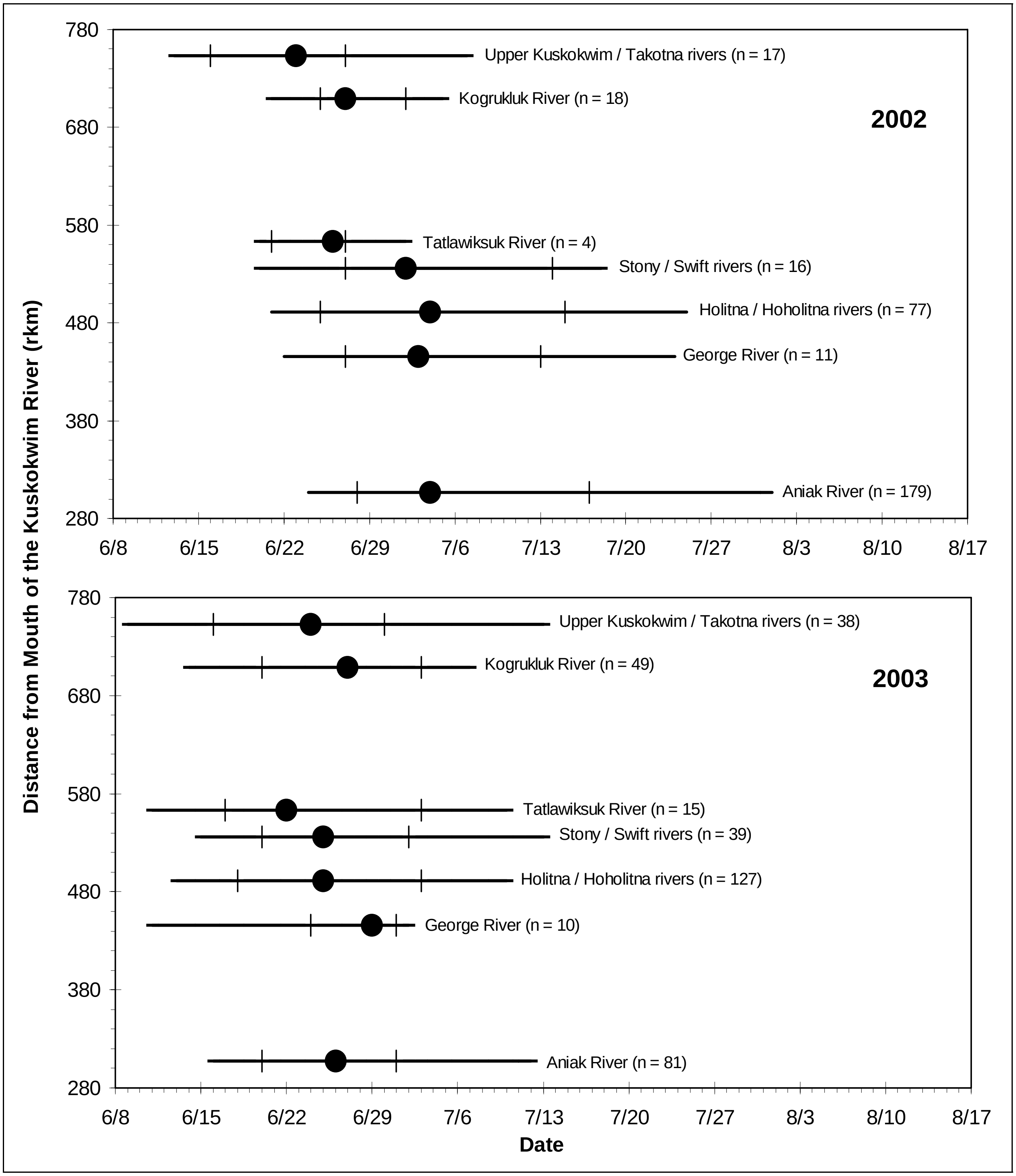
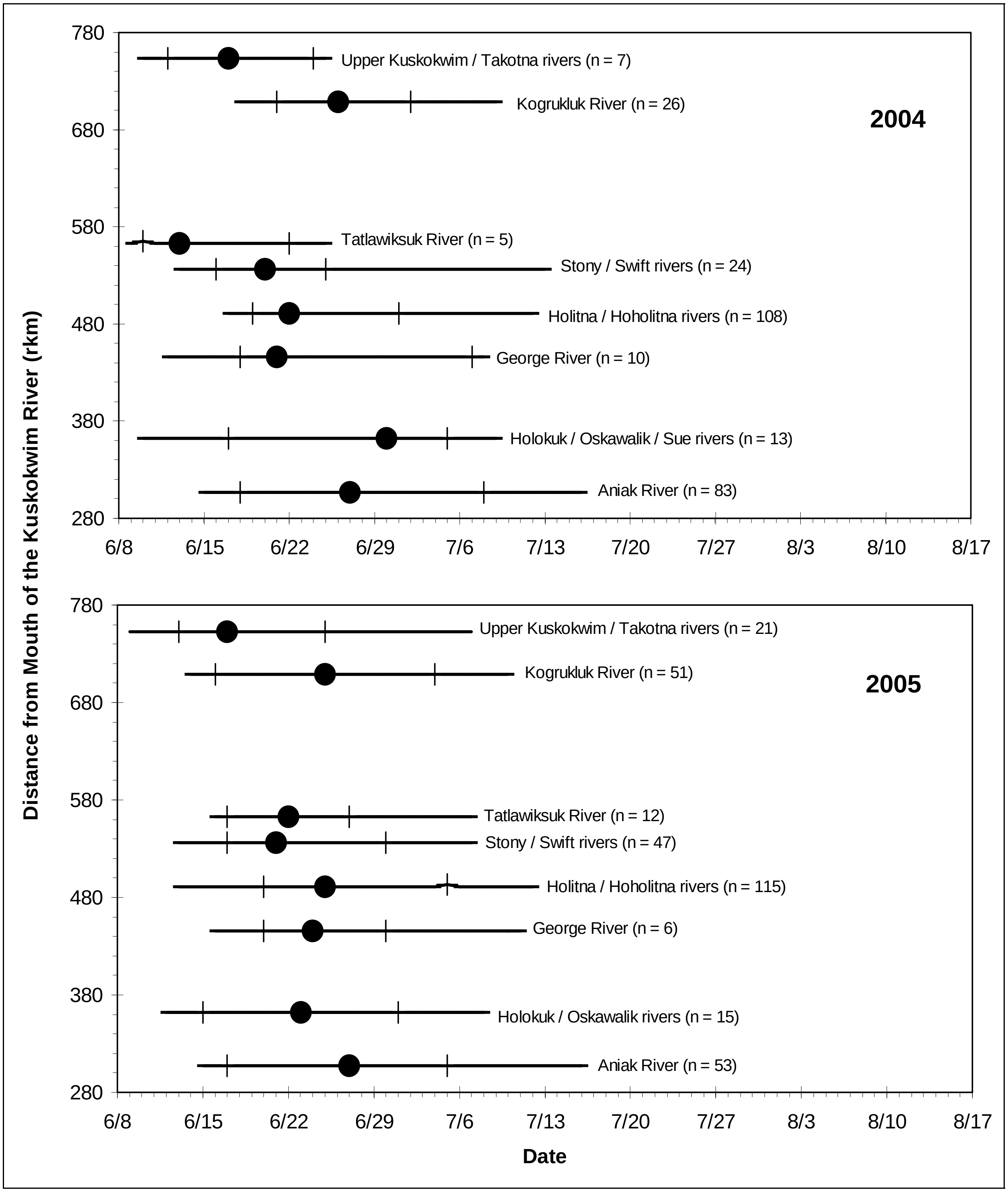


Figure 31.–Lengths of juvenile coho salmon caught using minnow traps in Index Areas 1–14 of the Takotna River drainage, 2005, with speculation of represented age class.



Note: Data for this analysis were collected as part of Inriver Abundance of Chinook Salmon in the Kuskokwim River (Stuby 2003 and 2004). Horizontal lines represent the central 80%, cross-bars represent the central 50%, and circles represent the median passage date for each stock. Distances are from marine waters.

Figure 32.–Dates when individual Chinook salmon stocks pass through the Kalskag tagging sites (rkm 271) based on radiotelemetry, 2002–2003.



Note: Data for this analysis were collected as part of *Inriver Abundance of Chinook Salmon in the Kuskokwim River* (Stuby 2005 and *In prep*). Horizontal lines represent the central 80%, cross-bars represent the central 50%, and circles represent the median passage date for each stock. Distances are from marine waters.

Figure 33.–Dates when individual Chinook salmon stocks pass through the Kalskag tagging sites (rkm 271) based on radiotelemetry, 2004–2005.

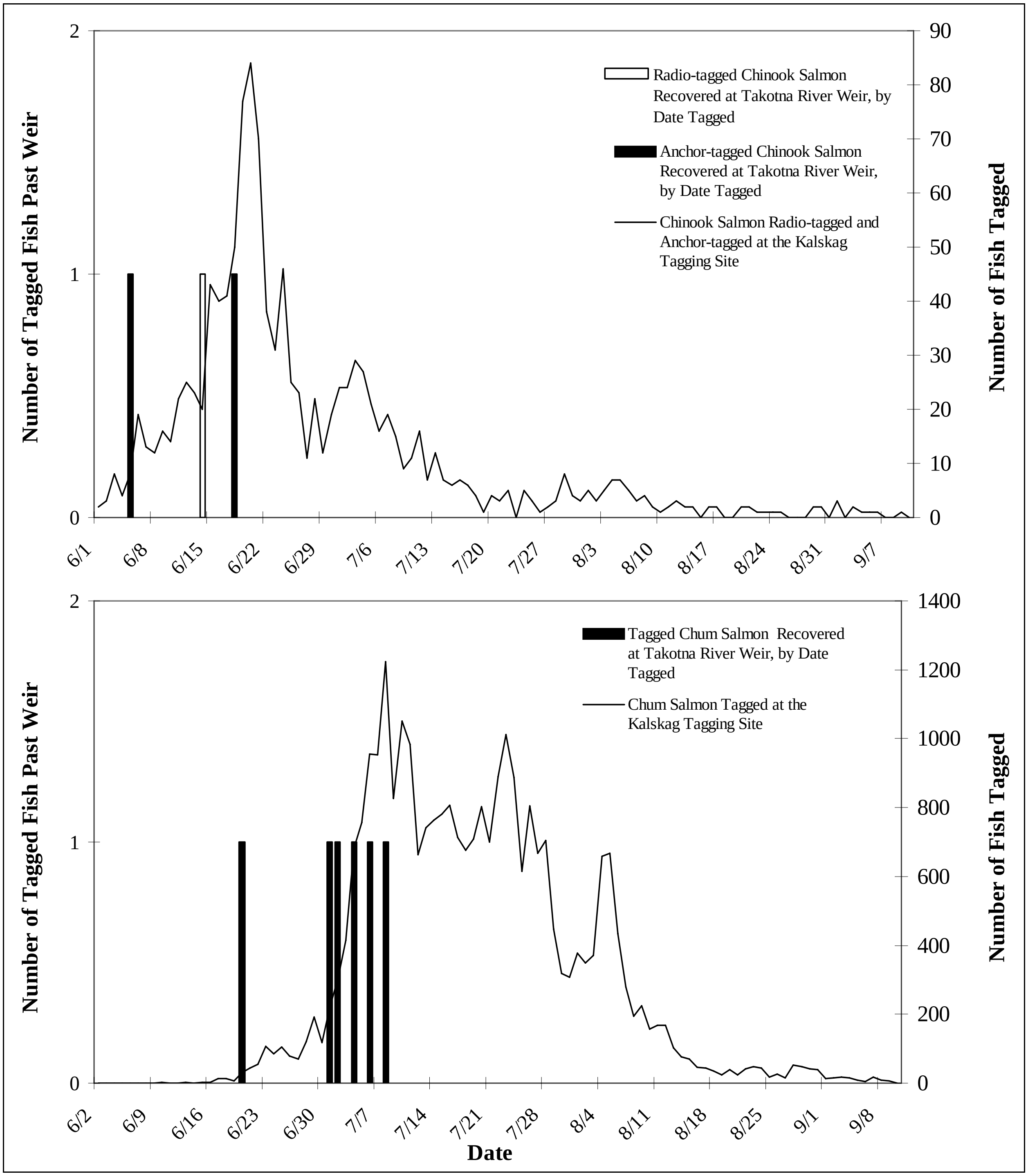


Figure 34.–Chinook and chum salmon captured at the lower Kalskag tagging site, by date, compared to Chinook and chum salmon recovered at the Takotna River weir, by date tagged, 2005.

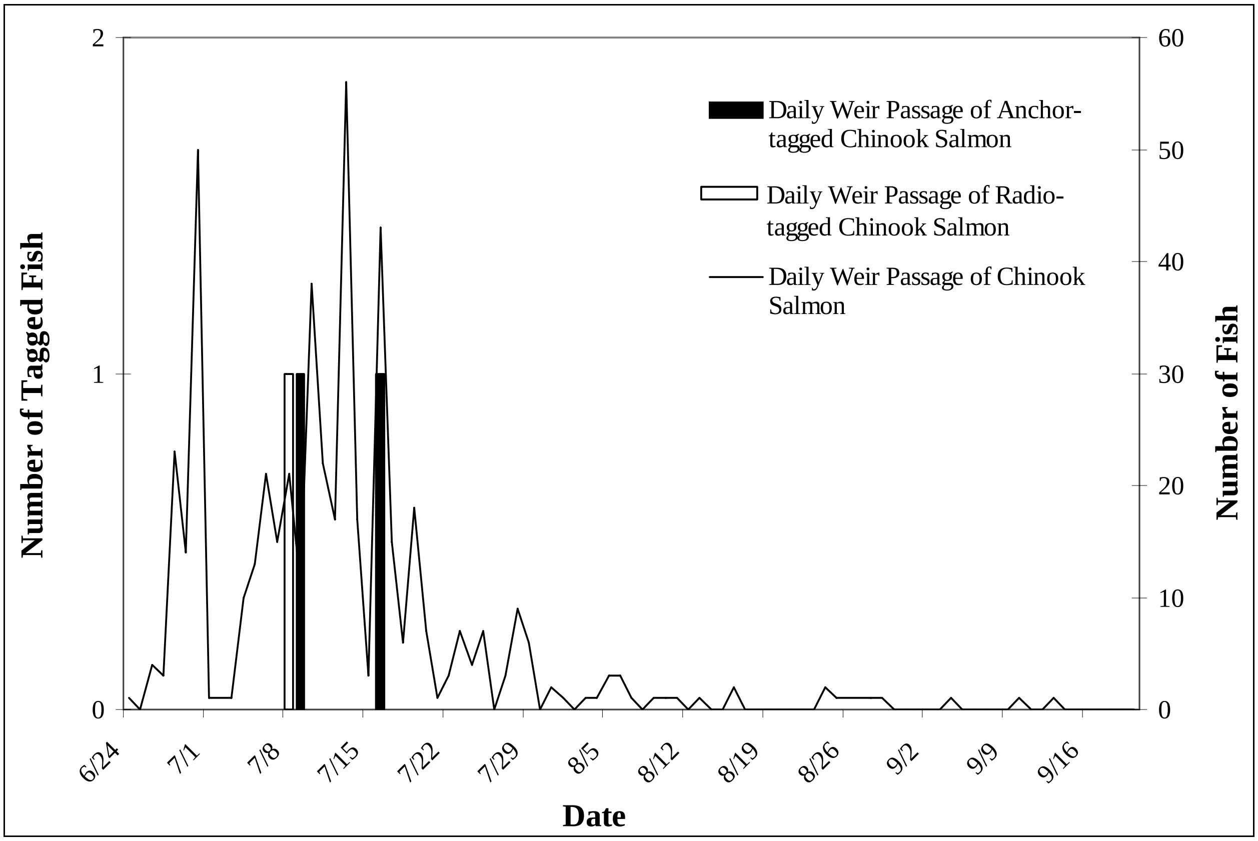
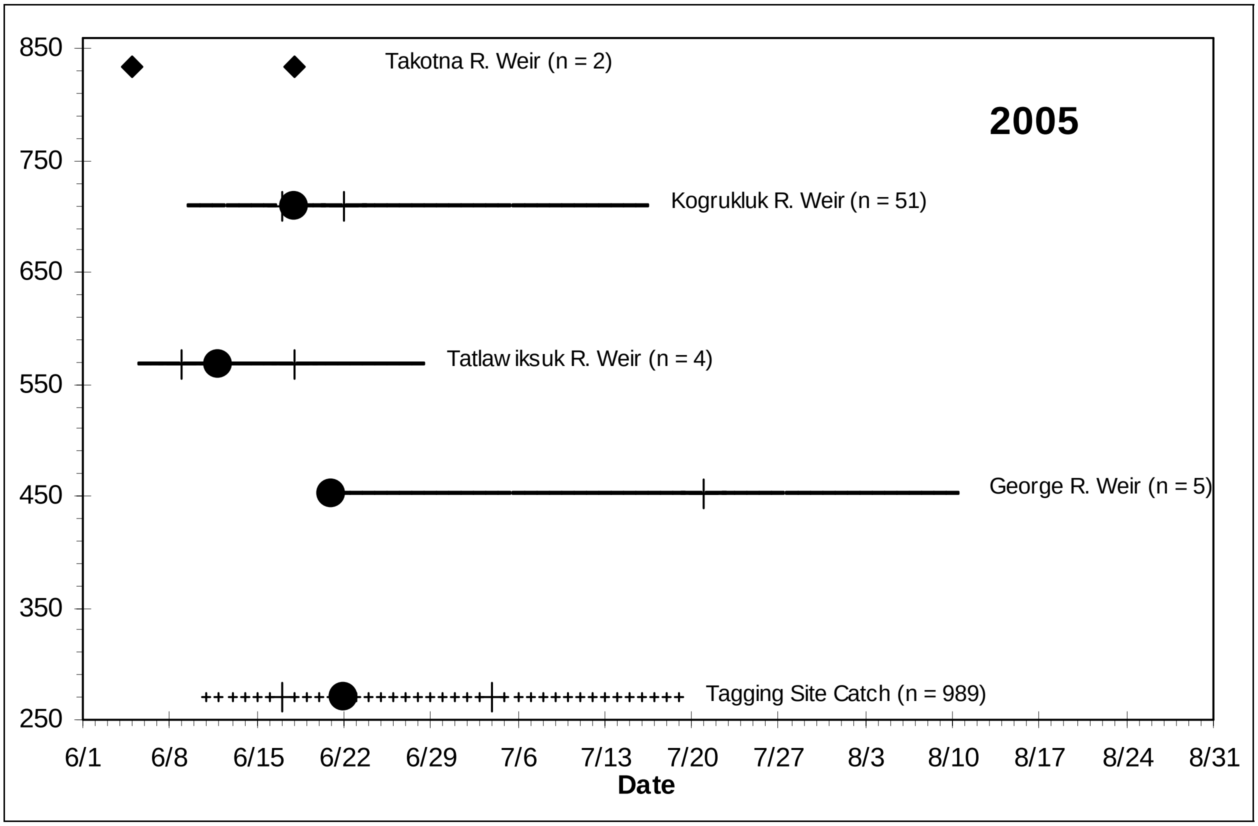


Figure 35.–Daily passage of tagged Chinook salmon compared to overall daily Chinook salmon passage at the Takotna River weir in 2005.



Source: Pawluk et al. *In prep* b.

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

Figure 36.–Dates when individual Chinook salmon stocks passed through the Kalskag tagging sites (rkm 271) based on a tagging study, 2005.

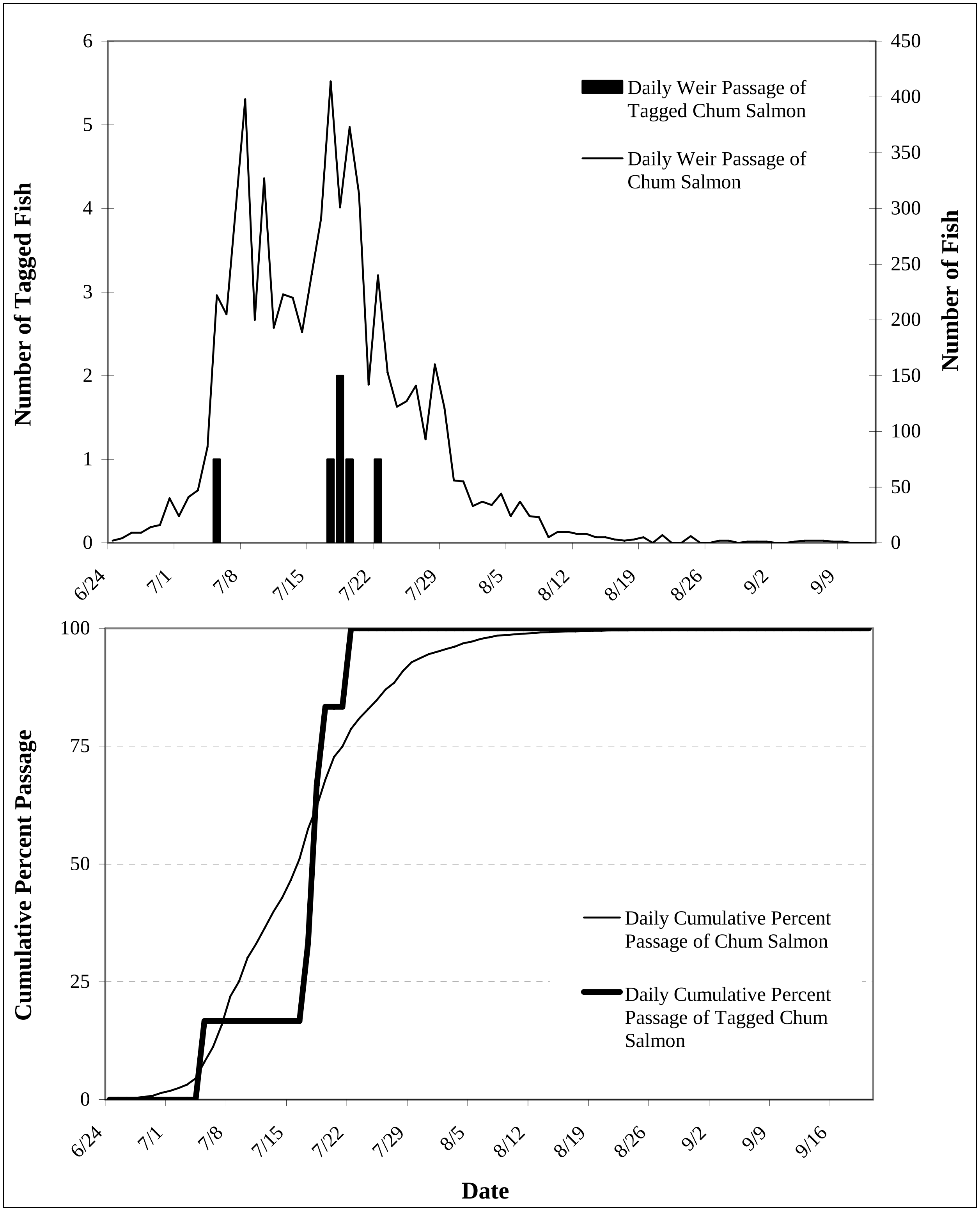
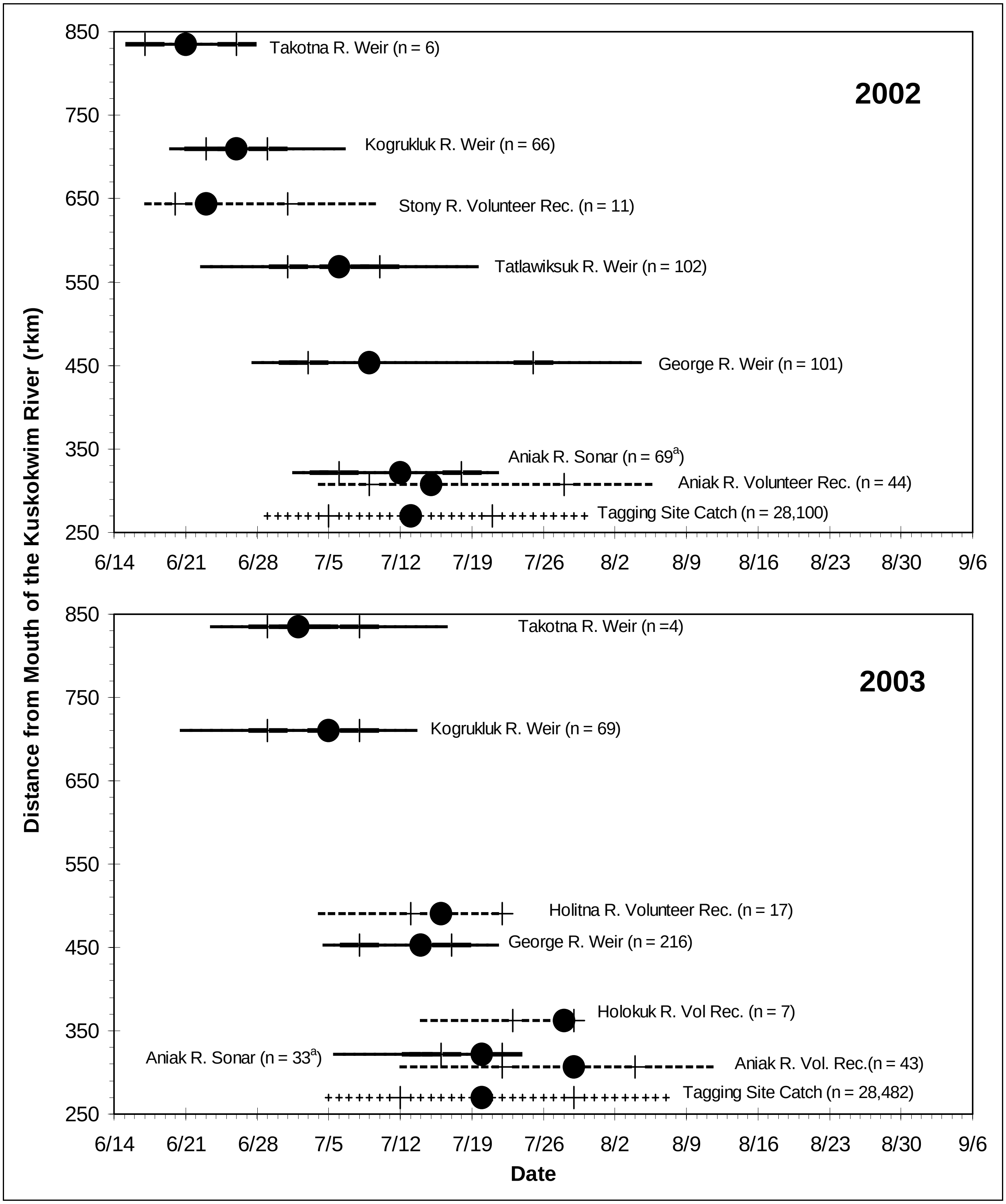


Figure 37.–Daily and cumulative percent passage of overall chum salmon passage compared to tagged chum salmon passage at the Takotna River weir in 2005.

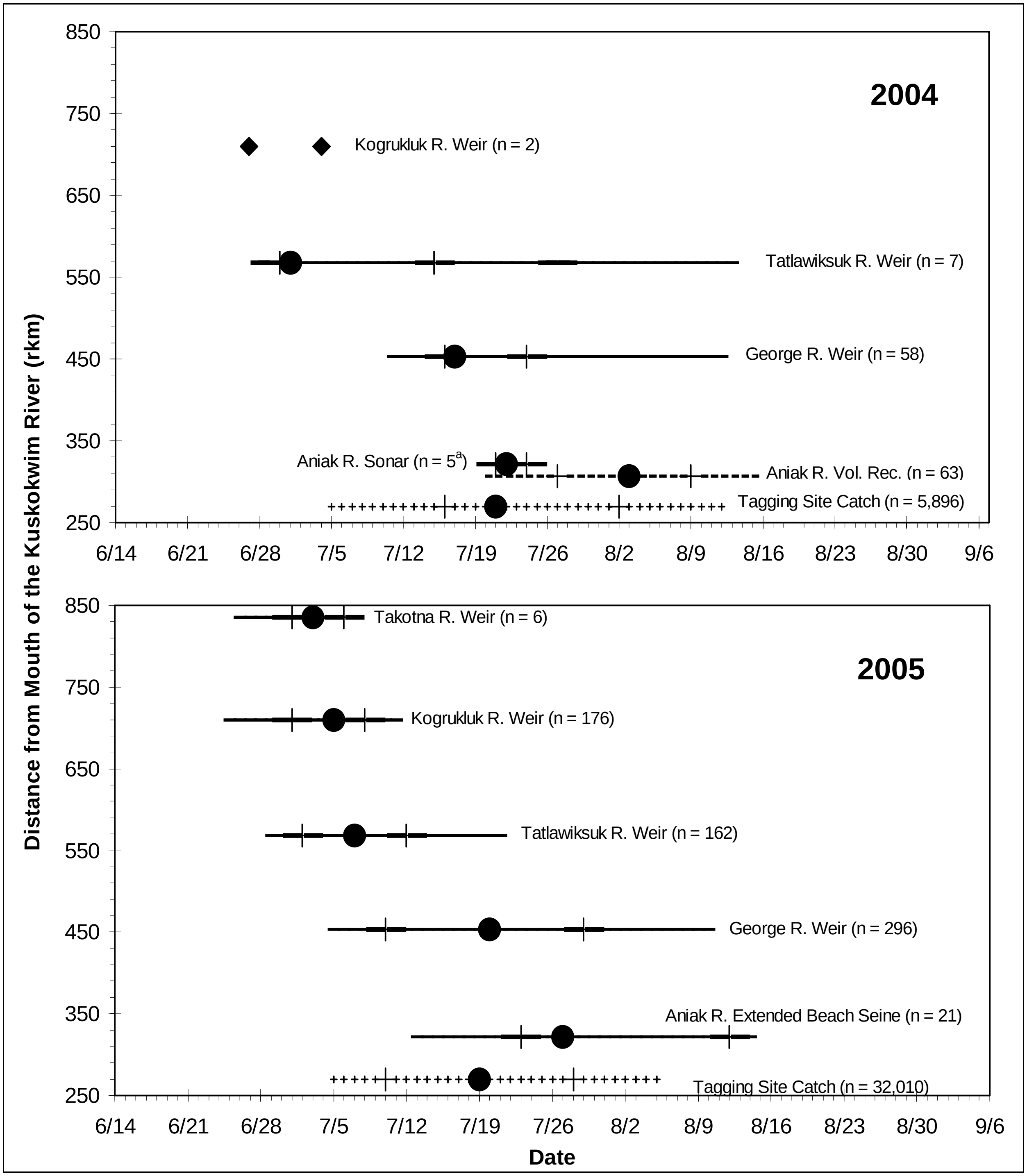


Source: Pawluk et al. *In prep* b.

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

[a] Aniak River sonar is biased early. Aniak River volunteer recovery probably more truly represents run timing.

Figure 38.–Dates when individual chum salmon stocks passed through the Kalskag tagging sites (rkm 271) based on a tagging study, 2002–2003.



Source: Pawluk et al. *In prep* b.

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

[a] Aniak River sonar is biased early. Aniak River volunteer recovery probably more truly represents run timing.

Figure 39.–Dates when individual chum salmon stocks passed through the Kalskag tagging sites (rkm 271) based on a tagging study, 2004–2005.

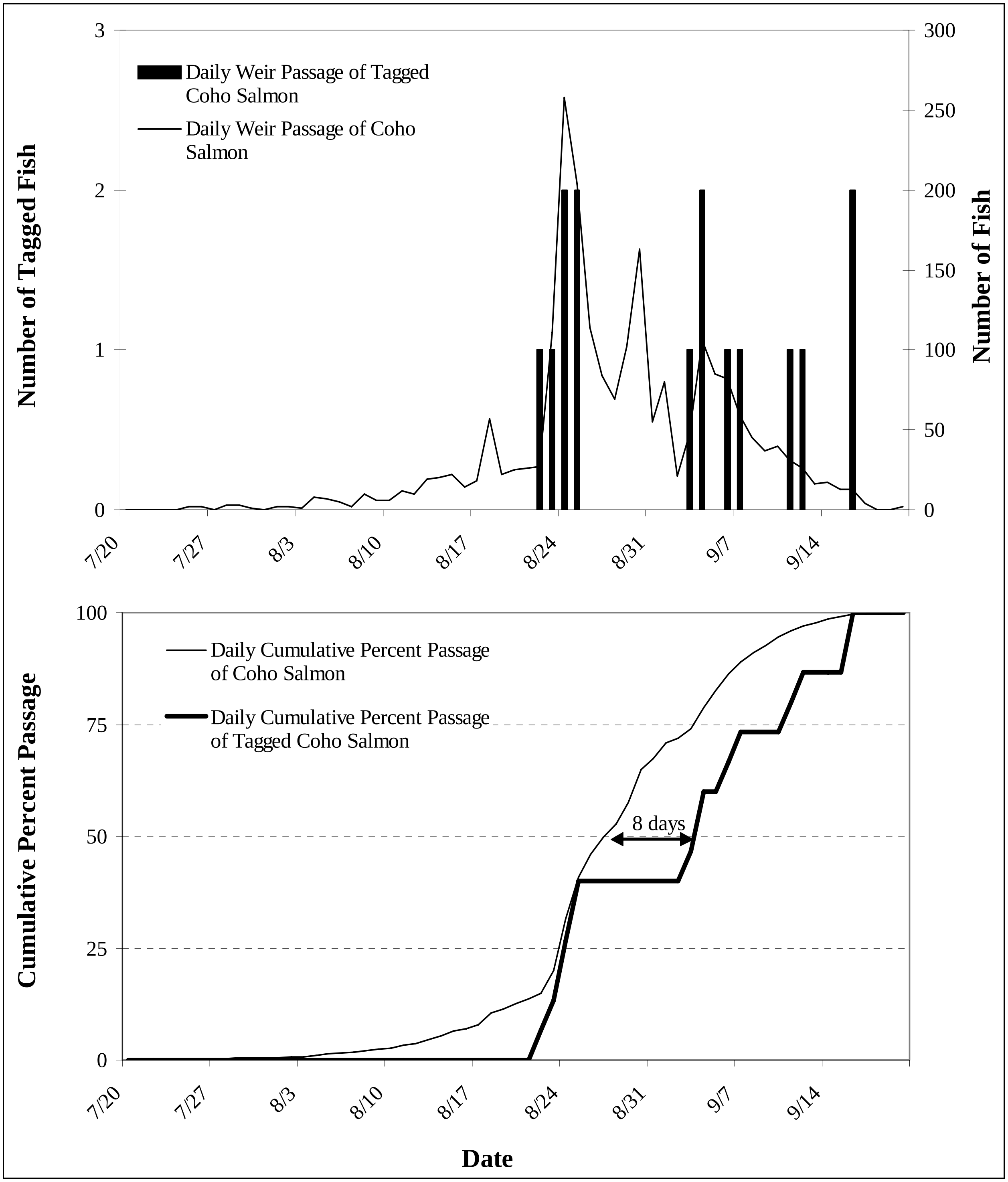
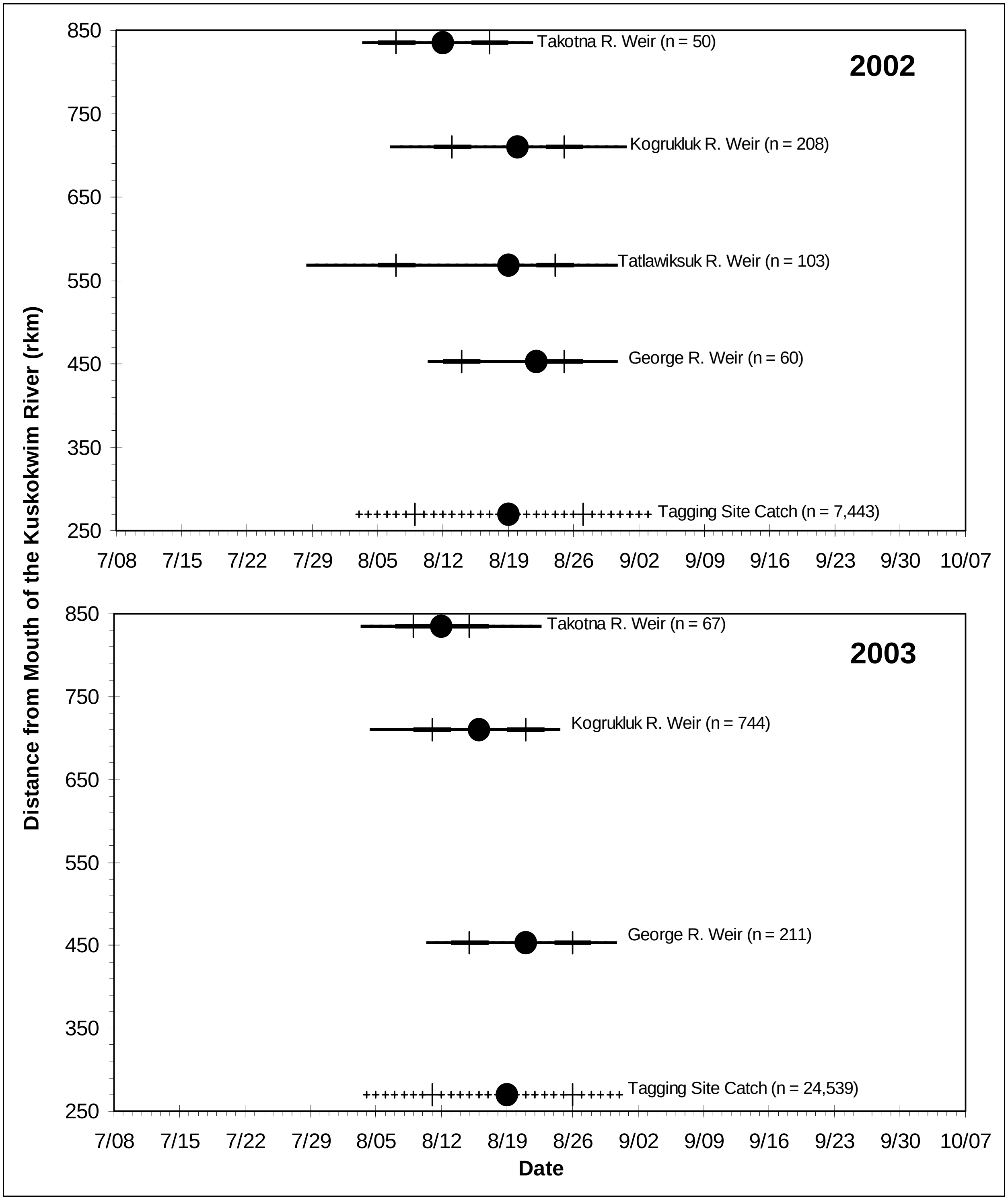


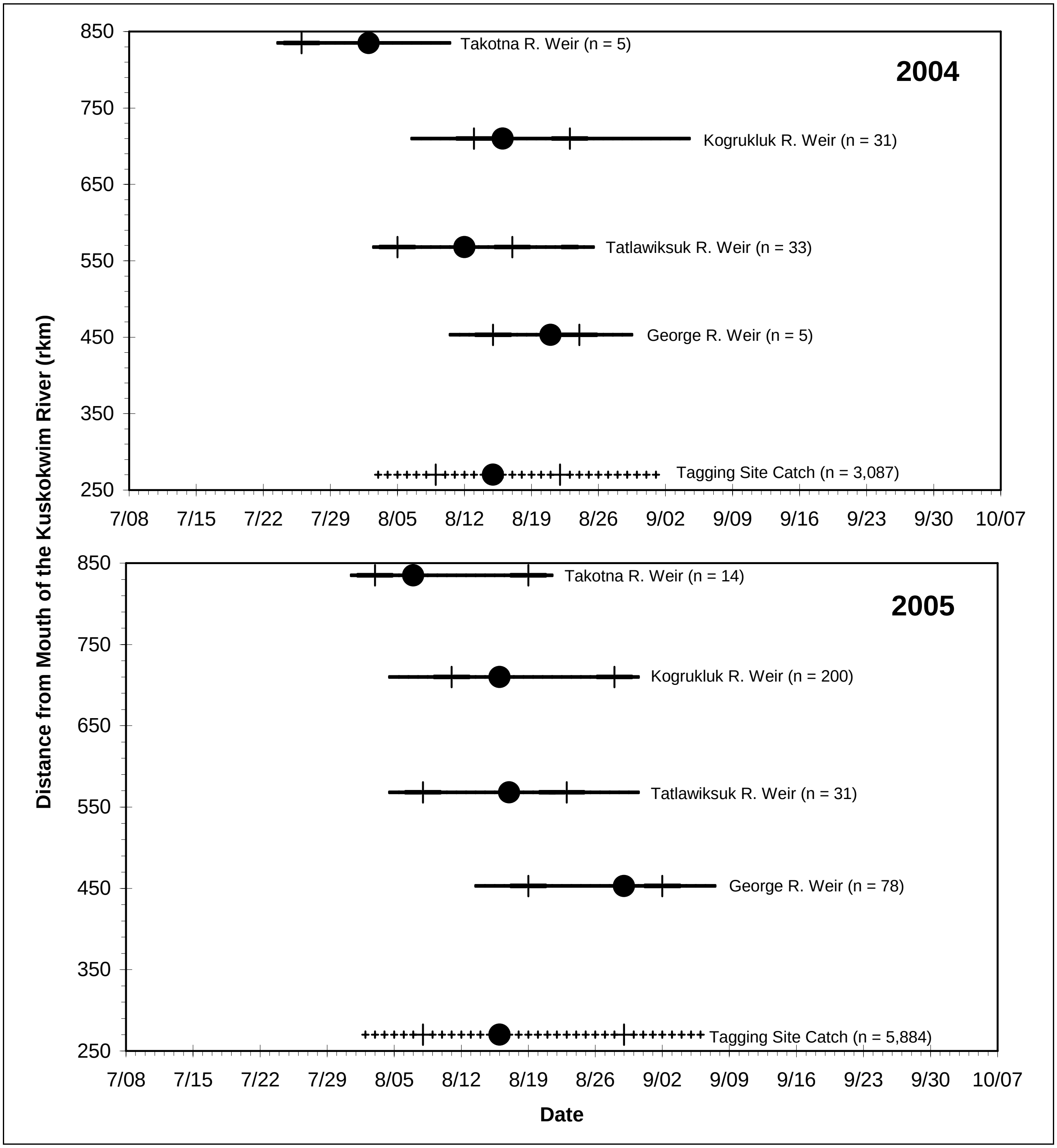
Figure 40.–Daily and cumulative percent passage of overall coho salmon passage compared to tagged coho salmon passage at the Takotna River weir in 2005.



*Source***:** Pawluk et al. *In prep* b.

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

Figure 41.–Dates when individual coho salmon stocks passed through the Kalskag tagging sites (rkm 271) based on a tagging study, 2002–2003.



Source: Pawluk et al. *In prep* b.

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

Figure 42.–Dates when individual coho salmon stocks passed through the Kalskag tagging sites (rkm 271) based on a tagging study, 2004–2005.

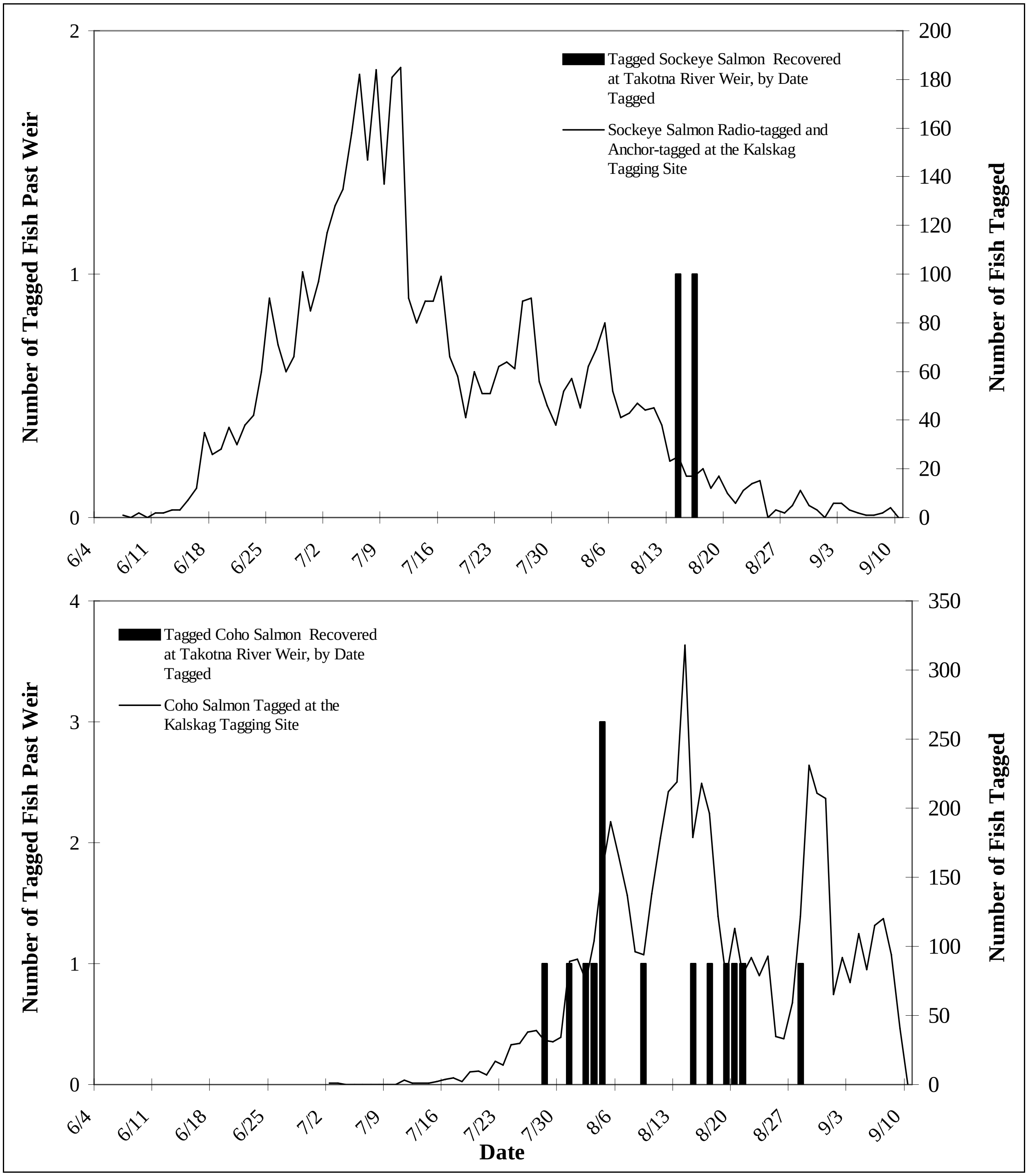
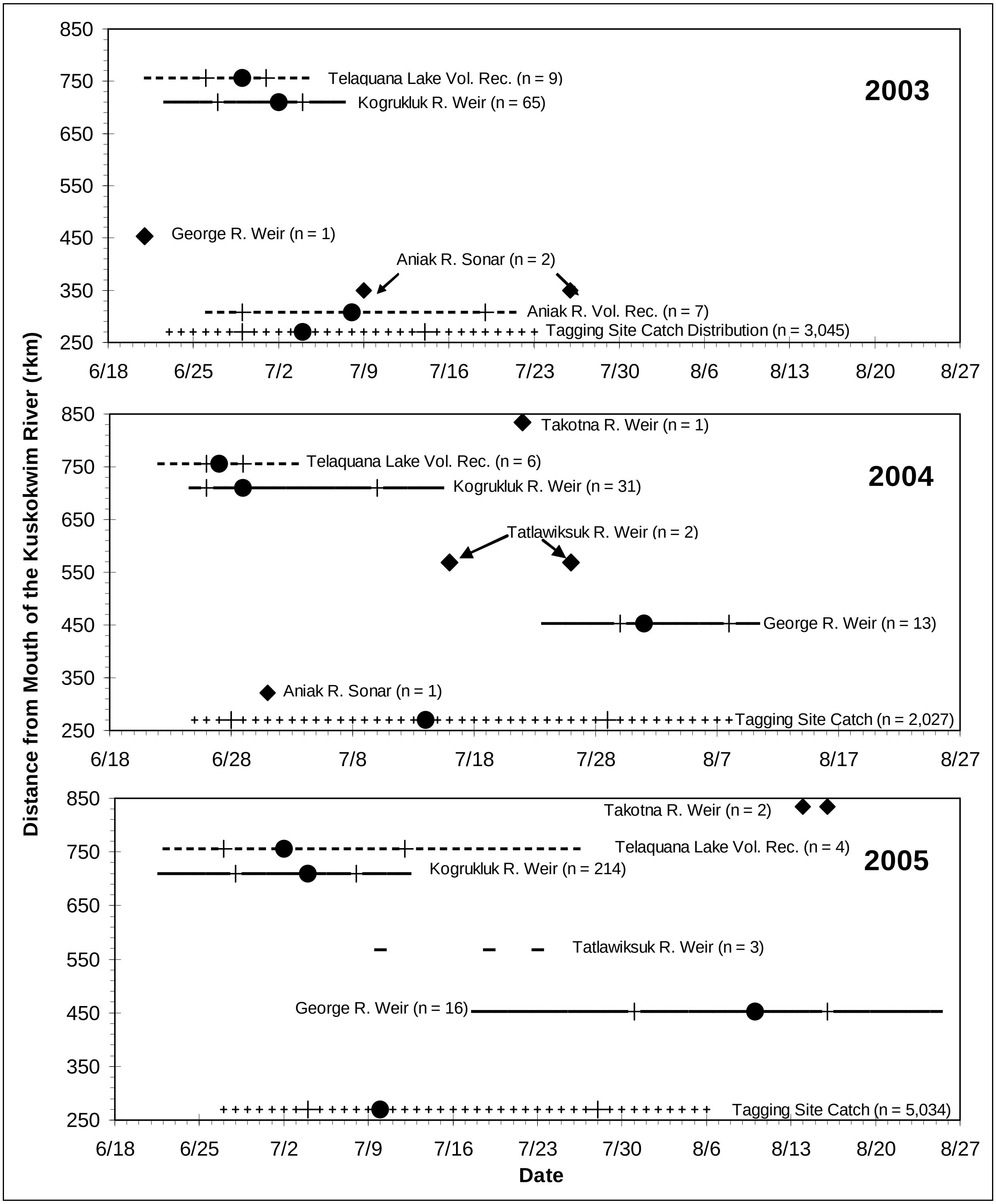


Figure 43.–Sockeye and coho salmon captured at the Kalskag tagging site, by date, compared to Sockeye and coho salmon recovered at the Takotna River weir, by date tagged, 2005.



*Source***:** Pawluk et al. *In prep* b.

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

Figure 44.–Dates when individual sockeye salmon stocks passed through the Kalskag tagging sites (rkm 271) based on a tagging study, 2003–2005.

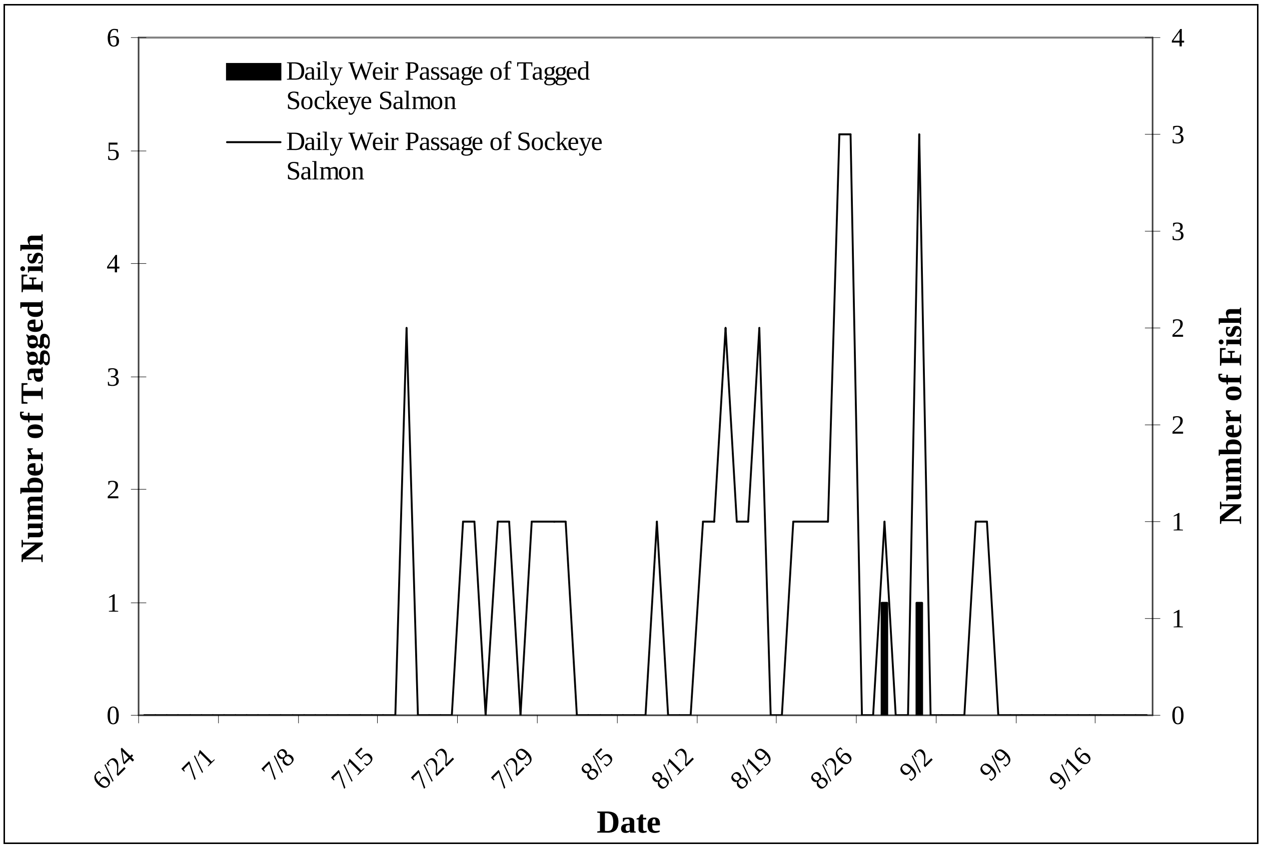


Figure 45.–Daily overall sockeye salmon passage compared to tagged sockeye salmon passage at the Takotna River weir in 2005.

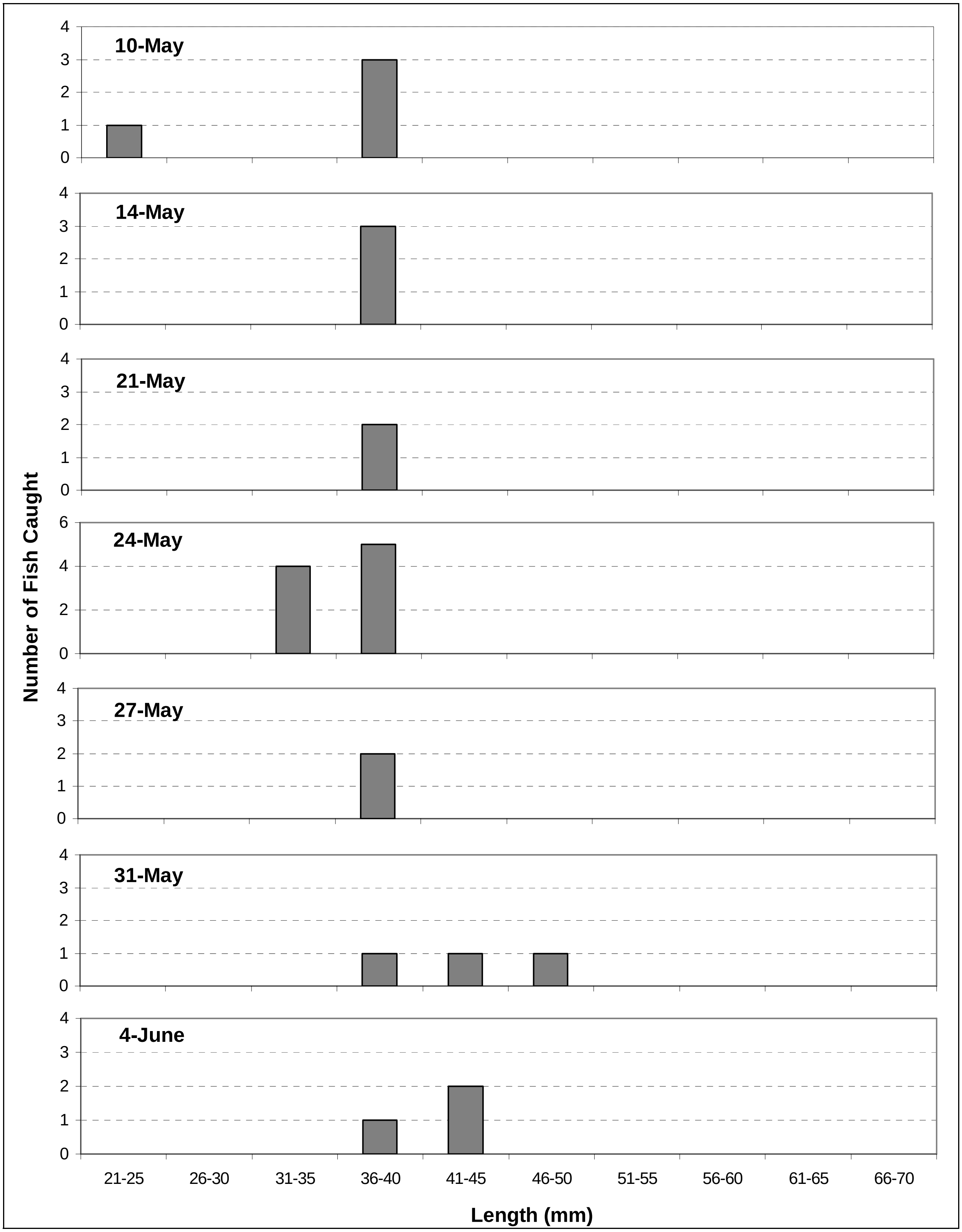


Figure 46.–Lengths of juvenile chum salmon caught in Index Areas 1–14 of the Takotna River drainage, 10 May–4 June 2005.

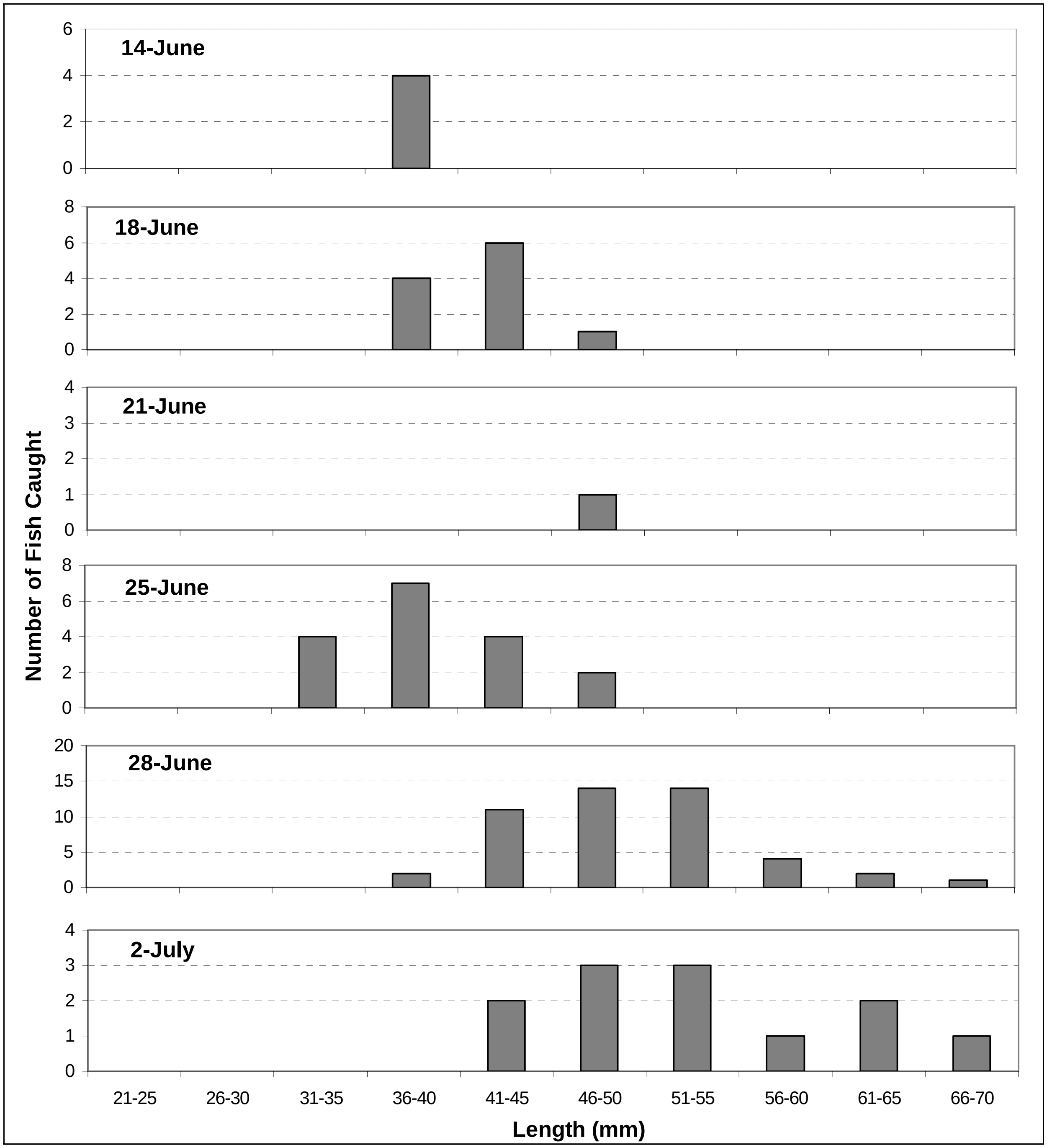


Figure 47.–Lengths of juvenile chum salmon caught in Index Areas 1–14 of the Takotna River drainage, 14 June–2 July 2005.

APPENDIX A. HISTORICAL SALMON PASSAGE AT THE TAKOTNA RIVER WEIR

Appendix A1.–Historical daily and daily cumulative Chinook salmon passage at the Takotna River weir.

	Daily Passage									Cumulative Passage								
Date	**1995**	**1996**	**1997**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**1995**	**1996**	**1997**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
6/10[a]									0									
6/11[a]									0									
6/12[a]									0									
6/13[a]									0									
6/14[a]									0									
6/15[a]									1									
6/16[a]									1									
6/17[a]									2									
6/18[a]									0									
6/19[a]									0									
6/20[a]									1									
6/21[a]			0						0									
6/22[a]			6						1									
6/23[a]			0		0	0		1	1									
6/24	[b]	0	12	0	1	1	[b]	1	1		0	12	0	1	1		1	1
6/25	[b]	0	30	2	3	0	[b]	2	0		0	42	2	4	1		3	1
6/26	[b]	9	24	2	1	0	[b]	3	4		9	66	4	5	1		6	5
6/27	[b]	17	9	1	4	2	[b]	7	3		26	75	5	9	3		13	8
6/28	[b]	8	33	0	1	4	[b]	16	23		34	108	5	10	7		29	31
6/29	[b]	21	36	1	1	3	[b]	4	14		55	144	6	11	10		33	45
6/30	[b]	18	57	1	13	1	[b]	16	50		73	201	7	24	11		49	95
7/01	[b]	15	0	0	17	5	[b]	2	1		88	201	7	41	16		51	96
7/02	[b]	12	30	15	4	0	10	1	1		100	231	22	45	16	10	52	97
7/03	[b]	12	72	16	23	1	5	4	1		112	303	38	68	17	15	56	98
7/04	[b]	73	66	3	10	2	[b]	23	10		185	369	41	78	19	15	79	108
7/05	[b]	39	54	14	1	3	6	6	13		224	423	55	79	22	21	85	121
7/06	[b]	10	54	7	3	11	6	17	21		234	477	62	82	33	27	102	142
7/07	4	37	33	12	15	17	6	6	15	4	271	510	74	97	50	33	108	157
7/08	7	24	54	37	110	32	10	19	21	11	295	564	111	207	82	43	127	178
7/09	2	3	69	9	17	7	37	147	11	13	298	633	120	224	89	80	274	189
7/10	8	4	51	3	69	2	23	16	38	21	302	684	123	293	91	103	290	227
7/11	41	5	69	8	9	93	10	15	22	62	307	753	131	302	184	113	305	249
7/12	8	5	48	22	30	51	16	14	17	70	312	801	153	332	235	129	319	266
7/13	12	7	24	1	45	2	24	3	56	82	319	825	154	377	237	153	322	322
7/14	17	7	66	3	29	2	5	16	17	99	326	891	157	406	239	158	338	339
7/15	9	9	27	4	41	2 [c]	2	12	3	108	335	918	161	447	241	160	350	342

-continued-

Appendix A1.–Page 2 of 3.

	Daily Passage									Cumulative Passage								
Date	**1995**	**1996**	**1997**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**1995**	**1996**	**1997**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
7/16	6	0	12	4	28	0	5	9	43	114	335	930	165	475	241	165	359	385
7/17	0	20	36	2	17	3	9	4	15	114	355	966	167	492	244	174	363	400
7/18	12	11	48	6	14	5	22	9	6	126	366	1,014	173	506	249	196	372	406
7/19	12	9	12	4	31	4	26	1	18	138	375	1,026	177	537	253	222	373	424
7/20	6	8	15	8	26	9	26	3	7	144	383	1,041	185	563	262	248	376	431
7/21	0	7	3	7	23	5	8	6	1	144	390	1,044	192	586	267	256	382	432
7/22	9	5	12	39	21	2	15	2	3	153	395	1,056	231	607	269	271	384	435
7/23	0	4	9	2	13	0	6	26	7	153	399	1,065	233	620	269	277	410	442
7/24	0	3	18	5	17	0	11	1	4	153	402	1,083	238	637	269	288	411	446
7/25	0	0	15	17	10	6	7	0	7	153	402	1,098	255	647	275	295	411	453
7/26	0	0 [d]	18	3	11	5	4	9	0	153	402	1,116	258	658	280	299	420	453
7/27	0	0 [d]	12	9	6	2	9	2	3	153	402	1,128	267	664	282	308	422	456
7/28	0	1 [d]	6	5	11	1	6 [e]	3	9	153	403	1,134	272	675	283	314	425	465
7/29	0	0 [d]	15	9	3	8	6 [d]	2	6	153	403	1,149	281	678	291	320	427	471
7/30	3	1 [d]	0	5	2	5	6 [d]	12	0	156	404	1,149	286	680	296	326	439	471
7/31	0	5 [d]	0	2	4	0	5 [d]	0	2	156	409	1,149	288	684	296	331	439	473
8/01	0	2 [d]	3	1	1	2	5 [e]	0	1	156	411	1,152	289	685	298	336	439	474
8/02	0	1 [d]	6	1	3	0	4	1	0	156	412	1,158	290	688	298	340	440	474
8/03	0	0 [d]	3	5	0	0	5	0	1	156	412	1,161	295	688	298	345	440	475
8/04	0	2 [d]	0	8	2	1	5	1	1	156	414	1,161	303	690	299	350	441	476
8/05	0 [d]	1 [d]	[b]	7	1	0	4	6	3	156	415		310	691	299	354	447	479
8/06	0 [d]	0 [d]	[b]	4	4	1	1	2	3	156	415		314	695	300	355	449	482
8/07	0	0 [d]	[b]	1	1	2	2	1	1	156	415		315	696	302	357	450	483
8/08	0 [d]	2 [d]	[b]	7	3	0	5	0	0	156	417		322	699	302	362	450	483
8/09	0 [d]	0 [d]	[b]	7	1	3	2	2	1	156	417		329	700	305	364	452	484
8/10	0	1 [d]	[b]	0	2	2	0	1	1	156	418		329	702	307	364	453	485
8/11	0 [d]	0 [d]	[b]	3	1	0	0	0	1	156	418		332	703	307	364	453	486
8/12	0	0 [d]	[b]	6	2	4	0	0	0	156	418		338	705	311	364	453	486
8/13	0 [d]	1 [d]	[b]	2	1	1	0	2	1	156	418		340	706	312	364	455	487
8/14	0 [d]	1 [d]	[b]	1	1	0	2	0	0	156	419		341	707	312	366	455	487
8/15	0	1 [d]	[b]	0	0	1	0	1	0	156	420		341	707	313	366	456	487
8/16	0 [d]	0 [d]	[b]	0	1	0	0	0	2	156	420		341	708	313	366	456	489
8/17	0 [d]	0 [d]	[b]	0	0	0	1	0	0	156	420		341	708	313	367	456	489
8/18	0 [d]	0 [d]	[b]	2	1	0	2	1	0	156	420		343	709	313	369	457	489
8/19	0 [d]	1 [d]	[b]	0	0	0	1	1	0	156	421		343	709	313	370	458	489
8/20	0 [d]	0 [d]	[b]	0	1 [e]	0	1	1	0	156	421		343	710	313	371	459	489

-continued-

Appendix A1.–Page 3 of 3.

	Daily Passage									Cumulative Passage								
Date	1995	1996	1997	2000	2001	2002	2003	2004	2005	1995	1996	1997	2000	2001	2002	2003	2004	2005
8/21	0	1 [d]	[b]	0	1 [d]	0	1	0	0	156	422		343	711	313	372	459	489
8/22	0 [d]	0 [d]	[b]	0	1 [d]	0	0	0	0	156	422		343	712	313	372	459	489
8/23	0	0 [d]	[b]	0	1	0	2	0	0	156	422		343	713	313	374	459	489
8/24	0 [d]	0 [d]	[b]	0	0	0	0	1	2	156	422		343	713	313	374	460	491
8/25	0	0 [d]	[b]	0	0	1	1	0	1	156	422		343	713	314	375	460	492
8/26	0 [d]	0 [d]	[b]	0	1	0	1	1	1	156	422		343	714	314	376	461	493
8/27	0 [d]	0 [d]	[b]	1	1	0	1	0	1	156	422		344	715	314	377	461	494
8/28	0	0 [d]	[b]	0	1	0	0	0	1	156	422		344	716	314	377	461	495
8/29	0	0 [d]	[b]	0	1	0	0	0	1	156	422		344	717	314	377	461	496
8/30	0	0 [d]	[b]	0	1	0	0	0	0	156	422		344	718	314	377	461	496
8/31	0	0 [d]	[b]	0	1	0	0	0	0	156	422		344	719	314	377	461	496
9/01	0	0 [d]	[b]	0	0	0	1	0	0	156	422		344	719	314	378	461	496
9/02	[b]	0 [d]	[b]	0	0	0	0	0	0	156	422		344	719	314	378	461	496
9/03	[b]	0 [d]	[b]	0	1	0	0	0	0		422		344	720	314	378	461	496
9/04	[b]	0 [d]	[b]	0	1	0	0	0	1		422		344	721	314	378	461	497
9/05	[b]	0 [d]	[b]	0	0	0	0	0	0		422		344	721	314	378	461	497
9/06	[b]	0 [d]	[b]	0	0	0	0	0	0		422		344	721	314	378	461	497
9/07	[b]	0 [d]	[b]	0	0	0 [c]	0	0	0		422		344	721	314	378	461	497
9/08	[b]	0 [d]	[b]	0	0	0	0	0	0		422		344	721	314	378	461	497
9/09	[b]	0 [d]	[b]	1	0	0	0	0	0		422		345	721	314	378	461	497
9/10	[b]	0 [d]	[b]	0	0	0	0	0	1		422		345	721	314	378	461	498
9/11	[b]	0 [d]	[b]	0	0	0	0	0	0		422		345	721	314	378	461	498
9/12	[b]	0 [d]	[b]	0	0	0	0	0	0		422		345	721	314	378	461	498
9/13	[b]	0 [d]	[b]	0	0	1	0	0	1		422		345	721	315	378	461	499
9/14	[b]	0 [d]	[b]	0	0	0	0	0	0		422		345	721	315	378	461	499
9/15	[b]	0 [d]	[b]	0	0 [d]	1	0	0	0		422		345	721	316	378	461	499
9/16	[b]	0 [d]	[b]	0	0 [d]	0	0	0	0		422		345	721	316	378	461	499
9/17	[b]	0 [d]	[b]	0	0 [d]	0	0	0	0		422		345	721	316	378	461	499
9/18	[b]	0 [d]	[b]	0	0 [d]	0	0	0	0		422		345	721	316	378	461	499
9/19	[b]	0 [d]	[b]	0	0 [d]	0	0	0 [d]	0		422		345	721	316	378	461	499
9/20	[b]	0 [d]	[b]	0	0 [d]	0	0	0 [d]	0		422		345	721	316	378	461	499

Note: The tower was operated for only 8 days in 1998; hence, that year is excluded from the table.

[a] Date outside of target operational period (not included in accumulative totals).

[b] The weir or tower was not operational; daily passage was not estimated.

[c] partial day count; passage was not estimated.

[d] The weir or tower was not operational; daily passage was estimated.

[e] Partial day count; passage was estimated.

[f] Daily passage was estimated due to the occurrence of a hole in the weir.

Appendix A2.–Historical daily and daily cumulative chum salmon passage at the Takotna River weir.

	Daily Passage									Cumulative Passage								
Date	1995	1996	1997	2000	2001	2002	2003	2004	2005	1995	1996	1997	2000	2001	2002	2003	2004	2005
6/10[a]									0									
6/11[a]									0									
6/12[a]									0									
6/13[a]									0									
6/14[a]									0									
6/15[a]									0									
6/16[a]									1									
6/17[a]									2									
6/18[a]									0									
6/19[a]									0									
6/20[a]									0									
6/21[a]									1									
6/22[a]									1									
6/23[a]					6	9		3	0									
6/24	[b]	0	12	1	3	29	0 [c]	4	2		0	12	1	3	29	0	4	2
6/25	[b]	0	30	24	9	55	0 [c]	8	4		0	42	25	12	84	0	12	6
6/26	[b]	9	24	23	10	55	1 [c]	31	9		9	66	48	22	139	1	43	15
6/27	[b]	17	9	11	12	111	5 [c]	28	9		26	75	59	34	250	6	71	24
6/28	[b]	8	33	9	4	116	7 [c]	32	14		34	108	68	38	366	13	103	38
6/29	[b]	21	36	6	19	168	4 [c]	29	16		55	144	74	57	534	17	132	54
6/30	[b]	18	57	6	20	147	12 [c]	34	40		73	201	80	77	681	29	166	94
7/01	[b]	15	0	10	42	180	10 [c]	54	24		88	201	90	119	861	39	220	118
7/02	[b]	12	30	18	24	72	40 [d]	41	41		100	231	108	143	933	79	261	159
7/03	[b]	12	72	17	47	145	57 [d]	59	47		112	303	125	190	1,078	136	320	206
7/04	[b]	73	66	39	40	94	54 [c]	58	86		185	369	164	230	1,172	190	378	292
7/05	[b]	39	54	12	21	250	111	48	222		224	423	176	251	1,422	301	426	514
7/06	[b]	10	54	45	60	204	120	108	205		234	477	221	311	1,626	421	534	719
7/07	4	37	33	44	106	251	126	66	301	4	271	510	265	417	1,877	547	600	1,020
7/08	7	24	54	101	188	124	137	65	398	11	295	564	366	605	2,001	684	665	1,418
7/09	2	3	69	49	78	110	142	92	200	13	298	633	415	683	2,111	826	757	1,618
7/10	8	4	51	27	204	205	88	87	327	21	302	684	442	887	2,316	914	844	1,945
7/11	41	5	69	58	198	259	47	74	193	62	307	753	500	1,085	2,575	961	918	2,138
7/12	8	5	48	29	372	266	77	73	223	70	312	801	529	1,457	2,841	1,038	991	2,361
7/13	12	7	24	49	275	80	62	23	220	82	319	825	578	1,732	2,921	1,100	1,014	2,581
7/14	17	7	66	50	309	103	140	33	189	99	326	891	628	2,041	3,024	1,240	1,047	2,770
7/15	9	9	27	35	265	97 [d]	129	22	241	108	335	918	663	2,306	3,121	1,369	1,069	3,011

-continued-

Appendix A2.–Page 2 of 3.

Date	Daily Passage 1995	1996	1997	2000	2001	2002	2003	2004	2005	Cumulative Passage 1995	1996	1997	2000	2001	2002	2003	2004	2005
7/16	6	0	12	33	257	88	155	31	291	114	335	930	696	2,563	3,209	1,524	1,100	3,302
7/17	0	20	36	51	206	117	150	57	414	114	355	966	747	2,769	3,326	1,674	1,157	3,716
7/18	12	11	48	34	264	73	172	92	301	126	366	1,014	781	3,033	3,399	1,846	1,249	4,017
7/19	12	9	12	59	352	161	187	29	373	138	375	1,026	840	3,385	3,560	2,033	1,278	4,390
7/20	6	8	15	50	301	109	231	36	313	144	383	1,041	890	3,686	3,669	2,264	1,314	4,703
7/21	0	7	3	43	212	72	155	15	142	144	390	1,044	933	3,898	3,741	2,419	1,329	4,845
7/22	9	5	12	53	215	95	168	25	240	153	395	1,056	986	4,113	3,836	2,587	1,354	5,085
7/23	0	4	9	33	165	79	87	58	153	153	399	1,065	1,019	4,278	3,915	2,674	1,412	5,238
7/24	0	3	18	23	168	67	69	33	122	153	402	1,083	1,042	4,446	3,982	2,743	1,445	5,360
7/25	0	0	15	25	145	62	63	15	127	153	402	1,098	1,067	4,591	4,044	2,806	1,460	5,487
7/26	0	0 [c]	18	20	93	53	53	24	141	153	402	1,116	1,087	4,684	4,097	2,859	1,484	5,628
7/27	0	0 [c]	12	14	117	23	53	13	93	153	402	1,128	1,101	4,801	4,120	2,912	1,497	5,721
7/28	0	1 [c]	6	11	135	49	50 [d]	13	150	153	403	1,134	1,112	4,936	4,169	2,962	1,510	5,881
7/29	0	0 [c]	15	18	58	39	46 [c]	17	121	153	403	1,149	1,130	4,994	4,208	3,008	1,527	6,002
7/30	3	1 [c]	0	12	64	21	43 [c]	26	56	156	404	1,149	1,142	5,058	4,229	3,051	1,553	6,058
7/31	0	5 [c]	0	10	68	15	39 [c]	17	55	156	409	1,149	1,152	5,126	4,244	3,090	1,570	6,113
8/01	0	2 [c]	3	3	38	21	36 [d]	12	33	156	411	1,152	1,155	5,164	4,265	3,126	1,582	6,146
8/02	0	1 [c]	6	12	30	22	29	8	37	156	412	1,158	1,167	5,194	4,287	3,155	1,590	6,183
8/03	0	0 [c]	3	2	34	15	35	3	34	156	412	1,161	1,169	5,228	4,302	3,190	1,593	6,217
8/04	0	2 [c]	0	22	30	17	32	5	44	156	414	1,161	1,191	5,258	4,319	3,222	1,598	6,261
8/05	0 [c]	1 [c]	[b]	5	38	5	44	4	24	156	415		1,196	5,296	4,324	3,266	1,602	6,285
8/06	0 [c]	0 [c]	[b]	11	25	4	28	5	37	156	415		1,207	5,321	4,328	3,294	1,607	6,322
8/07	0	0 [c]	[b]	5	16	13	18	4	24	156	415		1,212	5,337	4,341	3,312	1,611	6,346
8/08	0 [c]	2 [c]	[b]	11	11	3	11	2	23	156	417		1,223	5,348	4,344	3,323	1,613	6,369
8/09	0 [c]	0 [c]	[b]	5	13	5	6	3	5	156	417		1,228	5,361	4,349	3,329	1,616	6,374
8/10	0	1 [c]	[b]	10	8	6	6	1	10	156	418		1,238	5,369	4,355	3,335	1,617	6,384
8/11	0 [c]	0 [c]	[b]	6	8	6	6	2	10	156	418		1,244	5,377	4,361	3,341	1,619	6,394
8/12	0	0 [c]	[b]	6	5	4	4	4	8	156	418		1,250	5,382	4,365	3,345	1,623	6,402
8/13	0 [c]	1 [c]	[b]	2	2	2	10	2	8	156	418		1,252	5,384	4,367	3,355	1,625	6,410
8/14	0 [c]	1 [c]	[b]	0	3	0	7	1	5	156	419		1,252	5,387	4,367	3,362	1,626	6,415
8/15	0	1 [c]	[b]	0	2	0	6	0	5	156	420		1,252	5,389	4,367	3,368	1,626	6,420
8/16	0 [c]	0 [c]	[b]	0	1	3	5	0	3	156	420		1,252	5,390	4,370	3,373	1,626	6,423
8/17	0 [c]	0 [c]	[b]	0	0	1	0	1	2	156	420		1,252	5,390	4,371	3,373	1,627	6,425
8/18	0 [c]	0 [c]	[b]	0	7	0	2	1	3	156	420		1,252	5,397	4,371	3,375	1,628	6,428
8/19	0 [c]	1 [c]	[b]	0	4	0	0	1	5	156	421		1,252	5,401	4,371	3,375	1,629	6,433
8/20	0 [c]	0 [c]	[b]	1	3 [d]	1	4	0	0	156	421		1,253	5,404	4,372	3,379	1,629	6,433
8/21	0	1 [c]	[b]	0	3 [c]	0	2	0	7	156	422		1,253	5,407	4,372	3,381	1,629	6,440

-continued-

Appendix A2.–Page 3 of 3.

	Daily Passage									Cumulative Passage								
Date	**1995**	**1996**	**1997**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**1995**	**1996**	**1997**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
8/22	0 [c]	0 [c]	[b]	0	3 [c]	0	0	0	0	156	422		1,253	5,410	4,372	3,381	1,629	6,440
8/23	0	0 [c]	[b]	0	0	1	5	0	1	156	422		1,253	5,410	4,373	3,386	1,629	6,440
8/24	0 [c]	0 [c]	[b]	0	1	1	0	0	6	156	422		1,253	5,411	4,374	3,386	1,629	6,446
8/25	0	0 [c]	[b]	0	2	2	1	0	0	156	422		1,253	5,413	4,376	3,387	1,629	6,446
8/26	0 [c]	0 [c]	[b]	0	0	0	0	0	0	156	422		1,253	5,413	4,376	3,387	1,629	6,446
8/27	0 [c]	0 [c]	[b]	0	0	0	0	0	2	156	422		1,253	5,413	4,376	3,387	1,629	6,448
8/28	0	0 [c]	[b]	0	1	0	1	0	2	156	422		1,253	5,414	4,376	3,388	1,629	6,450
8/29	0	0 [c]	[b]	1	0	0	0	0	0	156	422		1,254	5,414	4,376	3,388	1,629	6,450
8/30	0	0 [c]	[b]	0	0	0	0	0	1	156	422		1,254	5,414	4,376	3,388	1,629	6,451
8/31	0	0 [c]	[b]	0	0	1	1	0	1	156	422		1,254	5,414	4,377	3,389	1,629	6,452
9/01	0	0 [c]	[b]	0	0	0	0	0	1	156	422		1,254	5,414	4,377	3,389	1,629	6,453
9/02	[b]	0 [c]	[b]	0	0	0	0	0	0		422		1,254	5,414	4,377	3,389	1,629	6,453
9/03	[b]	0 [c]	[b]	0	0	0	0	0	0		422		1,254	5,414	4,377	3,389	1,629	6,453
9/04	[b]	0 [c]	[b]	0	0	0	0	1	1		422		1,254	5,414	4,377	3,389	1,630	6,454
9/05	[b]	0 [c]	[b]	0	0	0	0	0	2		422		1,254	5,414	4,377	3,389	1,630	6,456
9/06	[b]	0 [c]	[b]	0	0	0	1	0	2		422		1,254	5,414	4,377	3,390	1,630	6,458
9/07	[b]	0 [c]	[b]	0	0	0	1 [b]	0	2		422		1,254	5,414	4,377	3,391	1,630	6,460
9/08	[b]	0 [c]	[b]	0	0	0	1	0	1		422		1,254	5,414	4,377	3,392	1,630	6,461
9/09	[b]	0 [c]	[b]	0	0	0	1	0	1		422		1,254	5,414	4,377	3,393	1,630	6,462
9/10	[b]	0 [c]	[b]	0	0	0	0	0	0		422		1,254	5,414	4,377	3,393	1,630	6,462
9/11	[b]	0 [c]	[b]	0	0	0	0	0	0		422		1,254	5,414	4,377	3,393	1,630	6,462
9/12	[b]	0 [c]	[b]	0	0	0	0	0	0		422		1,254	5,414	4,377	3,393	1,630	6,462
9/13	[b]	0 [c]	[b]	0	0	0	0	0	0		422		1,254	5,414	4,377	3,393	1,630	6,462
9/14	[b]	0 [c]	[b]	0	0	0	0	0	2		422		1,254	5,414	4,377	3,393	1,630	6,464
9/15	[b]	0 [c]	[b]	0	0 [b]	0	0	0	2		422		1,254		4,377	3,393	1,630	6,466
9/16	[b]	0 [c]	[b]	0	0 [b]	0	0	0	1		422		1,254		4,377	3,393	1,630	6,467
9/17	[b]	0 [c]	[b]	0	0 [b]	0	0	0	0		422		1,254		4,377	3,393	1,630	6,467
9/18	[b]	0 [c]	[b]	0	0 [b]	0	0	0	0		422		1,254		4,377	3,393	1,630	6,467
9/19	[b]	0 [c]	[b]	0	0 [b]	0	0	0	0 [c]		422		1,254		4,377	3,393	1,630	6,467
9/20	[b]	0 [c]	[b]	0	0 [b]	0	0	0	0 [c]		422		1,254		4,377	3,393	1,630	6,467

Note: The tower was operated for only 8 days in 1998; hence, that year is excluded from the table.
[a] Date outside of target operational period (not included in accumulative totals).
[b] The weir or tower was not operational; daily passage was not estimated.
[c] The weir or tower was not operational; daily passage was estimated.
[d] Partial day count; passage was estimated.

Appendix A3.–Historical daily and daily cumulative coho salmon passage at the Takotna River weir.

	Daily Passage						Cumulative Passage					
Date	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
6/10[a]						0						
6/11[a]						0						
6/12[a]						0						
6/13[a]						0						
6/14[a]						0						
6/15[a]						0						
6/16[a]						0						
6/17[a]						0						
6/18[a]						0						
6/19[a]						0						
6/20[a]						0						
6/21[a]						0						
6/22[a]						0						
6/23[a]		0	0		0	0						
6/24	0	0	0	0 [b]	0	0	0	0	0	0	0	0
6/25	0	0	0	0 [b]	0	0	0	0	0	0	0	0
6/26	0	0	0	0 [b]	0	0	0	0	0	0	0	0
6/27	0	0	0	0 [b]	0	0	0	0	0	0	0	0
6/28	0	0	0	0 [b]	0	0	0	0	0	0	0	0
6/29	0	0	0	0 [b]	0	0	0	0	0	0	0	0
6/30	0	0	0	0 [b]	0	0	0	0	0	0	0	0
7/01	0	0	0	0 [b]	0	0	0	0	0	0	0	0
7/02	0	0	0	0 [b]	0	0	0	0	0	0	0	0
7/03	0	0	0	0 [b]	0	0	0	0	0	0	0	0
7/04	0	0	0	0 [b]	0	0	0	0	0	0	0	0
7/05	0	0	0	0	0	0	0	0	0	0	0	0
7/06	0	0	0	0	0	0	0	0	0	0	0	0
7/07	0	0	0	0	0	0	0	0	0	0	0	0
7/08	0	0	0	0	0	0	0	0	0	0	0	0
7/09	0	0	0	0	0	0	0	0	0	0	0	0
7/10	0	0	0	0	0	0	0	0	0	0	0	0
7/11	0	0	0	0	0	0	0	0	0	0	0	0
7/12	0	0	0	0	0	0	0	0	0	0	0	0
7/13	0	0	0	0	0	0	0	0	0	0	0	0
7/14	0	0	0	0	0	0	0	0	0	0	0	0
7/15	0	0	0 [c]	0	0	0	0	0	0	0	0	0
7/16	0	0	0	0	0	0	0	0	0	0	0	0
7/17	0	0	0	0	0	0	0	0	0	0	0	0
7/18	0	0	0	0	0	0	0	0	0	0	0	0
7/19	0	0	0	0	0	0	0	0	0	0	0	0
7/20	0	0	0	0	0	0	0	0	0	0	0	0
7/21	0	0	0	0	0	0	0	0	0	0	0	0
7/22	0	0	0	0	0	0	0	0	0	0	0	0
7/23	0	0	0	0	0	0	0	0	0	0	0	0
7/24	0	0	0	0	0	0	0	0	0	0	0	0
7/25	0	0	0	0	0	2	0	0	0	0	0	2
7/26	0	0	0	4	0	2	0	0	0	4	0	4
7/27	0	0	0	3	0	0	0	0	0	7	0	4

-continued-

Appendix A3.–Page 2 of 3.

	Daily Passage						Cumulative Passage					
Date	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
7/28	0	0	0	4 [c]	0	3	0	0	0	11	0	7
7/29	0	0	0	4 [b]	0	3	0	0	0	15	0	10
7/30	0	1	1	5 [b]	0	1	0	1	1	20	0	11
7/31	0	0	1	5 [b]	1	0	0	1	2	25	1	11
8/1	0	0	0	6 [c]	1	2	0	1	2	31	2	13
8/2	0	0	0	4	1	2	0	1	2	35	3	15
8/3	0	1	0	8	0	1	0	2	2	43	3	16
8/4	3	0	0	13	3	8	3	2	2	56	6	24
8/5	11	0	0	15	4	7	14	2	2	71	10	31
8/6	8	3	2	27	16	5	22	5	4	98	26	36
8/7	14	1	0	25	14	2	36	6	4	123	40	38
8/8	19	1	2	48	19	10	55	7	6	171	59	48
8/9	40	2	6	40	24	6	95	9	12	211	83	54
8/10	31	3	6	50	18	6	126	12	18	261	101	60
8/11	44	12	4	85	28	12	170	24	22	346	129	72
8/12	80	19	26	139	78	10	250	43	48	485	207	82
8/13	42	20	27	150	20	19	292	63	75	635	227	101
8/14	51	29	23	212	61	20	343	92	98	847	288	121
8/15	58	31	36	140	60	22	401	123	134	987	348	143
8/16	54	51	49	131	92	14	455	174	183	1,118	440	157
8/17	98	44	20	121	182	18	553	218	203	1,239	622	175
8/18	146	77	159	160	124	57	699	295	362	1,399	746	232
8/19	192	66	17	348	56	22	891	361	379	1,747	802	254
8/20	80	91 [c]	11	197	74	25	971	452	390	1,944	876	279
8/21	387	91 [b]	266	356	57	26	1,358	543	656	2,300	933	305
8/22	178	91 [b]	326	254	61	27	1,536	634	982	2,554	994	332
8/23	241	74	328	176	88	111	1,777	708	1,310	2,730	1,082	443
8/24	152	145	397	189	57	258	1,929	853	1,707	2,919	1,139	701
8/25	107	156	301	217	137	204	2,036	1,009	2,008	3,136	1,276	905
8/26	86	275	267	299	572	114	2,122	1,284	2,275	3,435	1,848	1,019
8/27	314	175	107	429	73	84	2,436	1,459	2,382	3,864	1,921	1,103
8/28	490	151	134	335	44	69	2,926	1,610	2,516	4,199	1,965	1,172
8/29	140	164	121	288	74	102	3,066	1,774	2,637	4,487	2,039	1,274
8/30	120	104	127	219	46	163	3,186	1,878	2,764	4,706	2,085	1,437
8/31	62	137	205	267	37	55	3,248	2,015	2,969	4,973	2,122	1,492
9/1	70	105	133	285	398	80	3,318	2,120	3,102	5,258	2,520	1,572
9/2	66	92	107	277	330	21	3,384	2,212	3,209	5,535	2,850	1,593
9/3	54	71	63	192	70	47	3,438	2,283	3,272	5,727	2,920	1,640
9/4	70	73	90	91	11	106	3,508	2,356	3,362	5,818	2,931	1,746
9/5	46	68	118	262	20	85	3,554	2,424	3,480	6,080	2,951	1,831
9/6	100	26	134	209	3	82	3,654	2,450	3,614	6,289	2,954	1,913
9/7	42	13	109 [d]	188	6	59	3,696	2,463	3,723	6,477	2,960	1,972
9/8	25	14	79	200	23	45	3,721	2,477	3,802	6,677	2,983	2,017
9/9	30	14	39	131	18	37	3,751	2,491	3,841	6,808	3,001	2,054
9/10	36	15	19	70	192	40	3,787	2,506	3,860	6,878	3,193	2,094
9/11	40	11	21	78	0	31	3,827	2,517	3,881	6,956	3,193	2,125
9/12	27	24	37	83	0	26	3,854	2,541	3,918	7,039	3,193	2,151

-continued-

Appendix A3.–Page 3 of 3.

	Daily Passage						Cumulative Passage					
Date	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
9/13	29	12	13	79	0	16	3,883	2,553	3,931	7,118	3,193	2,167
9/14	16	15	14	28	9	17	3,899	2,568	3,945	7,146	3,202	2,184
9/15	9	6 [b]	16	10	3	13	3,908	2,574	3,961	7,156	3,205	2,197
9/16	15	11 [b]	7	9	2	13	3,923	2,585	3,968	7,165	3,207	2,210
9/17	5	3 [b]	7	4	0	4	3,928	2,588	3,975	7,169	3,207	2,214
9/18	8	5 [b]	2	1	0	0	3,936	2,593	3,977	7,170	3,207	2,214
9/19	10	6 [b]	2	1	0 [b]	0	3,946	2,599	3,979	7,171	3,207	2,214
9/20	11	7 [b]	5	0	0 [b]	2	3,957	2,606	3,984	7,171	3,207	2,216

[a] Date outside of target operational period (not included in accumulative totals).
[b] The weir was not operational; daily passage was estimated.
[c] Partial day count; passage was estimated.
[d] The weir was not operational; daily passage was not estimated.
[e] Daily passage was estimated due to the occurrence of a hole in the weir.

Appendix A4.–Historical daily and daily cumulative longnose sucker passage at the Takotna River weir.

	Daily Passage						Cumulative Passage					
Date	2000	2001	2002	2003	2004	2005	2000	2001	2002	2003	2004	2005
6/10[a]						404						
6/11[a]						414						
6/12[a]						149						
6/13[a]						271						
6/14[a]						320						
6/15[a]						162						
6/16[a]						113						
6/17[a]						108						
6/18[a]						4						
6/19[a]						43						
6/20[a]						86						
6/21[a]						17						
6/22[a]						42						
6/23[a]		2,186	0		6	28		2,186	0			
6/24	2	571	3	[b]	3	17	2	2,757	3		3	17
6/25	67	2,746	1	[b]	9	40	69	5,503	4		12	57
6/26	82	2,076	7	[b]	13	31	151	7,579	11		25	88
6/27	63	1,748	2	[b]	14	27	214	9,327	13		39	115
6/28	101	113	21	[b]	9	24	315	9,440	34		48	139
6/29	100	1,095	3	[b]	2	24	415	10,535	37		50	163
6/30	220	641	19	[b]	4	23	635	11,176	56		54	186
7/01	406	633	11	[b]	2	1	1,041	11,809	67		56	187
7/02	641	207	0	[b]	1	1	1,682	12,016	67		57	188
7/03	489	94	0	[b]	0	5	2,171	12,110	67		57	193
7/04	264	30	0	[b]	1	5	2,435	12,140	67		58	198
7/05	134	23	8	0	0	9	2,569	12,163	75	0	58	207
7/06	107	5	1	1	2	9	2,676	12,168	76	1	60	216
7/07	158	0	4	0	0	2	2,834	12,168	80	1	60	218
7/08	229	93	5	8	0	0	3,063	12,261	85	9	60	218
7/09	118	38	2	1	1	4	3,181	12,299	87	10	61	222
7/10	112	117	0	13	1	1	3,293	12,416	87	23	62	223
7/11	94	1	96	1	0	0	3,387	12,417	183	24	62	223
7/12	56	20	75	1	11	0	3,443	12,437	258	25	73	223
7/13	112	110	15	9	1	1	3,555	12,547	273	34	74	224
7/14	60	140	1	29	9	0	3,615	12,687	274	63	83	224
7/15	63	107	7	23 [c]	0	7	3,678	12,794	281	86	83	231
7/16	22	58	0	9	0	0	3,700	12,852	281	95	83	231
7/17	9	9	0	27	0	0	3,709	12,861	281	122	83	231
7/18	7	95	2	0	1	0	3,716	12,956	283	122	84	231
7/19	0	203	4	38	9	0	3,716	13,159	287	160	93	231
7/20	3	39	3	144	0	0	3,719	13,198	290	304	93	231
7/21	9	38	1	6	0	0	3,728	13,236	291	310	93	231
7/22	4	9	0	43	1	0	3,732	13,245	291	353	94	231
7/23	0	19	13	38	3	0	3,732	13,264	304	391	97	231
7/24	0	39	0	2	6	0	3,732	13,303	304	393	103	231
7/25	1	19	1	0	0	0	3,733	13,322	305	393	103	231
7/26	4	1	19	22	7	0	3,737	13,323	324	415	110	231
7/27	4	6	0	2	0	0	3,741	13,329	324	417	110	231

-continued-

Appendix A4.–Page 2 of 3.

	Daily Passage						Cumulative Passage					
Date	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
7/28	1	1	4	0	0	0	3,742	13,330	328	417	110	231
7/29	7	34	5		0	0	3,749	13,364	333	417	110	231
7/30	0	0	98		0	0	3,749	13,364	431	417	110	231
7/31	2	7	52		0	0	3,751	13,371	483	417	110	231
8/1	2	9	4	0	1	0	3,753	13,380	487	417	111	231
8/2	7	22	5	0	0	0	3,760	13,402	492	417	111	231
8/3	3	0	2	1	0	0	3,763	13,402	494	418	111	231
8/4	1	0	0	1	0	0	3,764	13,402	494	419	111	231
8/5	8	0	0	0	6	0	3,772	13,402	494	419	117	231
8/6	4	0	20	4	14	0	3,776	13,402	514	423	131	231
8/7	3	0	14	9	0	0	3,779	13,402	528	432	131	231
8/8	3	0	0	3	1	0	3,782	13,402	528	435	132	231
8/9	0	0	0	4	0	0	3,782	13,402	528	439	132	231
8/10	1	0	0	7	0	0	3,783	13,402	528	446	132	231
8/11	0	0	0	8	0	0	3,783	13,402	528	454	132	231
8/12	7	0	5	0	3	0	3,790	13,402	533	454	135	231
8/13	0	0	6	2	2	0	3,790	13,402	539	456	137	231
8/14	0	0	5	106	0	0	3,790	13,402	544	562	137	231
8/15	0	0	2	19	0	0	3,790	13,402	546	581	137	231
8/16	0	0	2	4	0	0	3,790	13,402	548	585	137	231
8/17	0	0	6	1	1	0	3,790	13,402	554	586	138	231
8/18	0	0	1	0	0	0	3,790	13,402	555	586	138	231
8/19	0	0	0	1	0	0	3,790	13,402	555	587	138	231
8/20	0	0 [c]	0	0	0	0	3,790	13,402	555	587	138	231
8/21	0	0 [b]	0	0	0	0	3,790	13,402	555	587	138	231
8/22	2	0 [b]	1	11	0	0	3,792	13,402	556	598	138	231
8/23	4	0	2	0	0	0	3,796	13,402	558	598	138	231
8/24	1	0	12	0	0	0	3,797	13,402	570	598	138	231
8/25	0	0	9	0	0	0	3,797	13,402	579	598	138	231
8/26	1	0	3	3	0	0	3,798	13,402	582	601	138	231
8/27	0	0	7	0	0	0	3,798	13,402	589	601	138	231
8/28	0	0	1	0	0	0	3,798	13,402	590	601	138	231
8/29	0	0	1	0	0	0	3,798	13,402	591	601	138	231
8/30	0	0	1	0	0	0	3,798	13,402	592	601	138	231
8/31	0	0	1	0	0	0	3,798	13,402	593	601	138	231
9/1	0	4	2	0	0	0	3,798	13,406	595	601	138	231
9/2	0	23	0	0	0	0	3,798	13,429	595	601	138	231
9/3	0	16	2	0	0	0	3,798	13,445	597	601	138	231
9/4	0	5	1	0	1	0	3,798	13,450	598	601	139	231
9/5	0	1	1	0	4	0	3,798	13,451	599	601	143	231
9/6	0	1	4	0	0	0	3,798	13,452	603	601	143	231
9/7	0	1	1	0 [b]	0	0	3,798	13,453	604	601	143	231
9/8	0	0	0	0	0	0	3,798	13,453	604	601	143	231
9/9	0	1	0	0	0	0	3,798	13,454	604	601	143	231
9/10	0	1	0	0	0	0	3,798	13,455	604	601	143	231
9/11	0	0	0	0	0	0	3,798	13,455	604	601	143	231
9/12	0	1	0	0	0	0	3,798	13,456	604	601	143	231

-continued-

Appendix A4.–Page 3 of 3.

	Daily Passage						Cumulative Passage					
Date	2000	2001	2002	2003	2004	2005	2000	2001	2002	2003	2004	2005
9/13	0	0	0	2	0	0	3,798	13,456	604	603	143	231
9/14	0	2	0	0	2	0	3,798	13,458	604	603	145	231
9/15	0	0 [b]	0	0	0	0	3,798	13,458	604	603	145	231
9/16	0	0 [b]	0	0	0	0	3,798	13,458	604	603	145	231
9/17	0	0 [b]	0	0	0	0	3,798	13,458	604	603	145	231
9/18	0	0 [b]	0	3	0	0	3,798	13,458	604	606	145	231
9/19	0	0 [b]	0	0	0	0	3,798	13,458	604	606	145	231
9/20	0	0 [b]	0	3	0	0	3,798	13,458	604	609	145	231

[a] Date outside of target operational period (not included in accumulative totals).

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

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

APPENDIX B. DAILY CARCASS COUNTS, 2005

Appendix B1.–Daily carcass counts for Chinook, sockeye, chum, coho salmon, and longnose suckers at the Takotna River weir, 2005.

	Chinook			Sockeye			Chum			Coho			Longnose sucker
Date	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Total
6/10	0	0	0	0	0	0	0	0	0	0	0	0	0
6/11	0	0	0	0	0	0	0	0	0	0	0	0	0
6/12	0	0	0	0	0	0	0	0	0	0	0	0	0
6/13	0	0	0	0	0	0	0	0	0	0	0	0	0
6/14	0	0	0	0	0	0	0	0	0	0	0	0	1
6/15	0	0	0	0	0	0	0	0	0	0	0	0	0
6/16	0	0	0	0	0	0	0	0	0	0	0	0	0
6/17	0	0	0	0	0	0	0	0	0	0	0	0	0
6/18	0	0	0	0	0	0	0	0	0	0	0	0	0
6/19	0	0	0	0	0	0	0	0	0	0	0	0	0
6/20	0	0	0	0	0	0	0	0	0	0	0	0	2
6/21	0	0	0	0	0	0	0	0	0	0	0	0	6
6/22	0	0	0	0	0	0	0	0	0	0	0	0	2
6/23	0	0	0	0	0	0	0	0	0	0	0	0	1
6/24	0	0	0	0	0	0	0	0	0	0	0	0	0
6/25	0	0	0	0	0	0	0	0	0	0	0	0	0
6/26	0	0	0	0	0	0	0	0	0	0	0	0	0
6/27	0	0	0	0	0	0	0	0	0	0	0	0	0
6/28	0	0	0	0	0	0	0	0	0	0	0	0	0
6/29	0	0	0	0	0	0	0	0	0	0	0	0	0
6/30	0	0	0	0	0	0	0	0	0	0	0	0	0
7/1	0	0	0	0	0	0	0	0	0	0	0	0	0
7/2	0	0	0	0	0	0	0	0	0	0	0	0	0
7/3	0	0	0	0	0	0	0	0	0	0	0	0	0
7/4	0	0	0	0	0	0	0	0	0	0	0	0	0
7/5	0	0	0	0	0	0	0	0	0	0	0	0	0
7/6	0	0	0	0	0	0	0	0	0	0	0	0	0
7/7	0	0	0	0	0	0	0	0	0	0	0	0	0
7/8	0	0	0	0	0	0	0	0	0	0	0	0	0
7/9	1	0	1	0	0	0	0	0	0	0	0	0	0
7/10	0	0	0	0	0	0	0	0	0	0	0	0	0
7/11	0	0	0	0	0	0	0	0	0	0	0	0	0
7/12	0	0	0	0	0	0	0	0	0	0	0	0	0
7/13	0	0	0	0	0	0	0	0	0	0	0	0	0
7/14	0	0	0	0	0	0	0	0	0	0	0	0	0
7/15	0	0	0	0	0	0	0	0	0	0	0	0	0
7/16	0	0	0	0	0	0	0	1	1	0	0	0	0
7/17	0	0	0	0	0	0	2	1	3	0	0	0	0
7/18	0	0	0	0	0	0	0	0	0	0	0	0	0
7/19	0	0	0	0	0	0	4	2	6	0	0	0	1
7/20	0	0	0	0	0	0	3	1	4	0	0	0	0
7/21	0	0	0	0	0	0	0	0	0	0	0	0	0
7/22	0	0	0	0	0	0	2	1	3	0	0	0	0
7/23	0	0	0	0	0	0	1	0	1	0	0	0	0
7/24	0	0	0	0	0	0	0	1	1	0	0	0	0
7/25	0	0	0	0	0	0	0	0	0	0	0	0	0
7/26	0	0	0	0	0	0	2	0	2	0	0	0	1
7/27	0	0	0	0	0	0	2	0	2	0	0	0	1
7/28	0	0	0	0	0	0	1	0	1	0	0	0	0
7/29	1	0	1	0	0	0	3	1	4	0	0	0	1
7/30	0	0	0	0	0	0	1	0	1	0	0	0	0
7/31	0	0	0	0	0	0	4	0	4	0	0	0	3
8/1	0	0	0	0	0	0	0	0	0	0	0	0	0
8/2	0	0	0	0	0	0	1	0	1	0	0	0	0
8/3	0	0	0	0	0	0	0	0	0	0	0	0	0
8/4	0	0	0	0	0	0	1	0	1	0	0	0	1
8/5	0	0	0	0	0	0	1	0	1	0	0	0	0
8/6	0	0	0	0	0	0	0	0	0	0	0	0	0
8/7	0	0	0	0	0	0	1	0	1	0	0	0	3
8/8	0	0	0	0	0	0	0	0	0	0	0	0	3
8/9	0	0	0	0	0	0	1	0	1	0	0	0	0

-continued-

Appendix B1.–Page 2 of 2.

	Chinook			Sockeye			Chum			Coho			Longnose sucker
Date	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Total
8/10	0	0	0	0	0	0	1	0	1	0	0	0	1
8/11	0	0	0	0	0	0	0	0	0	0	0	0	3
8/12	0	0	0	0	0	0	0	0	0	0	0	0	6
8/13	0	0	0	0	0	0	1	0	1	0	0	0	3
8/14	0	0	0	0	0	0	0	0	0	0	0	0	2
8/15	0	0	0	0	0	0	0	0	0	0	0	0	0
8/16	0	0	0	0	0	0	0	0	0	0	0	0	1
8/17	0	0	0	0	0	0	1	0	1	0	0	0	0
8/18	0	0	0	0	0	0	0	0	0	0	0	0	10
8/19	0	0	0	0	0	0	0	0	0	0	0	0	3
8/20	0	0	0	0	0	0	0	0	0	0	0	0	0
8/21	0	0	0	0	0	0	0	0	0	0	0	0	0
8/22	0	0	0	0	0	0	0	0	0	0	0	0	0
8/23	0	0	0	0	0	0	0	0	0	0	0	0	1
8/24	0	0	0	0	0	0	0	1	1	0	0	0	16
8/25	0	0	0	0	0	0	0	0	0	0	0	0	16
8/26	0	0	0	0	0	0	0	0	0	0	0	0	24
8/27	0	0	0	0	0	0	0	0	0	0	0	0	9
8/28	0	0	0	0	0	0	0	0	0	0	0	0	11
8/29	0	0	0	0	0	0	0	0	0	0	0	0	1
8/30	0	0	0	0	0	0	0	0	0	0	0	0	5
8/31	0	0	0	0	0	0	0	0	0	0	0	0	11
9/1	0	0	0	0	0	0	0	0	0	0	0	0	0
9/2	0	0	0	0	0	0	0	0	0	0	0	0	0
9/3	0	0	0	0	0	0	0	0	0	0	0	0	0
9/4	0	0	0	0	0	0	0	0	0	0	0	0	0
9/5	0	0	0	0	0	0	0	0	0	0	0	0	8
9/6	0	0	0	0	0	0	0	0	0	0	0	0	0
9/7	0	0	0	0	0	0	0	0	0	0	1	1	26
9/8	0	0	0	0	0	0	0	0	0	0	0	0	8
9/9	0	0	0	0	0	0	0	0	0	0	0	0	0
9/10	0	0	0	0	0	0	0	0	0	0	0	0	11
9/11	0	0	0	0	0	0	0	1	1	0	0	0	6
9/12	0	0	0	0	0	0	0	0	0	0	0	0	5
9/13	0	0	0	0	0	0	0	0	0	0	1	1	7
9/14	0	0	0	0	0	0	0	0	0	0	1	1	2
9/15	0	0	0	0	0	0	0	0	0	0	0	0	3
9/16	0	0	0	0	0	0	0	0	0	0	0	0	26
9/17	0	0	0	0	0	0	0	0	0	1	0	1	25
9/18	1	0	1	0	0	0	1	0	1	0	0	0	16
9/19	0	0	0	0	0	0	0	0	0	0	0	0	0
9/20	0	0	0	0	0	0	0	0	0	0	0	0	2
Totals:	3	0	**3**	0	0	**0**	34	10	**44**	1	3	**4**	**294**

APPENDIX C. WEATHER AND STREAM OBSERVATIONS, 2005

Appendix C1.–Daily weather and stream observations at the Takotna River weir, 2005.

	Observations by Hour						Daily Totals	Daily Averages		
Date	Time	Sky Codes[a]	Wind	Air Temperature (°C)	Water Temperature (°C)	Water Stage (cm)	Precipitation (mm)	Air Temperature (°C)[b]	Obs. Water Temperature (°C)[b]	Water Stage (cm) (°C)[b]
6/10	17:00	3	0	ND	ND	65.0	0.0	-	-	-
6/11	17:00	4	SE 10	15.5	13.0	ND	2.3	-	-	-
6/12	8:00	0	0	10.0	11.0	ND				
	21:00	3	0	11.0	15.0	60.0	0.0	10.5	13.0	-
6/13	8:00	5	0	19.0	13.0	61.0				
	17:00	4	0	24.0	15.0	59.0	1.0	21.5	14.0	60.0
6/14	8:00	1	0	15.0	13.0	58.0				
	17:00	4	SE 10	20.0	15.0	57.5	0.0	17.5	14.0	57.8
6/15	8:00	1	SW 5	15.0	13.0	57.0				
	18:00	2	SW 10	20.0	17.0	56.0	1.0	17.5	15.0	56.5
6/16	8:00	2	0	13.5	14.5	58.0				
	17:00	3	0	25.5	18.0	58.0	0.0	19.5	16.3	58.0
6/17	8:00	1	0	15.0	15.0	56.0				
	17:00	3	N 10	28.0	18.0	55.0	0.0	21.5	16.5	55.5
6/18	8:00	4	SW 10	12.5	16.0	53.0				
	17:00	4	0	13.5	15.5	54.0	8.0	13.0	15.8	53.5
6/19	8:00	4	0	7.0	12.5	58.0				
	15:00	4	0	9.0	13.0	61.0	1.3	8.0	12.8	59.5
6/20	8:00	3	0	10.5	12.0	66.0				
	17:00	4	0	15.0	13.0	64.0	9.0	12.8	12.5	65.0
6/21	8:00	4	0	11.6	11.8	63.0				
	17:00	1	0	24.0	14.6	61.0	0.0	17.8	13.2	62.0
6/22	8:00	4	0	11.0	12.0	58.0				
	18:00	3	W 10	19.5	15.5	56.5	0.8	15.3	13.8	57.3
6/23	8:00	4	0	11.6	13.5	56.0				
	17:00	2	NW 5	22.9	15.2	56.0	0.0	17.3	14.4	56.0
6/24	8:00	4	0	13.6	13.9	55.5				
	17:00	4	0	13.6	17.5	55.0	3.0	13.6	15.7	55.3
6/25	8:00	1	0	17.0	14.0	53.0				
	17:30	3	0	20.9	17.6	53.0	0.0	19.0	15.8	53.0
6/26	8:00	1	0	13.0	15.0	53.0				
	17:00	3	E 10	21.0	17.0	52.5	0.0	17.0	16.0	52.8
6/27	8:00	1	0	16.0	15.0	50.5				
	17:00	1	NE 10	26.5	17.5	50.5	0.0	21.3	16.3	50.5
6/28	8:00	1 [c]	0	16.4	15.5	48.0				
	19:00	1 [c]	0	28.8	16.3	48.0	0.0	22.6	15.9	48.0

-continued-

Appendix C1.–Page 2 of 6.

	Observations by Hour						Daily Totals	Daily Averages		
Date	Time	Sky Codes[a]	Wind	Air Temperature (°C)	Water Temperature (°C)	Water Stage (cm)	Precipitation (mm)	Air Temperature (°C)[b]	Obs. Water Temperature (°C)[b]	Water Stage (cm) (°C)[b]
6/29	8:00	1 [c]	0	16.6	16.5	47.0				
	17:00	3 [c]	NE 10	22.5	17.0	47.0	0.0	19.6	16.8	47.0
6/30	8:00	5	0	16.0	15.0	48.0				
	17:00	4	0	16.2	16.5	49.0	0.8	16.1	15.8	48.5
7/1	8:00	4	0	13.5	14.7	50.5				
	17:00	3	0	19.4	16.2	51.5	0.0	16.5	15.5	51.0
7/2	8:00	3	0	13.8	15.0	50.5				
	17:00	2	0	22.2	17.0	50.5	0.0	18.0	16.0	50.5
7/3	8:00	3	0	12.4	14.9	50.5				
	18:00	3	SW 5	18.3	17.0	50.0	0.0	15.4	16.0	50.3
7/4	8:00	3	0	13.9	15.3	48.0				
	17:00	3	0	20.3	17.6	50.0	8.3	17.1	16.5	49.0
7/5	8:00	3	0	17.9	15.0	50.5				
	17:00	3	SW 10	23.5	18.6	53.0	1.0	20.7	16.8	51.8
7/6	8:00	2	0	13.6	15.8	52.0				
	17:00	2	SW 10	23.8	18.8	53.0	0.0	18.7	17.3	52.5
7/7	8:00	3	0	15.5	16.8	49.0				
	17:00	2	SE 5	22.5	19.0	48.0	0.0	19.0	17.9	48.5
7/8	8:00	2	SE 5	18.0	16.0	48.0				
	17:00	2	SW 10	21.8	18.8	46.5	0.0	19.9	17.4	47.3
7/9	8:00	3	0	14.5	17.0	45.5				
	17:00	3	SW 20	19.1	22.9	45.0	0.0	16.8	20.0	45.3
7/10	8:00	3	SW 30	13.2	15.5	43.0				
	17:00	3	S 25	22.2	17.4	43.0	0.0	17.7	16.5	43.0
7/11	8:00	4	0	13.0	15.0	43.0				
	17:00	3	SW 10	19.4	16.8	42.0	0.0	16.2	15.9	42.5
7/12	8:00	4	0	12.8	15.0	41.5				
	19:30	4	SE 5	21.5	18.9	41.5	0.0	17.2	17.0	41.5
7/13	8:00	3	0	12.0	14.0	41.0				
	17:00	3	N 5	21.8	16.8	41.0	0.0	16.9	15.4	41.0
7/14	8:00	2	0	16.5	15.7	40.0				
	17:30	3	0	24.7	18.7	40.0	0.0	20.6	17.2	40.0
7/15	8:00	1	0	21.0	17.1	40.0				
	17:00	3	SW 5	24.1	19.9	40.0	0.0	22.6	18.5	40.0
7/16	8:00	4	0	11.7	16.8	42.0				
	19:00	3	S 3	15.7	17.2	44.0	7.0	13.7	17.0	43.0

-continued-

Appendix C1.–Page 3 of 6.

	Observations by Hour						Daily Totals	Daily Averages		
Date	Time	Sky Codes[a]	Wind	Air Temperature (°C)	Water Temperature (°C)	Water Stage (cm)	Precipitation (mm)	Air Temperature (°C)[b]	Obs. Water Temperature (°C)[b]	Water Stage (cm) (°C)[b]
7/17	8:00	3	0	14.9	15.9	42.5				
	17:00	3	SW 10	21.1	18.2	44.0	0.0	18.0	17.1	43.3
7/18	8:00	2	0	13.7	15.1	44.0				
	17:00	4	0	18.7	16.9	46.0	0.0	16.2	16.0	45.0
7/19	8:00	3	0	11.7	15.0	49.0				
	17:30	4	0	16.3	14.9	51.0	0.0	14.0	15.0	50.0
7/20	8:30	2	0	16.0	13.5	48.0				
	17:00	3	0	22.7	16.1	47.0	0.3	19.4	14.8	47.5
7/21	8:00	1	0	13.9	14.1	45.5				
	17:00	1	0	24.4	16.5	42.0	0.0	19.2	15.3	43.8
7/22	8:00	1	0	21.7	14.7	42.0				
	17:00	2	0	28.5	18.5	42.0	0.0	25.1	16.6	42.0
7/23	8:00	1	0	17.1	16.1	41.0				
	17:00	1	NE 5	25.2	19.5	40.5	0.0	21.2	17.8	40.8
7/24	8:00	3	0	14.9	17.3	40.0				
	17:00	2	SE 5	26.0	19.6	39.5	0.0	20.5	18.5	39.8
7/25	8:00	2 [c]	0	20.9	16.6	39.0				
	17:00	3	E 10	ND	ND	39.0	0.3	-	-	39.0
7/26	8:00	3	0	12.3	16.5	39.0				
	17:00	3 [c]	0	21.5	18.9	38.5	0.0	16.9	17.7	38.8
7/27	8:00	3 [c]	0	18.2	16.3	39.5				
	17:00	3 [c]	W 10	25.6	18.3	39.5	0.0	21.9	17.3	39.5
7/28	8:00	3 [c]	0	12.4	16.5	40.0				
	17:00	3 [c]	N 10	25.8	18.3	41.0	0.0	19.1	17.4	40.5
7/29	8:00	3 [c]	0	14.7	16.0	40.0				
	17:00	3 [c]	SW 10	21.6	18.8	39.0	0.0	18.2	17.4	39.5
7/30	8:00	1 [c]	0	15.7	16.5	38.0				
	17:00	2	N 10	25.3	19.5	38.0	0.0	20.5	18.0	38.0
7/31	8:00	4	0	13.0	17.0	38.5				
	17:00	2	N 10	20.0	17.7	39.0	18.0	16.5	17.4	38.8
8/1	8:30	2	0	14.0	15.0	38.0				
	17:00	3	N 5	20.8	18.0	37.5	0.0	17.4	16.5	37.8
8/2	8:00	2	0	15.0	14.8	37.0				
	17:00	3	S 5	23.0	17.7	36.5	0.0	19.0	16.3	36.8
8/3	8:00	1	0	14.5	15.3	38.0				
	17:00	1	0	26.0	17.0	38.0	0.0	20.3	16.2	38.0

-continued-

Appendix C1.–Page 4 of 6.

	Observations by Hour						Daily Totals	Daily Averages		
Date	Time	Sky Codes[a]	Wind	Air Temperature (°C)	Water Temperature (°C)	Water Stage (cm)	Precipitation (mm)	Air Temperature (°C)[b]	Obs. Water Temperature (°C)[b]	Water Stage (cm) (°C)[b]
8/4	8:00	3 [c]	0	10.0	14.7	35.0				
	17:00	3	N 10	23.6	17.2	35.0	0.0	16.8	16.0	35.0
8/5	8:30	4 [c]	0	9.9	14.4	35.0				
	17:00	4 [c]	SW 10	20.0	16.4	34.5	0.0	15.0	15.4	34.8
8/6	8:00	3 [c]	0	13.7	14.4	34.0				
	17:00	4	W 15	18.8	17.8	34.0	0.0	16.3	16.1	34.0
8/7	8:00	3 [c]	SW 10	13.1	15.0	33.5				
	17:00	4	SW 5	17.7	15.7	33.0	0.0	15.4	15.4	33.3
8/8	8:00	3	0	13.8	14.2	33.0				
	17:00	1	0	25.3	18.0	33.0	0.0	19.6	16.1	33.0
8/9	8:00	3 [c]	0	10.8	15.1	32.5				
	17:00	1	SE 5	29.3	19.6	32.5	0.0	20.1	17.4	32.5
8/10	8:00	1	0	17.4	16.2	32.0				
	17:00	2 [c]	SE 5	27.6	19.7	32.0	0.0	22.5	18.0	32.0
8/11	8:00	3 [c]	0	11.7	17.6	31.5				
	17:00	3 [c]	E 5	25.1	18.3	31.0	0.0	18.4	18.0	31.3
8/12	8:00	5 [c]	0	11.9	15.4	30.5				
	17:00	1 [c]	NE 5	28.5	18.7	30.5	0.0	20.2	17.1	30.5
8/13	8:00	5 [c]	0	10.6	15.3	30.5				
	17:00	1 [c]	0	30.0	18.3	30.5	0.0	20.3	16.8	30.5
8/14	8:00	5 [c]	0	12.2	16.0	30.0				
	17:00	1 [c]	0	28.5	18.7	30.0	0.0	20.4	17.4	30.0
8/15	8:00	5 [c]	0	9.8	15.7	30.0				
	17:00	1 [c]	0	25.0	18.0	30.0	0.0	17.4	16.9	30.0
8/16	8:00	3 [c]	SW 5	11.7	15.2	30.0				
	17:00	2 [c]	W 5	21.3	16.5	30.0	0.0	16.5	15.9	30.0
8/17	8:00	0 [d]	0	15.3	13.8	30.0				
	17:00	3	0	22.2	16.8	30.0	0.0	18.8	15.3	30.0
8/18	8:00	3	0	12.0	15.4	30.0				
	17:00	3 [c]	0	18.3	16.3	30.0	0.0	15.2	15.9	30.0
8/19	8:00	5	0	0.3	13.1	30.0				
	17:00	3	S 5	20.5	14.5	30.0	0.0	10.4	13.8	30.0
8/20	8:00	5 [c]	SW 5	5.0	11.8	30.0				
	18:00	4	SW 10	13.6	11.3	30.0	0.0	9.3	11.6	30.0
8/21	8:00	3	SE 5	9.1	12.2	31.5				
	17:00	4	S 5	12.0	12.2	33.0	14.0	10.6	12.2	32.3

-continued-

Appendix C1.–Page 5 of 6.

	Observations by Hour						Daily Totals	Daily Averages		
Date	Time	Sky Codes[a]	Wind	Air Temperature (°C)	Water Temperature (°C)	Water Stage (cm)	Precipitation (mm)	Air Temperature (°C)[b]	Obs. Water Temperature (°C)[b]	Water Stage (cm) (°C)[b]
8/22	8:00	5	0	4.1	10.5	33.5				
	17:00	4	W 5	12.2	11.8	35.0	0.0	4.1	10.5	33.5
8/23	8:00	5	0	13.3	11.4	40.0				
	17:00	4	SE 15	13.0	12.0	43.0	16.6	13.2	11.7	41.5
8/24	8:00	5	0	9.0	10.4	47.0				
	17:00	3	S 10	12.0	11.6	50.0	4.9	9.0	10.4	47.0
8/25	8:00	3	0	4.7	9.7	52.0				
	17:00	3	W 5	11.6	15.0	55.0	0.0	8.2	12.4	53.5
8/26	8:00	2	0	8.1	10.4	54.0				
	17:00	4	0	12.1	10.6	52.0	0.0	10.1	10.5	53.0
8/27	8:00	2	0	8.1	9.4	48.5				
	17:00	4	0	13.3	10.6	47.0	0.2	10.7	10.0	47.8
8/28	8:00	4	0	8.1	9.9	45.0				
	17:00	4	0	12.0	9.9	45.0	1.0	10.1	9.9	45.0
8/29	8:00	4	0	9.0	9.9	45.0				
	17:00	4	S 5	12.5	10.6	47.0	7.3	10.8	10.3	46.0
8/30	8:00	3	0	9.1	9.8	50.0				
	17:00	3	W 10	14.5	11.5	51.5	0.0	11.8	10.7	50.8
8/31	8:00	2	0	7.4	9.9	53.0				
	17:00	2	SW 5	14.7	11.5	52.0	0.0	11.1	10.7	52.5
9/1	8:00	2	0	-2.5	8.1	49.0				
	17:00	2	SE 5	13.1	10.1	48.0	0.0	5.3	9.1	48.5
9/2	8:00	1	0	1.0	7.7	45.5				
	17:00	1	SW 5	14.1	9.1	45.5	0.0	7.6	8.4	45.5
9/3	8:00	4	0	6.1	8.4	46.0				
	17:00	3	SE 5	9.7	8.6	46.0	13.0	7.9	8.5	46.0
9/4	8:00	4	0	7.8	7.2	50.0				
	17:00	4	0	12.6	9.3	57.0	6.0	10.2	8.3	53.5
9/5	8:00	4	0	9.4	8.7	65.0				
	17:00	4	0	12.6	9.1	64.0	5.2	11.0	8.9	64.5
9/6	8:00	4	0	9.5	8.6	66.0				
	17:00	3	0	14.7	9.2	70.0	8.3	12.1	8.9	68.0
9/7	8:00	4	SW 5	6.1	8.3	78.5				
	16:00	3	0	15.9	9.0	81.0	1.2	11.0	8.7	79.8
9/8	8:00	2	0	6.2	8.5	78.5				
	16:00	2	SE 5	14.5	8.8	73.0	0.3	10.4	8.7	75.8

-continued-

Appendix C1.–Page 6 of 6.

	Observations by Hour						Daily Totals	Daily Averages		
Date	Time	Sky Codes[a]	Wind	Air Temperature (°C)	Water Temperature (°C)	Water Stage (cm)	Precipitation (mm)	Air Temperature (°C)[b]	Obs. Water Temperature (°C)[b]	Water Stage (cm) (°C)[b]
9/9	8:00	4	0	8.0	8.5	72.0				
	16:00	4	SE 10	11.4	8.6	74.0	12.1	9.7	8.6	73.0
9/10	8:00	4	SW 10	8.7	8.4	79.0				
	17:00	4	0	10.5	8.6	87.0	2.2	9.6	8.5	83.0
9/11	8:00	4	0	7.7	7.8	85.0				
	16:00	4	0	10.7	8.4	81.0	0.8	9.2	8.1	83.0
9/12	8:00	4	SW 15	7.3	8.1	78.0				
	17:00	4	S 10	9.4	8.4	79.0	3.8	8.4	8.3	78.5
9/13	8:00	4	SW 10	7.8	7.8	84.0				
	17:00	4	0	7.8	8.1	87.0	1.7	7.8	8.0	85.5
9/14	8:00	4	0	8.3	7.8	81.0				
	17:00	4	SE 5	11.3	7.8	83.0	0.1	9.8	7.8	82.0
9/15	8:00	4	SE 5	7.6	7.4	81.0				
	17:00	4	SE 15	13.7	7.8	86.0	5.9	10.7	7.6	83.5
9/16	8:00	4	0	7.7	7.4	86.0				
	19:00	2	0	9.6	8.0	99.0	0.5	8.7	7.7	92.5
9/17	8:00	5	0	7.3	5.4	104.0				
	18:00	4	0	12.2	7.7	100.0	0.0	9.8	6.6	102.0
9/18	13:00	4	0	ND	ND	91.0	0.0	-	-	-
9/19	ND	0	ND	ND	ND	ND	ND	-	-	-
9/20	19:00	2	0	7.6	6.8	84.0	0.7	-	-	-
			Average:	15.4[e]	14.1[e]	49.6	1.6	15.4	14.1	49.0
			Minimum:	-2.5[e]	5.4[e]	30.0	0.0	4.1	6.6	30.0
			Maximum:	30.0[e]	22.9[e]	104.0	18.0	25.1	20.0	102.0
			Total:	-	-	-	167.9	-	-	-

[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] Averages are calculated from the 8:00 and the 15:00–21:00 observations. Averages were not computed if no observations were made during one of these times.

[c] Smoke haze was present.

[d] Cloud cover was obscured by smoke haze.

[e] Calculated using only days with a morning observation at 8:00 and an afternoon observation between 15:00–21:00. Observations outside of these times were ignored.

APPENDIX D. JUVENILE SAMPLING EVENTS, 2005

Appendix D1.–Summary of juvenile sampling events, 2005.

Sampling Date	Survey Type[a]	Index Area[b]	Gear Type	Number Caught Chinook	Number Caught Coho	Number Caught Chum	Number Measured Chinook	Number Measured Coho	Number Measured Chum
16-Jan	A	1	Minnow Trap	15	3	0	15	3	0
24-Jan	A	14	Minnow Trap	22	0	0	22	0	0
29-Apr	B	1	Stationary Net	0	0	0	0	0	0
30-Apr	B	1	Stationary Net	0	0	0	0	0	0
2-May	B	1	Stationary Net	0	0	0	0	0	0
6-May	B	4	Stationary Net	0	0	0	0	0	0
10-May	B	4	Stationary Net	0	0	4	0	0	4
14-May	B	4	Stationary Net	0	0	3	0	0	3
17-May	B	4	Stationary Net	0	0	0	0	0	0
21-May	B	4	Dip Net	6	0	2	6	0	2
21-May	B	4	Stationary Net	0	0	0	0	0	0
24-May	B	4	Dip Net	3	0	1	3	0	1
24-May	B	4	Stationary Net	1	0	8	1	0	8
27-May	B	4	Stationary Net	0	0	2	0	0	2
31-May	B	4	Stationary Net	1	0	3	1	0	3
4-Jun	B	4	Dip Net	0	0	1	0	0	1
4-Jun	B	4	Stationary Net	0	0	2	0	0	2
11-Jun	B	4	Dip Net	12	0	0	0	0	0
11-Jun	B	4	Stationary Net	0	0	0	0	0	0
14-Jun	B	4	Dip Net	49	2	4	0	0	4
14-Jun	B	4	Stationary Net	0	0	0	0	0	0
15-Jun	A	1	Minnow Trap	0	0	0	0	0	0
18-Jun	B	4	Dip Net	8	2	11	0	0	11
21-Jun	B	4	Beach Seine	0	0	0	0	0	0
21-Jun	B	4	Dip Net	8	18	1	0	0	1
25-Jun	B	4	Beach Seine	0	0	15	0	0	15
25-Jun	B	4	Dip Net	0	0	2	0	0	2
25-Jun	B	4	Stationary Net	0	0	0	0	0	0
28-Jun	B	4	Beach Seine	0	0	48	0	0	48
2-Jul	B	4	Beach Seine	0	0	12	0	0	12
7-Jul	B	4	Beach Seine	0	0	0	0	0	0
19-Jul	A	7	Minnow Trap	1	0	0	1	0	0
19-Jul	A	8	Minnow Trap	0	0	0	0	0	0
19-Jul	A	12	Minnow Trap	0	0	0	0	0	0
20-Jul	A	5	Beach Seine	0	0	0	0	0	0
1-Aug	A	14	Minnow Trap	55	0	0	55	0	0
3-Aug	A	3	Minnow Trap	0	84	0	0	84	0
15-Aug	A	14	Minnow Trap	105	0	0	105	0	0
31-Aug	A	14	Minnow Trap	178	10	0	89	5	0

continued-

Appendix D1.–Page 2 of 2.

Sampling Date	Survey Type[a]	Index Area[b]	Gear Type	Number Caught			Number Measured		
				Chinook	Coho	Chum	Chinook	Coho	Chum
3-Sep	A	5	Minnow Trap	0	0	0	0	0	0
3-Sep	A	7	Minnow Trap	0	0	0	0	0	0
3-Sep	A	8	Beach Seine	0	0	0	0	0	0
3-Sep	A	9	Beach Seine	0	0	0	0	0	0
18-Sep	A	11	Minnow Trap	8	33	0	8	33	0
27-Sep	A	14	Minnow Trap	36	1	0	18	1	0
4-Dec	A	14	Minnow Trap	1	6	0	1	6	0
			Totals:	509	159	119	325	132	119

[a] Survey Type:

A = Surveys focused on distribution and length patterns of juvenile Chinook and coho salmon.

B = Sampling focused on the collection of juvenile chum salmon for *Body condition and feeding ecology of Kuskokwim River chum salmon fry during freshwater outmigration.*

[b] See Figure 4 for description of Index Areas.

APPENDIX E. LENGTH DATA FOR JUVENILE SALMON IN THE TAKOTNA RIVER DRAINAGE, 2005

Appendix E1.–Trap-caught juvenile Chinook salmon lengths by date, Index Area, and number caught, 2005.

	Index Area 1[a]	Index Area 7[b]	Index Area 11[c]	Index Area 14[d]						
Lengths (mm)	16-Jan	19-Jul	18-Sep	24-Jan	1-Aug	15-Aug	31-Aug	27-Sep	4-Dec	Total
56	0	0	0	0	0	0	1	0	0	1
57	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	1	0	0	0	0	1
59	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	1	0	0	0	0	1
61	0	0	0	0	0	1	0	0	0	1
62	1	0	0	0	2	1	3	0	0	7
63	0	0	0	0	1	3	1	0	0	5
64	2	0	0	0	2	3	2	0	0	9
65	0	0	0	0	3	2	2	0	0	7
66	1	0	0	2	0	7	1	0	0	11
67	0	0	0	0	1	3	3	0	0	7
68	2	0	0	0	3	7	4	0	0	16
69	0	1	0	0	1	1	0	0	0	3
70	1	0	0	0	2	3	5	0	0	11
71	0	0	0	0	2	4	1	0	0	7
72	1	0	0	2	2	5	3	0	0	13
73	0	0	0	0	4	7	3	1	0	15
74	2	0	0	2	2	5	3	0	0	14
75	1	0	0	0	5	12	4	0	0	22
76	0	0	0	2	0	9	5	0	0	16
77	2	0	0	2	3	3	5	0	0	15
78	2	0	0	1	1	1	8	0	0	13
79	0	0	0	1	2	2	7	1	0	13
80	0	0	0	1	5	4	3	2	0	15
81	0	0	0	1	1	2	5	2	0	11
82	0	0	0	1	1	5	5	2	0	14
83	0	0	1	1	3	3	2	2	1	13
84	0	0	0	2	2	1	1	0	0	6
85	0	0	0	0	0	5	3	1	0	9
86	0	0	2	0	3	0	0	1	0	6
87	0	0	0	1	0	2	2	0	0	5
88	0	0	1	1	1	1	2	0	0	6
89	0	0	1	1	1	1	0	1	0	5
90	0	0	1	0	0	1	2	1	0	5
91	0	0	0	1	0	1	0	0	0	2
92	0	0	0	0	0	0	1	0	0	1
93	0	0	1	0	0	0	1	1	0	3
94	0	0	0	0	0	0	0	2	0	2
95	0	0	0	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0	0	0
97	0	0	0	0	0	0	0	1	0	1
98	0	0	1	0	0	0	1	0	0	2
Totals	15	1	8	22	55	105	89	18	1	314

[a] Takotna River, below weir

[b] Minnie Creek

[c] Moore Creek

[d] Gold Creek

Appendix E2.–Trap-caught juvenile coho salmon lengths by date, Index Area, and number caught, 2005.

	Index Area 1[a]	Index Area 7[b]	Index Area 11[c]	Index Area 14[d]			
Lengths (mm)	16-Jan	19-Jul	18-Sep	31-Aug	27-Sep	4-Dec	Total
43	0	0	0	0	0	1	1
44	0	1	0	0	0	0	1
45	0	2	0	0	0	0	2
46	0	4	0	0	0	0	4
47	0	3	0	1	0	0	4
48	0	6	1	1	0	1	9
49	0	2	0	0	0	1	3
50	0	4	0	0	0	0	4
51	0	0	0	0	0	0	0
52	0	6	0	1	1	1	9
53	0	6	0	0	0	0	6
54	0	2	0	0	0	0	2
55	0	8	0	0	0	0	8
56	0	3	0	0	0	0	3
57	0	4	0	0	0	0	4
58	0	5	3	0	0	0	8
59	0	5	0	0	0	0	5
60	0	3	0	0	0	0	3
61	0	1	2	0	0	0	3
62	0	1	3	1	0	1	6
63	0	1	2	0	0	0	3
64	0	0	1	0	0	0	1
65	0	1	2	0	0	0	3
66	0	1	1	0	0	0	2
67	0	1	1	0	0	0	2
68	0	1	1	0	0	0	2
69	0	1	0	0	0	0	1
70	0	1	2	1	0	0	4
71	0	1	3	0	0	0	4
72	0	1	2	0	0	0	3
73	0	0	2	0	0	0	2
74	0	0	1	0	0	0	1
75	0	1	0	0	0	0	1
76	0	0	1	0	0	0	1
77	0	0	1	0	0	0	1
78	1	0	0	0	0	0	1
79	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0
81	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0
83	0	0	2	0	0	0	2
84	0	0	0	0	0	0	0
85	0	0	1	0	0	0	1
86	0	0	1	0	0	0	1
87	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0
93	0	0	0	0	0	0	0
94	0	0	0	0	0	0	0

-continued-

Appendix E2.–Page 2 of 2.

	Index Area 1[a]	Index Area 7[b]	Index Area 11[c]	Index Area 14[d]			
Lengths (mm)	16-Jan	19-Jul	18-Sep	31-Aug	27-Sep	4-Dec	Total
95	0	0	0	0	0	0	0
96	1	1	0	0	0	0	2
97	0	0	0	0	0	0	0
98	1	0	0	0	0	0	1
99	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0
101	0	0	0	0	0	0	0
102	0	0	0	0	0	0	0
103	0	0	0	0	0	0	0
104	0	1	0	0	0	0	1
105	0	0	0	0	0	0	0
106	0	0	0	0	0	0	0
107	0	0	0	0	0	0	0
108	0	1	0	0	0	0	1
109	0	0	0	0	0	0	0
110	0	0	0	0	0	0	0
111	0	1	0	0	0	0	1
112	0	1	0	0	0	0	1
113	0	0	0	0	0	0	0
114	0	1	0	0	0	0	1
115	0	1	0	0	0	0	1
116	0	0	0	0	0	0	0
117	0	0	0	0	0	0	0
118	0	0	0	0	0	0	0
119	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0
121	0	0	0	0	0	0	0
122	0	0	0	0	0	0	0
123	0	0	0	0	0	0	0
124	0	0	0	0	0	0	0
125	0	0	0	0	0	0	0
126	0	0	0	0	0	0	0
127	0	0	0	0	0	0	0
128	0	0	0	0	0	0	0
129	0	0	0	0	0	0	0
130	0	1	0	0	0	0	1
131	0	0	0	0	0	0	0
132	0	0	0	0	0	0	0
133	0	0	0	0	0	0	0
134	0	0	0	0	0	0	0
135	0	0	0	0	0	0	0
136	0	0	0	0	0	0	0
137	0	0	0	0	0	1	1
Totals	3	84	33	5	1	6	132

[a] Takotna River, below weir

[b] Minnie Creek

[c] Moore Creek

[d] Gold Creek

Appendix E3.–Trap-caught juvenile chum salmon lengths by date and number caught, 2005.

Lengths (mm)	10-May	14-May	21-May	24-May	27-May	31-May	4-Jun	14-Jun	18-Jun	21-Jun	25-Jun	28-Jun	2-Jul	Total
22	1	0	0	0	0	0	0	0	0	0	0	0	0	1
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	1	0	0	1
32	0	0	0	1	0	0	0	0	0	0	0	0	0	1
33	0	0	0	2	0	0	0	0	0	0	1	0	0	3
34	0	0	0	0	0	0	0	0	0	0	2	0	0	2
35	0	0	0	1	0	0	0	0	0	0	0	0	0	1
36	1	1	0	0	1	0	0	1	0	0	1	1	0	6
37	2	1	1	2	1	0	0	2	2	0	3	0	0	14
38	0	0	1	1	0	1	0	1	0	0	3	1	0	8
39	0	0	0	2	0	0	0	0	1	0	0	0	0	3
40	0	1	0	0	0	0	1	0	1	0	0	0	0	3
41	0	0	0	0	0	0	1	0	0	0	0	1	0	2
42	0	0	0	0	0	1	0	0	2	0	1	1	0	5
43	0	0	0	0	0	0	0	0	2	0	1	4	1	8
44	0	0	0	0	0	0	1	0	2	0	1	2	0	6
45	0	0	0	0	0	0	0	0	0	0	1	3	1	5
46	0	0	0	0	0	0	0	0	1	0	2	3	0	6
47	0	0	0	0	0	0	0	0	0	0	0	3	1	4
48	0	0	0	0	0	1	0	0	0	0	0	2	0	3
49	0	0	0	0	0	0	0	0	0	0	0	3	1	4
50	0	0	0	0	0	0	0	0	0	1	0	3	1	5
51	0	0	0	0	0	0	0	0	0	0	0	1	0	1
52	0	0	0	0	0	0	0	0	0	0	0	4	1	5
53	0	0	0	0	0	0	0	0	0	0	0	3	1	4
54	0	0	0	0	0	0	0	0	0	0	0	3	1	4
55	0	0	0	0	0	0	0	0	0	0	0	3	0	3

-continued-

Appendix E3.–Page 2 of 2.

Lengths (mm)	10-May	14-May	21-May	24-May	27-May	31-May	4-Jun	14-Jun	18-Jun	21-Jun	25-Jun	28-Jun	2-Jul	Total
56	0	0	0	0	0	0	0	0	0	0	0	2	0	2
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	1	1
59	0	0	0	0	0	0	0	0	0	0	0	2	0	2
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	1	1	2
63	0	0	0	0	0	0	0	0	0	0	0	1	0	1
64	0	0	0	0	0	0	0	0	0	0	0	0	1	1
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	1	0	1
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Totals	4	3	2	9	2	3	3	4	11	1	17	48	12	119

[a] Takotna River, below weir

[b] Minnie Creek

[c] Moore Creek

[d] Gold Creek

APPENDIX F. HISTORICAL CUMULATIVE PERCENT SALMON PASSAGE

Appendix F1.–Historical daily cumulative percent passage of Chinook and chum salmon at the Takotna River weir.

	Chinook								Chum							
Date	**1996**	**1997**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**1996**	**1997**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
6/24	0	1	0	0	0		0	0	4	1	0	0	1	0	0	0
6/25	0	4	1	1	0		1	0	4	2	2	0	2	0	1	0
6/26	2	6	1	1	0		1	1	4	3	4	0	3	0	3	0
6/27	6	6	1	1	1		3	2	8	6	5	1	6	0	4	0
6/28	8	9	1	1	2		6	6	10	8	5	1	8	0	6	1
6/29	14	12	2	2	3		7	9	15	13	6	1	12	1	8	1
6/30	18	17	2	3	3		11	19	19	16	6	1	16	1	10	1
7/01	22	17	2	6	5		11	19	22	17	7	2	20	1	13	2
7/02	25	20	6	6	5	3	11	19	25	19	9	3	21	2	16	2
7/03	28	26	11	9	5	4	12	19	28	20	10	4	25	4	20	3
7/04	46	32	12	11	6	4	17	21	33	24	13	4	27	6	23	5
7/05	56	36	16	11	7	6	18	24	42	28	14	5	32	9	26	8
7/06	58	41	18	11	10	7	22	28	52	33	18	6	37	12	33	11
7/07	67	44	21	13	16	9	23	31	61	35	21	8	43	16	37	16
7/08	73	49	32	29	26	11	28	35	68	37	29	11	46	20	41	22
7/09	74	55	35	31	28	21	59	37	74	41	33	13	48	24	46	25
7/10	75	59	36	41	29	27	63	45	78	44	35	16	53	27	52	30
7/11	76	65	38	42	58	30	66	49	81	48	40	20	59	28	56	33
7/12	78	69	44	46	74	34	69	52	83	49	42	27	65	31	61	37
7/13	79	71	45	52	75	40	70	64	86	51	46	32	67	32	62	40
7/14	81	77	46	56	76	42	73	67	86	58	50	38	69	37	64	43
7/15	83	79	47	62	76	42	76	67	87	60	53	43	71	40	66	47
7/16	83	80	48	66	76	44	78	76	88	63	56	47	73	45	67	51
7/17	88	83	48	68	77	46	79	79	90	67	60	51	76	49	71	58
7/18	91	87	50	70	79	52	81	80	92	71	62	56	78	54	77	62
7/19	93	88	51	74	80	59	81	84	94	72	67	63	81	60	78	68
7/20	95	90	54	78	83	66	82	85	95	73	71	68	84	67	81	73
7/21	97	90	56	81	84	68	83	85	95	77	74	72	85	71	82	75
7/22	98	91	67	84	85	72	83	86	96	79	79	76	88	76	83	79
7/23	99	92	68	86	85	73	89	87	97	82	81	79	89	79	87	81
7/24	100	93	69	88	85	76	89	88	97	86	83	82	91	81	89	83
7/25	100	95	74	90	87	78	89	89	97	87	85	85	92	83	90	85
7/26	100	96	75	91	89	79	91	91	98	88	87	87	94	84	91	87
7/27	100	97	77	92	89	81	92	92	98	92	88	89	94	86	92	89

-continued-

Appendix F1.–Page 2 of 3.

	Chinook								Chum							
Date	**1996**	**1997**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**1996**	**1997**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
7/28	100	98	79	94	90	83	92	93	99	93	89	91	95	87	93	91
7/29	100	99	81	94	92	85	93	94	99	96	90	92	96	89	94	93
7/30	100	99	83	94	94	86	95	94	99	98	91	93	97	90	95	94
7/31	100	99	83	95	94	88	95	95	99	99	92	95	97	91	96	95
8/01	100	99	84	95	94	89	95	95	99	100	92	95	97	92	97	95
8/02	100	100	84	95	94	90	95	95	100	100	93	96	98	93	98	96
8/03	100	100	86	95	94	91	95	95	100	100	93	97	98	94	98	96
8/04	100	100	88	96	95	93	96	95	100	100	95	97	99	95	98	97
8/05	100	100	90	96	95	94	97	96	100	100	95	98	99	96	98	97
8/06	100	100	91	96	95	94	97	97	100	100	96	98	99	97	99	98
8/07	100	100	91	97	96	94	98	97	100	100	97	99	99	98	99	98
8/08	100	100	93	97	96	96	98	97	100	100	98	99	99	98	99	98
8/09	100	100	95	97	97	96	98	97	100	100	98	99	99	98	99	99
8/10	100	100	95	97	97	96	98	97	100	100	99	99	99	98	99	99
8/11	100	100	96	98	97	96	98	97	100	100	99	99	100	98	99	99
8/12	100	100	98	98	98	96	98	97	100	100	100	99	100	99	100	99
8/13	100	100	99	98	99	96	99	98	100	100	100	99	100	99	100	99
8/14	100	100	99	98	99	97	99	98	100	100	100	100	100	99	100	99
8/15	100	100	99	98	99	97	99	98	100	100	100	100	100	99	100	99
8/16	100	100	99	98	99	97	99	98	100	100	100	100	100	99	100	99
8/17	100	100	99	98	99	97	99	98	100	100	100	100	100	99	100	99
8/18	100	100	99	98	99	98	99	98	100	100	100	100	100	99	100	99
8/19	100	100	99	98	99	98	99	98	100	100	100	100	100	99	100	99
8/20	100	100	99	98	99	98	100	98	100	100	100	100	100	100	100	99
8/21	100	100	99	99	99	98	100	98	100	100	100	100	100	100	100	100
8/22	100	100	99	99	99	98	100	98	100	100	100	100	100	100	100	100
8/23	100	100	99	99	99	99	100	98	100	100	100	100	100	100	100	100
8/24	100	100	99	99	99	99	100	98	100	100	100	100	100	100	100	100
8/25	100	100	99	99	99	99	100	99	100	100	100	100	100	100	100	100
8/26	100	100	99	99	99	99	100	99	100	100	100	100	100	100	100	100
8/27	100	100	100	99	99	100	100	99	100	100	100	100	100	100	100	100
8/28	100	100	100	99	99	100	100	99	100	100	100	100	100	100	100	100
8/29	100	100	100	99	99	100	100	99	100	100	100	100	100	100	100	100
8/30	100	100	100	100	99	100	100	99	100	100	100	100	100	100	100	100

-continued-

Appendix F1.–Page 3 of 3.

Date	Chinook 1996	Chinook 1997	Chinook 2000	Chinook 2001	Chinook 2002	Chinook 2003	Chinook 2004	Chinook 2005	Chum 1996	Chum 1997	Chum 2000	Chum 2001	Chum 2002	Chum 2003	Chum 2004	Chum 2005
8/31	100	100	100	100	99	100	100	99	100	100	100	100	100	100	100	100
9/01	100	100	100	100	99	100	100	99	100	100	100	100	100	100	100	100
9/02	100	100	100	100	99	100	100	99	100	100	100	100	100	100	100	100
9/03	100	100	100	100	99	100	100	99	100	100	100	100	100	100	100	100
9/04	100	100	100	100	99	100	100	100	100	100	100	100	100	100	100	100
9/05	100	100	100	100	99	100	100	100	100	100	100	100	100	100	100	100
9/06	100	100	100	100	99	100	100	100	100	100	100	100	100	100	100	100
9/07	100	100	100	100	99	100	100	100	100	100	100	100	100	100	100	100
9/08	100	100	100	100	99	100	100	100	100	100	100	100	100	100	100	100
9/09	100	100	100	100	99	100	100	100	100	100	100	100	100	100	100	100
9/10	100	100	100	100	99	100	100	100	100	100	100	100	100	100	100	100
9/11	100	100	100	100	99	100	100	100	100	100	100	100	100	100	100	100
9/12	100	100	100	100	99	100	100	100	100	100	100	100	100	100	100	100
9/13	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
9/14	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
9/15	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
9/16	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
9/17	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
9/18	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
9/19	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
9/20	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Note: The tower was operated for only 8 days in 1998; hence, that year is excluded from the table. The boxes represent the median passage date and central 50% of the run. Days with no data are days when the project was not operational.

Appendix F2.–Historical daily cumulative percent passage of coho and sockeye salmon at the Takotna River weir.

	Coho						Sockeye					
Date	2000	2001	2002	2003	2004	2005	2000	2001	2002	2003	2004	2005
6/24	0	0	0	0	0	0	0	0	0	0	0	0
6/25	0	0	0	0	0	0	0	0	0	0	0	0
6/26	0	0	0	0	0	0	0	0	0	0	0	0
6/27	0	0	0	0	0	0	0	0	0	0	0	0
6/28	0	0	0	0	0	0	0	0	0	0	0	0
6/29	0	0	0	0	0	0	0	0	0	0	0	0
6/30	0	0	0	0	0	0	0	0	0	0	0	0
7/01	0	0	0	0	0	0	0	0	0	0	0	0
7/02	0	0	0	0	0	0	0	0	0	0	0	0
7/03	0	0	0	0	0	0	0	0	0	0	0	0
7/04	0	0	0	0	0	0	0	0	0	0	0	0
7/05	0	0	0	0	0	0	0	0	0	0	0	0
7/06	0	0	0	0	0	0	0	0	0	0	0	0
7/07	0	0	0	0	0	0	0	0	0	0	0	0
7/08	0	0	0	0	0	0	0	0	0	0	0	0
7/09	0	0	0	0	0	0	0	0	0	0	0	0
7/10	0	0	0	0	0	0	0	0	0	0	0	0
7/11	0	0	0	0	0	0	0	0	0	0	0	0
7/12	0	0	0	0	0	0	0	0	0	0	0	0
7/13	0	0	0	0	0	0	0	0	0	0	0	0
7/14	0	0	0	0	0	0	0	0	0	0	0	0
7/15	0	0	0	0	0	0	0	0	0	0	0	0
7/16	0	0	0	0	0	0	0	0	0	0	0	0
7/17	0	0	0	0	0	0	0	0	0	0	0	6
7/18	0	0	0	0	0	0	0	0	0	0	0	6
7/19	0	0	0	0	0	0	0	0	0	0	0	6
7/20	0	0	0	0	0	0	0	0	0	0	0	6
7/21	0	0	0	0	0	0	0	0	0	0	0	6
7/22	0	0	0	0	0	0	0	0	0	0	0	9
7/23	0	0	0	0	0	0	0	0	0	0	0	11
7/24	0	0	0	0	0	0	0	0	0	0	0	11
7/25	0	0	0	0	0	0	0	0	0	0	0	14
7/26	0	0	0	0	0	0	0	0	0	0	0	17
7/27	0	0	0	0	0	0	0	0	0	0	0	17
7/28	0	0	0	0	0	0	0	0	0	0	0	20
7/29	0	0	0	0	0	0	0	0	0	0	0	23
7/30	0	0	0	0	0	0	0	0	0	0	0	26
7/31	0	0	0	0	0	0	0	0	0	0	6	29
8/1	0	0	0	0	0	1	0	0	0	0	6	29
8/2	0	0	0	0	0	1	0	0	0	0	6	29
8/3	0	0	0	1	0	1	0	0	0	0	6	29
8/4	0	0	0	1	0	1	0	0	0	0	6	29
8/5	0	0	0	1	0	1	25	0	0	0	6	29
8/6	1	0	0	1	1	2	25	0	0	0	6	29
8/7	1	0	0	2	1	2	25	0	0	0	6	29
8/8	1	0	0	2	2	2	25	0	0	25	6	31
8/9	2	0	0	3	3	2	25	0	0	50	6	31
8/10	3	0	0	4	3	3	25	100	0	50	12	31
8/11	4	1	1	5	4	3	25	100	0	50	12	31
8/12	6	2	1	7	6	4	25	100	0	50	12	34

-continued-

Appendix F2.–Page 2 of 2.

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

Note: The tower was operated for only 8 days in 1998; hence, that year is excluded from the table. The boxes represent the median passage date and central 50% of the run. Days with no data are days when the project was not operational.