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George River Salmon Studies, 2006

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

by

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Symbols and Abbreviations

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Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Measures (fisheries)

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

Mathematics, statistics

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

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TABLE OF CONTENTS

Page

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES (Continued)

Figure **Page**

LIST OF APPENDICES

ABSTRACT

The George River is a tributary of the Kuskokwim River, and produces Chinook salmon *Oncorhynchus tshawytscha*, chum salmon *O. keta*, and coho salmon *O. kisutch* that contribute to intensive subsistence and commercial salmon fisheries downstream of its confluence. The George 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 Sustainable Fishery Policy (5 AAC 39.222), this array of projects is a tool to assure appropriate geographic and temporal distribution of spawning salmon, and provide a means to assess trends in escapement that should be monitored and considered in harvest management decisions. Towards this end, George River weir has been operated annually since 1996 to determine daily and total salmon escapements for the target operational period of 15 June through 20 September; to estimate age, sex, and length compositions of Chinook, chum, and coho salmon escapement; to monitor environmental variables that influence salmon productivity; and to provide part of an integrated platform in support of other Kuskokwim Area fisheries projects.

In 2006, a resistance board weir was operated on the George River from 15 June through 20 September. Escapements for the target operational period were estimated as 4,357 Chinook, 41,467 chum, and 11,296 coho salmon. Escapement goals have not been set for the George River. Chinook, chum, and coho salmon escapements were near average in 2006. Age, sex, and length data indicated a relatively strong return of age-1.4 Chinook salmon and age-0.3 chum salmon, similar to what was seen throughout the Kuskokwim River drainage in 2006. Information collected at the weir from fish tagged in the mainstem Kuskokwim River suggest George River salmon are a later component of runs migrating past the tagging site, located near the village of Kalskag.

Key words: Chinook salmon, *Oncorhynchus tshawytscha*, chum salmon, *O. keta*, coho salmon, *O. kisutch*, longnose suckers, *Catostomus catostomus*, escapement, age, sex, and length composition, George River, Kuskokwim River, resistance board weir, 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, 11% of the total area of Alaska (Figure 1; Brown 1983). Each year mature Pacific salmon *Oncorhynchus spp.* return to the river and its tributaries to spawn, supporting an annual average subsistence and commercial harvest of nearly one million salmon (Whitmore et al. 2005). The subsistence salmon fishery in the Kuskokwim Area is one of the largest in the state, and remains a fundamental component of local culture (ADF&G 2004; Coffing 1991, *Unpublished* a, b; Coffing et al. 2000; Whitmore et al. 2005). The commercial salmon fishery, though modest in value compared to other areas of Alaska, has been an important component of the market economy of lower Kuskokwim River communities (Buklis 1999; Whitmore et al. 2005). Salmon that contribute to these fisheries spawn and rear in nearly every tributary of the Kuskokwim River basin.

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

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

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

The need for long-term escapement monitoring projects became more evident in September 2000, when the Alaska Board of Fisheries (BOF) classified both Kuskokwim River Chinook (*O. tshawytscha*) and chum salmon (*O. keta*) as "stocks of yield concerns" (5 AAC 39.222, 2001) (Burkey et al. 2000a, b). This designation was upheld during the 2004 BOF meeting (Bergstrom and Whitmore 2004) but was rescinded during the 2007 BOF meeting at the recommendation of ADF&G following several years of expected harvest levels and relatively strong escapements (Linderman and Bergstrom 2006). The value of long-term data sets to sustainable management highlights the importance of long-term projects and promotes the need for continued escapement monitoring at established ground-based projects throughout the drainage where long-term historical data sets are currently lacking, such as George River weir.

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

BACKGROUND

The George River drainage is located in the middle Kuskokwim River basin (Figure 1) and provides spawning and rearing habitat for Chinook salmon, chum salmon, and coho salmon *O. kisutch* which contribute to the subsistence, commercial, and sport fisheries of the Kuskokwim River (ADF&G 1998). Smaller numbers of sockeye salmon *O. nerka* and pink salmon *O. gorbuscha* also spawn and rear in the George River. In addition to Pacific salmon, several resident fish species are found throughout the system: Arctic grayling *Thymallus arcticus*, various whitefishes *Coregonus spp.*; *Stenodus leucichthys*; *Prosopium cylindraceum*, Dolly Varden *Salvelinus malma*, northern pike *Esox lucius*, longnose suckers *Catostomus catostomus*, lampreys *Lampetra species*, slimey sculpin *Cottus cognatus*, burbot *Lota lota*, blackfish *Dallia pectoralis*, and nine-spine stickleback *Pungitius pungitius*. The production of both Pacific salmon and resident species contributes to the diversity of Kuskokwim River fish populations and numbers of fish supporting sport, commercial, and subsistence fisheries.

George River is popular for sport fishing, and the river is an access route for recreational and subsistence fishers and hunters. Professional guide operations based within and outside the Kuskokwim Area use George River as an angling and hunting destination for their clients. In 2000, George River received some of the highest Chinook salmon sport fishing angler effort in the Middle Kuskokwim River area (Burr 2002).

Historically, the George River drainage has supported a relatively high level of mining activity. Since the early 1900s, several small to moderate size mining camps have operated intermittently in the middle and upper George River drainage (Brown 1983). A small tributary of George River named Julian Creek received intermittent mining activity since the early 1900s, and this activity continues at a recreational level today. Mining interest in the northern region of the Kuskokwim Mountains expanded in recent years with proposed large-scale open-pit gold mining operations at Donlin Creek in the Crooked Creek drainage, which borders the George River drainage. Expected development of the Donlin Creek Mine heightens interest in local aquatic systems and highlights the need for baseline data collection specific to salmon population dynamics and habitat quality such as water chemistry and hydrology. Impacts of this proposed mine will likely include increased recreational and subsistence fishing activities in the George River area because of a resulting increase in human population associated with development of the Donlin Creek Mine. Salmon escapement monitoring will help ensure continued wise management practices to provide sustainable harvest opportunity for these various user groups.

The George River weir escapement monitoring project has been annually operated cooperatively by ADF&G and the Kuskokwim Native Association (KNA) since its inception in 1996. George River weir has developed into a highly useful tool for sustainable salmon management, and both organizations make use of weir data during inseason salmon management deliberations. Project responsibilities are shared between the KNA and ADF&G. Generally, ADF&G takes the lead in data management, data analysis, and reporting; and KNA takes the lead in field operations and community outreach. The primary purpose of this project is to accurately monitor total annual Pacific salmon escapement to the George River system. Secondary to this is the goal to promote local education and involvement in fisheries monitoring and develop the capacity of KNA to engage effectively in salmon resource management. To this end, the George River weir crew annually consists of 2 locally hired KNA technicians, 1 ADF&G technician, and several student interns from surrounding communities for a "hands-on" work experience.

OBJECTIVES

1. Determine daily and annual escapements of Chinook, chum, and coho salmon to George River from 15 June through 20 September.
2. Estimate the age, sex, and length (ASL) composition of total Chinook, chum, and coho salmon escapements to George River from a minimum of 3 pulse samples, 1 collected from each third of the run, such that simultaneous 95% confidence intervals of age composition in each pulse are no wider than 0.20 ($\alpha = 0.05$ and $d = 0.10$).
3. Monitor habitat variables including daily water temperature and daily water level.
4. Participate in related fisheries projects:
   - Serve as a recapture site for Chinook salmon equipped with radio transmitters deployed as part of *Inriver Abundance of Chinook Salmon in the Kuskokwim River* (FIS 02-015).
   - Serve as a recapture site for sockeye salmon equipped with radio transmitters deployed as part of *Kuskokwim River Sockeye Salmon Investigations* (AYKSSI).
   - Serving as a recovery location for anchor-tagged Chinook and sockeye salmon as part of the *Kuskokwim River Salmon Mark-Recapture Project* (FIS 04-308).
   - Installation of a stream gauge at the George River to begin collecting hydrologic data as part of the *Hydrologic Data for the George River Project* (SWG).

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

METHODS

STUDY AREA

The George River drains a 3,558 km^2 watershed formed by surface runoff from the northern Kuskokwim Mountains within the middle Kuskokwim River basin. Major tributaries of the George River include Beaver Creek, Michigan Creeks, North Fork George River, South Fork George River, and East Fork George River consisting of Little South Fork and Moose Creek (Figure 2). From its headwaters the George River flows southerly for approximately 120 river kilometers (rkm) to its confluence with the Kuskokwim River (Figure 1). The mouth of the George River is located near the community of Georgetown, 446 rkm upstream of the mouth of the Kuskokwim River, 340 rkm upstream of Bethel, and 139 rkm upstream of Aniak.

Over its course the George River flows through a poorly drained moderately confined floodplain consisting of soft sediments that erode easily. The substrate is composed of predominately gravels and cobbles with some sand. At normal flow the George River is considerably stained due to organic leaching, limiting visibility to approximately 0.5 m. Throughout the drainage oxbows, sloughs, and large log jams are common creating a complex mosaic of habitats suitable for salmon and resident fish species. Riparian areas consist of predominantly upland spruce-hardwood forests. White spruce *Picea glauca* and scattered birch *Betula spp.* or aspen *Populus trenuloides* are common on south-facing slopes, and black spruce *P. mariana* is characteristic on northern exposures and poorly drained areas. The understory consists of spongy moss and low brush in poorly drained areas, grasses in well-drained areas, and willows *Salix spp.*, and alders *Alnus spp.* in open forest near timberline.

The George River weir is located 7 rkm upstream of the mouth of the George River (N61° 55.4' Latitude and W157° 41.9' Longitude) and captures nearly the entire salmon spawning habitat within the drainage (Figure 2). The weir has operated at this location since the project began in 1996. At the weir site the channel is approximately 110 m wide with a depth of about 1 m during normal summer operations. Discharge measurements taken at the site over the years have ranged between 16 and 128 m^3/s, with velocities ranging from 0.6 and 1.3 m/s in the thalweg. Discharge measurements have not been attempted during flood conditions and therefore discharge data do not represent the full potential range of flows.

WEIR DESIGN

Construction

The George River weir is a "floating panel" resistance board weir. Detailed design and construction are presented in Tobin (1994) with panel modifications described by Stewart (2002). The weir was installed across the entire 110 m channel following the techniques described by Stewart (2003). The substrate rail and resistance board panels covered the middle 100-m portion of the channel, and fixed weir materials extended the weir 5 m to each bank. The pickets were 3.33 cm (1-5/16 in) in diameter and spaced at intervals of 6.67 cm (2-5/8 in) to leave a gap of 3.33 cm (1-5/16 in) between each picket.

A fish passage chute, live trap, and skiff gate were installed within the deeper portion of the channel. The live trap was designed as the primary means of upstream fish passage. The fish passage chute was simply a modified weir panel that allowed fish to pass upstream of the weir. The fish trap, which was 1.5 by 2.5 m and included an entrance gate, holding box, and exit gate, was located immediately upstream of fish passage chute so that all fish passing through the chute passed through the trap. The trap could be easily configured to pass fish freely upstream or capture individuals or groups of fish for a variety of sampling purposes. The skiff gate consisted of several modified weir panels that allowed boat operators to pass with little or no involvement by the weir crew as the weight of a boat submerged the panels allowing boats to pass over the weir. Boats with jet-drive engines were the most common and could pass up or downstream over the skiff gate after reducing their speed to 5 miles per hour or less.

To accommodate downstream migration of longnose suckers and other resident species, downstream passage chutes were incorporated into the weir when resident species were observed congregating just upstream. At locations where downstream migrants were most concentrated, chutes were created by releasing the resistance boards on 1 or 2 adjacent weir panels so the distal ends dipped slightly below the stream surface. The chute's shallow profile guides downstream migrants while preventing upstream salmon passage. The chutes were monitored and adjusted to ensure salmon were not passing upstream. 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 several times each day, typically at the end of a counting shift. A technician walked across the weir partially submerging each panel, thereby allowing the current to wash any debris downstream. A rake was used to push larger debris loads off the weir. Each time the weir was cleaned, a visual inspection was made of weir panels, substrate rail, fish trap, and fixed weir sections to ensure no breaches would allow fish to pass upstream uncounted. If conditions prevented an adequate visual inspection, technicians used snorkel gear to complete their inspection.

ESCAPEMENT MONITORING

A "target operational period," spanning most of the salmon runs, was observed to provide for consistent comparisons of annual escapements among years. The target operational period for George River weir has been established as 15 June through 20 September, although actual operational dates may vary with stream conditions. Daily and total annual escapements consisted of the observed passage plus any estimated passage of Chinook, chum, or coho salmon missed during the target operational period. Counts of all other species were reported simply as observed passage (i.e. no estimation of missed passage was determined during inoperable periods within the target operational period).

Passage Counts

Passage counts were conducted periodically during daylight hours. Substantial delays in fish passage occurred only at night or during ASL sampling. Crew members visually identified each fish as it passed upstream and recorded it by species on a multiple tally counter. Counting continued for a minimum of 1 hour, or until passage waned. 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. Crew members recorded the total upstream fish count in a designated notebook 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. An observer positioned on the trap viewed fish entering from downstream through a clear-bottom viewing box that reduced glare and water turbulence. In addition to aiding in clear identification of fish, this allowed observers to anticipate and effectively trap fish tagged in the mainstem Kuskokwim River. When salmon were reluctant to enter the fish trap, such as during periods of extreme low water, it was necessary to employ an alternative counting method in which the observer removed a connecting picket between 2 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 assisting in the identification of passing fish. This method was typically employed near the trap which was used as an elevated platform for viewing upstream passage. 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.

Estimating Missed Passage

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

Single Day

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

Linear Method

When adequate data exist before and after a relatively short inoperable period, 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, resulting 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:

$$\hat{n}_{d_i} = \alpha + \beta \cdot i \tag{1}$$

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

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

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.

Proportion Method

When adequate data before or after an inoperable period does not exist (i.e. when weir operation begins after the start target operational period or the weir operation ends prior to the end of the target operational period), or the inoperable period is relatively long, a "proportion method" is used to extrapolate missed passage from a model data set with similar passage characteristics to the George River weir. A model data set could be from a different year at George River, or from the same year at a neighboring project. In either case, daily passage is based on the model data set's daily passage proportions, and is calculated using the formula:

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

where

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

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

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

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

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

Estimates Required in 2006

In 2006, the "linear method" was used to estimate missed chum, coho, and sockeye salmon passage when the weir became inoperative from 19–25 August. Data sets from previous years at George River weir were chosen as models. Estimates were not required for Chinook salmon because few pass upstream during this time based on historical run-timing and abundance information.

Carcass Counts

The weir was cleaned several times each day, typically at the beginning and end of counting shifts. Spawned out salmon and carcasses of dead salmon (both hereafter referred to as carcasses) washed up on the weir, were counted by species and sex and passed downstream. Daily and cumulative carcass counts were copied to logbook forms.

AGE, SEX, AND LENGTH COMPOSITION

The ASL composition of the total Chinook, chum, and coho salmon escapements were estimated by sampling a fraction of the fish passage and applying the ASL composition of those samples to the total escapement as described in DuBois and Molyneaux (2000).

Sample Collection

The crew at the George 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 days followed by a few days without sampling. The goal of each pulse was to sample 200 chum and 170 coho salmon. The pulse sample design was not strictly followed with Chinook salmon such that the goal to sample a minimum of 210 Chinook salmon from each third of the run preceded the goal to sample in pulses. This method results in a near daily Chinook salmon sample collection throughout most of the target operational period. 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 (or per third of the run in the case of Chinook salmon) 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. Target 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 sampling events was 3 per species, 1 event from each third of the run, to account for temporal dynamics in the ASL composition.

ASL sampling consisted of capturing salmon with the fish trap by opening the entrance gate while the exit gate remained closed. Fish were allowed to swim freely into the holding box, but the V-shape positioning of the entrance gate prevented them from easily escaping. The holding box was allowed to fill with fish until a reasonable number was inside. Crew members used a dip net to remove fish from the holding box. Fish were removed from the dip net and placed into a partially submerged fish cradle. Three scales were taken from the preferred area (INPFC 1963) as described in standard procedures and transferred to numbered gum cards (DuBois and Molyneaux 2000). Sex was determined through visual examination of the external morphology, keying in on the development of the kype, roundness of the belly, and the presence or absence of an ovipositor. Length was measured to the nearest millimeter from mid-eye to tail fork (METF) using a straight-edged meter stick. Sex and length data were recorded on standardized numbered data sheets that correspond with numbers on the gum cards used for scale preservation. After sampling, each fish was released upstream of the weir. The procedure was repeated until the holding box was emptied.

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

After sampling was completed, relevant information such as sex, length, sampling date, and sampling location was copied to computer mark-sense forms that correspond to numbered gum cards. The completed gum cards and mark-sense forms were sent to the Bethel and/or Anchorage ADF&G offices for processing. The original ASL gum cards, acetates, and mark-sense forms were archived at the ADF&G office in Anchorage. The computer files were archived by ADF&G in the Anchorage and Bethel offices. Data were also loaded into the Arctic-Yukon-Kuskokwim (AYK) salmon database management system (Brannian et al. 2005). Further details of sampling procedures can be found in DuBois and Molyneaux (2000) and Linderman et al. (2003).

Estimating Age, Sex, and Length Composition

ADF&G staff in Bethel and Anchorage aged scales, processed the ASL data, and generated data summaries as described by DuBois and Molyneaux (2000). These procedures generated 2 types of summary tables for each species; one described the age and sex composition and the other described length statistics. These summaries accounted for changes in the ASL composition throughout the season by first partitioning the season into temporal strata based on pulse sample dates and/or sample size requirements, and then applying the ASL composition of individual temporal samples to the corresponding temporal stratum, and finally summing the strata to generate the estimated ASL composition for the season. This procedure ensured that the ASL composition of the total annual escapement was weighted by the abundance of fish in the escapement rather than the abundance of fish in the samples. For example, if samples of chum salmon were collected in 6 pulses, then the season would be partitioned into 6 temporal strata with 1 pulse sample occurring in each stratum. Hence, a hypothetical sample of 200 chum salmon collected from 3 to 4 July would be used to estimate the ASL composition of the hypothetical escapement of 2,000 chum salmon that passed the weir during the temporal stratum that might extended from 1 to 7 July. This procedure would be repeated for each temporal stratum, and the estimated age and sex composition for the total annual escapement would be calculated as the sum of chum salmon in each stratum. In similar fashion, the estimated mean length composition for the total annual escapement would be calculated by weighting the mean lengths in each temporal stratum by the escapement of chum salmon that passed the weir during that stratum. Confidence intervals were constructed for the estimated mean lengths according to Thompson (1992, p.105).

Throughout this document fish 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 has spent in freshwater and the second numeral indicates the number of winters spent in the ocean (Groot and Margolis 1991). Total age of a fish is equal to the sum of these 2 numerals, plus 1 year to account for the winter when the egg was incubating in gravel. For example, a Chinook salmon described as age-1.4 was actually 6 years of age.

Weather and Stream Observations

Water and air temperatures were manually measured each day at approximately 0730 and 1700 hours. Water temperature was determined by submerging a calibrated thermometer (°C) below the water surface until the temperature reading stabilized. Air temperature was obtained by placing the thermometer in a shaded location until the temperature reading stabilized. Temperature readings were recorded in a designated logbook, along with notations about wind direction, estimated wind speed, cloud cover, and precipitation. Daily precipitation was measured using a rain gauge calibrated in millimeters. These manual techniques are consistent with past years at this project. In 2005 and 2006, water temperature was also measured with a remote temperature logger located at mid-channel near the weir. The data logger was programmed to record temperature every hour during the operational period. Records were retrieved at the end of the season and compared to temperatures measured manually using a thermometer.

Daily operations included monitoring river depth (stage height) with a standardized staff gauge at approximately 0730 and 1700 hours. The staff gauge consisted of a metal rod driven into the stream channel with a meter stick attached. The staff gauge was located near the bank just downstream of the weir. The height of the water surface, as measured from the meter stick, and represented the "stage" of the river in centimeters above an established datum plane. The staff gauge was calibrated to the datum plane by a semi-permanent benchmark (Appendix A) to provide for consistent measurements between years. Benchmarks established in 2000 consisting of steel pipes driven near flush with the substrate have been damaged by ice in recent years. A new benchmark was established in 2005 and used again in 2006. The new benchmark consists of a small rectangular aluminum plate fixed to the top of a tree stump located in the middle of the field camp approximately 10 m back from the riverbank. This benchmark represents a river stage of 300 cm, and is directly comparable with benchmarks and stage measurements maintained since 2000. The new benchmark requires the use of a surveyor's rod and level to calibrate the river gauge.

Related Projects

In-river Abundance of Chinook Salmon in the Kuskokwim River

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

The George River weir and crew facilitated this project by monitoring a receiver station located upstream of the weir, enumerating total passage of Chinook salmon upstream of the weir, recapturing radio-tagged Chinook salmon passing upstream of the weir, and collecting ASL data from Chinook salmon passing upstream of the weir. The receiver station was downloaded by the weir crew and data was sent to researchers as often as possible throughout the season.

Kuskokwim River Sockeye Salmon Investigations

The George River weir was used as a platform for the project entitled *Kuskokwim River Sockeye Salmon Investigations*. This project was designed to address critical knowledge gaps in the biology and ecology of Kuskokwim River sockeye salmon. Specifically, this project aimed to describe the location and relative abundance of sockeye salmon spawning aggregates, estimate stock-specific run-timing in the main stem of the Kuskokwim River, describe and compare habitat use and seasonal migration patterns of river-type and lake-type juveniles, and describe and compare smolt size and growth among tributaries and habitat types. These goals were addressed by conducting a 2-sample mark–recapture study within the upper Kuskokwim River drainage above Kalskag and conducting juvenile studies within various habitat types throughout the Holitna drainage. Similar to the Chinook project, radio transmitters were inserted into Sockeye salmon caught near Kalskag. Radio-tagged fish were also equipped with a spaghetti tag to estimate tag loss. A combination of radio receiver stations located throughout the upper Kuskokwim River drainage (the same receiver stations used for the Chinook project) and aerial surveys were used to monitor the movement of tagged fish. Juvenile salmon were sampled from various habitat types throughout the Holitna drainage using standard seining techniques. The known sockeye salmon passage at the weir projects located throughout the upper drainage, coupled with data collected from tracking efforts, was used to address distribution, abundance, and run-timing of spawning aggregates. Data from seining efforts were used to address habitat use, out migration timing, and variation in size and growth of juvenile sockeye salmon.

The George River weir and crew facilitated this effort by monitoring and downloading the receiver station located near the weir, enumerating total passage of sockeye salmon upstream of the weir, recapturing radio-tagged sockeye salmon passing upstream of the weir, collecting scales from adult sockeye salmon passing upstream of the weir, and conducting juvenile sampling in the lower Holitna River. The receiver station was downloaded by the weir crew and data was sent to researchers as often as possible throughout the season. Scale samples were collected from approximately 75 adult sockeye salmon. Juvenile sampling was conducted over a 2–3 day period in June, July, August, and September. The crew collected a total of 10–12 samples during each sampling period, representing both main channel and side channel habitats. Sampled fish were identified to species and counted. A sub-sample of each salmon species from each habitat type was measured for total length and preserved for aging.

Kuskokwim River Salmon Mark–recapture Project

The George River weir was used as a platform for the project entitled *Kuskokwim River Salmon Mark-Recapture Project*. In 2006 this project was designed to investigate stock-specific run-timing and travel speed of Kuskokwim River Chinook and sockeye salmon. These goals were addressed by conducting a 2-sample mark–recapture study within the upper Kuskokwim River drainage above Kalskag. Uniquely numbered anchor tags were attached to Chinook and sockeye salmon caught near Kalskag. Weir crews at projects located throughout the upper Kuskokwim River drainage recaptured observed tagged fish in the weir trap. Known recapture dates and tag number from the weirs coupled with known deployment dates of recaptured tags from the Kalskag tagging site was used to develop estimates of stock-specific run-timing and travel speed. For the purpose of estimating stock-specific run-timing and travel speed for each species, fish radio-tagged as part of concurrent research efforts were pooled with anchor-tagged fish to increase sample size. This was considered appropriate since similar gear types were used for capture, and the objectives of both projects were considered in the tag deployment schedule. The pooling of both samples likely resulted in a better estimate of stock-specific run-timing and travel speed than either considered independently because the radio tag to anchor tag ratio varied from day to day when radio tags were deployed according to a rigid pre-determined schedule and anchor tags were affixed to the remaining catch. Complete methodology is presented by Baumer et al. (*In prep*).

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

Hydrologic Data for the George River

This project was developed to better understand relationships among aquatic species and their freshwater habitats by collecting baseline hydrologic data for the George River. The objective of this project was to install a stream gauge on the George River and collect accurate hydrologic data. This data is required to assess relationships between fish population dynamics and flow characteristics throughout freshwater stages of their life cycle. In addition, baseline hydrologic data is critical for the establishment of water reservations; the legal right (or appropriation of water) to maintain a specific flow rate or level in a given body of water for one or a combination of purposes: 1) protection of fish and wildlife habitat, migration, and propagation; 2) recreation and parks purposes; 3) navigation and transportation purposes; and 4) sanitary and water quality purposes (Estes 1996). The coordination of the installation and operation of the stream gauge with the operations of the George River weir will allow comparison of hydrologic dynamics with salmon fish migration rates. The 2006 season marked the first year of a 5-year study aimed at addressing temporal flow dynamics.

The George River weir and crew facilitated with this efforts by installing an Aquistar stream gauge (Instrumentation Northwest, Inc.) approximately 200 yards downstream of the weir (river right) on 21 June. The stream gauge was installed at a water level of 69 cm. The station was monitored throughout the season as directed by the Statewide Aquatic Resources Coordination Unit (SARCU). The stream gauge was calibrated from stream discharge measurements representing 4 contrasting water levels “stages” during the season following methods described by the U.S. Geological Survey (Rantz 1982). Discharge was measured using a Price AA current-meter and top-setting wading rod. Information collected for calculating discharge was recorded in the camp logbook. Stream discharge was calculated using standard area velocity methods.

RESULTS

ESCAPEMENT MONITORING

The George River weir operated from 0000 hours on 15 June through 18 August. The weir was inoperable for 7 days from 19 August through 25 August due to high water and heavy debris loads. Operations resumed on 26 August and continued through 20 September.

Chinook Salmon

Total annual Chinook salmon escapement upstream of the George River weir during the target operational period in 2006 was 4,357 fish, which includes no estimate of fish passage during the inoperable period (Table 1). Passage missed during the inoperable period was considered negligible based on available passage and run-timing data. The first Chinook salmon was observed on 15 June, daily passage peaked at 589 fish on 4 July, and the last Chinook salmon was observed on 10 September. The median passage date was 7 July and the central 50% of the passage occurred between 4 July and 16 July (Appendix B1).

Chum Salmon

Total annual chum salmon escapement upstream of the George River weir during the target operational period in 2006 was 41,467 fish, which includes an estimated 232 fish (0.6% of the total run) that passed during the inoperable period (Table 1). The first chum salmon was observed on 18 June, daily passage peaked at 2,795 fish on 19 July, and the last chum salmon was observed on 20 September, the last day of operation. The median passage date was 14 July and the central 50% of the passage occurred between 6 and 22 July (Appendix B2).

Coho Salmon

Total annual coho salmon escapement upstream of the George River weir during the target operational period in 2006 was 11,296 fish, which includes an estimated 1,675 fish (14.8% of the total run) that passed during the inoperable period (Table 1). The first coho salmon was observed on 26 July, daily passage peaked at 791 fish on 15 August, and the last coho salmon was observed on 20 September, the last day of operation. The median passage date was 28 August and the central 50% of the run occurred between 18 August and 6 September (Appendix B3).

Other Species

Sockeye Salmon

Total annual sockeye salmon escapement upstream of the George River weir during the target operational period in 2006 was 164 fish, which includes an estimated 18 fish (11.0% of the total run) that passed during the inoperable period (Appendix B4). The first sockeye salmon was observed on 9 July and the last fish was observed on 17 September. Peak daily passage of 10 fish occurred on 5, 12, and 14 August The median passage date was 7 August and the central 50% of the run occurred between 31 July and 14 August (Appendix B4).

Pink Salmon

Total annual observed pink salmon escapement upstream of the George River weir during the target operational period in 2006 was 1,232 fish, which includes no estimate of fish that passed during the inoperable period (Appendix B4). Passage missed during the inoperable period was considered negligible based on available passage and run-timing data. The first pink salmon was observed on 27 June, passage peaked at 155 on 20 July, and the last fish was observed on 14 September. The median passage date was 19 July and the central 50% of the passage occurred between 17 through 22 July (Appendix B4).

Resident Species

Several other species were routinely observed passing up and downstream of the weir by crew members during normal salmon enumeration routines. Other species observed passing upstream of the George River weir during the 2006 field season include: 10,051 longnose suckers, 33 Arctic grayling, 99 whitefish, and 10 Dolly Varden (Appendix B4). No estimates of missed passage were made for these species during the inoperable period.

Carcass Counts

A total of 7,449 salmon carcasses were recovered from the George River weir in 2006 (Appendix B5). A total of 311 male and 71 female (total = 382) Chinook salmon carcasses were recovered (8.8% of the observed annual escapement) from 26 June through 30 August. A total of 3,008 male, 2,074 female, and 7 unknown sex (total = 5,089) chum salmon carcasses were recovered (12.3% of the observed annual escapement) from 26 June through 16 September. A total of 5 male and 8 female (total = 13) coho salmon carcasses were recovered (0.1% of the observed annual escapement) from 24 July through 18 September. A total of 5 male and 7 female (total = 12) sockeye salmon carcasses were recovered (8.2% of the observed annual escapement) from 7 July through 17 September. A total of 847 male and 272 female (total = 1,119) pink salmon carcasses were recovered (90.8% of the observed annual escapement) from 12 July through 4 September.

AGE, SEX, AND LENGTH COMPOSITION

Chinook Salmon

Sampling was conducted daily from 25 June to 5 August for a total of 269 fish. Age, sex, and length were determined for 223 fish, 82.9% of the sampled Chinook salmon, or 5.1% of the total annual Chinook salmon escapement (Table 2). The run was partitioned into 3 temporal strata based on sample size and duration, with sample sizes of 74, 66, and 83 fish per stratum (Table 2). Postseason analysis revealed that sample sizes were adequate for estimating total and intra-annual age, sex, and length composition of Chinook salmon escapement to the George River weir.

The Chinook salmon run was nearly uniformly represented by the 3 most common age classes. Combined, these age classes comprised over 88% of the total Chinook salmon escapement at the George River weir (Table 2). Age-1.4 was the most abundant age class (35.8%), followed by age-1.3 (28.2%), age-1.2 (24.9%), age-1.5 (10.8%), and age-1.1 (0.2%). No other age classes were sampled although they are known to occur in some systems (Table 2). Age composition was fairly consistent over the course of the run; however, intra-annual variation in the proportion of age-1.2, -1.3, and -1.4 Chinook salmon was observed. As the run progressed, the proportion of age-1.2 varied, age-1.3 decreased, and age-1.4 increased (Table 2).

The Chinook salmon escapement past the weir was approximately 2:1 males to females. Females composed 35.1% of the total escapement based on weighted ASL samples (Table 2). Sex composition varied, with the highest proportion of females occurring toward the end of the run (Table 2). The female escapement was dominated (65%) by older age-1.4 individuals.

Conversely, the male escapement was largely comprised of younger age-1.2 and -1.3 individuals, representing 37.4% and 37.3% of the total male escapement respectively (Table 2).

The Chinook salmon escapement past the weir suggested length partitioning by sex and age class. The length of females ranged from 495 to 950 mm, and males ranged from 409 to 995 mm (Table 3). Mean length at age was different for males and females; however, no sex was consistently larger than the other at age. Average length increased with age for both females and males. Average length for female age-1.2, -1.3, -1.4, and -1.5 fish was 595, 649, 850 and 834 mm respectively. The average length for male age-1.1, -1.2, -1.3, -1.4 and -1.5 fish was 409, 540, 677, 837, and 853 mm respectively (Table 3). Average length at age showed some intra-annual variation for both males and females, but no consistent trends were apparent (Table 3).

Chum Salmon

Intensive sampling was conducted during 6 sampling pulses distributed evenly throughout the run for a total of 1,043 fish. Age, sex, and length were determined for 934 fish, 89.5% of the sampled chum salmon, or 2.3% of the total annual chum salmon escapement (Table 4). The run was partitioned into 6 temporal strata based on the temporal distribution of sampling effort, with sample sizes ranging between 32 and 184 fish per stratum (Table 4). Postseason analysis revealed sample sizes were adequate for estimating total and intra-annual age, sex, and length composition of chum salmon escapement past the George River weir.

The chum salmon escapement past the weir was largely represented by 2 age classes comprising over 96% of the total annual escapement at the George River weir (Table 4). Age-0.3 was the most abundant age class (50.8%), followed by age-0.4 (45.5%), age-0.2 (3.5%), and age-0.5 (0.2%; Table 4). Age composition varied consistently over the course of the run. As the run progressed, the proportion of age-0.2 and -0.3 increased, and age-0.4 decreased (Table 4).

The chum salmon escapement past the weir was approximately 2:3 males to females. Females composed 57.5% of the total escapement based on weighted ASL samples (Table 4). Sex composition was fairly consistent, although the proportion of females increased slightly as the run progressed (Table 4). The female escapement was mostly age-0.3 fish (52.4%); although age-0.4 fish also comprised a considerable component of the total return (43.5%). The male escapement was more evenly composed of age-0.3 and age-0.4 individuals, representing 48.7% and 48.1% respectively (Table 4).

The chum salmon escapement past the weir suggested length partitioning by sex and age class (Table 5). The length of females ranged from 445 to 639 mm, and males ranged from 440 to 659 mm (Table 5). Males were generally larger at age than females; and average length generally increased with age for both males and females. Average length for females age-0.2, -0.3, and -0.4 were 493, 524, 538 mm respectively. Average length for males age-0.2,-0.3,-0.4, and -0.5 were 510, 551, 568, and 647 mm respectively (Table 5). Average length at age decreased throughout the run for both males and females, with the exception of male age-0.2 fish, which were fairly constant (Table 5).

Coho Salmon

Intensive sampling was conducted during 3 sampling pulses distributed throughout the run for a total of 540 fish. Age, sex, and length were determined for 440 fish, 81.8% of the sampled coho salmon, or 3.9% of the total annual coho salmon escapement (Table 6). The run was partitioned into 3 temporal strata based on the temporal distribution of sampling effort, with sample sizes of

131, 144, and 165 fish per stratum (Table 6). Postseason analysis revealed sample sizes were adequate for estimating total and intra-annual age, sex, and length composition of coho salmon escapement past the George River weir.

The coho salmon escapement past the weir was dominated by 1 age class that comprised 88% of the total return. Age-2.1 was the most abundant age class (88%), followed by age 3.1 (7.7%), and age 1.1 (4.4%; Table 6). Age composition was fairly consistent; however, intra-annual variation in the proportion of age-1.1, 2.1, and 3.1 was observed. As the run progressed, the proportion of age-1.1 and -3.1, although consistently low, decreased, while the proportion of age-2.1 increased (Table 6).

The coho salmon escapement past the weir was approximately 1:1 males to females. Female coho salmon composed 50.5% of the total annual escapement based on weighted ASL samples (Table 6). Sex composition was fairly consistent, although the proportion of females increased slightly as the run progressed (Table 6). Both the male and female escapement was dominated by age-2.1 individuals, representing 85.1% and 90.8% of the total male and female escapement respectively (Table 6).

The coho salmon escapement past the weir suggested length partitioning by sex and age class. The length of females ranged from 402 to 608 mm, and males ranged from 405 to 635 mm (Table 7). Females were consistently larger at age than males; although moderately so. Average length for female fish age-1.1, -2.1 and -3.1, was 538, 530, and 542 mm respectively. Average length for male fish age-1.1, -2.1, and -3.1 were 515, 519 and 524 mm respectively. Average length at age showed some intra-annual variation for both males and females; although, no consistent pattern was observed (Table 7).

WEATHER AND STREAM OBSERVATIONS

A total of 196 complete weather and stream observations were recorded between 15 June and 24 September, 2006 (Appendix C1). Of these, 189 observations were recorded during the standard operational period. Based on twice-daily thermometer observations during the standard operational period, water temperature at the weir ranged from 5.0°C to 16.0°C, with an average of 10.4°C. Based on hourly data logger readings, daily average water temperature ranged from 5.2°C to 15.9°C, with an average daily temperature of 10.1°C (Appendix C2). Air temperature at the weir ranged from 1°C to 26°C, with an average of 13.0°C (Appendix C1). A total of 203.0 mm of precipitation was recorded throughout the season. River stage ranged from 41 cm to 138 cm, with an average of 60.4 cm.

The highest passage of Chinook occurred in pulses between 1 June and 12 July when water temperature gradually increased from 11 to 13^{o}C and stream gage decreased from 68 to 50 cm (Figures 3 and 4). The highest passage of chum occurred in pulses from 16 to 24 July when water temperature increased from 9 to 13^{o}C and stream gage decreased from 65 to 48 cm (Figures 3 and 4). The highest passage of coho appeared to be more closely correlated to stream gage than water temperature with the highest pulses between 8 August and 9 September with a maximum stream height of 137 cm (Figures 3 and 4).

RELATED PROJECTS

Inriver Abundance of Chinook Salmon in the Kuskokwim River

The inriver abundance of Chinook salmon in the Kuskokwim River upstream of Kalskag was estimated at 233,233 (SE = 28,450). The abundance of Chinook salmon in the Kuskokwim River above the Aniak River was estimated at 165, 538 (SE = 22,538). Based on this estimate, the George River stock represented 1.9% of the total abundance upstream of Kalskag, and 2.6% of the abundance upstream of the Aniak River confluence. Detailed results for the *Inriver Abundance of Chinook Salmon* radiotelemetry study are reported in Stuby (*In prep*).

Daily radio tag deployment of George River Chinook salmon at the Kalskag fish wheels was fairly evenly distributed across later phase of tagging effort (Figure 5). A total of 9 radio-tagged Chinook salmon were detected by the receiver station located near the George River weir and were considered recaptures. A total of 5 radio-tagged fish were observed by the weir crew, of which, tag numbers were recovered from 1. Though the sample size was too small for high confidence, the run-timing of radio-tagged fish past the weir was slightly later than the overall run-timing of the total escapement (Figure 6).

Kuskokwim River Sockeye Salmon Investigations

Tagged sockeye were tracked to tributaries throughout the basin using 17 ground-based tracking stations, and 3 aerial tracking surveys conducted in July, August, and September. Of 498 tags deployed, 448 (90%) successfully resumed upstream migration, and 383 (77%) were successfully tracked to tributary streams. Radio-tagged sockeye salmon were identified in all major drainages between Kalskag and the Swift River drainage. Large aggregates were observed in the Aniak, Holokuk, Holitna, Hoholitna, and Stony river drainages, with the highest concentrations being observed throughout the Holitna River. Detailed results for the *Kuskokwim River Sockeye Salmon Investigations* study will be reported by Gilk (*Unpublished*).

Daily radio tag deployment of George River sockeye salmon at the Kalskag fish wheels was concentrated toward the later phase the tagging effort (Figure 5). A total of 2 radio-tagged sockeye salmon were detected by the receiver station located near the George River weir and were considered recaptures. Of the 2 radio-tagged fish, the weir crew observed and recovered tag numbers from 1. Both radio-tagged sockeye salmon passed the weir toward the end of the overall sockeye salmon run (Figure 6).

A total of 4 juvenile sampling events, spread evenly throughout the season, were successfully conducted in the lower Holitna River. All habitat types were successfully sampled during each sampling period. Preliminary results indicate that “river-type” juvenile sockeye prefer slough and side channel habitat near spawning areas. Data from this project are still being analyzed (Greg Ruggerone, Vice President, Natural Resources Consultants, Seattle; personal communication).

Kuskokwim River Salmon Mark-recapture Project

Complete results for this project will be presented by Baumer (*In prep*). Tag recovery efforts at the George River weir in support of the *Kuskokwim River Salmon Mark–Recapture* project were successful in 2006. The weir remained operational for the entire Chinook salmon and nearly the entire sockeye salmon runs, and it is highly unlikely that any undetected tagged fish passed the weir. The affect of the premature end of weir operations on Chinook and sockeye salmon tag recovery was probably minimal based on passage estimates for the inoperable period. No

Chinook salmon were estimated to have passed the weir during the inoperable period, and daily passage estimates for sockeye salmon represented about 10.9% of the total annual escapement.

Chinook salmon

Recovered tag numbers from the George River weir indicate that the tagged fish recaptured at the George River weir were fairly evenly distributed across the total tagged sample (Figure 5). Despite the presumed success of tag recovery at the George River weir in 2006, only 6 Chinook salmon were observed with anchor tags. The weir crew recovered tag numbers from 5 of the 6 observed tagged fish. Daily escapement of tagged Chinook salmon past the weir was low throughout the run; however, run-timing of anchor-tagged fish past the weir was later than the overall run-timing, similar to what was observed for radio-tagged fish (Figure 6).

Run-timing of individual upriver stocks through the Kalskag fish wheels was similar suggesting no obvious pattern between run-timing through the lower drainage and spatial position of spawning tributaries (Figure 7). The median passage date of George River fish past the tagging site was 4 July. Transit time between the Kalskag fish wheels and passage at the George River weir ranged from 5 to 18 days, with an average of 11.4 days. Average run speed of George River Chinook salmon was 17.7 (rkm/day).

A total of 233 Chinook salmon were examined for the presence of secondary marks, indicating tag loss. No evidence of tag loss was observed.

Sockeye salmon

Daily anchor tag deployment of George River sockeye salmon at the Kalskag fish wheels was fairly evenly distributed across the tagging effort (Figure 5). Despite the presumed success of tag recovery at the George River weir in 2006, only 3 sockeye salmon were observed with anchor tags. The weir crew recovered tag numbers from all 3 of the observed tagged fish. Though the sample size was admittedly small, the run-timing of anchor-tagged fish past the weir was similar to the overall run-timing, and earlier than what was observed for radio-tagged fish (Figure 6).

Run-timing of individual upriver stocks through the Kalskag fish wheels suggests no obvious relationship between spatial position of spawning tributaries and run-timing through the lower drainage (Figure 8). The median passage date of George River fish past the tagging site occurred on 24 July. Transit time between the Kalskag fish wheels and passage at the George River weir ranged from 7 to 13 days, with an average of 10 days. Average run speed of George River sockeye salmon was 19.3 (rkm/day).

A total of 75 sockeye salmon were examined for the presence of secondary marks, indicating tag loss. No evidence of tag loss was observed.

Hydrologic Data for the George River

Complete results for this project will be presented by Mouw et al. (*Unpublished*). Installation and operation of the stream gauge was successful throughout the 2006 season. A total of 4 discharge measurements were taken in 2006 as a means of calibrating the stream gauge (Appendices C3–C6). Total stream discharge measurements of 77.8m^3/sec, 45.8m^3/sec, 132m^3/sec, and 103m^3/sec were recorded on 21 June, 8 July, 26 August, and 29 August respectively.

DISCUSSION

ESCAPEMENT MONITORING

The 2006 field season at George River weir was successful in providing reliable estimates of Chinook, chum, and coho salmon escapements. Escapement monitoring was conducted throughout the target operational period of 15 June to 20 September and was consistent with past years. Salmon passage was low to moderate for several days following weir installation (Table 1), suggesting relatively few fish passed upstream of the weir site before installation. This statement is further supported by an absence of radio-tagged salmon detected by the receiver station prior to weir installation, considering tagging efforts began at the Kalskag fish wheels on 7 June. River conditions were favorable during much of the operational period allowing accurate and efficient escapement monitoring. However, the weir was inoperable due to high water from 19 to 25 August. Historical run-timing data for the George River suggests that the inoperable period occurred after the majority of the Chinook, chum, and sockeye salmon runs passed the weir; however, this was not the case for coho salmon (Appendices B4 and D1–D3). Consequently, the timing of the inoperable period resulted in the need to estimate 15% of the 2006 coho salmon escapement (Table 1). Historical Chinook, chum, and sockeye salmon run-timing data combined with the consistent operational start date suggests accurate assessments of escapement that will provide an important reference for constructing future estimates and models for these species.

Escapement monitoring at the George River weir in 2006 revealed average Chinook salmon escapement and higher than average chum and coho salmon escapements compared to recent years at this project (Appendices D1–D3). Relatively high salmon escapements have been observed at this project and throughout the Kuskokwim River drainage over the past 2–3 years for all salmon species except coho salmon, which have been steadily declining since 2003 (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep;* Plumb et al. 2007). This spatially consistent increase in escapement follows a period of low escapement in 1999 and 2000 which lead to the BOF classification of Kuskokwim River Chinook and chum salmon as “stocks of yield concern” (5 AAC 39.222, 2001) due to the chronic inability of these stocks to maintain expected harvest levels despite the use of specific management measures (Burkey et al. 2000a, b). The 2006 season represents the third consecutive year of higher than average salmon escapement to the Kuskokwim River and prompted the BOF to rescind the stocks of yield concern designation in February 2007 (Linderman and Bergstrom 2006).

The increased escapement of most Pacific salmon species throughout the Kuskokwim drainage may be explained in part and to differing degrees by the conservative subsistence and commercial harvest measures employed over the past few years by regional managers in response to the stocks of concern classification (Bergstrom and Whitmore 2004). Since 2001, ADF&G has annually initiated 3 conservation measures: 1) subsistence fishers were required to follow a fishing schedule in June and July; 2) commercial fishing was closed in Districts W-1 and W-2 in June and July or until managers had sufficient evidence that escapement goals would be achieved; and 3) the northern boundary of District W-4 was moved south by about 5 km to make it more distant from the Kuskokwim River (Whitmore et al. 2005). The yield concern finding was continued following the January 2004 BOF meeting (Bergstrom and Whitmore 2004), although the original northern boundary of District W-4 was reinstated. In practice, however, these conservation measures were implemented loosely in 2005 and 2006 because in both years most run assessment tools indicated strong returns of Chinook and chum salmon (Linderman and Bergstrom 2006).

Species specific subsistence fishing pressure within the Kuskokwim River varies greatly, with Chinook and chum salmon being the more heavily targeted (Martz and Dull 2006). Although historically subsistence harvests have been stable from year to year, the proportion of the total run of each salmon species impacted by subsistence fishers varies annually (Martz and Dull 2006). Similar to past years, in 2006 a subsistence fishing schedule observing a 3-day weekly closure was implemented by ADF&G. This closure was designed to allow subsistence users to achieve subsistence needs while spreading harvest efforts across the run, allowing fish to pass up river for use by other fishers, and meeting spawning ground escapement goals. During 2006 this schedule was implemented on 4 June from Bogus Creek downstream and on 11 June from Chuathbaluk downstream. The subsistence fishing schedule was rescinded on 18 June after run assessment tools indicated it was no longer necessary (Linderman and Bergstrom 2006). Subsistence fishing was then permitted continuously with the exception of closures 6 hours before, during, and 3 hours after commercial fishing periods.

Species specific commercial fishing pressure varies annually due to variation in fish abundance, market value, and processing capabilities. In 2006, ADF&G permitted commercial fishing in District W-1 during late June for the third time since the Kuskokwim River Chinook and chum salmon stocks of concern designations of 2000 (Linderman and Bergstrom 2006). District W-2 remained closed, however, due to the lack of a commercial market. Two W-1 sub-district chum- and sockeye-directed commercial openings occurred between 26 June and 28 June, after most run assessment tools indicated strong returns of Chinook and chum salmon to the Kuskokwim River (Linderman and Bergstrom 2006). In addition to the chum- and sockeye salmon directed commercial openings, 17 coho salmon directed commercial fishing periods occurred from 1 to 30 August in District W-1 (Linderman and Bergstrom 2006). Since 1987, there has been no directed commercial fishery for Chinook salmon in the Kuskokwim River. The only directed Chinook salmon fishery in the Kuskokwim region occurs in District 4 and targets fish bound for the Kanektok and Arolik rivers (Linderman and Bergstrom 2006).

Chinook Salmon

Abundance

The early installation date and the limited number and timing of inoperable days of the George River weir in 2006 provided a complete picture of the total annual Chinook salmon escapement to the George River. Consequently, the reported escapement of 4,357 fish is considered a reliable estimate of the total annual Chinook salmon escapement past the weir. The 2006 season marked a 13% increase in total annual escapement to this system compared to 2005. Only the George River and Takotna River saw higher escapements in 2006 than 2005 (Figure 9; Costello et al. 2007 a, b; Liller et al. *In prep*; Plumb et al. 2007). Review of Kuskokwim River Chinook salmon escapement indices show considerable variation in annual escapement. Of particular interest is the contrast between the relatively low escapements of 1999 and 2000 and the relatively high escapements of 2004, 2005, and 2006. This contrast is apparent, to varying degrees, at all weir projects, but to a lesser extent at the George River weir. The George River has been unique in that annual escapement has been relatively stable over the past 5–10 years compared to other escapement monitoring projects operating throughout the Kuskokwim drainage (Figure 9). A formal escapement goal was not in place during the 2006 Chinook salmon run to use for inseason assessment, but an escapement goal was adopted by the Alaska BOF in February 2007. Chinook salmon escapement to the George River weir in 2006 was well within the newly adopted escapement goal range.

The recent 2-3 year increase in Chinook salmon escapements at all weir projects is mirrored by the increasing estimates of inriver abundance of Chinook salmon in all waters above the Aniak River from 2002-2006 (Stuby *In prep*). The annual proportion of the total run above Aniak monitored by each upriver weir project has been fairly consistent over time. The Kogrukluk River weir represents the highest proportion (12%) followed by the George River weir (3%), Tatlawiksuk River weir (2%), and Takotna (0.3%). Consistency in the proportional contribution of each weir project suggest that the Kogrukluk, George, Tatlawiksuk, and Takotna river weirs, singly and in concert, provide a reasonable index of inriver abundance of Chinook salmon within the upper Kuskokwim drainage.

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

Sustainable salmon management took a significant step in the early 1980s when fisheries management shifted from a strategy emphasizing guideline harvest levels to a strategy emphasizing escapement. ADF&G established species-specific escapement goals for streams that had sufficient historical baseline information (Buklis 1993). The first formal escapement goals were expressed as thresholds; more recently escapement goals are expressed as ranges so as to better address variability in annual escapement. To date, stock-specific exploitation rates, critical for the establishment of biological escapement goals (BEG), are not available for Kuskokwim River stocks. However sustainable escapement goals (SEG) have been established for several tributaries throughout the watershed. SEGs are levels of escapement, indicated by an index or an escapement estimate, which are known to provide for sustained yield over a 5–10 year period (ADF&G 2004). Because the commonly used Bue and Hasbrouck method (Bue and Hasbrouck 2001) requires 10 years of escapement data, early deliberations on establishing sustainable escapement goals at the George River resulted in inaction because of inadequate historical escapement information (ADF&G 2004), which emphasized the need for uninterrupted continuation of this projects. In preparation for the 2007 BOF meeting, Molyneaux and Brannian (2006) suggested escapement goals based on 10 years of weir escapement data (1996–2005), with 1 being an expansion of an aerial survey count using 5 years of paired aerial survey and weir escapement data. Based on these data, Molyneaux and Brannian (2006) suggested an SEG range of 3,100 to 7,900 for George River Chinook salmon, which the BOF formally adopted in February 2007 (Linderman and Bergstrom 2006). This SEG range encompasses the estimate (5,309) for the number of spawners at maximum sustained yield (S_{msy}) and is well below the estimated spawners at carrying capacity (S_c) derived using the habitat-based model developed by Parken et al (2004) and described by Molyneaux and Brannian (2006). With the addition of the 2006 field season to the historical data set, an SEG can now be calculated for George River Chinook salmon without reliance on aerial survey data.

Run-timing at the Weir

Based on median passage dates, the timing of the 2006 Chinook salmon run at the George River weir was slightly later than average but well within the historical range (Figure 10). With exception of 1999, which was characterized by extraordinarily late median passage date (19 July) that is of dubious comparative value, median passage dates of Chinook salmon at the George River weir have ranged between 3 and 11 July. Chinook salmon run-timing was spatially variable throughout the Kuskokwim River drainage in 2006. Nearly average run-timing was observed at Kwethluk and George river weirs, later-than-average run-timing was observed at Tatlawiksuk, Takotna, Tuluksak, and Kogrukluk river weirs (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007).

Chum Salmon

Abundance

The early installation date and the limited number and timing of inoperable days of the George River weir in 2006 provided a complete picture of the total annual chum salmon escapement to the George River. Consequently, the reported escapement of 41,467 fish is considered a reliable estimate of the total annual chum salmon escapement past the weir. The 2006 chum salmon escapement was the highest on record for this project. Markedly high chum salmon escapements were recorded by all weir projects throughout the Kuskokwim drainage; although, most projects saw a slight decrease compared to 2005 (Figure 11; Costello et al. 2007 a, b; Liller et al. *In prep*; Plumb et al. 2007). Only the George River and Takotna River saw higher escapements in 2006 than 2005 (Figure 11; Costello et al. 2007 a, b; Liller et al. *In prep*; Plumb et al. 2007). In fact, the 2006 season marked a two-fold increase in total annual escapement to the George River compared to 2005 (Figure 11). Of particular importance is that all escapement monitoring projects, including George River, report considerably higher escapements in 2006 than the critically low years of 1999 and 2000 which contributed to the stocks of concern designations (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007). However, there is currently no formal chum salmon escapement goal for most Kuskokwim River tributaries prohibiting adequate assessment of the escapement. Currently, the Kogrukluk River and Aniak River are the only 2 drainages in the Kuskokwim with established chum salmon escapement goals. Based on the Bue and Hasbrouck method for establishing SEG's and a combination of 10 years of weir- and aerial survey-determined escapement data collected through 2006, a reasonable escapement goal for George River chum salmon would be a range between 6,034 and 14,828 fish.

Management initiatives employed in 2006 such as the implementation of the subsistence fishing schedule and the limited chum salmon-directed commercial fishery likely had differing effects on George River chum salmon. Recent analysis of past performances of subsistence fishing schedule suggests that the intended purpose of spreading harvest effort across the run has not been achieved (T. Hamazaki, Biometrician, ADF&G, Anchorage; personal communication). Consequently, George River chum salmon likely received no benefit from early season subsistence fishing closures. Conversely, the reduced chum salmon-directed fishery in 2006 and recent years resulted in a lower than average total annual harvest (Linderman and Bergstrom 2006) that likely did benefit George River chum salmon by reducing exploitation rates and increasing total escapement. Weak runs kept the commercial chum salmon fishery closed for most of 1999 and 2000 and all of 2001–2003. Improved runs permitted commercial chum salmon fishing in 2004 and 2005, but poor market conditions for Kuskokwim River chum salmon resulted in relatively small harvests. This year's commercial harvest of 44,070 chum salmon was below the previous 10-year average of 55,661 fish (Linderman and Bergstrom 2006). The actual effect of the combined pressure of subsistence and commercial harvest on George River chum salmon is unknown, but believed to be minimal. There are currently no subsistence harvest estimates for chum salmon in the Kuskokwim River for 2006; however, the most recent 10-year average (1995–2004) of 57,981 fish is a reasonable estimate (Martz and Dull 2006). The subsistence harvest combined with the moderate commercial harvest of 44,070 (Linderman and Bergstrom 2006) results in an estimate of approximately 100,000 harvested Kuskokwim River chum salmon. These harvest estimates are in comparison to the estimated 41,467 chum salmon observed at the George River alone, the estimated 298,631 chum salmon observed across all other Kuskokwim River weir projects combined (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007), and the 1,108,626 chum salmon observed at the Aniak River Sonar (McEwen *In prep*). These comparisons suggest a reasonable harvestable surplus is available to Kuskokwim Area users.

Run-timing at the Weir

Based on median passage dates, the timing of the 2006 chum salmon run at the George River weir was intermediate relative to previous years and similar to 2005 (Figure 10). The median passage date in 2006 was within the historical range for the George River weir of 7 to 21 July. Chum salmon run-timing was spatially variable throughout the Kuskokwim River drainage in 2006. Nearly average run-timing was observed at Takotna and Kogrukluk river weirs, while earlier-than-average run-timing was observed at Tuluksak and Tatlawiksuk River weirs, and later-than-average run-timing was observed at Kwethluk and George river weirs (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007).

Coho Salmon

Abundance

The early installation date and the limited number and timing of inoperable days of the George River weir in 2006 provided a complete picture of the total annual coho salmon escapement to the George River. Consequently, the reported escapement of 11,296 fish is considered a fairly reliable estimate of the total annual coho salmon escapement past the weir. The George, Tatlawiksuk, and Takotna river weirs were the only Kuskokwim River projects reporting increasing coho salmon escapements in 2006 compared to 2005 (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007). The 2006 escapement at George River marked a 38% increase compared to 2005 (Figure 12). Considerable variation in abundance of coho salmon has been observed throughout the history of escapement monitoring at this project and others throughout the drainage (Figure 12; Appendix D3). Of particular concern is the spatially consistent decrease in coho salmon escapement since 2003 (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007). Currently, escapement goals have not been established for any Kuskokwim River tributaries except the Kogrukluk River, precluding assessment of the escapement adequacy for much of the drainage. Even though escapement levels have been generally decreasing at each of these projects in recent years, the escapement goal was achieved at Kogrukluk River weir in 2006 (Liller et al. *In prep*). Based on the Bue and Hasbouck method for establishing SEG’s and a combination of 10 years of weir- and aerial survey-determined escapement data collected through 2006, a reasonable escapement goal for George River coho salmon would be a range between 8,236 and 14,303 fish.

Kuskokwim River coho salmon have not been identified as a stock of concern, even though harvests and escapement have generally been below average in recent years (Whitemore et al. 2005). The level of coho salmon escapement seen in the George River is influenced in part by harvest activity in the main stem Kuskokwim River. Over 85% of coho salmon subsistence harvest and all commercial harvest occurs downstream of the George River confluence (Whitmore et al. 2005). Kuskokwim River coho salmon have likely received no benefit from the conservation measures discussed above for Chinook and chum salmon because of the disparity in run-timing of these 3 species. Kuskokwim River coho salmon pass through the lower regions of the drainage beginning early August well after the closure of the subsistence schedule. In addition, 2006 saw an increase in the number and duration of commercial coho salmon-directed fishing periods compared with recent years (Linderman and Bergstrom 2006). However, this year’s commercial harvest of 185,598 coho salmon was below the previous 10-year average of 268,985 fish resulting in a slightly reduced overall exploitation rate (Linderman and Bergstrom 2006). The actual effect of the combined pressure of subsistence and commercial harvest on George River coho salmon is unknown. There are currently no subsistence harvest estimates for coho salmon in the Kuskokwim River for 2006; however, the most recent 10-year average (1995–2004) of 31,729 fish is a reasonable estimate (Martz and Dull 2006). The subsistence harvest combined with the less than average commercial harvest of 185,598 (Linderman and Bergstrom 2006) results in an estimate of over 200,000 harvested Kuskokwim River coho salmon. These harvest estimates are in comparison to the estimated 11,296 coho salmon observed at the George River and the estimated 57,638 coho salmon observed across all other Kuskokwim River weir projects combined (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007).

Run-timing at the Weir

The 2006 coho salmon run at the George River weir was intermediate relative to previous years (Figure 10). The median passage date in 2006 was within the historical range for the George River weir of 21 August to 6 September. Near average run-timing was observed at Tatlawiksuk and Kogrukluk river weirs, while earlier-than-average run-timing was observed at Kwethluk, Tuluksak, and George river weirs, and later-than-average run-timing was observed at Takotna River weir (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007).

Other Species

Sockeye salmon

Sockeye salmon are regularly observed returning to spawn each year at the George River weir; although, annual escapement has historically been low. The George River is not a primary spawning tributary for this species; therefore, the relatively low annual escapements to this system are not surprising. The 2006 escapement of 164 sockeye salmon to the George River was the fourth highest on record for this project (Figure 13). Interestingly, the past 3 year's escapements represent some of the largest recorded returns of sockeye salmon to this system, considerably greater than most years for this project (Figure 13). Higher than average escapements of sockeye salmon in recent years has been spatially consistent throughout much of the Kuskokwim River drainage (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*, Plumb et al. 2007).

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

Sockeye salmon in the Kuskokwim River have not been identified as a stock of concern, although escapements have may have benefited from the conservation measures discussed above for Chinook and chum salmon because of the concurrent run-timing of these 3 species in June and early July. The actual effect of the combined pressure of subsistence and commercial harvest on George River sockeye salmon is unknown. There are currently no subsistence harvest estimates for sockeye salmon in the Kuskokwim River for 2006; however, the most recent 10-year average (1995–2004) of 37,076 fish is a reasonable estimate (Martz and Dull 2006). The subsistence harvest combined with the moderate commercial harvest of 12,618 (Linderman and Bergstrom 2006) results in an estimate of approximately 50,000 harvested Kuskokwim River sockeye salmon. These harvest estimates are in comparison to the estimated 68,789 sockeye salmon observed across all Kuskokwim River weir projects combined (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007).

Pink salmon

Pink salmon are regularly observed returning to spawn each year at the George River weir; although, annual escapement has historically been low. The George River is not a primary spawning tributary for this species; therefore, the relatively low annual escapements to this system are not surprising. Historically, pink salmon escapement past the George River weir is 181 fish per year. The 2006 escapement of 1,232 fish was nearly twice as high as the previous record escapement of 644 in 1996 and nearly 7 times greater than the historical average.

No tributary system in the middle to upper Kuskokwim River drainage has a history of enumerating large escapements of pink salmon. Generally, pink salmon make less extensive spawning migrations into freshwater than other Pacific salmon species (Heard 1991); and given the spatial orientation of the George River and other upper river tributaries the small escapements observed at these sites is not surprising. The increase in escapement of pink salmon at George River weir appears to be a spatially consistent phenomenon; as pink salmon also showed marked increases at the Kogrukluk and Tatlawiksuk river weirs (Costello et al. 2007 b; Liller et al. *In prep*). The reasons for the increased abundance in upper river tributaries are unknown. Possible factors may be associated with low exploitation rates (Linderman and Bergstrom 2006), favorable oceanic conditions, and increased straying. Adequate enumeration of pink salmon runs using weirs is difficult due to the specie's small size and ability to pass between weir pickets. However, it does appear that the contribution of pink salmon to this and other Kuskokwim River systems, although small compared to other Pacific salmon species, is greater than previously believed. To date, the relatively few pink salmon that return to spawn in upper Kuskokwim River tributaries are among the farthest known migrating pink salmon in the world (Morrow 1980; Heard 1991), and continued monitoring is needed to better understand the abundance dynamics of this unique stock and their importance to the ecosystem.

Other species

Other species observed at George River weir in 2006 include 10,051 longnose suckers, 99 whitefish, and 33 arctic grayling (Appendix B4). Longnose suckers are historically the most abundant non-salmon species counted at George River weir; however, counts are likely incomplete because smaller individuals may be able to pass freely between pickets and upstream migration appears to start before weir operations typically begin. The highest recorded passage of this species was 15,840 in 2001. Longnose suckers have been reported as common in the Aniak, Tatlawiksuk, and Takotna rivers, but they appear to be uncommon or absent from the Kwethluk, Tuluksak, and Kogrukluk rivers.

Carcass Counts

Though not a project objective, carcass counts may provide a means for measuring nutrient retention and loss in the George River. Approximately 8.8% of the Chinook salmon, 12.3% of chum salmon, 8.2% of the sockeye salmon, 0.1% of the coho salmon, and 90.8% of the pink salmon escapement was later observed as carcasses at the George River weir in 2006 (Appendix B5). The proportion of carcasses to escapement does not account for carcasses washed downstream during inoperable periods or removed by scavengers, and are likely higher than reported. Decreasing water levels throughout the Chinook and chum salmon run in 2006 likely resulted in a lower than historical proportion of carcasses at the weir. The protracted retention of salmon carcasses upstream of the weir in 2006 likely enhanced the absorption of marine derived nutrients, and further contributed to the productivity of the George River

(Cederholm et al. 1999, 2000). No speculation is made from coho salmon carcass data because carcass counts remained low during the operational period. In addition, the weir was likely removed before the majority of coho salmon in the George River completed spawning.

AGE, SEX, AND LENGTH COMPOSITION

Chinook Salmon

The age, sex, and length composition of Chinook salmon escaping to the George River drainage varied throughout the 2006 run. As the run progressed, the proportion of age-1.2 individuals was variable, the proportion of age-1.3 individuals decreased, and the proportion of age-1.4 individuals increased (Table 2). These younger (age-1.2 and -1.3) age classes were predominately composed of males; conversely, females made up a large proportion of the older (age-1.4) age classes (Table 2). As expected, mean length increased with age (Table 3). Mean length at age differed for males and females but no sex was consistently larger at age (Table 3). Consequently, as the run progressed, the overall composition shifted slightly from a smaller, younger, male dominated run to one consisting of larger, older individuals as a result of an increasing female component.

Kuskokwim River Chinook salmon tend to show a strong sibling relationship wherein the relative strength of each age class produced from a given brood year is often mirrored in subsequent year escapements, given consistency in survival (Table 8). By this relationship, it is possible to make limited predictions about age specific run strength in subsequent years based on past sibling returns (Molyneaux et al. 2006). The most abundant age class for 2006 (age-1.4) was anticipated by the highest abundance on record of age-1.3 siblings in 2005 (Figure 14). Similarly, a strong return of age-1.4 Chinook salmon may be forecasted for 2007 based on the abundance of age-1.3 fish in 2006; assuming consistency in ocean survival. However, the abundance of age-1.4 fish may be modest compared to 2006 considering the lower number of age-1.3 fish in 2006 compared to 2005 (Figure 14). The number of age-1.2 Chinook salmon increased considerably between 2005 and 2006 (Figure 14). Consequently, a healthy return (greater than 2006) of age-1.3 fish may be forecasted for 2007 based on the abundance of age-1.2 fish this year. The escapement of age-1.5 Chinook salmon was the highest on record since 1996. This escapement was anticipated from the high escapement of age-1.4 fish in 2005 (Figure 14). The number of age-1.4 fish in 2005 and 2006 was similar, thus we may expect a similar return of age-1.5 fish in 2007 (Figure 14).

Similar to past years, the 2006 Chinook salmon escapement past the George River weir was largely represented by age-1.2, -1.3, and -1.4 individuals, with age-1.5 and other less common age classes comprising less than 10% of the total annual escapement (Figure 15). These 3 dominant age classes comprised the majority of the run at all escapement projects in 2006 (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007) a pattern consistently seen throughout the Kuskokwim River drainage (Molyneaux et al. 2006). Historical trends in annual age composition tend to vary among escapement projects throughout the Kuskokwim River drainage. For example, only Tatlawiksuk River weir reported an annual age composition similar to past years, while most projects, including the George River weir, reported higher than average proportions of age-1.2 and lower than average proportions of age-1.4 individuals (Costello et al. 2007 a, b; Liller et al. *In prep*; Plumb et al. 2007). However, Kogrukluk River weir is the only escapement monitoring project within the Kuskokwim River with a long-term historical data set that suggests a general shift toward a younger overall age composition (Liller et al. *In prep*).

In 2006, the total contribution of each of the dominate age classes to the annual Chinook salmon escapement past the George River weir was similar; however, the proportional contribution of each age class varied throughout the run. The proportion of younger individuals was highest in the early phases of the run while older individuals were more abundant toward the end of the run (Figure 16). Intra-annual trends in age composition vary spatially and temporally; however, in 2006 most projects throughout the drainage reported an increase in age-1.4 fish as the run progressed (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007). This pattern is commonly observed throughout the Kuskokwim River drainage and is likely explained by the later migration times of Kuskokwim area female Chinook salmon which tend to return in greater abundances as age-1.4 fish (Molyneaux et al. 2006). Intra-annual trends in age composition are difficult to clearly define for a given monitoring project and the Kuskokwim drainage as a whole, because variations between strata are often greater than the total change in proportion from the first to the last (Molyneaux and Folletti *In prep*).

The annual sex ratio of male to female (2:1) Chinook salmon is consistent with historical data for the George River weir as well as ratios observed at other projects throughout the Kuskokwim (Figure 17; Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007). The proportion of females was approximately 35.1%; although, it has ranged from 33.0% to 53.9% over the course of this project (Table 2; Molyneaux and Folletti *In prep*). The annual proportion of females reported by other projects throughout the Kuskokwim River drainage generally range between 20% and 40%; although, considerable spatial and temporal variation is observed. Similar to past years at the George River the proportion of females in 2006 increased as the run progressed (Table 2; Stewart et al. 2005, 2006). Regardless of the total proportion of females observed in a given spatial and temporal context, the tendency for the proportion of females to increase as the run progresses is a common trend throughout this region. In general, George River and Kuskokwim River Chinook salmon females tend to make up a larger proportion of age-1.4 fish while males primarily return as age-1.2 and -1.3 fish. Consequently, the increase in the proportion of females corresponded to the observed increase in age-1.4 individuals during later phases of the run. However, these consistent intra-annual trends in sex composition do not appear to translate into consistent intra-annual trends in age composition.

In 2006 at the George River weir, mean Chinook salmon length-at-age was within the historical range reported for both males and females (Figures 18 and 19). George River Chinook salmon exhibited length partitioning by age-class for male and female fish in 2006, which is a pattern commonly observed at this project (Figures 18 and 19). Throughout the Kuskokwim River drainage Chinook salmon typically show length partitioning by both sex and age-class with females being larger at age than males (Molyneaux and Folletti *In prep*). The 2006 escapement at George River followed this trend in that length increased with age for both sexes but was contrary to this trend in that no sex was consistently larger than the other at age. Chinook salmon rarely show an obvious intra-annual trend in length by age class over the course of the season, and apparent trends tend to be weak and their significance is unknown. However, when 2006 results were combined with historical data, it does appear that average length of male age-1.3 and -1.4 fish increases slightly throughout the run but no obvious trend exists for other male age classes or females (Figure 18). The numerous age/sex categories representing Chinook salmon often result in small sample sizes inhibiting characterization of intra-annual changes in mean length at George River weir. It is important to note that Chinook salmon length trends observed at escapement projects may not be statistically significant, due to low sample sizes.

Pooled ASL data from escapement projects throughout the Kuskokwim River drainage provides a reasonable index of ASL composition for the total Chinook salmon run. However, annual ASL compositions of weir escapement must be considered with respect to the ASL compositions of the subsistence and commercial fisheries that harvest a portion of the stock returning to each tributary. ASL data obtained from all 3 sources allows for comparison and a better understanding of total run dynamics. Size selectivity of gear types used in commercial and subsistence fishing and escapement monitoring is responsible for most of the disparity observed in ASL composition. The mesh-size restriction (6 inches or less) imposed on commercial fishers in 2006, and previous years, was intended to limit the number and size of Chinook salmon harvested for commercial purposes. Since smaller fish tend to be younger fish and younger fish tend to be males the incidental harvest by the W-1 commercial fishery was composed primarily of small (average length = 620 cm) young (61% age-1.2) males (90%; Figure 20). However, the impact of the commercial harvest to the ASL composition of tributary escapements has likely been negligible in recent years due to relatively small harvests (Linderman and Bergstrom 2006). The subsistence fishery has no limitations on mesh size (Martz and Dull 2006). Most subsistence fishers use nets with a mesh size of 8 inches or greater because this gear is more efficient at capturing large Chinook salmon while minimizing harvest of the more abundant smaller chum salmon (Martz and Dull 2006). Since larger fish tend to be older and older fish tend to be females the use of large-mesh gillnets results in a subsistence harvest comprised of larger (average length = 787 cm) older (36% age-1.3, 53% age-1.4) fish representing a more even sex ratio (2:1 males to females; Figure 20). The quantity of Chinook salmon removed through the subsistence harvest is considerably greater than the commercial harvest (Linderman and Bergstrom 2006; Martz and Dull 2006) and likely effects the composition of escapements observed at tributary weirs by culling larger older fish. As a result, average length of the escapement past a given tributary weir is thought to be somewhat less than the average length of the total return bound for that tributary. Conversely, the proportion of younger age classes and males in tributary escapements are thought to be higher than in the total return.

Chum Salmon

The age, sex, and length composition of chum salmon escaping to the George River drainage varied throughout 2006. Age composition was fairly consistent over the course of the run; however some intra-annual variation in the proportion of age-0.2, -0.3, and -0.4 fish was observed. As the run progressed, the proportion of young (age-0.2, -0.3) individuals increased, while the proportion of older (age-0.4) individuals decreased; however, the overall run was dominated by older (age-0.4) individuals (Table 4). Sex composition was fairly consistent, with a slight increase in females (Table 4). Mean length increased with age and females tended to be smaller at age than males (Table 5). Consequently, as the run progressed, the overall age, sex, length composition shifted slightly from a larger, older, male run to one consisting of smaller, younger individuals as a result of an increasing female component.

Sibling relationships for chum salmon are not as reliable as with Chinook salmon at George River weir, even with the relatively low and stable harvest that has occurred since 1999 (Table 9; Linderman and Bergstrom 2006). However, the exceptionally high abundance of age-0.3 and -0.4 chum salmon was expected in 2006 given the record high abundance of age-0.2 and -0.3 fish in 2005 (Figure 14). The escapement of age-0.3 and -0.4 fish in 2006 were some of the highest on record for this project (Figure 14). In addition, this pattern of larger than average escapements of age-0.3 and -0.4 fish was consistent throughout the Kuskokwim River drainage (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007). The relatively high abundance of age-0.2, -0.3, and -0.4 chum salmon in 2006 may forecast a similar strong return of age-0.3, -0.4, and -0.5 fish in 2007, assuming consistency in survival (Figure 14).

Similar to past years, the 2006 chum salmon escapement at the George River weir was largely represented by age-0.3 and -0.4 individuals, with age-0.2 and -0.5 making up a negligible portion of the total annual escapement (Figure 15). Historically and in 2006, age-0.3 fish comprised the majority of the escapement at this project (Figure 15). Historical trends in age composition tend to vary spatially and temporally throughout the Kuskokwim River drainage; however, age-0.3 and -0.4 fish have consistently comprised the majority of the run at all escapement projects (Molyneaux et al. 2006). The 2006 return was no exception, age-0.3 and -0.4 fish composed over 96% of the total annual escapement at each Kuskokwim River escapement project (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007). Age-0.3 was dominant at all projects except Tuluksak and Kwethluk river weirs which are both located in the lower drainage (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007).

In 2006 the proportional contribution of the dominate age classes to the chum salmon escapement past the George River weir changed over the course of the run. Older individuals (age-0.4) dominated earlier phases of the run giving way to younger individuals (age-0.3) as the run progressed, a trend often observed at this project (Figure 21). In 2006 this pattern was observed at all Kuskokwim area escapement projects and was most evident by comparing the inverse proportions of age-0.3 and -0.4 fish (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007). The shift in chum salmon age composition from older to younger individuals as the run progresses is a consistent trend observed throughout the drainage (Molyneaux et al. 2006).

The proportion of females (57.5%) at the George River weir in 2006 was higher than the historical range of 42.8% to 53.8% (Molyneaux and Folletti *In prep*). Historically, the percentage of female chum salmon has been near 50% in most Kuskokwim area data sets (Molyneaux et al. 2006). Most all Kuskokwim area escapement projects reported a proportion of females in 2006 consistent with this larger spatial trend except Kogrukluk which had a lower (38%) proportion of females (Costello et al. 2007 a, b; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007). Similar to past years, the proportion of females passing the George River weir in 2006 increased as the run progressed (Figure 17). Regardless of the total proportion of females observed in a given spatial and temporal context, the tendency for the proportion of females to increase as the run progresses is a common trend throughout the Kuskokwim River drainage (Molyneaux et al. 2006). In addition, the majority of Kuskokwim River female chum salmon are age-0.3 fish (Molyneaux and Folletti *In prep*), a trend also seen in 2006 at this project. Consequently, the commonly observed intra-annual increase in the proportion of females as the run progresses corresponds to consistent intra-annual shifts in age composition.

George River chum salmon exhibited length partitioning by age class for male and female fish in 2006 a pattern commonly observed at this project (Figures 22–24). Males tended to be larger than females, and mean lengths increased with age. This pattern is commonly observed throughout the Kuskokwim River drainage (Molyneaux and Folletti *In prep*). Mean length was below average in 2006 compared to previous years at George River weir (Figures 22-24), a pattern noted at Kogrukluk and Tatlawiksuk rivers as well (Costello et al. 2007 b; Liller et al *In prep*). In fact, mean length-at-age was some of the lowest on record for males and females at this project. Similar to past years at this project mean length decreased slightly over the course of the run for all age/sex categories (Figure 22; Stewart et al. 2005, 2006).

Coho Salmon

The age, sex, and length composition of coho salmon escaping to the George River drainage varied throughout 2006. The proportion of age-2.1 fish dominated throughout the run. The proportion of females increased slightly as the run progressed. Males tended to be smaller than females at age. Consequently, the earlier phases of the run were generally composed of smaller males being replaced by an increasing number of moderately larger females as the run progressed.

Sibling relationships are not reliable for Kuskokwim River coho salmon and provide managers little insight into future year escapements (Table 10; Figure 25). Age-2.1 coho salmon typically comprise over 80% of coho salmon at George River weir, with the remainder mostly age-3.1 and a few age-1.1 fish (Figure 15). Similar age compositions are typically observed for coho salmon throughout the Kuskokwim River drainage (Molyneaux and Folletti *In prep*). Age composition remained fairly consistent over the 2006 season (Table 6), similar to previous years at George River weir and similar to other locations in the Kuskokwim River drainage (Figure 26; Costello et al. 2007 a, b; Liller et al *In prep*; Miller and Harper *In prep*; Plumb et al. 2007).

The proportion of females (50.5%) at the George River weir in 2006 is well within the historical range of 36.6% to 53.3% (Molyneaux and Folletti *In prep*). The proportion of female fish increased over the run in 2006 similar to previous years (Figure 17; Stewart et al. 2005, 2006). 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. 2007 a, b; Miller and Harper *In prep*; Plumb et al. 2007). 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 (Liller et al. In prep; Molyneaux and Folletti *In prep*).

George River coho salmon exhibited length partitioning by sex in 2006 similar to previous years (Figure 27 and 28). In general female coho salmon tend to be larger than males at age, a weak but fairly consistent pattern commonly seen at this project and throughout the Kuskokwim River drainage (Molyneaux et al. 2006). Similar to past years, mean length increased slightly as the run progressed (Figure 27). Mean length of all age classes in 2006 was less than 2005 except for age-3.1 males which was roughly equal (Figure 28). In fact, mean length-at-age was some of the smallest on record for this project (Figure 28). All Kuskokwim Area escapement projects that operated through coho salmon season in 2006 reported record low mean lengths for male and female age-2.1 fish (Costello et al. 2007 a; Liller et al. *In prep*; Miller and Harper *In prep*; Plumb et al. 2007). In addition, average weight per fish in the District-W1 commercial harvest was well below average and the historical range (Linderman and Bergstrom 2006).

WEATHER AND STREAM OBSERVATIONS

Measured against historical environmental data at George River weir, water temperature was below average throughout the season in 2006 (Figure 29) while river stage was above average during Chinook and chum migration and spiked during coho migration (Figure 30). Stream discharge measurements were taken 4 times during the season and ranged from 45.8 to 132m^3/sec (Appendix C3–C6).

Similar to past years at this project, no obvious relationship was observed between Chinook, chum, or sockeye salmon passage through the weir and local weather conditions. However, increases in coho salmon escapement did coincide with an increase in water level. Past years at this project have also seen a similar relationship (Stewart et al. 2005, 2006). In addition, this behavior has been observed in other stocks of coho salmon throughout their range (Sandercock 1991). However, coho salmon were not observed milling in large numbers below the weir prior to high water events. Furthermore, the run-timing of coho salmon past the George River weir was consistent with past years. Together, these observations suggest that the increased daily coho salmon escapement was likely not directly caused by increased water level and the concurrent timing was simply coincident.

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

RELATED FISHERIES PROJECTS

Inriver Abundance of Chinook Salmon in the Kuskokwim River

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

Kuskokwim River Sockeye Salmon Investigations

The George River weir contributed successfully to the *Kuskokwim River Sockeye Salmon Investigations* project. One tagged sockeye salmon was detected by the receiver station and observed passing upstream of the weir, the receiver station functioned properly throughout the season, as evidenced by the successful recording and offloading of this fish. Receiver station data coupled with aerial tracking results suggest that the largest sockeye salmon producing tributaries are the Aniak, Holitna, and Stony river systems. Data pertaining to other project objectives are still being analyzed.

Sockeye salmon have been documented in several other tributaries throughout the Kuskokwim River basin (Burkey and Salomone 1999), but little is known about these populations. Rearing ecology of these "river-type" sockeye salmon is not well known in the Kuskokwim Area, though river-spawning behavior among sockeye salmon is documented in other areas of both Asia and North America (Burgner 1991). Wood et al. (1987) found that "river-type" sockeye salmon contributed from 39% to 48% of total sockeye salmon returns to the Stikine River in 1984 and 1985. The contribution of these "river-type" sockeye salmon to the overall Kuskokwim River sockeye salmon production could be substantial. Further research addressing the biology and ecology of Kuskokwim River sockeye salmon will be essential to narrow current knowledge gaps and ensure successful management of a sustainable sockeye salmon fishery. A detailed discussion of this project will be presented by Gilk (*Unpublished*).

Kuskokwim River Salmon Mark–recapture Project

The George River weir contributed successfully to the *Kuskokwim River Salmon Mark–Recapture Project*, which afforded an opportunity to study migration characteristics of George River Chinook and sockeye salmon in 2006. Efforts in 2006 mark the sixth year that mark–recapture has been used to assess run-timing and travel speed. Details of this project are discussed by Baumer et al. (*In prep*).

Chinook Salmon

The run-timing information derived from pooling the tag samples from *Kuskokwim River Salmon Mark–Recapture Project* and *Inriver Abundance of Chinook Salmon* indicates little variation in stock-specific run-timing in 2006 (Figure 7; Baumer et al. *In prep*). In 2006, stock-specific median passage dates were similar, ranging from 26 June at the Salmon River weir, which is the nearest recovery location to the tagging site, to 4 July at the George River weir, which is the next nearest location to the tagging site (Figure 7). Based on the pooled radio- and anchor-tagged samples, the timing of the George River Chinook salmon stock past the Kalskag tagging sites was later than all other monitored upriver stocks, as evidenced by the difference in median passage dates (Figure 7). Run-timing results in 2006 were similar to past years in that George River Chinook salmon passed through the Kalskag tagging sites after most other stocks (Stuby *In prep*; Baumer et al. *In prep*; Pawluk et al. 2006a, b). Though sample sizes are small, the median passage dates for tagged George River-bound Chinook salmon past the tagging sites have been the latest of any stock in 3 of 5 years with comparable data, and later than only the Takotna/Upper Kuskokwim river stocks (locations much further upstream) in 2 of 5 years (Stuby *In prep*; Baumer et al. *In prep*; Pawluk et al. 2006a, b). Historical radiotelemetry data from 2002 to 2005 suggest an inverse relationship between natal stream distance and stock-specific run-timing; that is, Chinook salmon stocks bound for tributaries farthest upriver tend to pass through the tagging site earlier than stocks bound for tributaries nearer the tagging site (Stuby *In prep*; Baumer et al. *In prep*; Pawluk et al. 2006a, b). In fact, the Salmon River Chinook salmon stock exhibited the earliest run-timing of any investigated in 2006 despite being the closest to the tagging sites (Figure 7).

Travel speeds calculated using data provided by anchor-tagged Chinook salmon ranged from about 10 to 26 km/day, which is similar to past years considering small sample sizes, and to the speeds exhibited by Chinook salmon returning to the Kogrukluk and Tatlawiksuk rivers (Baumer et al. *In prep*; Costello et al. 2007 b; Liller et al. *In prep*). Mean stock-specific travel speed does not seem to vary much among Tatlawiksuk, George, and Kogrukluk river stocks, but fish bound for the Salmon River exhibited considerably slower travel speeds in 2006, which explains the stock's early run-timing through the tagging sites but relatively late run-timing at the weir based on cumulative percent passage (Baumer et al. *In prep*).

Travel speed and run-timing indicators provided by the Chinook salmon radiotelemetry project are valuable tools for fishery management. The timing of commercial fishery openings and the annual discontinuation of the subsistence fishing schedule is considered with respect to the stock-specific run-timing evident through the tagging and tracking of Chinook salmon. In 2006, District W-1 was separated into 2 sub-districts with separate commercial opening dates (26 June and 28 June). Based on daily travel time, the bulk of the Chinook salmon bound for the George River and other upper river tributaries had not completely moved through the lower portions of the Kuskokwim River drainage before these commercial openings concluded. George River bound Chinook salmon were probably harvested during this time period, although the effect when compared to the total escapement estimate for the Kuskokwim River above Kalskag (233,233) was likely negligible. The total Chinook harvested by the commercial fishing district W-1 was 2,777 (Linderman and Bergstrom 2006). Due to fewer restrictions and greater annual harvest, the subsistence fishery likely had a much greater effect on George River Chinook salmon. Late at-the-weir run-timing observed at every escapement monitoring project coupled with stock-specific run-timing data provided by the tagging projects suggests that the subsistence fishing schedule was probably rescinded before most of the Chinook salmon bound for upper river tributaries (such as the George River) had migrated past the lower river where subsistence fishing is most intense.

Sockeye Salmon

Sockeye salmon have been tagged at the main stem Kuskokwim River Salmon Project since 2002. The proportion of tagged fish recaptured at the George River weir has been consistently low (5% for 2005 and 8% for 2006). It has been suggested that George River sockeye migrate very late in the overall catch sample at the main stem tagging site (Figure 8). A pattern of upper river populations migrating past the tagging site earlier than lower river populations is fairly consistent with other species (Stuby *In prep*). However, comparisons can not be conducted due to the small proportion of tagged fish recovered at this site.

Hydrologic Data for the George River

The George River weir contributed successfully to the *Hydrologic Data for the George River Project*. The 2006 season was the first year of a 5-year study. Obtaining hydrologic baseline data for the George River is critical to the understanding of instream flow requirements for the salmon species that spawn and rear in this system as well as resident fish species. This information is required in order to identify and protect flow needs for fish production prior to development. Planned developments in and near the project area may have the potential to influence water quantity and quality in the George River and their influence cannot be assessed without adequate hydrologic data. This project is designed to gather data for another 4 years and projects results can be obtained from Mouw et al. (*Unpublished*).

CONCLUSIONS

ESCAPEMENTS

- The weir operated throughout the target operational period of 15 June to 20 September.
- The weir was inoperable due to high water from 19 to 25 August.
- The Chinook salmon escapement of 4,357 fish to the George River in 2006 represented an increased about 13% from 2005 and was consistent with other abundance indicators in the Kuskokwim drainage where escapements increased or remained near the robust levels observed in 2005.
- The chum salmon escapement of 41,467 fish to the George River in 2006 represented nearly a two-fold increase from 2005 and was consistent with other abundance indicators in the Kuskokwim drainage where escapements were also relatively high.
- The coho salmon escapement of 11,296 fish to the George River in 2006 represented an increased about 38% from 2005 and was consistent with other abundance indicators in the Kuskokwim drainage where escapements increased or remained near the levels observed in 2005.
- The sockeye salmon escapement at George River in 2006 decreased slightly from 2005, although high escapement was reported at other monitoring projects throughout the Kuskokwim River drainage.

AGE, SEX, AND LENGTH COMPOSITION

- The Chinook salmon run was primarily represented by age-1.2, -1.3, and -1.4 fish. As the run progressed the proportion of age-1.3 decreased while the proportion of age-1.4 increased.
- Female Chinook salmon made up approximately 35.1% of the total annual run. The proportion of females increased as the run progressed.
- The Chinook salmon run showed length partitioning by age class but no sex was consistently larger than the other at age. Average length increased with age.
- Healthy escapements of all Chinook salmon age classes suggests continued ocean survival compared to the conditions that led to the low runs to the Kuskokwim River in 1998, 1999, and 2000.
- Assuming consistency in ocean survival, the abundance of age-1.2, -1.3, and 1.4 Chinook salmon in 2006 may indicate healthy returns of age-1.3, -1.4, and -1.5 fish to the George River in 2007.
- The high return of age-1.3 Chinook salmon in 2006 indicates the potential for a strong return of age-1.4 fish in 2007.
- The chum salmon run was primarily represented by age-0.3 and age-0.4 fish. The proportion of age-0.4 fish decreased as the run progressed while the proportion of age-0.3 fish increased.

- Female chum salmon made up approximately 57.5% of the total annual run. The proportion of females increased slightly as the run progressed.
- The chum salmon run showed length partitioning by sex and age class. Average length increased with age and males were larger than females at age.
- Healthy escapements of all chum salmon age classes suggests continued ocean survival compared to the conditions that led to the low runs to the Kuskokwim River in 1998, 1999, and 2000.
- Assuming consistency in ocean survival, the abundance of age-0.2 and -0.3 chum salmon in 2006 may indicate a healthy return of age-0.3 and -0.4 fish to the George River in 2007.
- Mean length-at-age of male and female chum salmon were some of the smallest on record for this project.
- The high return of age-0.3 chum salmon in 2006 indicates the potential for a high return of age-0.4 fish in 2007.
- The coho salmon run was dominated by age-2.1 fish.
- Female coho salmon made up approximately 50.5% of the total annual run. The proportion of female increased slightly as the run progressed.
- The coho salmon run showed length partitioning by sex. Females were larger at age than males.
- Mean length-at-age of male and female coho salmon were the smallest on record for this project.
- Coho salmon escapement in 2006 was dominated by age-2.1 fish, which is consistent with previous years.

WEATHER AND STREAM OBSERVATIONS

- In general, water temperatures and river levels were lower than average in 2006 compared to previous years at George River weir.
- No obvious relationships were observed between water temperature or river level and salmon passage.

RELATED PROJECTS

- The George River weir served as an important platform for several projects conducted in the Kuskokwim River drainage in 2006, including *Inriver Abundance of Chinook Salmon in the Kuskokwim River* (FIS 05-302), *Kuskokwim River Sockeye Salmon Investigations, A Kuskokwim River Salmon Project* (AYKSSI), *Kuskokwim River Salmon Mark–Recapture Project* (FIS 04-308), and *Hydrologic Data for the George River Project* (SWG).

RECOMMENDATIONS

PROJECT OPERATION

- Annual operation of the George River weir should continue indefinitely. The George River weir project has been a valuable addition to the array of well-distributed escapement monitoring projects throughout the Kuskokwim River drainage. Adequate monitoring of Kuskokwim River salmon escapements is one of many requirements needed for long-term sustainable management of Kuskokwim River salmon stocks. Discontinuation of the George River weir, or any other escapement monitoring project, would be a step backward from progress made in recent years toward collecting salmon stock assessment and information needs in the Kuskokwim River drainage. Additionally, the George River weir project serves as one of several data collection platforms critical to other Kuskokwim River salmon research initiatives aimed at narrowing critical knowledge gaps toward the goal of sustainable salmon management. Without the existing array of escapement monitoring projects, such as the George River weir, these research initiatives would not be logistically or financially possible.

- Sustainable escapement goals (SEG) should be established for George River chum and coho salmon. SEGs require a 5 to 10 year data series of reliable escapement estimates that demonstrate sustainable yields. Previous deliberations regarding establishing escapement goals at the George River resulted in inaction because of inadequate historical escapement information (ADF&G 2004), heightening the need for uninterrupted continuation of the project. The 2006 field season provided the critical tenth year of data and appropriate SEGs can now be established. Using weir and tower determined escapement data collected through 2006, the SEGs derived from the Bue and Hasbrouck method would range between 6,034 and 14,828 for chum and 8,236 and 14,303 for coho salmon. Uninterrupted continuation of this project will serve to further refine SEGs established for this system providing managers with better estimates of the annual adequacy of escapements.

PROJECT MANAGEMENT

- The George River weir should continue to be operated jointly by KNA and ADF&G. The partnership developed between KNA and ADF&G in the operation of fisheries projects, including the George River weir, has proven to be a successful strategy. Each organization compliments the partnership by providing an element the other cannot.

  KNA provides a communication link to help its constituents be more informed and less prone to the distrust and misinformation that can result when local organizations and their constituents are not directly involved. Active involvement of KNA adds an element of trust and acceptance toward the projects and ADF&G, which would not exist if ADF&G operated these projects alone. KNA is more effective at hiring technicians for these projects from the local area, and makes these jobs more acceptable and accessible for potential applicants. Additionally, the proximity of KNA facilities to these cooperatively managed projects provides logistical benefits for staging and for responding to various inseason project needs.

  Despite these attributes, KNA would have difficulty managing the George River weir and other jointly operated fisheries projects without ADF&G involvement. The fisheries staff of ADF&G has a greater depth of experience in fisheries project management; both in terms of on-site field experience, and broader aspects such as planning, data management and analysis, and report writing. The addition of a Partners Fishery Biologist to the KNA staff has shifted some of these responsibilities to KNA, evident with the inclusion of a KNA biologist as a co-author of this report since 2003 and the lead author in 2007. Ultimately, however, the transfer of responsibility has been slow and ultimately limited. Currently, KNA employs 2 full-time fisheries biologists; a Fisheries Director and a Partners Fishery Biologist. However, the addition of these 2 fisheries biologists to the KNA staff is not sufficient to replace all ADF&G personnel involved and the many years of fisheries management experience, scientific expertise, and understanding they contribute. Additionally, KNA's fisheries biologists have a myriad of other responsibilities, and are involved with multiple projects and multiple cooperative partners. Specifically, the Fisheries Director oversaw all aspects of KNA's Fisheries Program while the Partners Fishery Biologist allocates a majority of time to community outreach and internship programs. This time limit reduces the direct attention KNA's biologist can contribute to individual project requirements.

Partnership between KNA and ADF&G is a major contributing factor to success of the many fisheries projects for which these organizations are responsible. Dissolution of this partnership would result in a detrimental loss of continuity and support to both inseason and postseason project requirements, and increases the possibility of misunderstanding and mistrust between ADF&G, KNA, and the public. Continued joint operation will help to ensure the success of these projects in the future.

WEATHER AND STREAM OBSERVATIONS

- Continue the use of a water temperature data logger in the river channel to enable the determination of high, low, and mean daily measurements. This will provide more complete temperature documentation and enable better comparisons between years.
- Conduct additional stream discharge surveys to reestablish a link between flows and a new more permanent benchmark. Several stream discharge surveys were conducted in previous years at George River weir, but these were never linked to a viable permanent benchmark.
- Continue operating a stream gauging station near the weir site to determine baseline flow characteristics required to establish water reservations for the George River system. Additional stream gauging stations should be installed on the following tributaries to the Kuskokwim River mainstem: the lower Holitna, Kogrukluk, Hoholitna, Tatlawiksuk, Aniak, and Takotna rivers. Installation of these stations is critical to establishing baseline conditions as well as providing managers with the tools necessary to ensure the continued productivity of these rivers.

  The establishment of stream gauging stations is particularly crucial for the Holitna drainage and priority should be given when considering future installation sites. A proposal under consideration by the Alaska Board of Fisheries is the establishment of the Holitna Basin Fisheries Reserve, which would elevate and emphasize the basin's high productivity and the importance of habitat maintenance for fisheries resources. Baseline hydrological data could be used to establish water reservation rights for the Holitna drainage. A reservation of water (AS 46.15.145) can be established after collecting baseline hydrological data to protect fish and wildlife habitat, migration, and propagation (Estes 1996).

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TABLES AND FIGURES

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

	Chinook Salmon			Chum Salmon			Coho Salmon		
Date	Daily	Cumulative	%	Daily	Cumulative	%	Daily	Cumulative	%
06/15	0 [a]	0	0	0 [a]	0	0	0 [a]	0	0
06/16	1	1	0	0	0	0	0	0	0
06/17	0	1	0	0	0	0	0	0	0
06/18	0	1	0	2	2	0	0	0	0
06/19	0	1	0	5	7	0	0	0	0
06/20	6	7	0	41	48	0	0	0	0
06/21	4	11	0	49	97	0	0	0	0
06/22	8	19	0	158	255	1	0	0	0
06/23	1	20	0	196	451	1	0	0	0
06/24	2	22	1	180	631	2	0	0	0
06/25	3	25	1	266	897	2	0	0	0
06/26	1	26	1	226	1,123	3	0	0	0
06/27	5	31	1	267	1,390	3	0	0	0
06/28	41	72	2	624	2,014	5	0	0	0
06/29	18	90	2	357	2,371	6	0	0	0
06/30	191	281	6	575	2,946	7	0	0	0
07/01	388	669	15	1,196	4,142	10	0	0	0
07/02	64	733	17	735	4,877	12	0	0	0
07/03	99	832	19	878	5,755	14	0	0	0
07/04	589	1,421	33	1,598	7,353	18	0	0	0
07/05	200	1,621	37	1,707	9,060	22	0	0	0
07/06	220	1,841	42	1,274	10,334	25	0	0	0
07/07	440	2,281	52	959	11,293	27	0	0	0
07/08	59	2,340	54	679	11,972	29	0	0	0
07/09	47	2,387	55	618	12,590	30	0	0	0
07/10	155	2,542	58	1,300	13,890	33	0	0	0
07/11	332	2,874	66	1,536	15,426	37	0	0	0
07/12	166	3,040	70	1,198	16,624	40	0	0	0
07/13	32	3,072	71	448	17,072	41	0	0	0
07/14	6	3,078	71	175	17,247	42	0	0	0
07/15	7	3,085	71	318	17,565	42	0	0	0
07/16	207	3,292	76	964	18,529	45	0	0	0
07/17	110	3,402	78	1,509	20,038	48	0	0	0
07/18	173	3,575	82	2,152	22,190	54	1	1	0
07/19	168	3,743	86	2,795	24,985	60	1	2	0
07/20	150	3,893	89	2,474	27,459	66	1	3	0
07/21	89	3,982	91	2,152	29,611	71	4	7	0
07/22	37	4,019	92	1,573	31,184	75	0	7	0
07/23	82	4,101	94	1,227	32,411	78	4	11	0
07/24	19	4,120	95	1,000	33,411	81	3	14	0
07/25	32	4,152	95	830	34,241	83	0	14	0
07/26	18	4,170	96	609	34,850	84	0	14	0
07/27	25	4,195	96	670	35,520	86	2	16	0
07/28	19	4,214	97	528	36,048	87	1	17	0
07/29	28	4,242	97	691	36,739	89	6	23	0
07/30	11	4,253	98	437	37,176	90	6	29	0
07/31	14	4,267	98	564	37,740	91	6	35	0
08/01	17	4,284	98	360	38,100	92	11	46	0
08/02	5	4,289	98	314	38,414	93	4	50	0
08/03	13	4,302	99	429	38,843	94	6	56	0
08/04	12	4,314	99	499	39,342	95	15	71	1
08/05	6	4,320	99	359	39,701	96	25	96	1

-continued-

Table 1.–Page 2 of 2.

	Chinook Salmon			Chum Salmon			Coho Salmon		
Date	Daily	Cumulative	%	Daily	Cumulative	%	Daily	Cumulative	%
08/06	2	4,322	99	219	39,920	96	7	103	1
08/07	7	4,329	99	268	40,188	97	14	117	1
08/08	4	4,333	99	162	40,350	97	8	125	1
08/09	4	4,337	100	142	40,492	98	8	133	1
08/10	2	4,339	100	102	40,594	98	25	158	1
08/11	2	4,341	100	90	40,684	98	67	225	2
08/12	5	4,346	100	95	40,779	98	218	443	4
08/13	0	4,346	100	80	40,859	99	21	464	4
08/14	0	4,346	100	107	40,966	99	336	800	7
08/15	1	4,347	100	44	41,010	99	791	1,591	14
08/16	0	4,347	100	49	41,059	99	400	1,991	18
08/17	1	4,348	100	59	41,118	99	129	2,120	19
08/18	1 [a]	4,349	100	48 [a]	41,166	99	781 [a]	2,901	26
08/19	1 [b]	4,350	100	43 [b]	41,209	99	254 [b]	3,155	28
08/20	0 [b]	4,350	100	37 [b]	41,247	99	249 [b]	3,405	30
08/21	0 [b]	4,350	100	32 [b]	41,278	100	244 [b]	3,649	32
08/22	0 [b]	4,350	100	26 [b]	41,305	100	239 [b]	3,888	34
08/23	0 [b]	4,350	100	21 [b]	41,325	100	234 [b]	4,122	36
08/24	0 [b]	4,350	100	15 [b]	41,340	100	229 [b]	4,352	39
08/25	0 [b]	4,350	100	10 [b]	41,350	100	224 [b]	4,576	41
08/26	0	4,350	100	3	41,353	100	337	4,913	43
08/27	0	4,350	100	5	41,358	100	101	5,014	44
08/28	2	4,352	100	16	41,374	100	676	5,690	50
08/29	0	4,352	100	9	41,383	100	523	6,213	55
08/30	0	4,352	100	7	41,390	100	368	6,581	58
08/31	1	4,353	100	10	41,400	100	221	6,802	60
09/01	0	4,353	100	16	41,416	100	368	7,170	63
09/02	1	4,354	100	8	41,424	100	294	7,464	66
09/03	0	4,354	100	4	41,428	100	462	7,926	70
09/04	1	4,355	100	3	41,431	100	280	8,206	73
09/05	0	4,355	100	2	41,433	100	77	8,283	73
09/06	0	4,355	100	3	41,436	100	430	8,713	77
09/07	0	4,355	100	3	41,439	100	535	9,248	82
09/08	1	4,356	100	3	41,442	100	529	9,777	87
09/09	0	4,356	100	2	41,444	100	280	10,057	89
09/10	1	4,357	100	6	41,450	100	203	10,260	91
09/11	0	4,357	100	0	41,450	100	247	10,507	93
09/12	0	4,357	100	4	41,454	100	81	10,588	94
09/13	0	4,357	100	2	41,456	100	3	10,591	94
09/14	0	4,357	100	3	41,459	100	232	10,823	96
09/15	0	4,357	100	3	41,462	100	150	10,973	97
09/16	0	4,357	100	1	41,463	100	190	11,163	99
09/17	0	4,357	100	1	41,464	100	56	11,219	99
09/18	0	4,357	100	0	41,464	100	9	11,228	99
09/19	0	4,357	100	2	41,466	100	58	11,286	100
09/20	0	4,357	100	1	41,467	100	10	11,296	100

[a] Partial day count; passage was estimate.

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

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

Sample Dates	Sample		Age Class 1.1		1.2		1.3		2.2		1.4		1.5		2.4		Total	
Stratum Dates	**Size**	**Sex**	**Esc.**	**%**	**Esc.**	**%**	**Esc.**	**%**	**Esc.**	**%**	**Esc.**	**%**	**Esc.**	**%**	**Esc.**	**%**	**Esc.**	**%**
6/25-7/6	74	M	0	0.0	524	23.0	647	28.4	0	0.0	308	13.5	62	2.7	0	0.0	1,541	67.6
(6/15-7/7)		F	0	0.0	31	1.3	154	6.7	0	0.0	463	20.3	92	4.1	0	0.0	740	32.4
		Subtotal[a]	0	0.0	555	24.3	801	35.1	0	0.0	771	33.8	154	6.8	0	0.0	2,281	100.0
7/8-18	66	M	0	0.0	465	31.8	310	21.2	0	0.0	155	10.6	67	4.6	0	0.0	997	68.2
(7/8-19)		F	0	0.0	0	0.0	22	1.5	0	0.0	244	16.7	199	13.6	0	0.0	465	31.8
		Subtotal[a]	0	0.0	465	31.8	332	22.7	0	0.0	399	27.3	266	18.2	0	0.0	1,462	100.0
7/20-8/5	83	M	7	1.2	67	10.8	96	15.7	0	0.0	104	16.9	15	2.4	0	0.0	289	47.0
(7/20-9/20)		F	0	0.0	0	0.0	0	0.0	0	0.0	288	47.0	37	6.0	0	0.0	325	53.0
		Subtotal[a]	7	1.2	67	10.8	96	15.7	0	0.0	392	63.9	52	8.4	0	0.0	614	100.0
Season[b]	223	M	7	0.2	1,056	24.2	1,054	24.2	0	0.0	567	13.0	143	3.3	0	0.0	2,827	64.9
		F	0	0.0	31	0.7	176	4.0	0	0.0	994	22.8	329	7.5	0	0.0	1,530	35.1
		Total	7	0.2	1,087	24.9	1,230	28.2	0	0.0	1,561	35.8	472	10.8	0	0.0	4,357	100.0

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

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

Table 3.–Mean length (mm) of Chinook salmon sampled at the George River weir in 2006 using escapement samples collected with a live trap.

Sample Dates (Stratum Dates)	Sex		Age Class 1.1	1.2	1.3	2.2	1.4	1.5	2.4
6/25-7/6	M	Mean Length		555	679		851	835	
(6/25-7/7)		SE		12	15		26	65	
		Range		450- 655	590- 875		720- 975	770- 900	
		Sample Size	0	17	21	0	10	2	0
	F	Mean Length		595	641		871	862	
		SE		-	40		10	51	
		Range		595- 595	495- 715		815- 930	775- 950	
		Sample Size	0	1	5	0	15	3	0
7/8-18	M	Mean Length		524	688		799	906	
(7/8-19)		SE		16	19		38	23	
		Range		415- 647	556- 803		660- 930	872- 949	
		Sample Size	0	21	14	0	7	3	0
	F	Mean Length			707		810	827	
		SE			-		14	19	
		Range			707- 707		723- 871	745- 914	
		Sample Size	0	0	1	0	11	9	0
7/20-8/5	M	Mean Length	409	535	628		853	689	
(7/20-9/20)		SE	-	24	18		28	69	
		Range	409- 409	413- 632	525- 780		660- 995	620- 758	
		Sample Size	1	9	13	0	14	2	0
	F	Mean Length					849	802	
		SE					10	20	
		Range					604- 947	737- 850	
		Sample Size	0	0	0	0	39	5	0
Season[a]	M	Mean Length	409	540	677		837	853	
		Range	409- 409	413- 655	525- 875		660- 995	620- 949	
		Sample Size	1	47	48	0	31	7	0
	F	Mean Length		595	649		850	834	
		Range		595- 595	495- 715		604- 947	737- 950	
		Sample Size	0	1	6	0	65	17	0

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

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

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

			Age Class									
Sample Dates	Sample		0.2		0.3		0.4		0.5		Total	
(Stratum Dates)	Size	Sex	Esc.	%	Esc.	%	Esc.	%	Esc.	%	Esc.	%
6/25-29	177	M	0	0.0	606	12.4	1,957	40.1	0	0.0	2,562	52.5
(6/15-7/2)		F	0	0.0	909	18.7	1,405	28.8	0	0.0	2,315	47.5
		Subtotal[a]	0	0.0	1,515	31.1	3,362	68.9	0	0.0	4,877	100.0
7/6-9	183	M	267	2.2	1,999	16.4	2,599	21.3	67	0.5	4,931	40.4
(7/3-13)		F	133	1.1	4,065	33.3	3,065	25.1	0	0.0	7,264	59.6
		Subtotal[a]	400	3.3	6,064	49.7	5,664	46.4	67	0.5	12,195	100.0
7/17-18	184	M	0	0.0	3,668	23.9	2,501	16.3	0	0.0	6,169	40.2
(7/14-23)		F	500	3.3	4,585	29.9	4,085	26.6	0	0.0	9,170	59.8
		Subtotal[a]	500	3.3	8,253	53.8	6,586	42.9	0	0.0	15,339	100.0
7/28-30	178	M	150	2.8	1,497	28.1	838	15.7	0	0.0	2,485	46.6
(7/24-31)		F	179	3.4	1,617	30.3	1,048	19.7	0	0.0	2,844	53.4
		Subtotal[a]	329	6.2	3,114	58.4	1,886	35.4	0	0.0	5,329	100.0
8/4-5	180	M	79	2.8	682	23.9	460	16.1	0	0.0	1,221	42.8
(8/1-10)		F	127	4.4	951	33.3	555	19.5	0	0.0	1,633	57.2
		Subtotal[a]	206	7.2	1,633	57.2	1,015	35.6	0	0.0	2,854	100.0
8/15-17	32	M	0	0.0	136	15.7	137	15.6	0	0.0	273	31.3
(8/11-9/20)		F	27	3.1	355	40.6	218	25.0	0	0.0	600	68.7
		Subtotal[a]	27	3.1	491	56.3	355	40.6	0	0.0	873	100.0
Season[b]	934	M	496	1.2	8,588	20.7	8,491	20.5	67	0.2	17,641	42.5
		F	967	2.3	12,482	30.1	10,376	25.0	0	0.0	23,826	57.5
		Total	1,463	3.5	21,070	50.8	18,867	45.5	67	0.2	41,467	100.0

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepencies 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 George River weir in 2006 based on escapement samples collected with a live trap.

Sample Dates (Stratum Dates)	Sex		Age Class 0.2	0.3	0.4	0.5
6/25-29	M	Mean Length		566	575	
(6/15-7/2)		SE		6	3	
		Range		510- 625	500- 640	
		Sample Size	0	22	71	0
	F	Mean Length		544	557	
		SE		5	4	
		Range		490- 610	515- 615	
		Sample Size	0	33	51	0
7/6-9	M	Mean Length	511	552	568	647
(7/3-13)		SE	23	5	7	-
		Range	449- 545	500- 615	497- 658	647- 647
		Sample Size	4	30	39	1
	F	Mean Length	506	540	547	
		SE	1	4	4	
		Range	505- 506	482- 615	496- 639	
		Sample Size	2	61	46	0
7/17-18	M	Mean Length		557	571	
(7/14-23)		SE		4	6	
		Range		490- 620	489- 659	
		Sample Size	0	44	30	0
	F	Mean Length	492	519	532	
		SE	10	3	3	
		Range	456- 519	479- 554	490- 568	
		Sample Size	6	55	49	0
7/28-30	M	Mean Length	506	540	548	
(7/24-31)		SE	19	5	5	
		Range	450- 545	465- 616	495- 600	
		Sample Size	5	50	28	0
	F	Mean Length	491	503	520	
		SE	11	3	5	
		Range	465- 537	445- 555	460- 570	
		Sample Size	6	54	35	0
8/4-5	M	Mean Length	515	538	565	
(8/1-10)		SE	18	7	7	
		Range	465- 575	440- 656	490- 620	
		Sample Size	5	43	29	0
	F	Mean Length	491	505	519	
		SE	8	4	6	
		Range	450- 530	450- 620	480- 600	
		Sample Size	8	60	35	0

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Table 5.–Page 2 of 2.

Sample Dates (Stratum Dates)	Sex		Age Class 0.2	0.3	0.4	0.5
8/15-17	M	Mean Length		520	558	
(8/11-9/20)		SE		18	11	
		Range		477- 574	518- 582	
		Sample Size	0	5	5	0
	F	Mean Length	475	507	519	
		SE	-	8	11	
		Range	475- 475	457- 554	457- 569	
		Sample Size	1	13	8	0
Season[a]	M	Mean Length	510	551	568	647
		Range	449- 575	440- 656	489- 659	647- 647
		Sample Size	14	194	202	1
	F	Mean Length	493	524	538	
		Range	450- 537	445- 620	457- 639	
		Sample Size	23	276	224	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 George River weir in 2006 based on escapement samples collected with a live trap.

Sample Dates (Stratum Dates)	Sample Size	Sex	Age Class 1.1 Esc.	1.1 %	2.1 Esc.	2.1 %	3.1 Esc.	3.1 %	Total Esc.	Total %
8/4-5,15-17	131	M	189	4.6	1,919	46.6	315	7.6	2,423	58.8
(6/15-8/23)		F	63	1.5	1,416	34.3	220	5.4	1,699	41.2
		Subtotal[a]	252	6.1	3,335	80.9	535	13.0	4,122	100.0
8/30-31	144	M	113	2.8	1,673	41.0	28	0.7	1,815	44.4
(8/24-9/4)		F	0	0.0	2,098	51.4	170	4.2	2,268	55.6
		Subtotal[a]	113	2.8	3,771	92.4	198	4.9	4,083	100.0
9/7-8	165	M	112	3.6	1,161	37.6	75	2.4	1,348	43.6
(9/5-20)		F	19	0.6	1,667	53.9	56	1.8	1,742	56.4
		Subtotal[a]	131	4.2	2,828	91.5	131	4.2	3,090	100.0
Season[b]	440	M	414	3.7	4,753	42.1	418	3.7	5,586	49.5
		F	82	0.7	5,181	45.9	446	4.0	5,709	50.5
		Total	496	4.4	9,934	88.0	864	7.7	11,295	100.0

[a] The number of fish in each stratum age and sex category are derived from the sample percentages; discrepencies 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 George River weir in 2006 based on escapement samples collected with a live trap.

Sample Dates (Stratum Dates)	Sex		Age Class 1.1	2.1	3.1
8/4-5,15-17	M	Mean Length	523	521	523
(6/15-8/23)		SE	11	6	15
		Range	478- 556	432- 619	432- 579
		Sample Size	6	61	10
	F	Mean Length	546	529	538
		SE	14	5	5
		Range	531- 560	439- 576	512- 556
		Sample Size	2	45	7
8/30-31	M	Mean Length	502	516	566
(8/24-9/4)		SE	21	6	-
		Range	476- 563	405- 635	566- 566
		Sample Size	4	59	1
	F	Mean Length		529	540
		SE		4	19
		Range		472- 601	494- 608
		Sample Size	0	74	6
9/7-8	M	Mean Length	514	521	512
(9/5-20)		SE	11	6	30
		Range	476- 546	412- 625	477- 602
		Sample Size	6	62	4
	F	Mean Length	512	531	562
		SE	-	3	19
		Range	512- 512	402- 592	529- 594
		Sample Size	1	89	3
Season[a]	M	Mean Length	515	519	524
		Range	476- 563	405- 635	432- 602
		Sample Size	16	182	15
	F	Mean Length	538	530	542
		Range	512- 560	402- 601	494- 608
		Sample Size	3	208	16

Note: The sum of the sample sizes in each stratum equal the total sample size reported for that stratum in Table 6.
[a] "Season" mean lengths are weighted by the escapement passage in each stratum.

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

Brood Years	Escapement (spawners)	Number by Age in Return Year						Returns[a]	Return per Spawner[a]
		3	4	5	6	7	8		
1988	ND	ND	ND	ND	ND	ND	0	-	-
1989	ND	ND	ND	ND	ND	2271	0	-	-
1990	ND	ND	ND	ND	3,070	0	-	-	-
1991	ND	ND	ND	1793	4,198	-	-	-	-
1992	ND	ND	551	913	-	-	-	-	-
1993	ND	0	2,709	-	-	-	0	-	-
1994	ND	0	-	-	-	257	0	-	-
1995	ND	-	-	-	1,537	201	-	-	-
1996	7,716	-	-	962	1,488	-	0	-	-
1997	7,834	-	395	448	-	130	12	-	-
1998	2,505[b c]	0	307	-	2,580	127	0	-	-
1999	3,548[b]	0	-	1103	1,563	472	ND	-	-
2000	2,960[b]	-	1,349	1689	1,561	ND	ND	-	-
2001	3,309	27	409	1230	ND	ND	ND	-	-
2002	2,444	0	1,087	ND	ND	ND	ND	-	-
2003	4,693[b]	7	ND	ND	ND	ND	ND	-	-
2004	5,207	ND	ND	ND	ND	ND	ND	ND	ND
2005	3,845	ND	ND	ND	ND	ND	ND	ND	ND
2006	4,357	ND	ND	ND	ND	ND	ND	ND	ND

[a] Total returns and return per spawner can not be calculated due to insufficient data.
[b] ASL sampling was not adequate to determine age composition of the escapement; returns from brood year are not known.
[c] Incomplete escapement count.

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

Brood Years	Escapement (spawners)	Number by Age in Return Year				Returns[a]	Return per Spawner[a]
		3	4	5	6		
1990	ND	ND	ND	ND	367	-	-
1991	ND	ND	ND	7,969	95	-	-
1992	ND	ND	12,990	2,732	-	-	-
1993	ND	344	3,037	-	-	-	-
1994	ND	42	-	-	55	-	-
1995	ND	-	-	1,756	0	-	-
1996	19,393	-	1,630	3,905	96	-	-
1997	5,907	47	7,696	2,999	104	10,846	1.84
1998	6,391[b c]	0	3,032	3,381	29	6,442	-
1999	11,558[b]	416	29,678	7,498	88	37,680	3.26
2000	3,492	502	5,559	664	67	6,792	0.59
2001	11,601	1,325	13,309	18,867	ND	-	-
2002	6,543	767	21,070	ND	ND	-	-
2003	33,666	1,463	ND	ND	ND	-	-
2004	14,411	ND	ND	ND	ND	ND	ND
2005	14,828	ND	ND	ND	ND	ND	ND
2006	41,467	ND	ND	ND	ND	ND	ND

[a] Total returns and return per spawner can not be calculated for most listed brood years due to insufficient data.

[b] ASL sampling was not adequate to determine age composition of the escapement; returns from brood year are not known.

[c] Incomplete escapement count.

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

Brood Years	Escapement (spawners)	Number by Age in Return Year			Returns[a]	Return per Spawner[a]
		3	4	5		
1991	ND	ND	ND	-	-	-
1992	ND	ND	-	166	-	-
1993	ND	-	8,575	-	-	-
1994	ND	196	-	2,451	-	-
1995	ND	-	6,236	122	-	-
1996	173[b]	243	10,984	4,851	16,078	-
1997	9,210	150	9,457	-	-	-
1998	52[b c]	111	-	3,673	-	-
1999	8,930	-	29,292	1,181	-	-
2000	11,262	316	11,897	1,541	13,754	1.22
2001	14,415	171	6,579	864	7,614	0.53
2002	6,759[c]	80	9,934	ND	-	-
2003	33,280	496	ND	ND	-	-
2004	13,248	ND	ND	ND	ND	ND
2005	8,200	ND	ND	ND	ND	ND
2006	11,296	ND	ND	ND	ND	ND

[a] Total returns and return per spawner can not be calculated for most listed brood years due to insufficient data.
[b] Incomplete escapement count.
[c] ASL sampling was not adequate to determine age composition of the escapement; returns from brood year are not known.

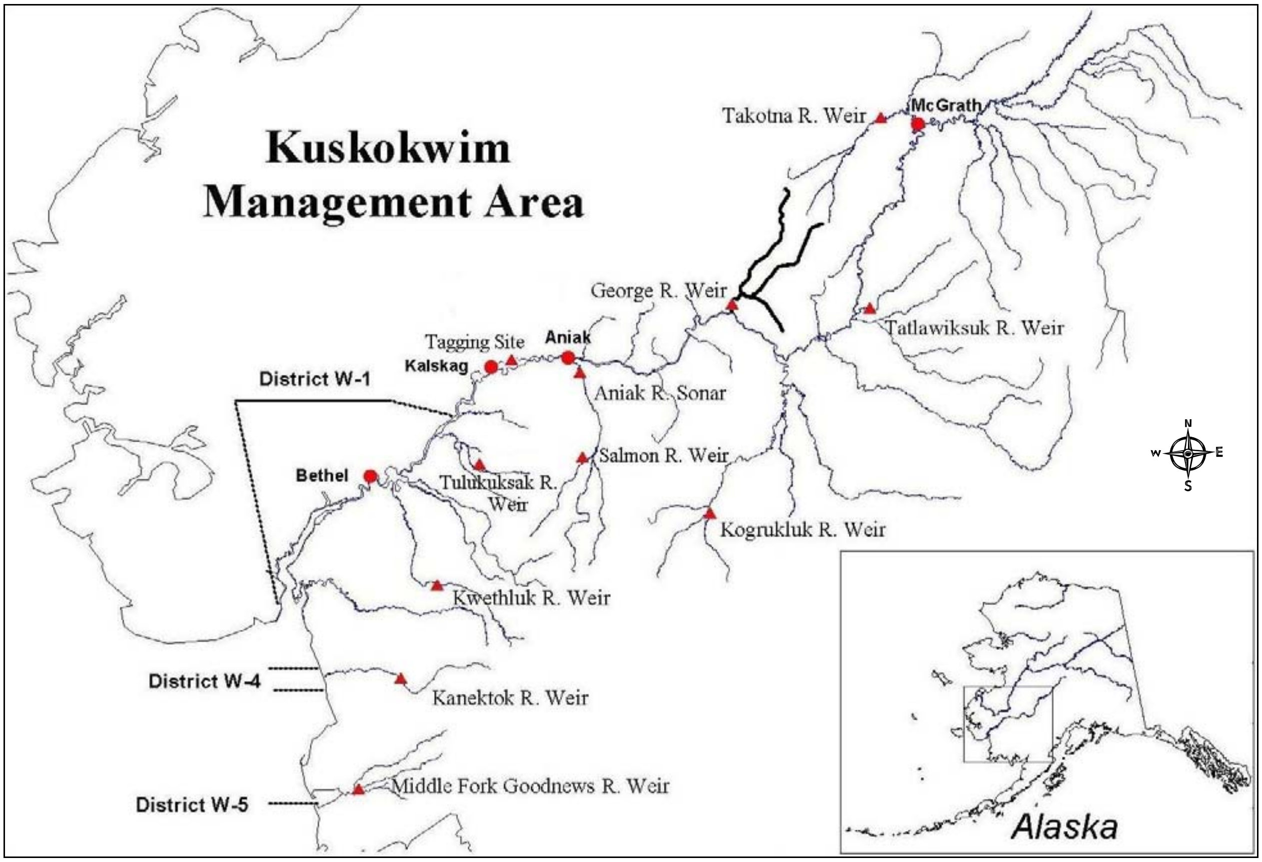


Figure 1.–Kuskokwim Area salmon management districts and escapement monitoring projects with emphasis on the George River.

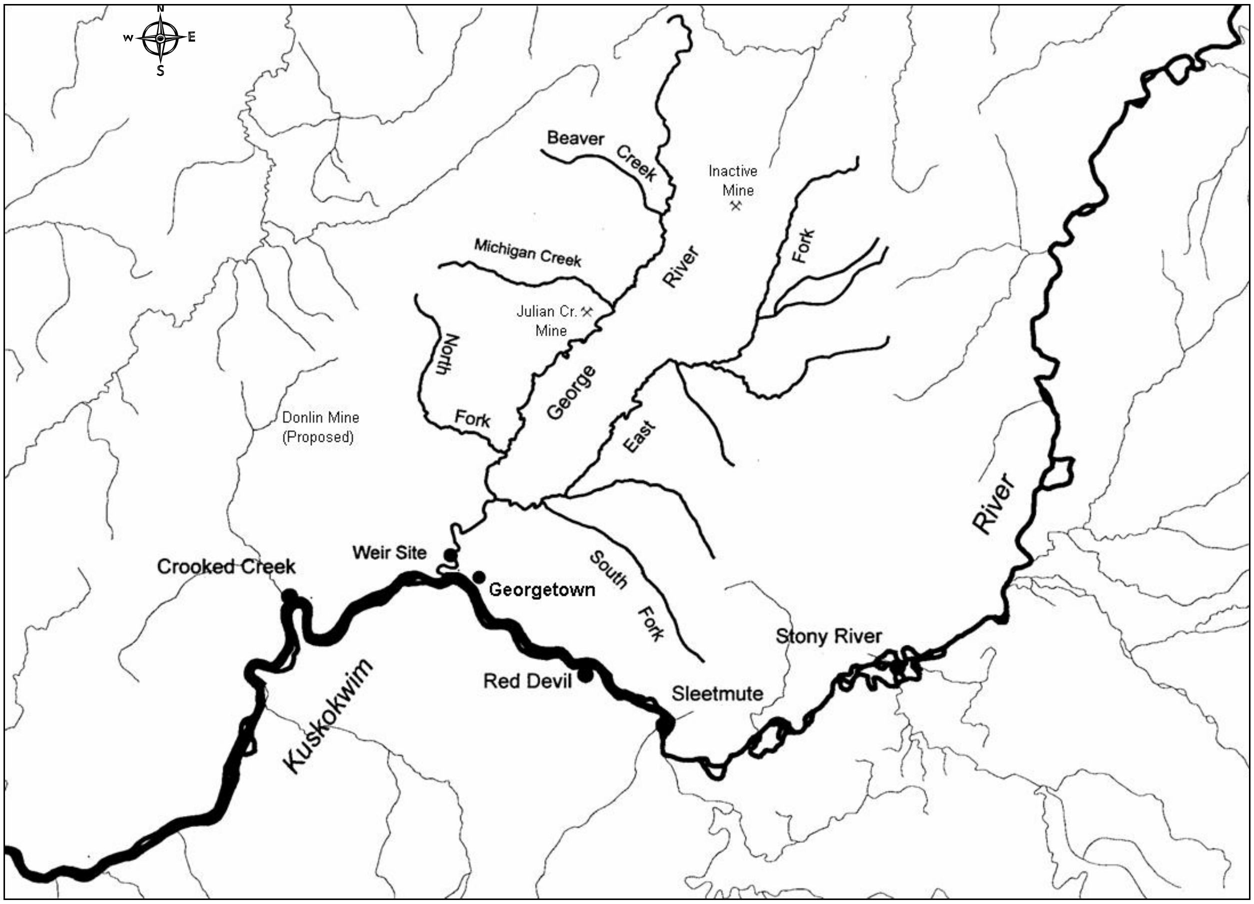


Figure 2.–George River, middle Kuskokwim River basin.

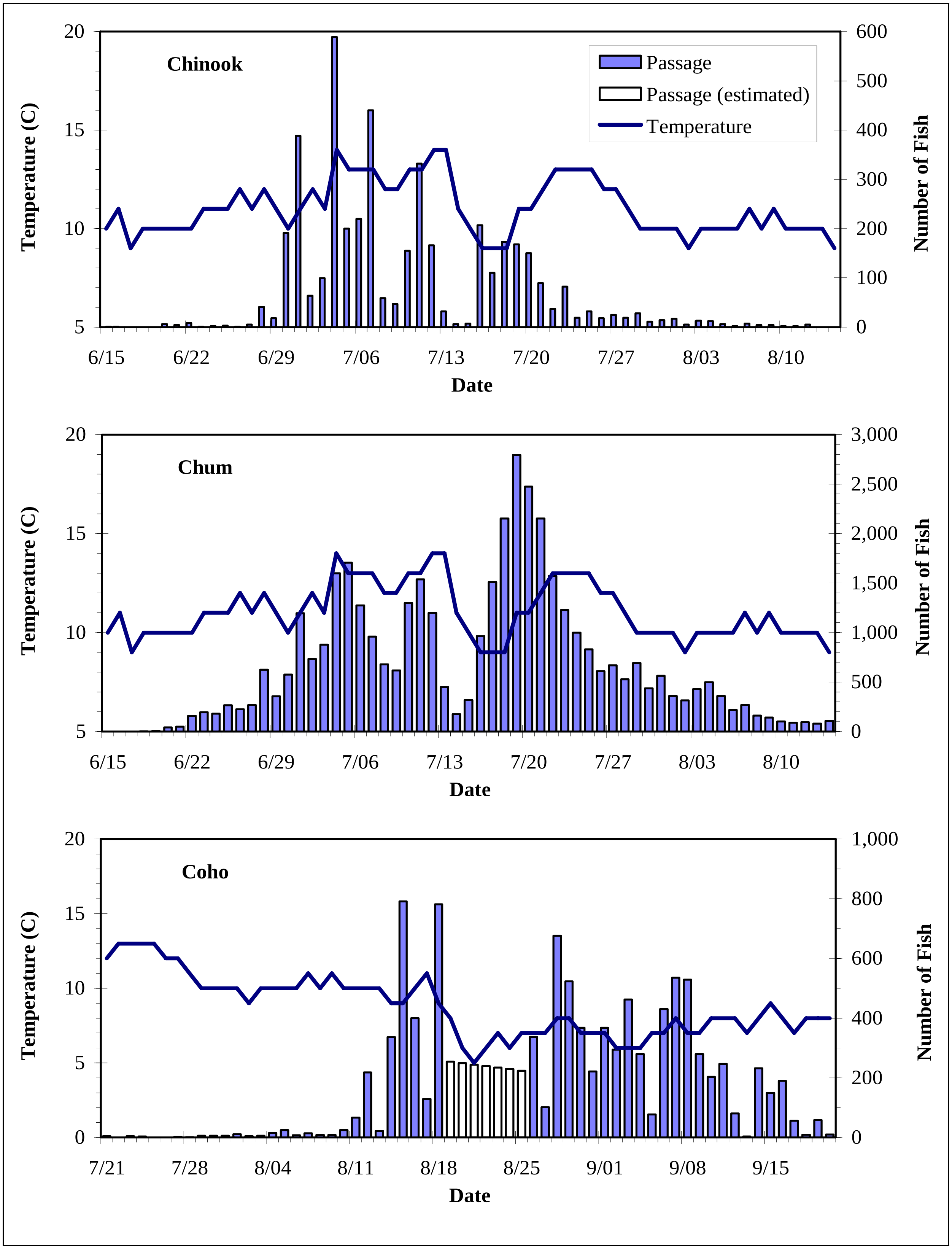


Figure 3.–Daily passage of Chinook, chum, and coho salmon relative to daily morning water temperature observations at George River weir, 2006.

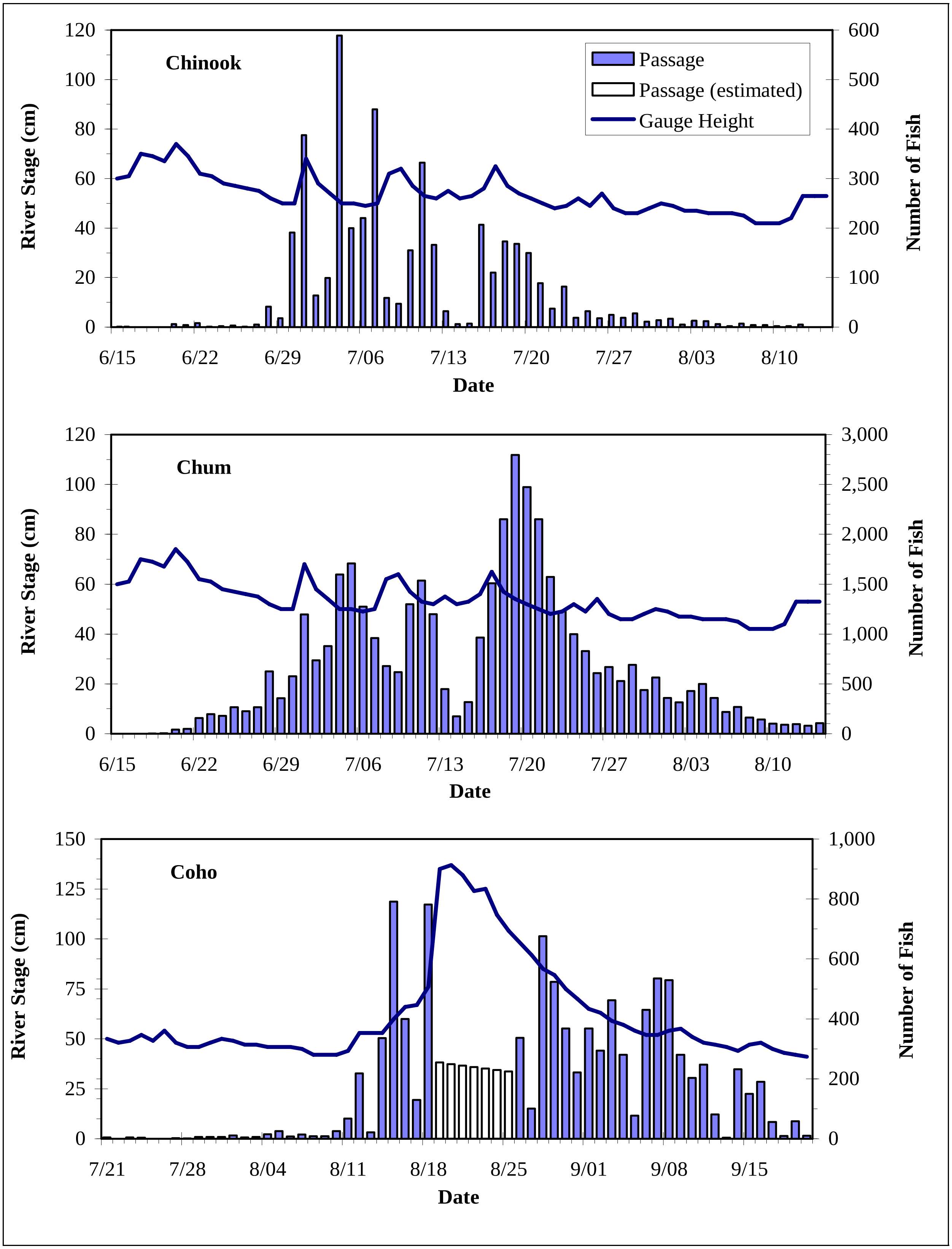
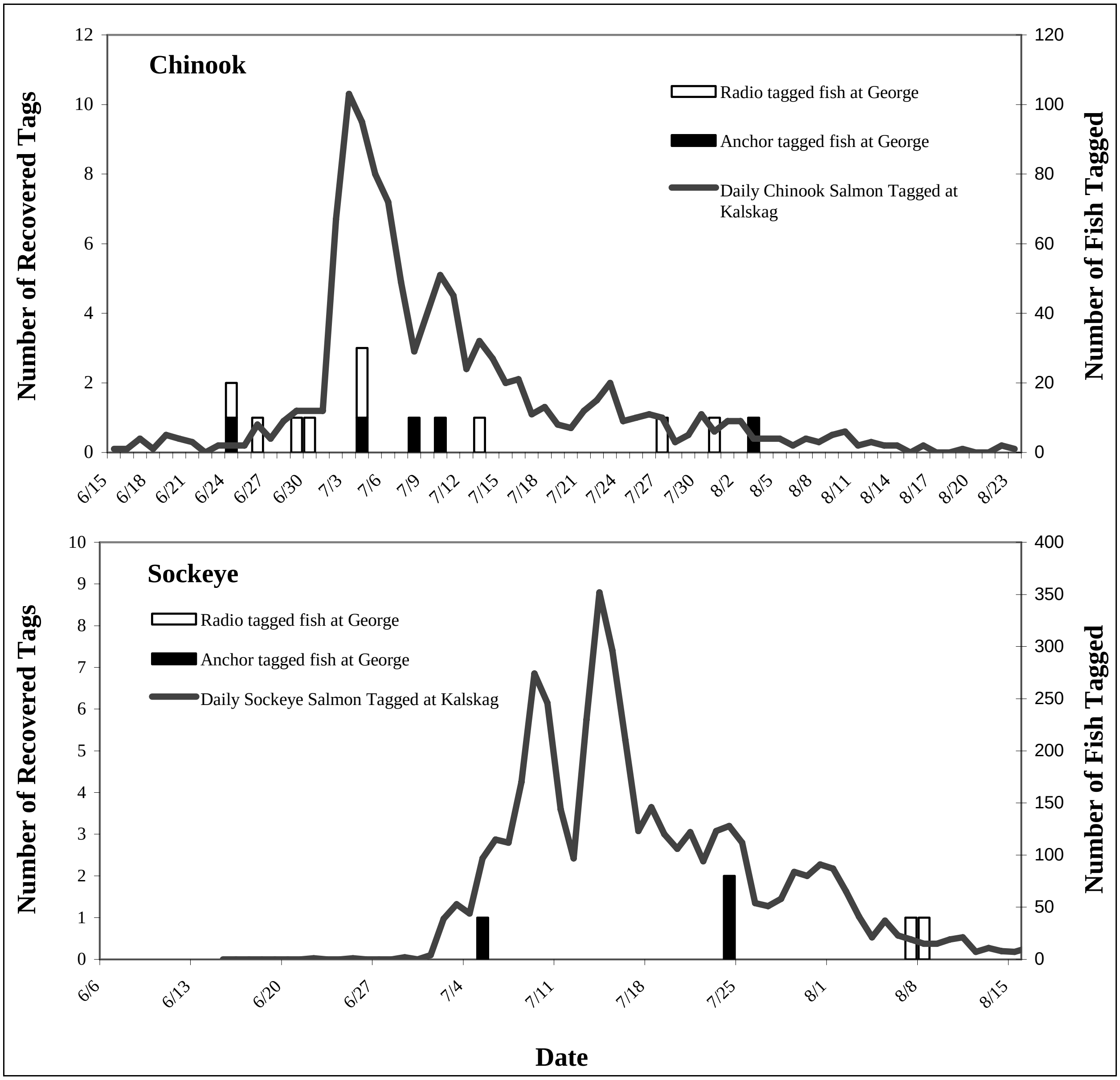


Figure 4.–Daily passage of Chinook, chum, and coho salmon relative to daily river stage observations at George River weir, 2006.



Note: Tagging began on 7 June.

Figure 5.–Run timing of Chinook and sockeye salmon captured at the Kalskag tagging site, compared to run timing of salmon recovered at George River weir by date tagged, 2006.

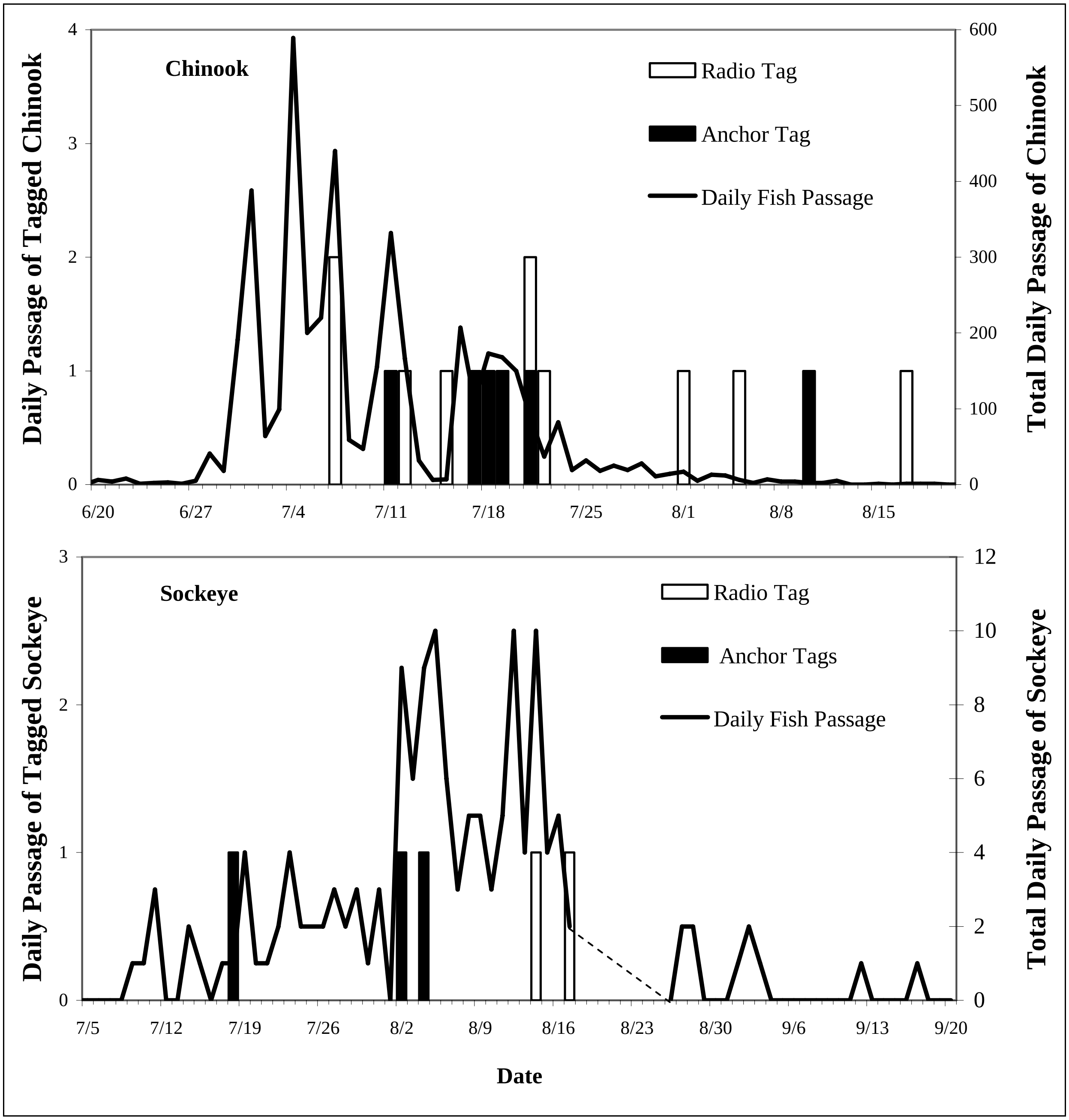
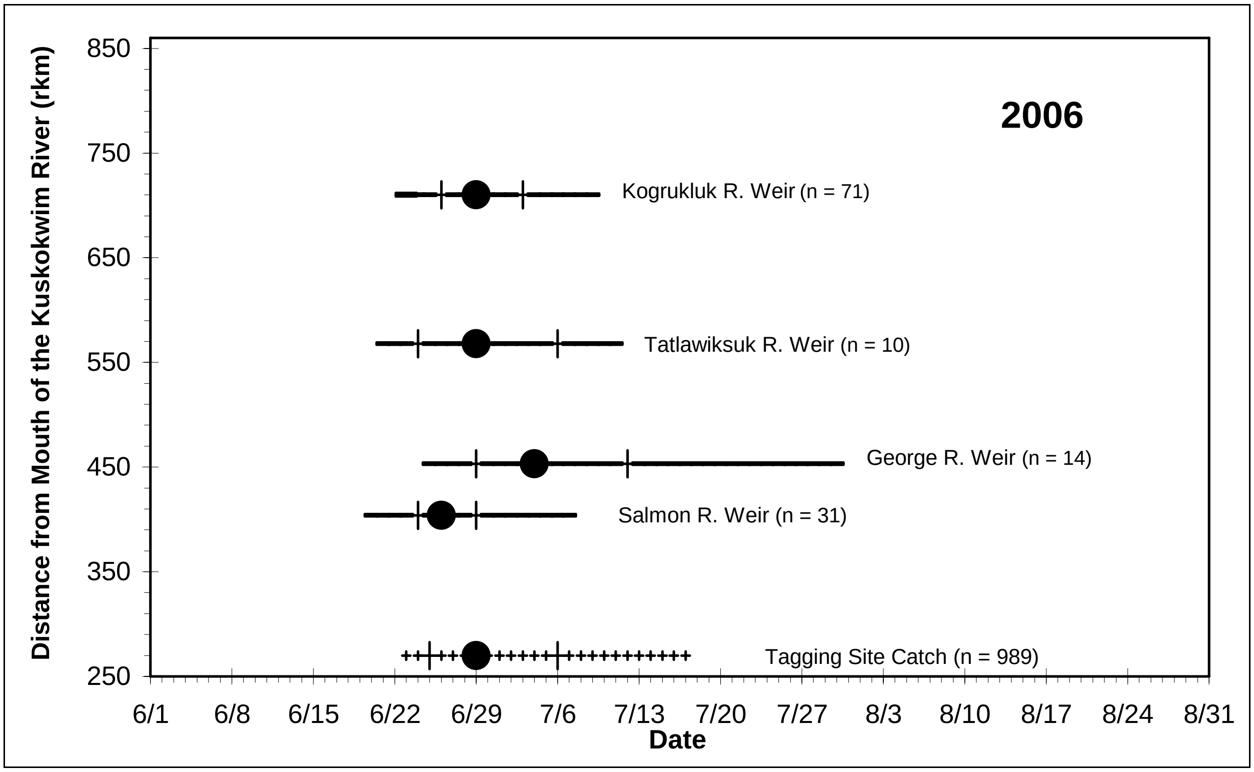


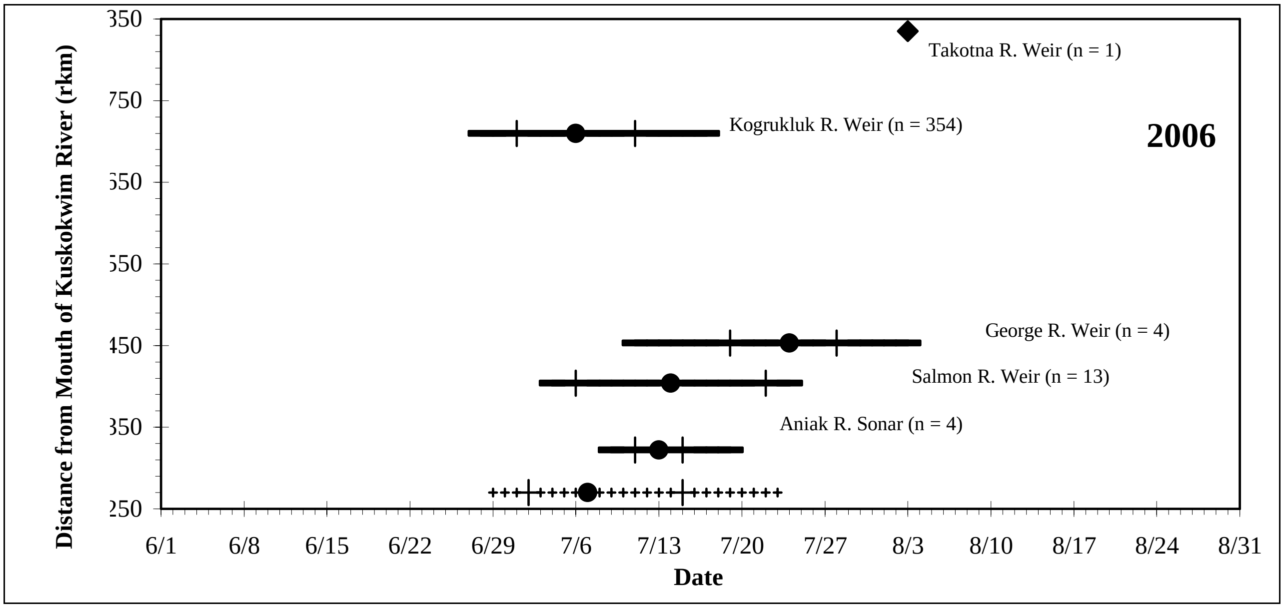
Figure 6.–Daily detection of tagged Chinook and sockeye salmon with daily escapement at George River weir in 2006.



Source: Baumer et al. *In prep*.

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

Figure 7.–Dates when individual Chinook salmon stocks passed through the Kalskag tagging sites (rkm 271) based on anchor- and radio-tagging studies conducted in 2006.



Source: Baumer et al. *In prep.*

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

Figure 8.–Dates when individual sockeye salmon stocks passed through the Kalskag tagging sites (rkm 271) based on anchor- and radio-tagging studies conducted in 2006.

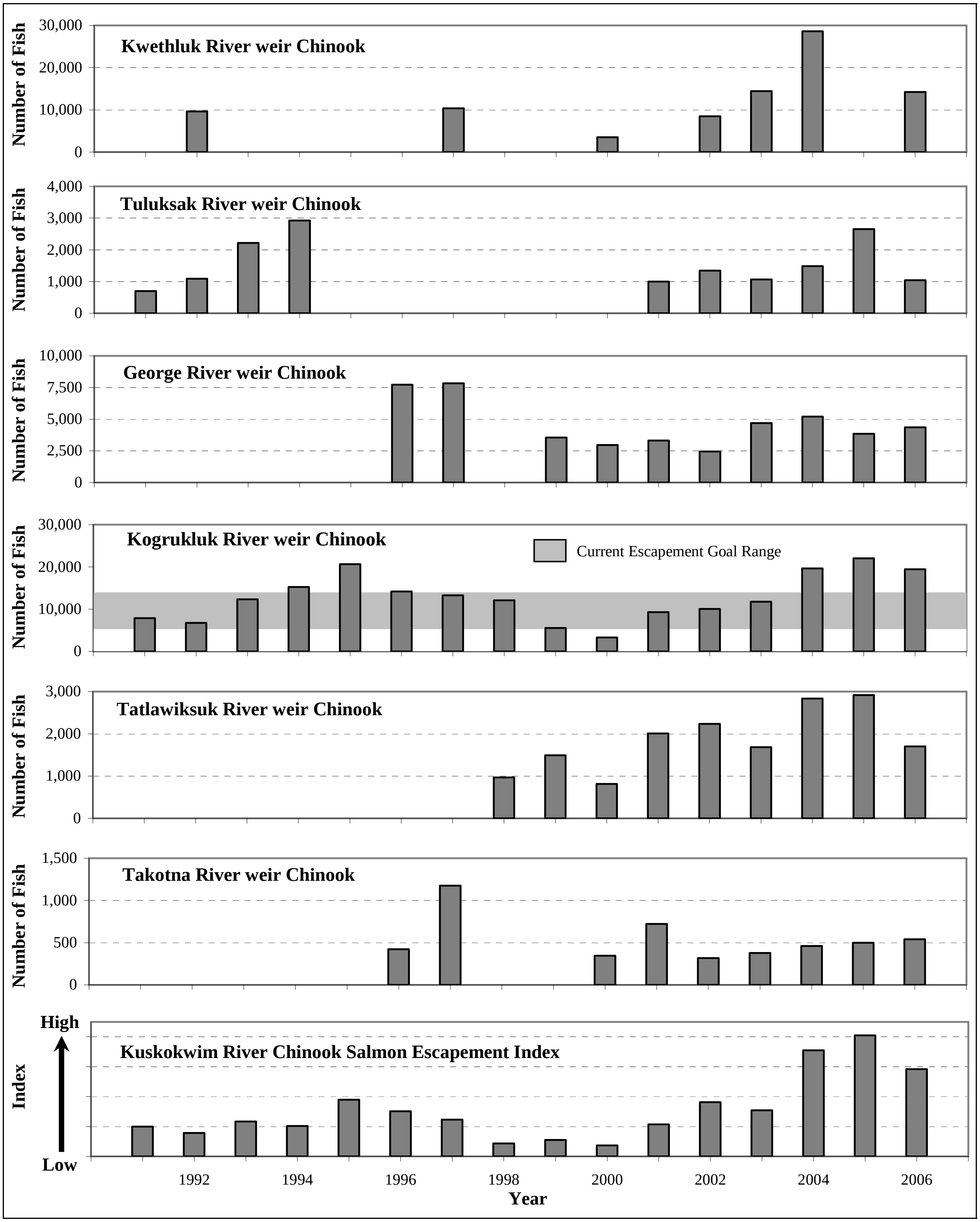
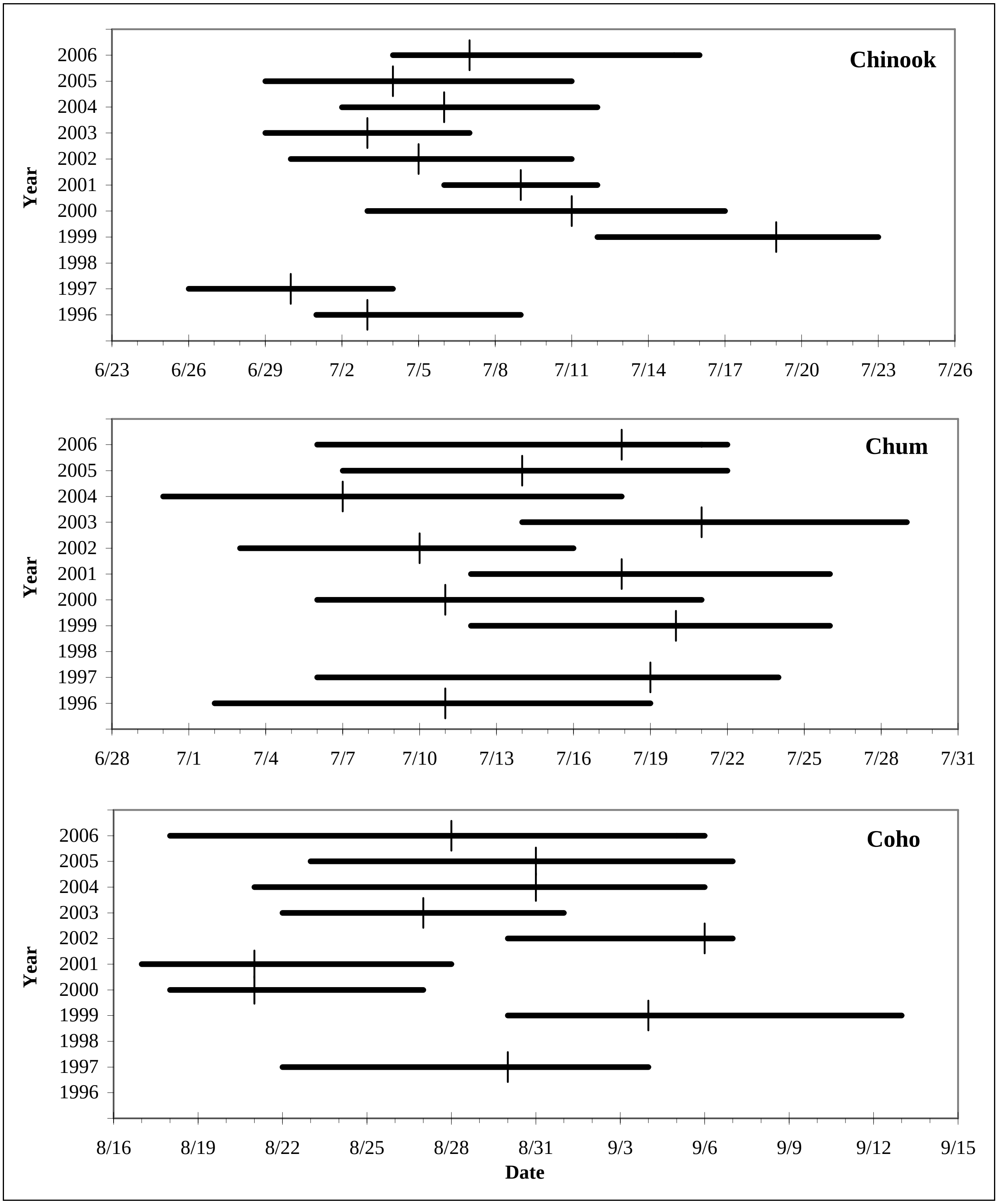


Figure 9.–Chinook salmon escapement into 6 Kuskokwim River tributaries, and the Kuskokwim River Chinook salmon escapement indices, 1991–2006.



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

Figure 10.–Annual run timing of Chinook, chum, and coho salmon based on cumulative percent passage at the George River weir, 1996–2006.

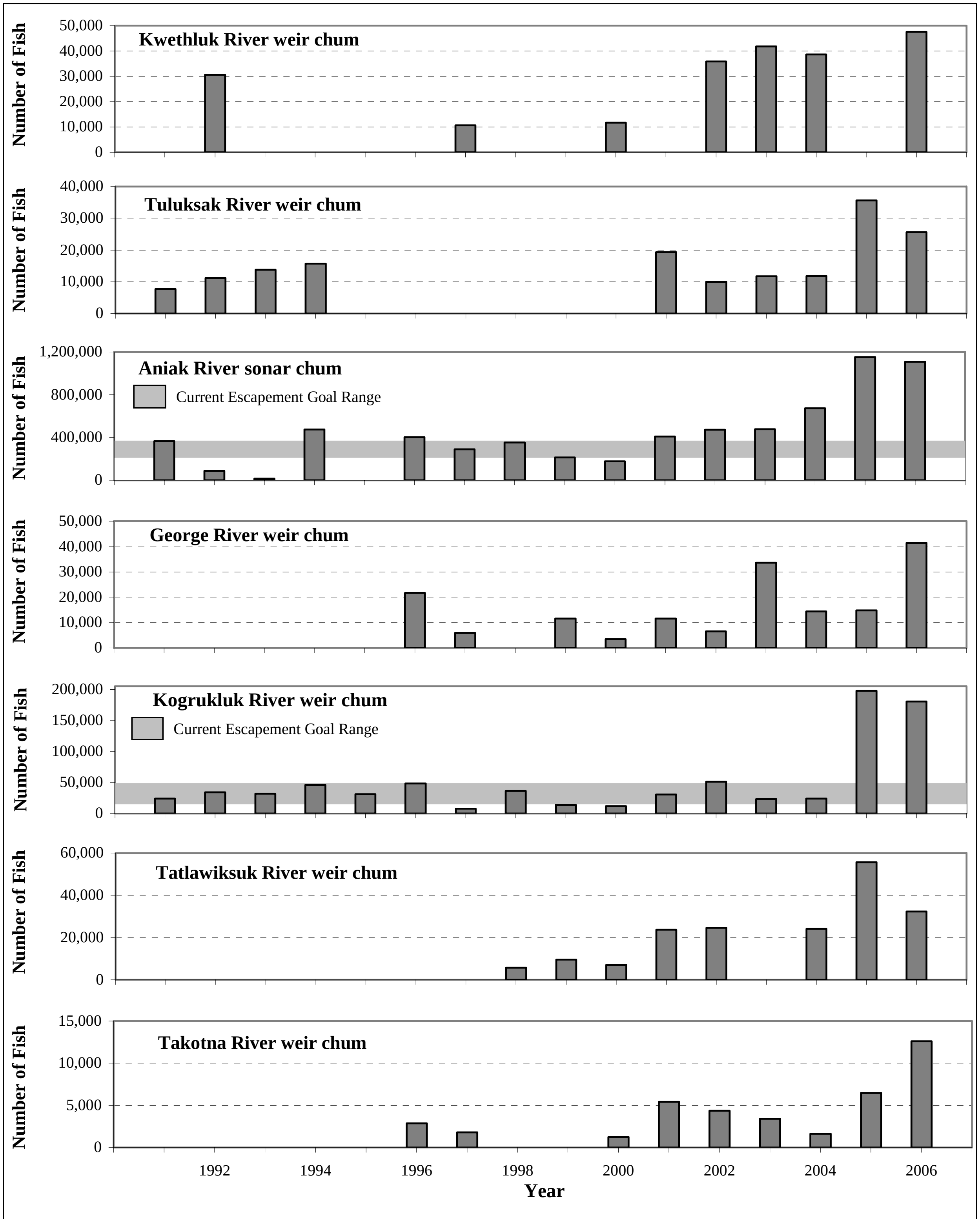


Figure 11.–Chum salmon escapement into 7 Kuskokwim River tributaries, 1991–2006.

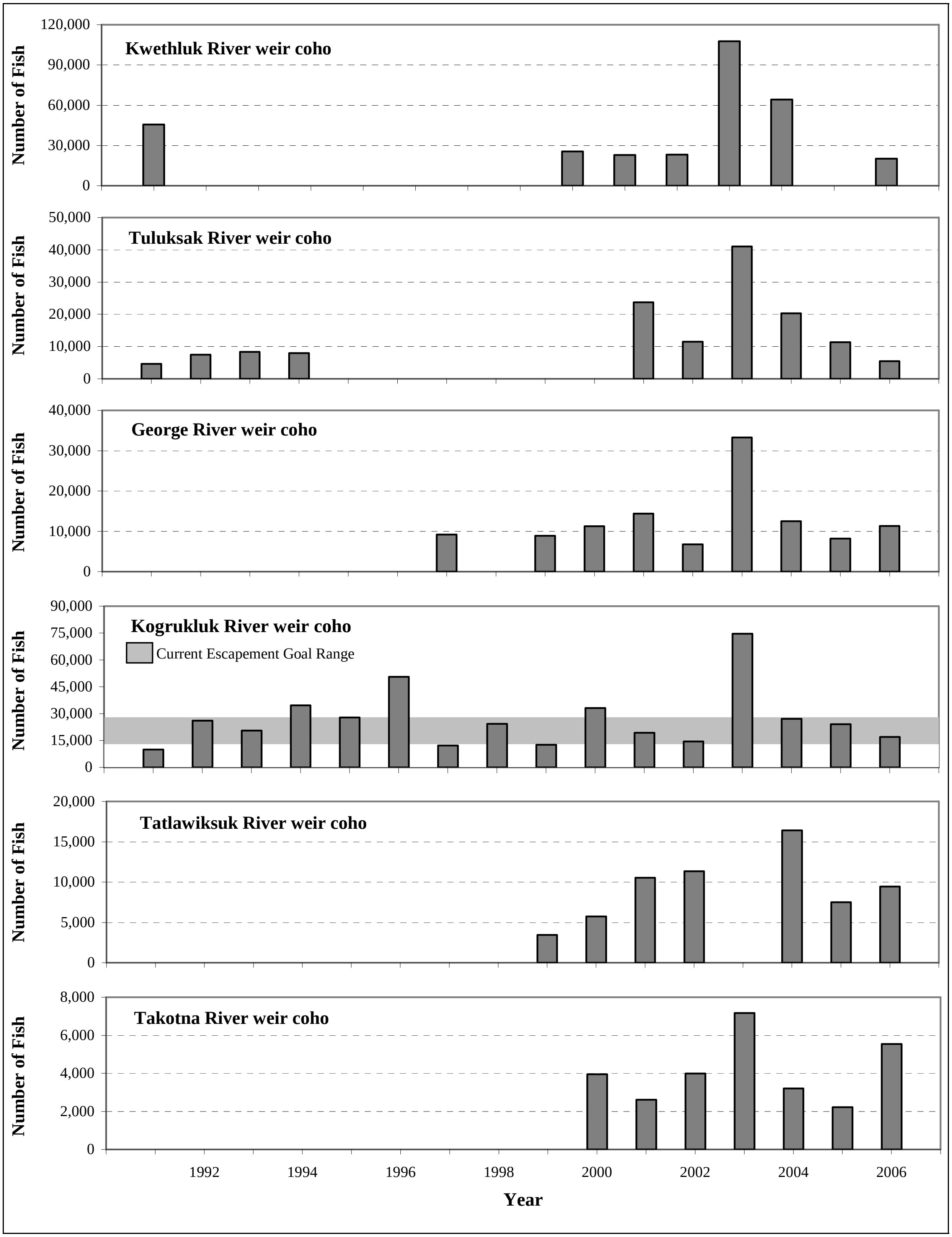


Figure 12.–Coho salmon escapement into 6 Kuskokwim River tributaries, 1991–2006.

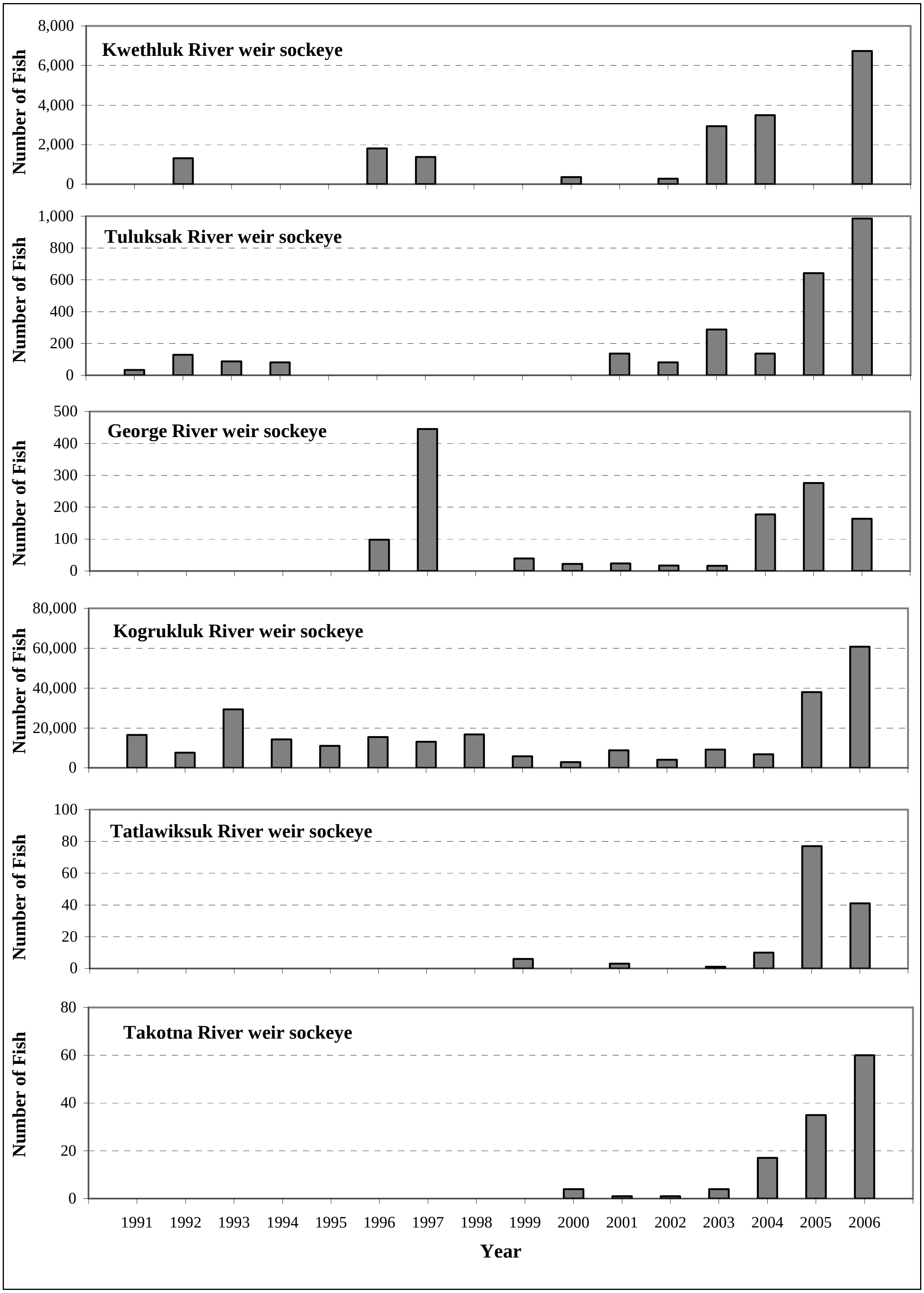
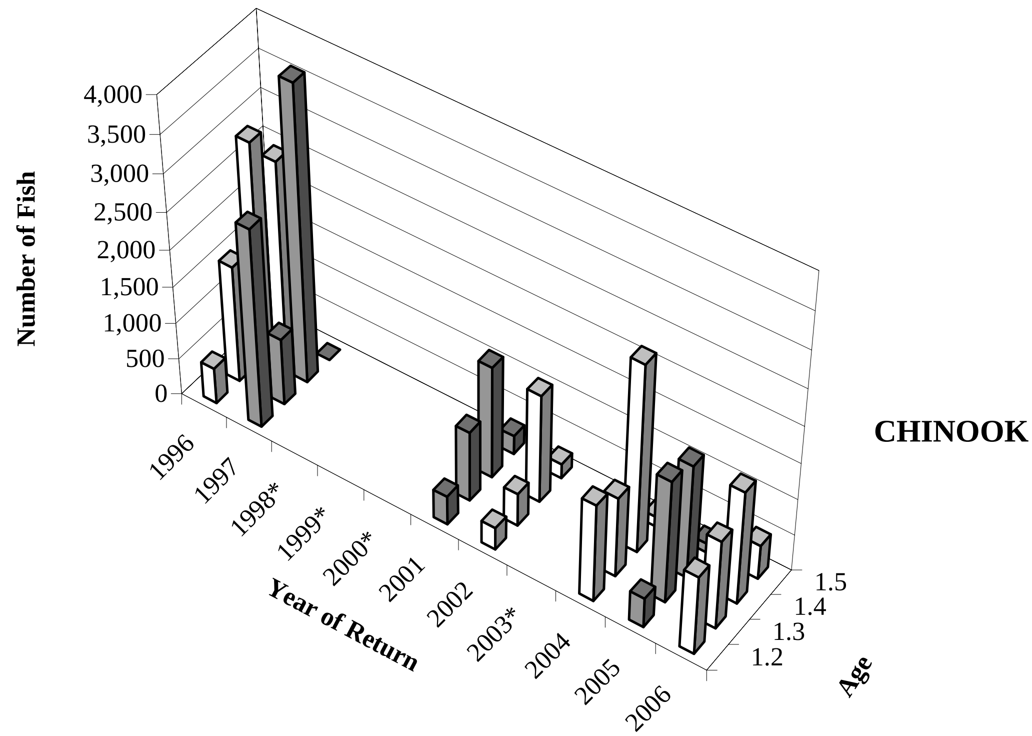


Figure 13.–Historical sockeye salmon escapement into 6 Kuskokwim River tributaries, 1991–2006.



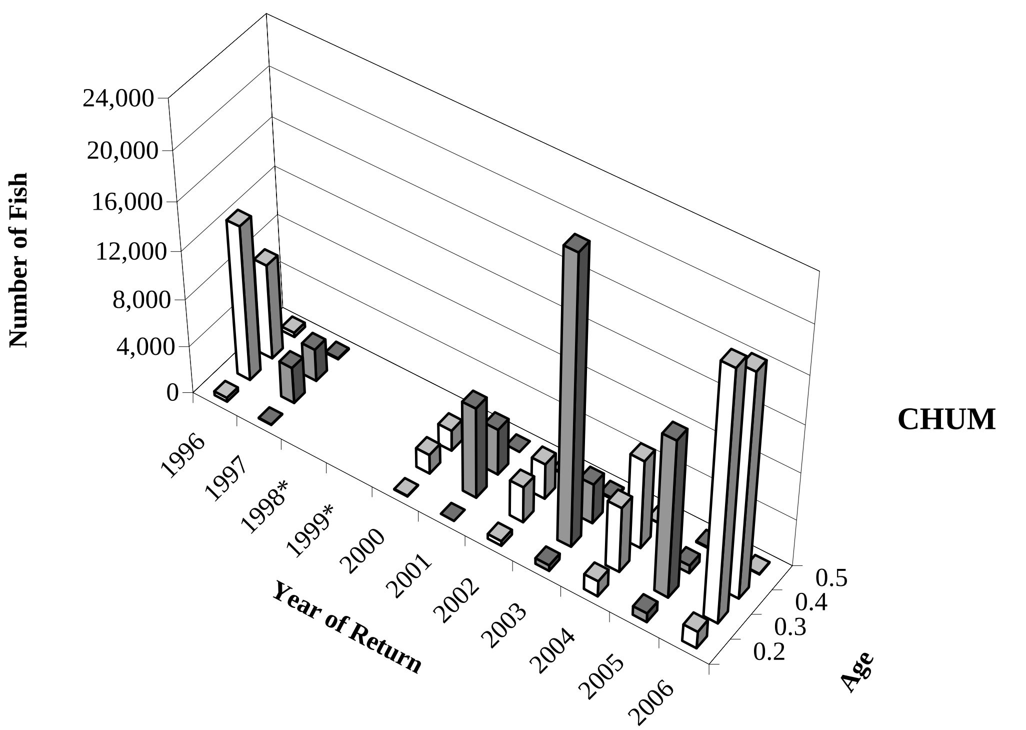


Figure 14.–Historical age distribution of annual Chinook and chum salmon escapements at George River weir.

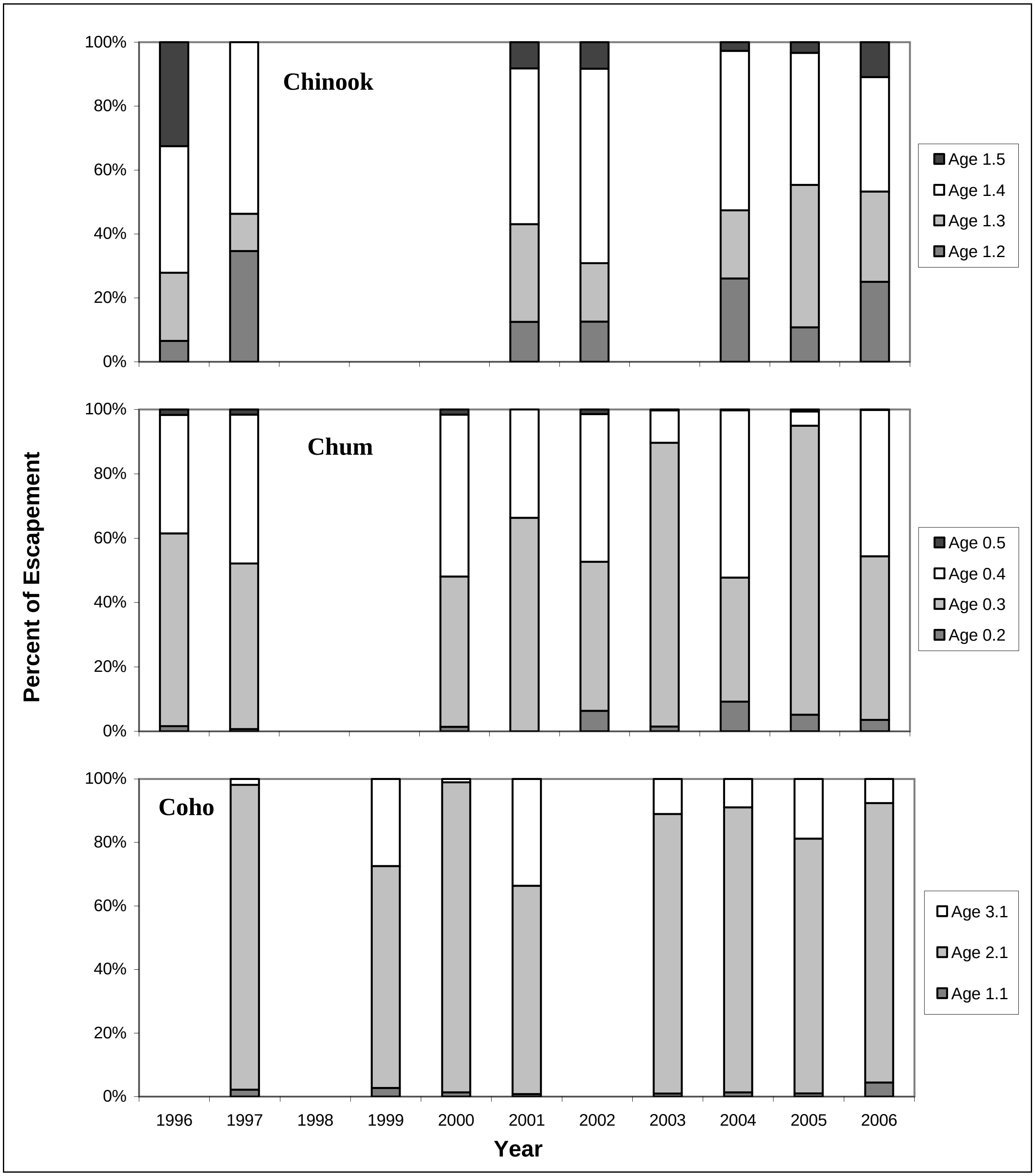


Figure 15.–Historical age composition of Chinook, chum, and coho salmon at the George River weir, 1996–2006.

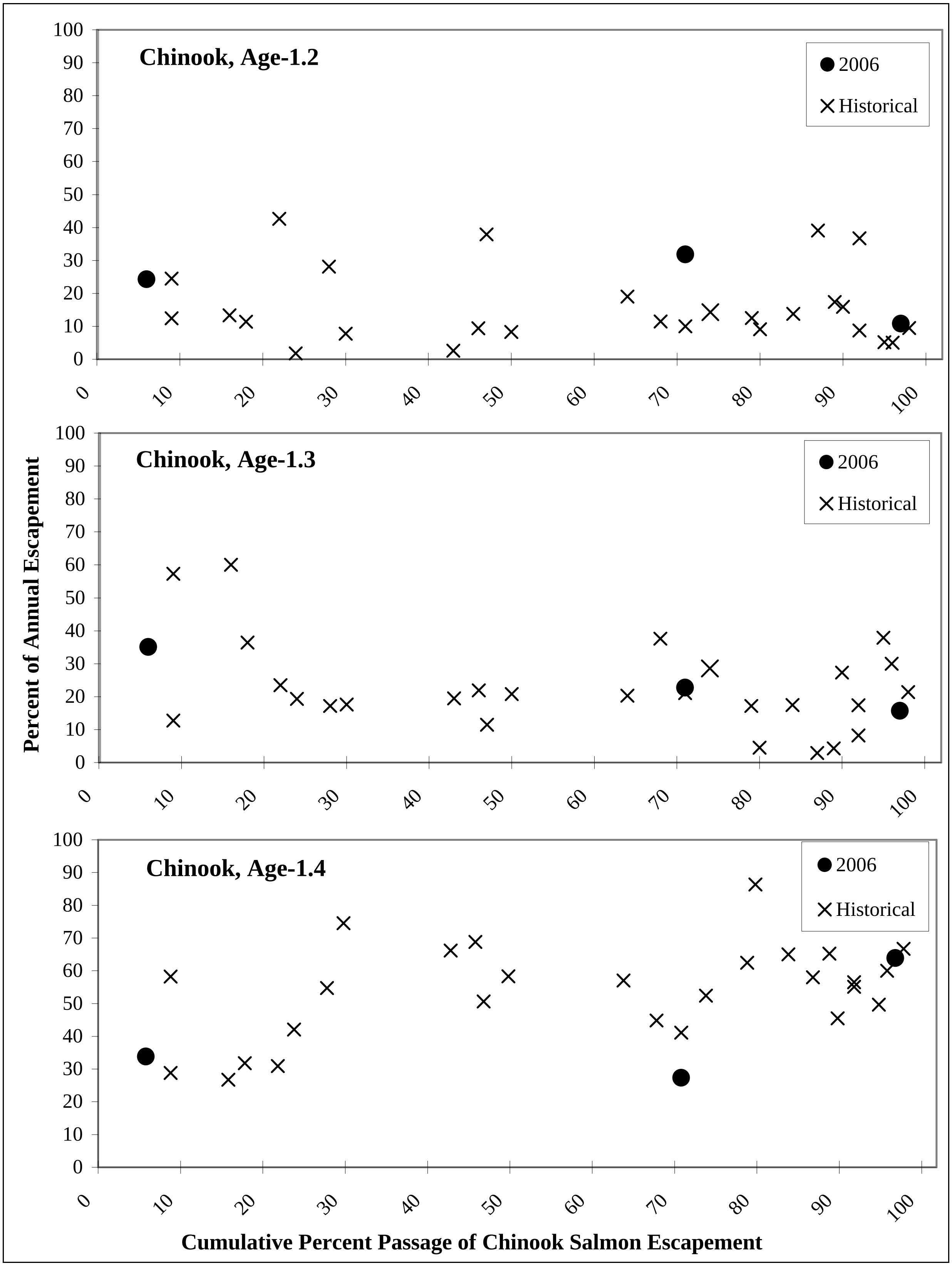


Figure 16.–Historical age composition by cumulative percent passage for Chinook salmon at George River weir.

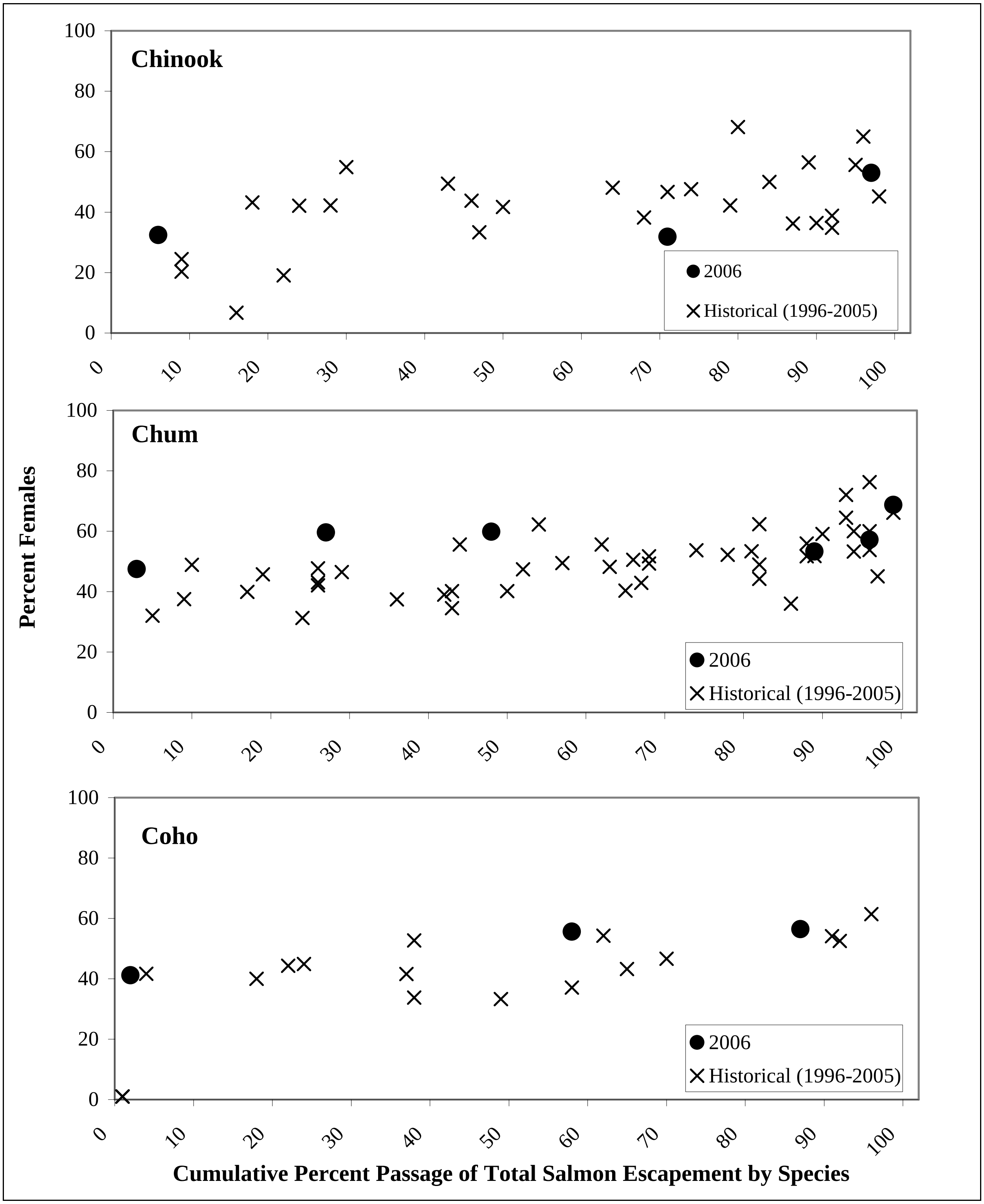


Figure 17.–Historical percentage of female Chinook, chum, and coho salmon by cumulative percent passage at George River weir.

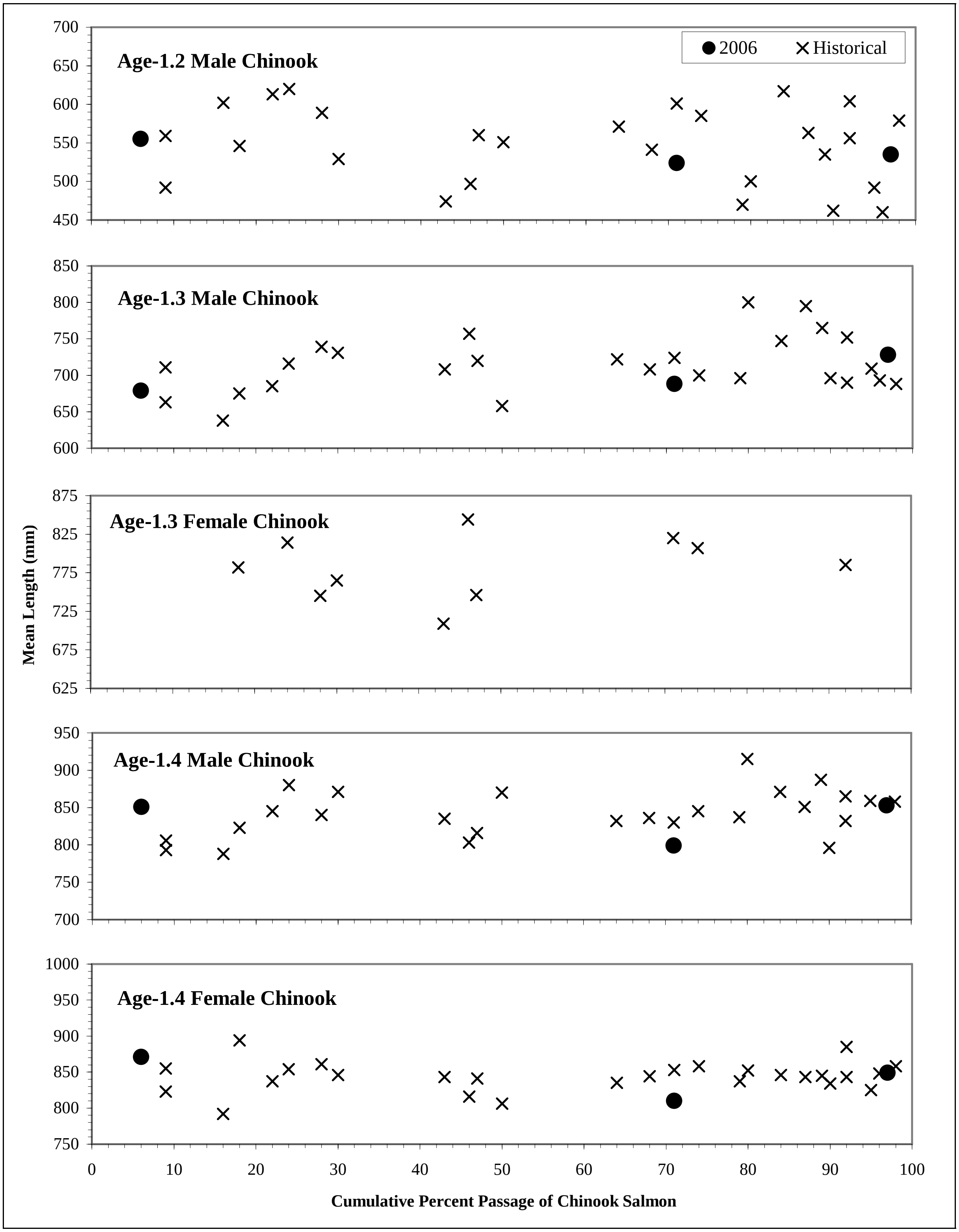


Figure 18.–Historical intra-annual mean length at age of male and female Chinook salmon by cumulative percent passage at George River weir.

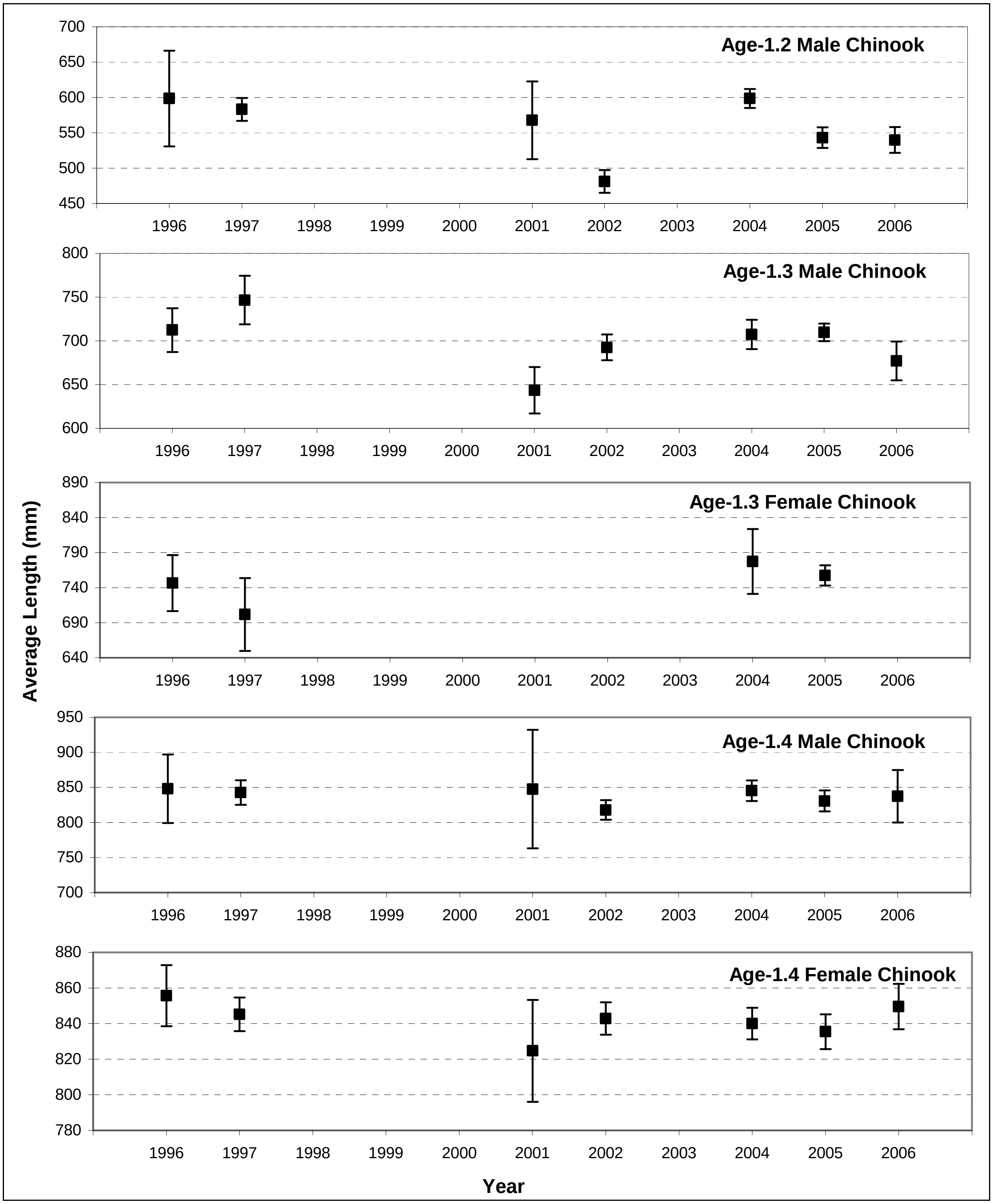


Figure 19.–Historical average annual length with 95% confidence intervals for Chinook salmon at George River weir.

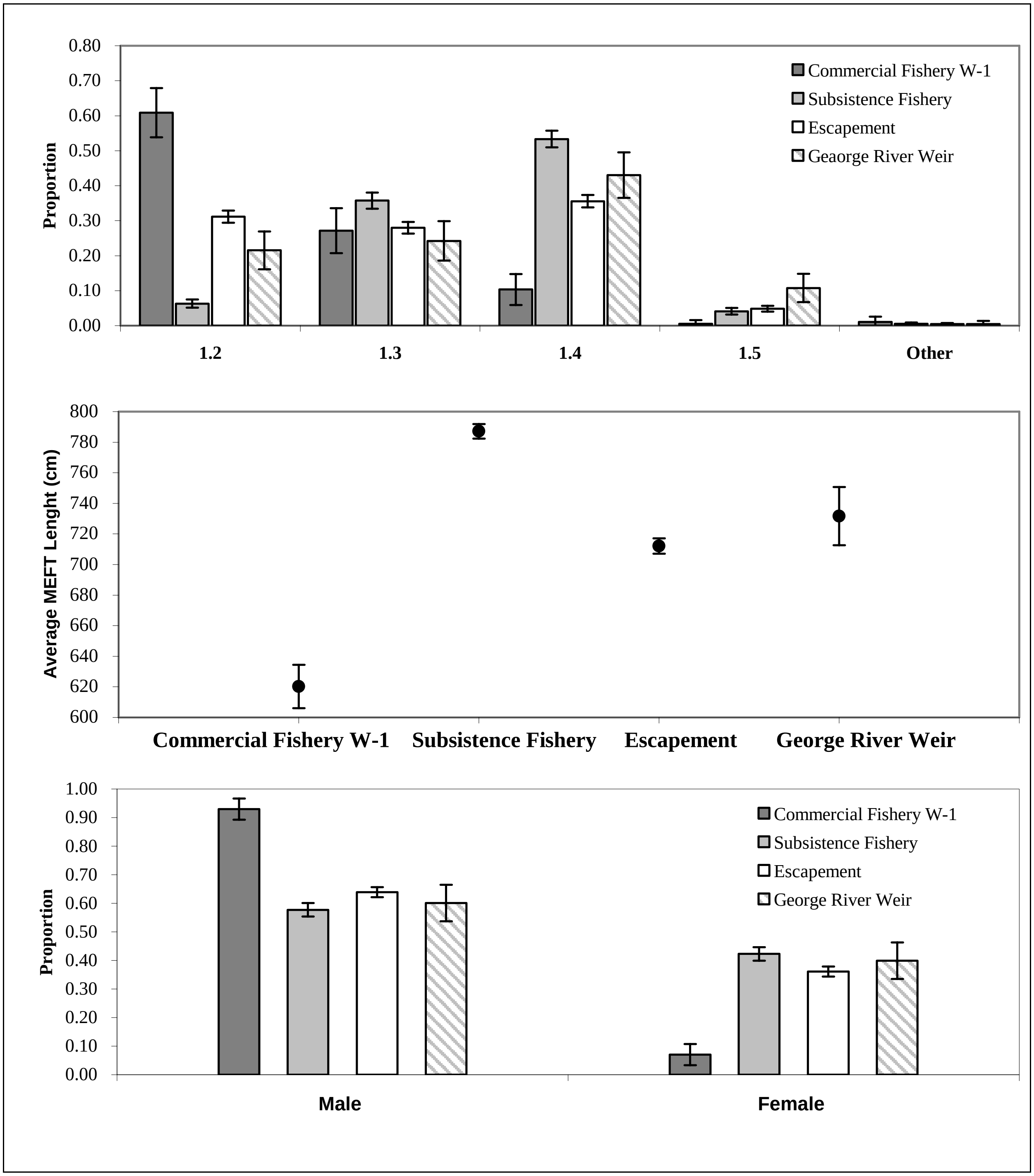


Figure 20.–ASL composition of the 2006 Kuskokwim River Chinook salmon commercial and subsistence harvests and total monitored escapement and George River weir (+/- 95% confidence interval).

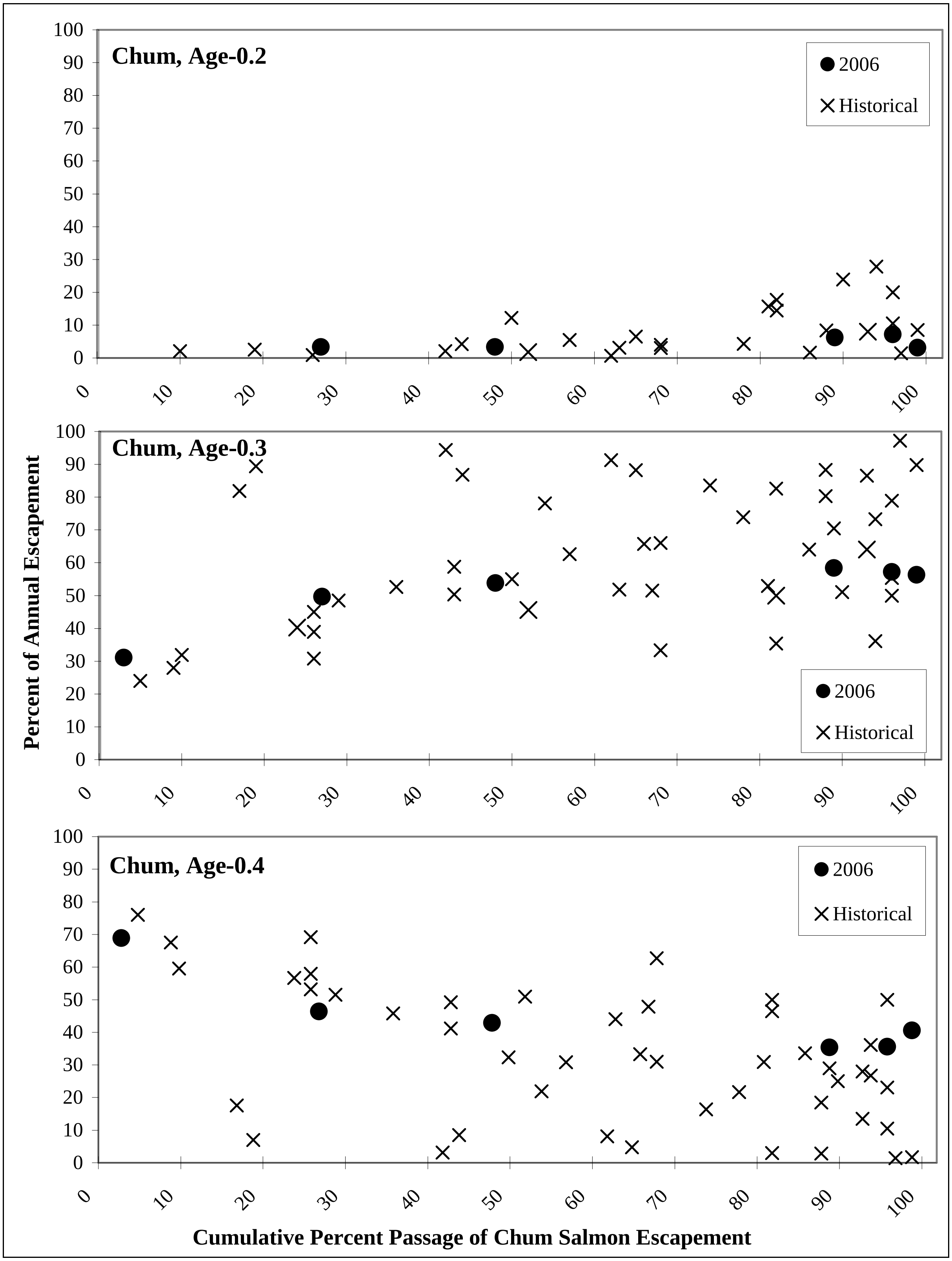


Figure 21.–Historical age composition by cumulative percent passage for chum salmon at George River weir.

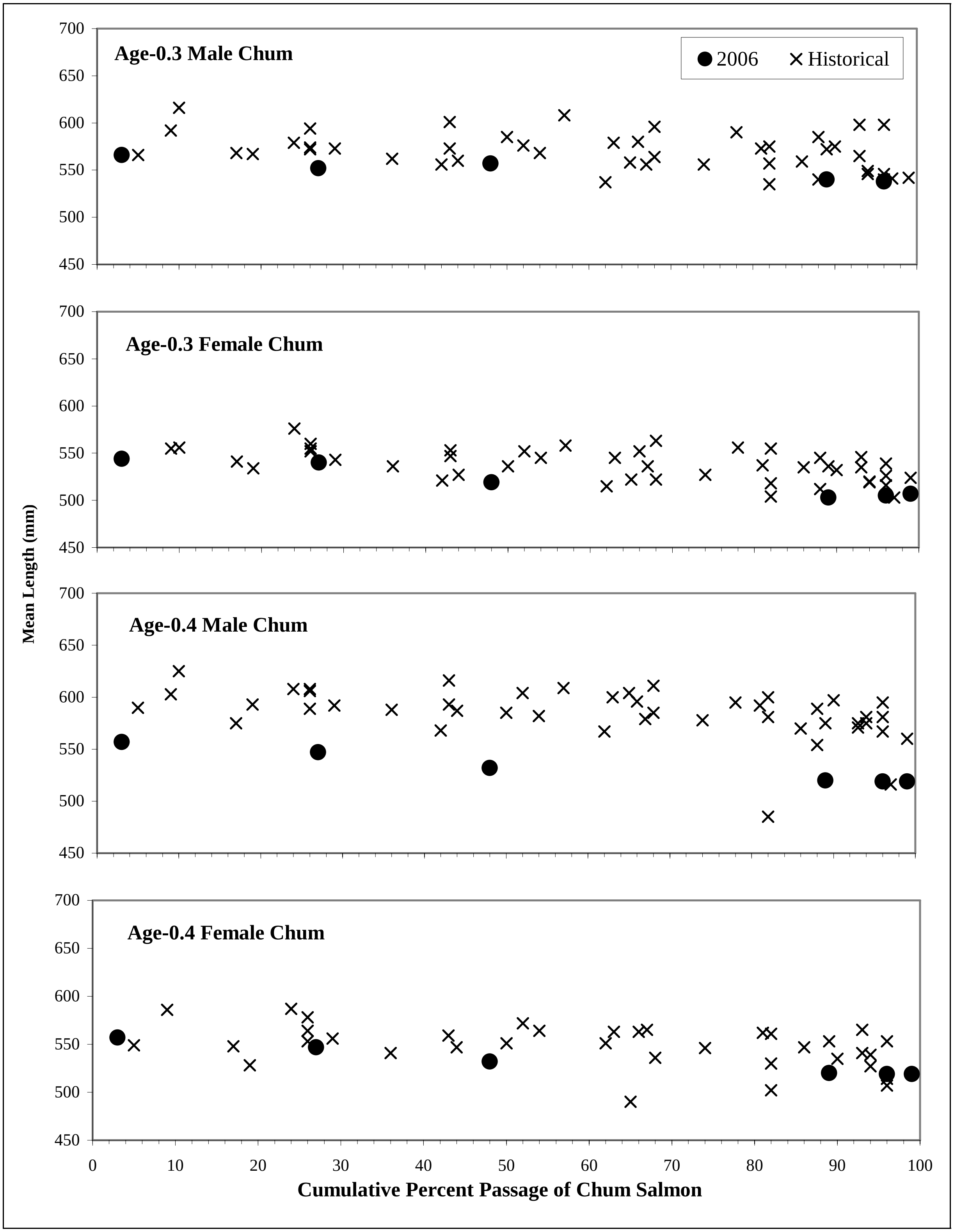


Figure 22.–Historical intra-annual mean length at age of chum salmon by cumulative percent passage at George River weir.

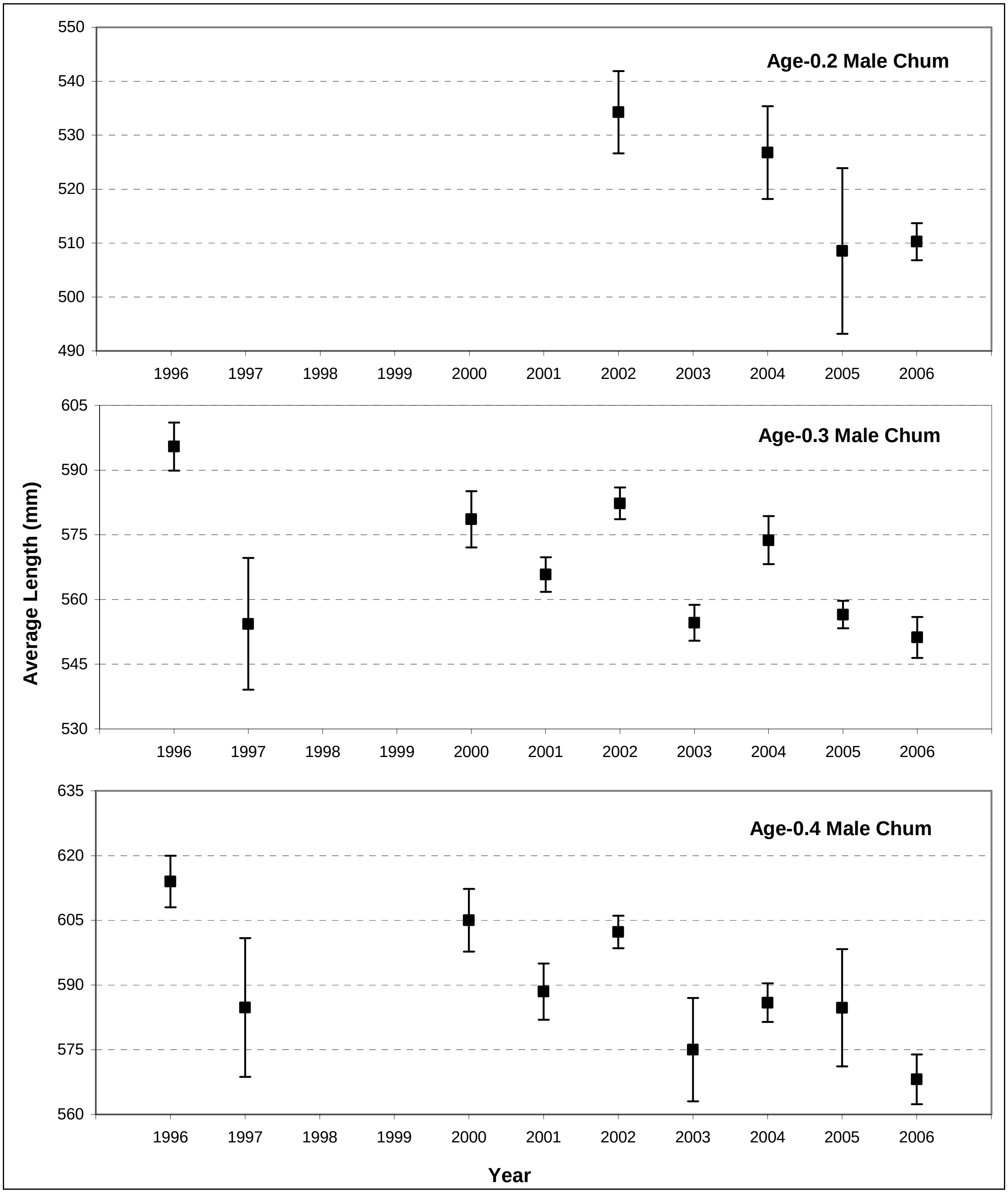


Figure 23.–Historical average annual length with 95% confidence intervals for male chum salmon at George River weir.

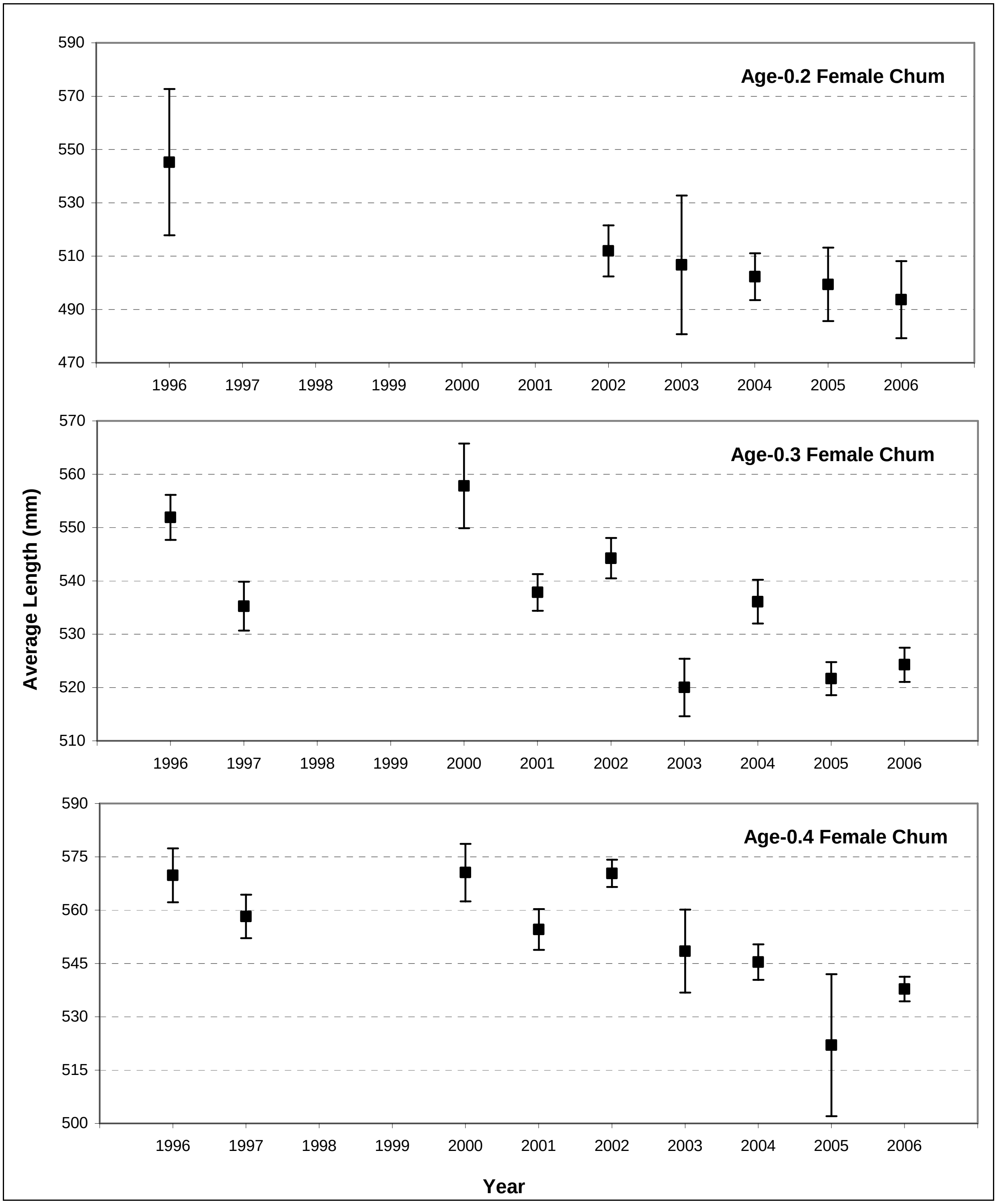
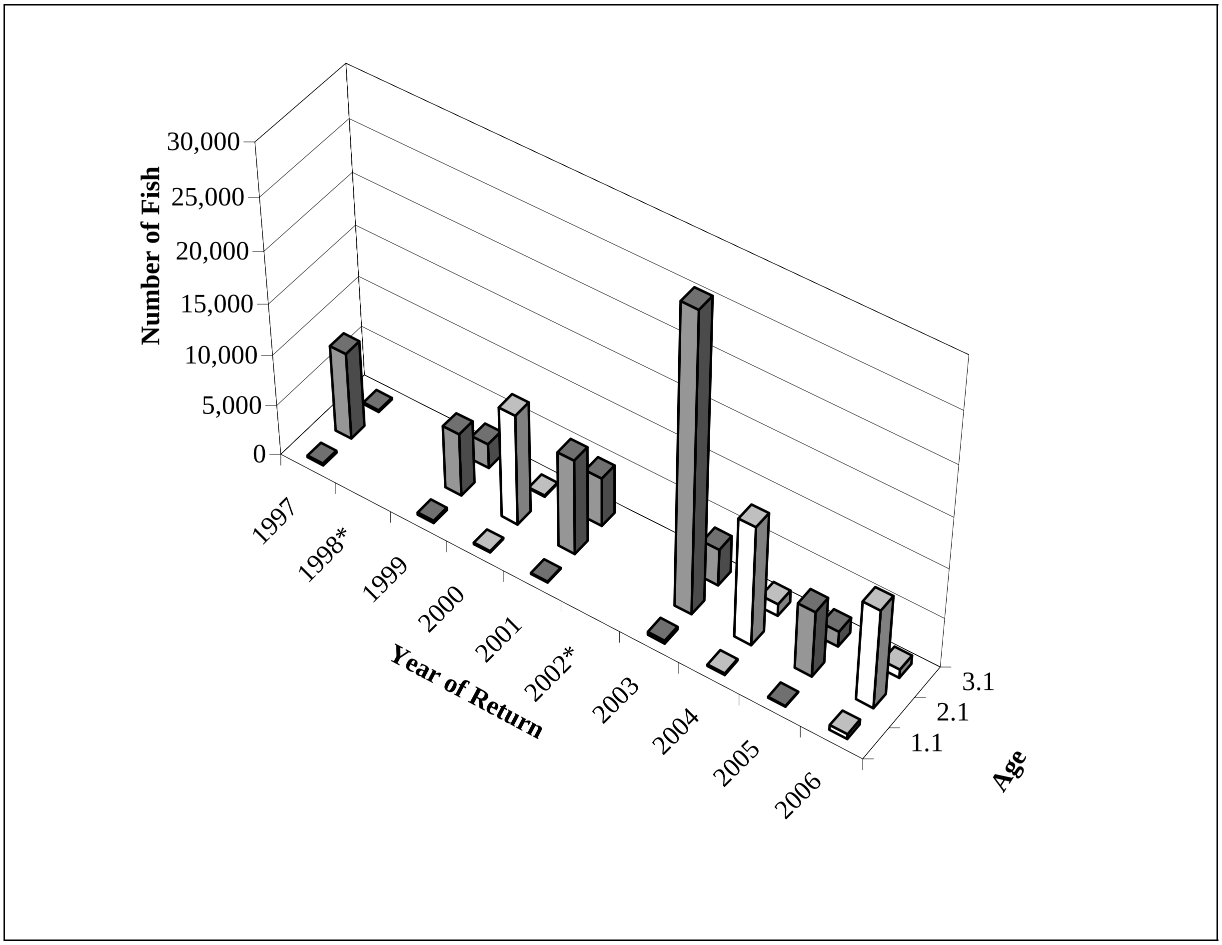


Figure 24.–Historical average annual length with 95% confidence intervals for female chum salmon at George River weir.



Note: Asterisks denote years that ASL sample goals were not achieved and/or escapement was not determined.

Figure 25.–Historical age distribution of annual coho salmon escapements at George River weir.

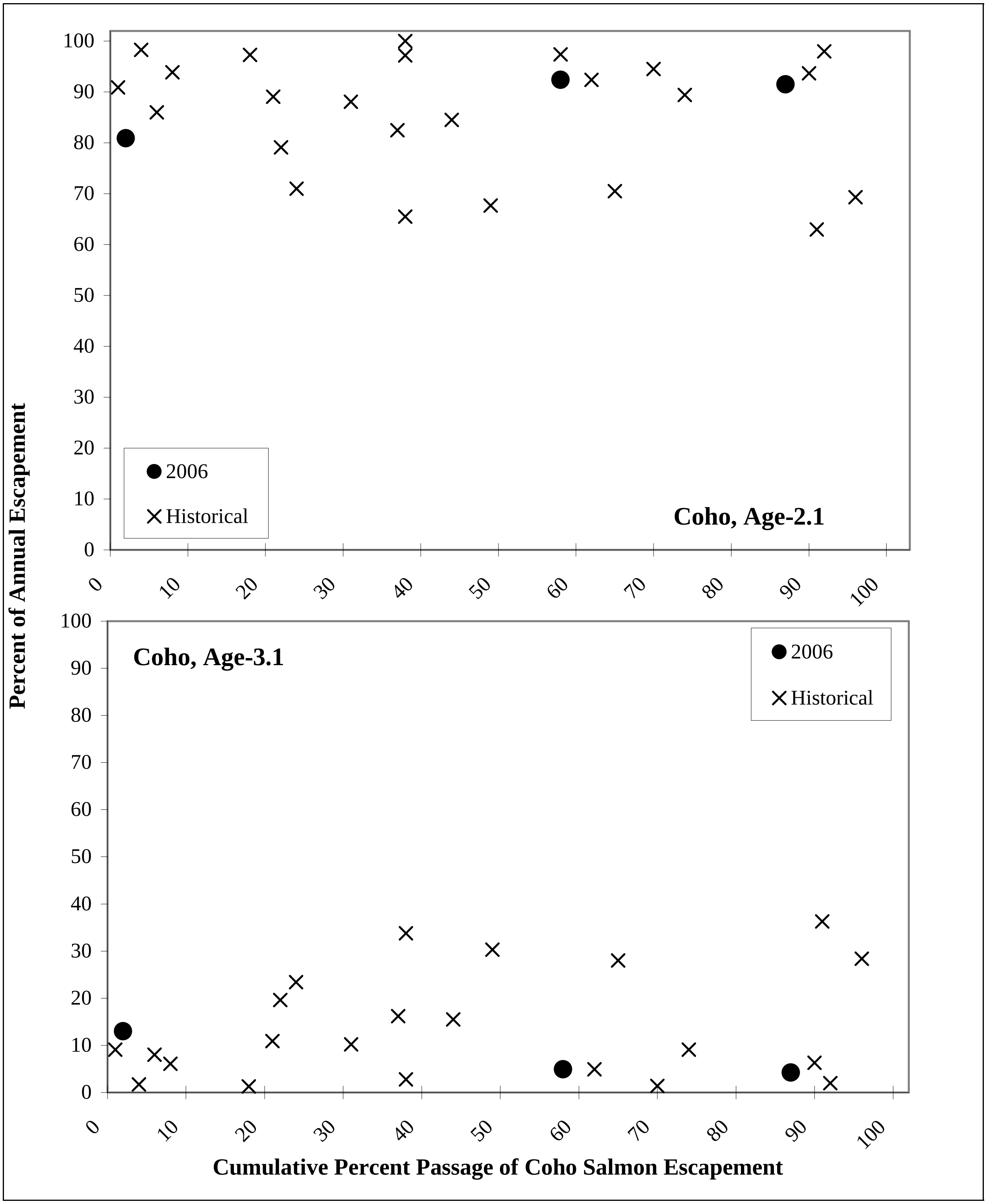


Figure 26.–Historical age composition by cumulative percent passage for coho salmon at George River weir.

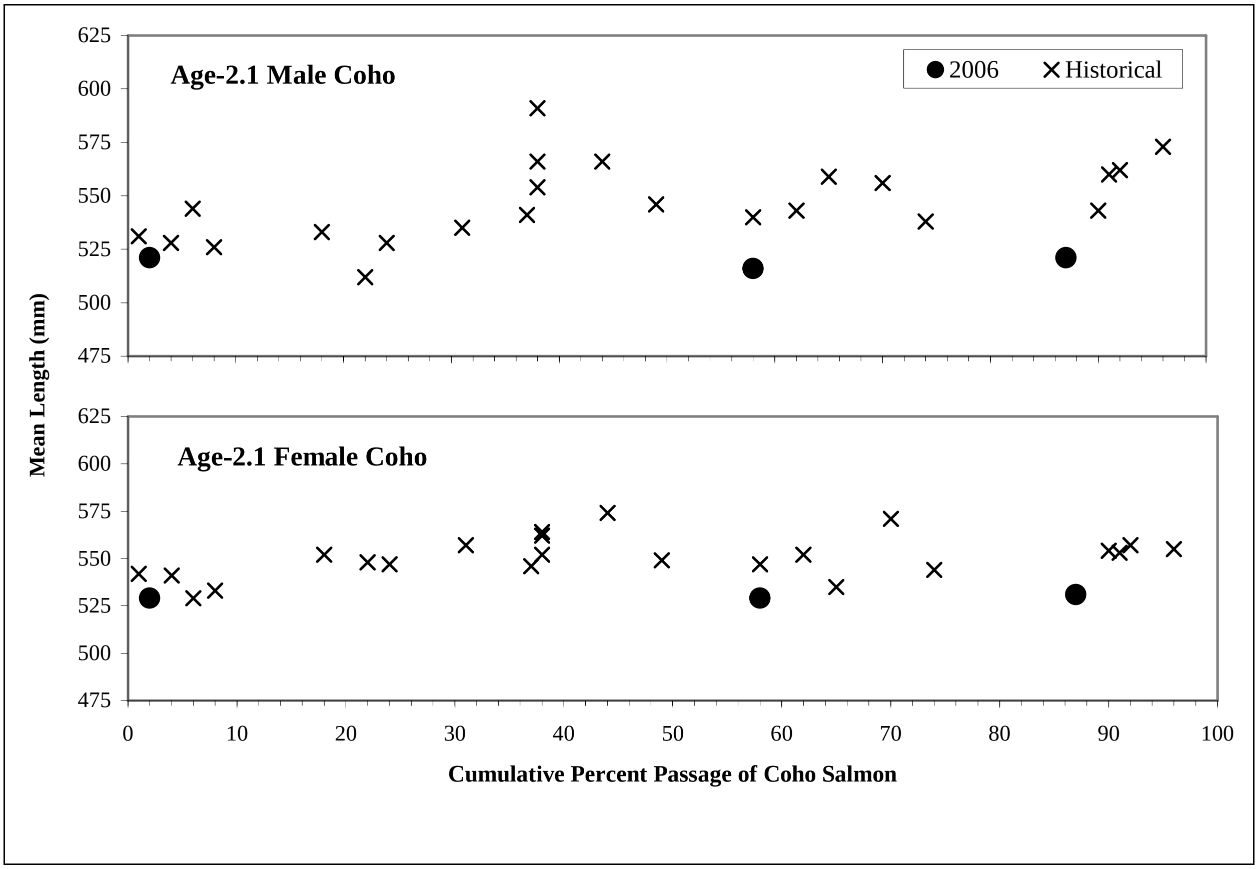


Figure 27.–Historical intra-annual mean length at age of male and female coho salmon by cumulative percent passage at George River weir.

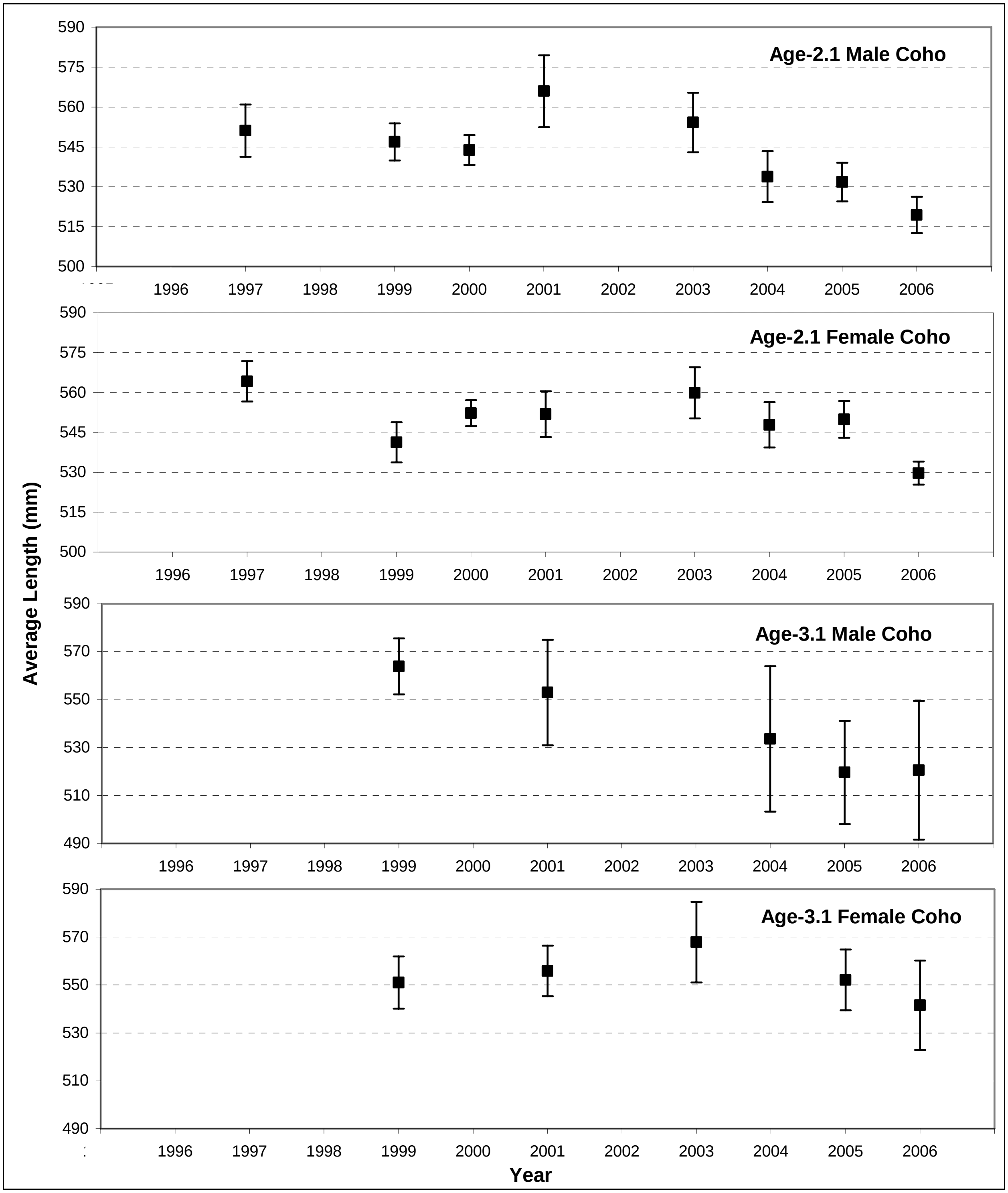


Figure 28.–Historical average annual length with 95% confidence intervals for coho salmon at George River weir.

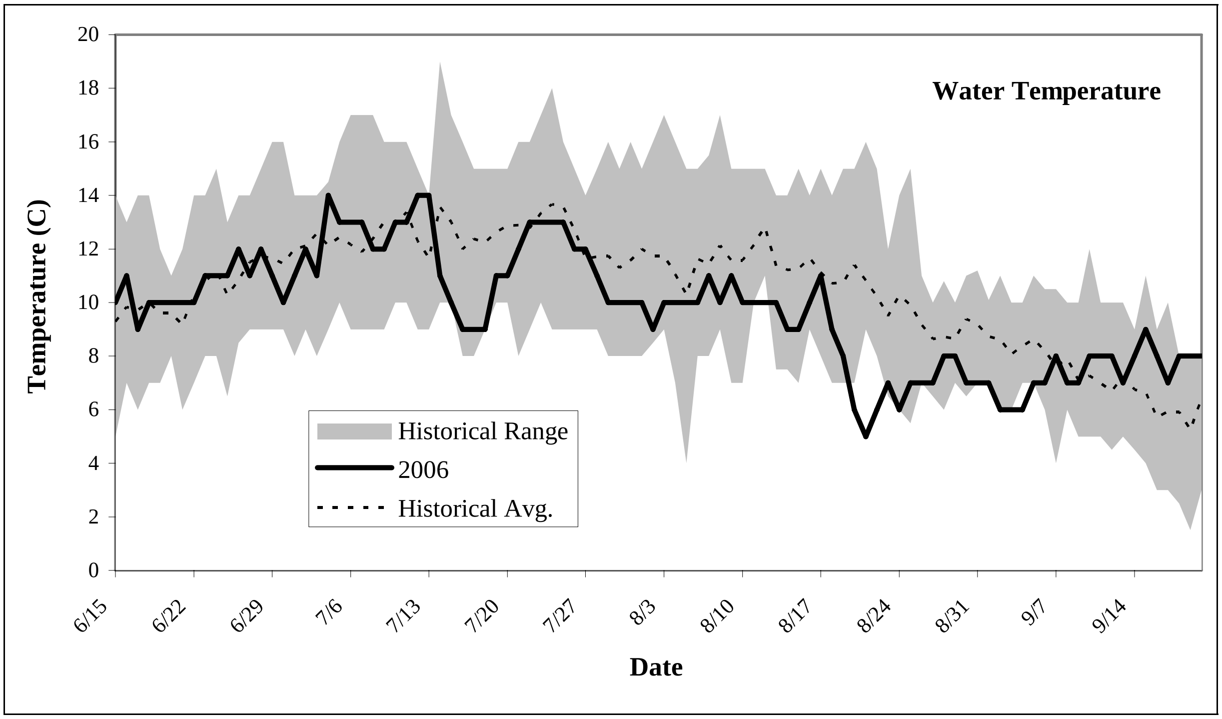


Figure 29.–Daily morning water temperature at George River weir in 2006 relative to historical average, minimum, and maximum morning readings, 1996–2005.

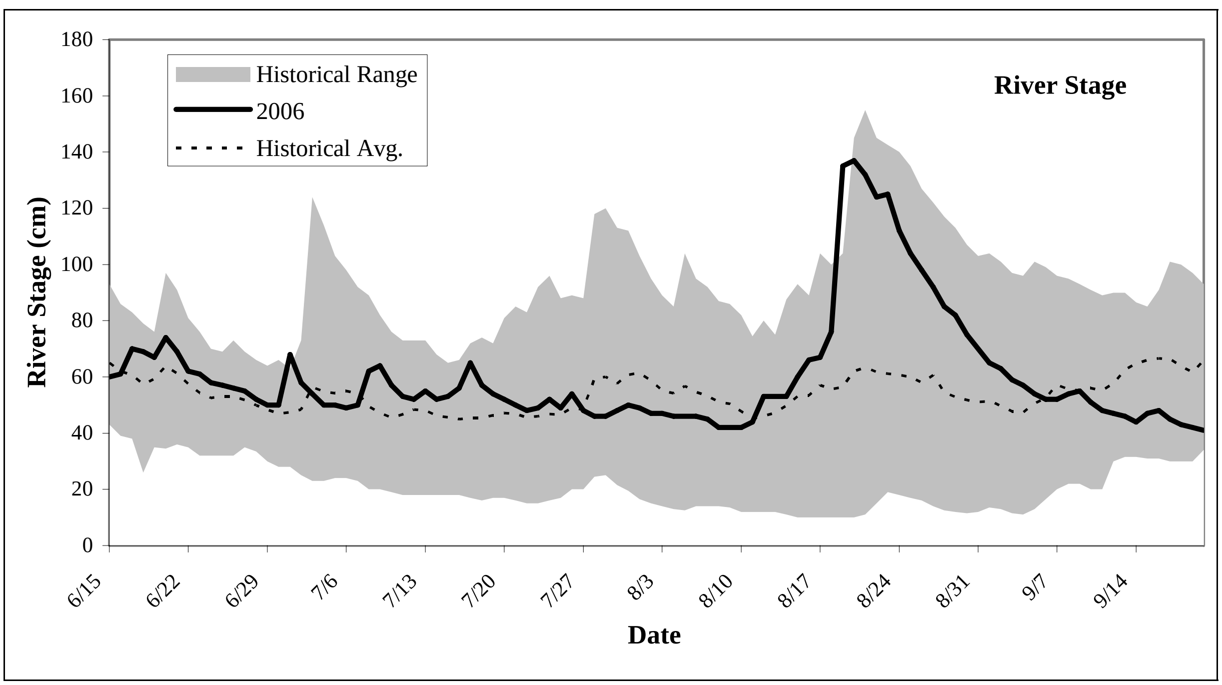
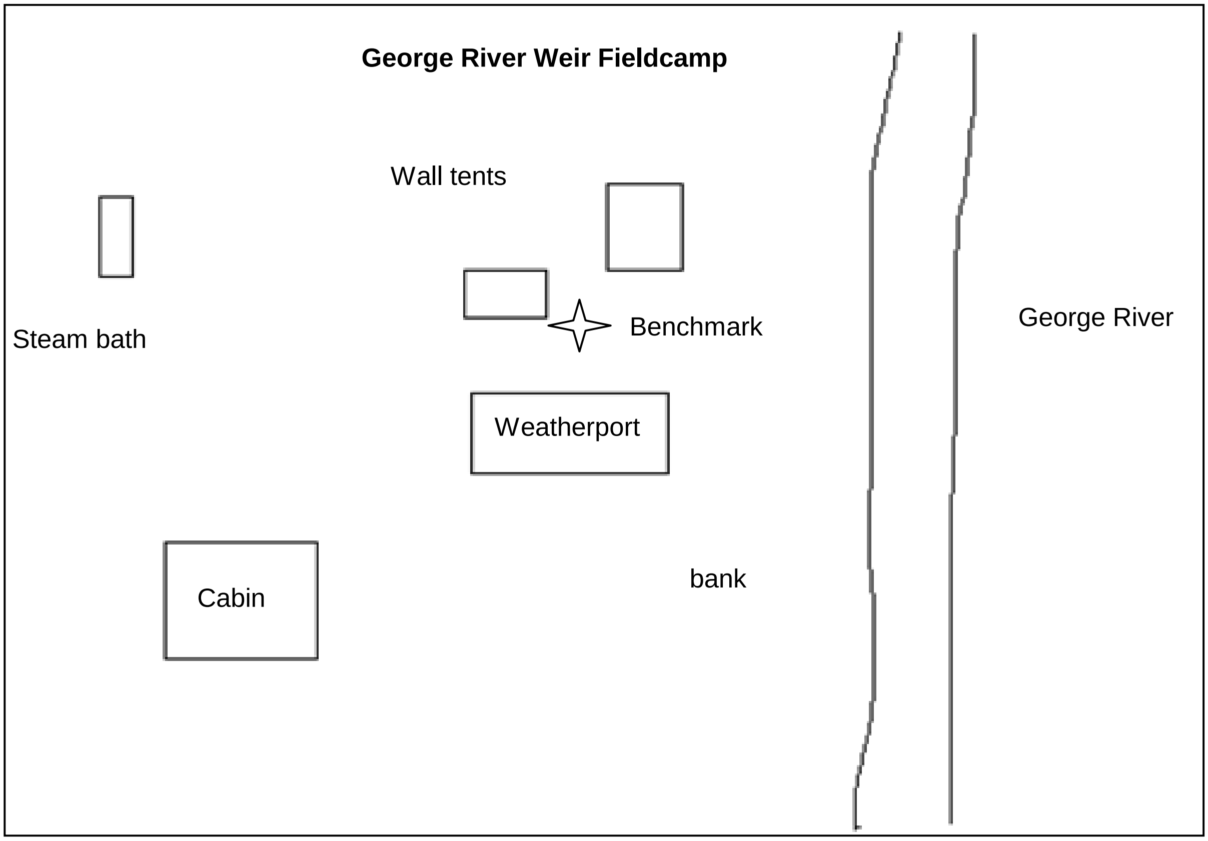


Figure 30.–Daily morning river stage at George River weir in 2006 relative to historical average, minimum, and maximum morning readings, 2000–2005.

APPENDIX A

Appendix A1.–Location and description of a stable river stage benchmark established at George River weir in 2005.



Note: This benchmark consists of a 5X8 cm aluminum plate mounted on top of a tree stump approximately 20 cm in diameter, and represents a river stage of 300 cm. This Benchmark was established in 2005 as a stable alternative to benchmarks located along the river bank subject to ice damage, and correlates to benchmarks and river stage measurements maintained since 2000.

APPENDIX B

Appendix B1.–Historical cumulative percent passage of Chinook salmon at the George River, 1996–2006, during the current target operational period.

Date	1996	1997	1999	2000	2001	2002	2003	2004	2005	2006
6/15	0	0	0	0	0	0	0	0	0	0
6/16	0	0	0	0	0	0	0	0	0	0
6/17	1	1	0	0	0	0	0	0	1	0
6/18	1	1	0	0	0	0	0	0	1	0
6/19	1	1	0	0	0	0	0	0	1	0
6/20	1	1	0	0	0	0	0	0	1	0
6/21	1	1	0	0	0	0	1	1	1	0
6/22	2	2	0	0	0	2	2	1	3	0
6/23	5	6	0	0	0	4	3	1	3	0
6/24	15	13	0	1	1	4	3	1	6	1
6/25	18	24	1	1	1	5	6	1	8	1
6/26	18	28	1	1	1	6	11	2	9	1
6/27	21	34	1	5	2	7	14	8	13	1
6/28	22	40	2	5	5	9	19	12	16	2
6/29	23	47	2	5	14	9	25	18	26	2
6/30	24	57	3	6	15	27	31	22	32	6
7/01	38	62	4	8	16	42	38	24	34	15
7/02	47	66	4	22	21	43	49	25	38	17
7/03	52	73	5	26	21	47	56	33	48	19
7/04	56	78	7	28	22	49	57	36	57	33
7/05	60	81	8	30	23	53	65	46	62	37
7/06	67	84	9	31	39	57	69	53	64	42
7/07	70	86	10	39	47	62	79	56	68	52
7/08	71	86	10	44	48	67	82	64	70	54
7/09	77	87	12	46	50	71	83	68	72	55
7/10	78	87	14	47	54	72	83	69	74	58
7/11	83	87	20	64	56	77	83	74	77	66
7/12	84	90	28	68	75	79	84	78	80	70
7/13	85	91	31	68	77	81	86	80	82	71
7/14	86	91	33	69	80	84	86	82	83	71
7/15	91	92	39	69	83	85	88	84	85	71
7/16	92	92	44	74	83	87	89	85	87	76
7/17	92	92	45	78	85	88	89	87	89	78
7/18	94	93	46	78	88	89	90	89	90	82
7/19	95	94	54	86	89	90	92	91	91	86
7/20	95	95	67	86	92	92	93	92	92	89
7/21	96	96	68	86	93	93	95	93	92	91
7/22	96	97	73	88	94	94	95	93	93	92
7/23	97	97	75	91	94	94	96	94	94	94
7/24	97	97	80	91	95	95	96	95	95	95
7/25	98	98	85	92	95	95	96	96	96	95
7/26	98	98	90	93	95	95	96	96	96	96
7/27	98	98	91	95	96	96	97	97	96	96
7/28	99	99	92	95	97	97	98	97	97	97
7/29	99	99	94	96	97	97	98	97	97	97
7/30	99	99	94	96	97	98	98	97	97	98
7/31	99	99	95	97	98	98	98	98	98	98
8/01	99	99	95	97	98	98	98	98	98	98
8/02	99	99	96	97	98	98	98	98	98	98
8/03	99	99	97	98	98	99	98	99	98	99
8/04	99	99	97	98	98	99	98	99	98	99
8/05	99	99	98	98	98	99	99	99	99	99

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Appendix B1.–Page 2 of 2.

Date	1996	1997	1999	2000	2001	2002	2003	2004	2005	2006
8/06	99	99	98	98	99	99	99	99	99	99
8/07	99	99	98	98	99	99	99	99	99	99
8/08	99	99	98	99	99	99	99	99	99	99
8/09	99	99	98	99	99	99	100	99	99	100
8/10	100	100	98	99	99	99	100	99	99	100
8/11	100	100	98	99	99	100	100	99	99	100
8/12	100	100	98	99	99	100	100	99	99	100
8/13	100	100	99	99	99	100	100	99	99	100
8/14	100	100	99	99	99	100	100	99	100	100
8/15	100	100	99	100	99	100	100	99	100	100
8/16	100	100	99	100	99	100	100	100	100	100
8/17	100	100	99	100	99	100	100	100	100	100
8/18	100	100	99	100	100	100	100	100	100	100
8/19	100	100	99	100	100	100	100	100	100	100
8/20	100	100	100	100	100	100	100	100	100	100
8/21	100	100	100	100	100	100	100	100	100	100
8/22	100	100	100	100	100	100	100	100	100	100
8/23	100	100	100	100	100	100	100	100	100	100
8/24	100	100	100	100	100	100	100	100	100	100
8/25	100	100	100	100	100	100	100	100	100	100
8/26	100	100	100	100	100	100	100	100	100	100
8/27	100	100	100	100	100	100	100	100	100	100
8/28	100	100	100	100	100	100	100	100	100	100
8/29	100	100	100	100	100	100	100	100	100	100
8/30	100	100	100	100	100	100	100	100	100	100
8/31	100	100	100	100	100	100	100	100	100	100
9/01	100	100	100	100	100	100	100	100	100	100
9/02	100	100	100	100	100	100	100	100	100	100
9/03	100	100	100	100	100	100	100	100	100	100
9/04	100	100	100	100	100	100	100	100	100	100
9/05	100	100	100	100	100	100	100	100	100	100
9/06	100	100	100	100	100	100	100	100	100	100
9/07	100	100	100	100	100	100	100	100	100	100
9/08	100	100	100	100	100	100	100	100	100	100
9/09	100	100	100	100	100	100	100	100	100	100
9/10	100	100	100	100	100	100	100	100	100	100
9/11	100	100	100	100	100	100	100	100	100	100
9/12	100	100	100	100	100	100	100	100	100	100
9/13	100	100	100	100	100	100	100	100	100	100
9/14	100	100	100	100	100	100	100	100	100	100
9/15	100	100	100	100	100	100	100	100	100	100
9/16	100	100	100	100	100	100	100	100	100	100
9/17	100	100	100	100	100	100	100	100	100	100
9/18	100	100	100	100	100	100	100	100	100	100
9/19	100	100	100	100	100	100	100	100	100	100
9/20	100	100	100	100	100	100	100	100	100	100

Note: The boxes represent the median passage date and central 50% of the run. All years except 2005 include daily passage estimates. 1998 was excluded from the table because the weir was not operational for most of the season.

Appendix B2.–Historical cumulative percent passage of chum salmon at the George River, 1996–2006, during the current target operational period.

Date	1996	1997	1999	2000	2001	2002	2003	2004	2005	2006
6/15	0	0	0	0	0	0	0	0	0	0
6/16	0	0	0	0	0	0	0	0	0	0
6/17	0	0	0	0	0	0	0	1	0	0
6/18	0	0	0	0	0	0	0	1	0	0
6/19	0	0	0	0	0	0	0	2	0	0
6/20	0	0	0	0	0	0	0	2	0	0
6/21	0	0	0	0	0	0	0	3	0	0
6/22	4	0	0	0	0	2	0	4	0	1
6/23	10	1	0	1	1	3	0	5	1	1
6/24	14	2	0	2	2	3	1	5	1	2
6/25	14	2	0	2	2	5	1	6	1	2
6/26	16	3	0	2	2	9	1	9	1	3
6/27	19	5	1	5	3	11	1	16	2	3
6/28	20	5	1	5	3	14	1	20	2	5
6/29	21	8	2	5	4	16	1	24	4	6
6/30	22	12	3	5	4	20	1	26	6	7
7/1	24	13	4	9	5	22	2	27	7	10
7/2	28	14	4	16	5	23	3	28	9	12
7/3	33	18	5	20	6	25	4	32	14	14
7/4	39	20	7	22	6	26	4	35	17	18
7/5	40	23	7	24	6	29	5	39	19	22
7/6	43	25	9	31	8	36	5	43	22	25
7/7	46	26	11	35	12	42	5	50	24	27
7/8	50	26	12	37	14	45	8	54	28	29
7/9	54	27	15	38	16	48	12	56	31	30
7/10	55	28	19	39	19	52	14	58	34	33
7/11	57	29	23	52	24	58	15	61	37	37
7/12	59	32	28	56	29	63	17	63	42	40
7/13	61	33	30	59	33	65	22	66	46	41
7/14	64	33	32	60	38	68	28	68	51	42
7/15	67	35	34	61	43	72	33	71	55	42
7/16	68	36	37	65	46	75	34	72	58	45
7/17	70	40	39	68	49	78	36	73	61	48
7/18	73	44	43	69	54	81	39	75	63	54
7/19	76	54	49	73	58	83	44	77	65	60
7/20	78	59	56	74	62	84	48	79	68	66
7/21	80	64	58	75	65	85	52	81	72	71
7/22	81	67	62	78	68	86	55	82	74	75
7/23	83	72	66	82	70	88	58	84	77	78
7/24	86	75	70	86	72	89	60	86	79	81
7/25	88	79	74	88	74	90	62	87	80	83
7/26	91	81	77	90	77	91	65	89	82	84
7/27	92	82	79	91	80	92	67	90	83	86
7/28	92	85	81	92	83	92	71	90	85	87
7/29	93	86	83	93	85	93	75	91	86	89
7/30	94	88	83	93	87	94	77	92	87	90
7/31	95	90	86	95	88	95	79	93	88	91
8/01	95	91	88	96	89	95	81	93	89	92
8/02	95	91	89	97	91	95	85	94	90	93
8/03	96	92	91	97	92	96	87	94	91	94
8/04	96	93	93	98	93	96	88	94	92	95
8/05	97	94	94	98	93	97	89	95	92	96

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Appendix B2.–Page 2 of 2.

Date	1996	1997	1999	2000	2001	2002	2003	2004	2005	2006
8/06	97	94	94	98	94	97	91	95	93	96
8/07	97	95	95	98	95	97	93	95	93	97
8/08	97	95	96	98	96	97	94	97	94	97
8/09	98	96	96	98	97	98	95	97	95	98
8/10	98	96	97	98	97	98	96	97	95	98
8/11	98	96	97	98	97	98	97	98	95	98
8/12	98	97	97	98	98	98	97	98	95	98
8/13	99	98	97	99	98	99	98	98	96	99
8/14	99	98	98	99	98	99	99	98	96	99
8/15	99	98	98	99	98	99	99	98	97	99
8/16	99	99	98	99	98	99	99	98	97	99
8/17	99	99	99	99	99	99	99	99	97	99
8/18	99	99	99	99	99	99	99	99	97	99
8/19	99	99	99	99	99	99	99	99	97	99
8/20	99	99	99	100	99	99	100	99	97	99
8/21	99	99	99	100	99	99	100	99	98	100
8/22	100	99	99	100	99	100	100	99	98	100
8/23	100	99	99	100	100	100	100	99	98	100
8/24	100	99	99	100	100	100	100	99	98	100
8/25	100	99	99	100	100	100	100	99	98	100
8/26	100	99	99	100	100	100	100	99	98	100
8/27	100	99	99	100	100	100	100	99	98	100
8/28	100	99	99	100	100	100	100	99	98	100
8/29	100	99	99	100	100	100	100	100	98	100
8/30	100	99	99	100	100	100	100	100	99	100
8/31	100	100	100	100	100	100	100	100	99	100
9/01	100	100	100	100	100	100	100	100	99	100
9/02	100	100	100	100	100	100	100	100	99	100
9/03	100	100	100	100	100	100	100	100	99	100
9/04	100	100	100	100	100	100	100	100	99	100
9/05	100	100	100	100	100	100	100	100	99	100
9/06	100	100	100	100	100	100	100	100	99	100
9/07	100	100	100	100	100	100	100	100	99	100
9/08	100	100	100	100	100	100	100	100	99	100
9/09	100	100	100	100	100	100	100	100	100	100
9/10	100	100	100	100	100	100	100	100	100	100
9/11	100	100	100	100	100	100	100	100	100	100
9/12	100	100	100	100	100	100	100	100	100	100
9/13	100	100	100	100	100	100	100	100	100	100
9/14	100	100	100	100	100	100	100	100	100	100
9/15	100	100	100	100	100	100	100	100	100	100
9/16	100	100	100	100	100	100	100	100	100	100
9/17	100	100	100	100	100	100	100	100	100	100
9/18	100	100	100	100	100	100	100	100	100	100
9/19	100	100	100	100	100	100	100	100	100	100
9/20	100	100	100	100	100	100	100	100	100	100

Note: The boxes represent the median passage date and central 50% of the run. All years except 2005 include daily passage estimates. 1998 was excluded from the table because the weir was not operational for most of the season.

Appendix B3.–Historical cumulative percent passage of coho salmon at the George River, 1996–2006, during the current target operational period.

Date	1997	1999	2000	2001	2002	2003	2004	2005	2006
6/15	0	0	0	0	0	0	0	0	0
6/16	0	0	0	0	0	0	0	0	0
6/17	0	0	0	0	0	0	0	0	0
6/18	0	0	0	0	0	0	0	0	0
6/19	0	0	0	0	0	0	0	0	0
6/20	0	0	0	0	0	0	0	0	0
6/21	0	0	0	0	0	0	0	0	0
6/22	0	0	0	0	0	0	0	0	0
6/23	0	0	0	0	0	0	0	0	0
6/24	0	0	0	0	0	0	0	0	0
6/25	0	0	0	0	0	0	0	0	0
6/26	0	0	0	0	0	0	0	0	0
6/27	0	0	0	0	0	0	0	0	0
6/28	0	0	0	0	0	0	0	0	0
6/29	0	0	0	0	0	0	0	0	0
6/30	0	0	0	0	0	0	0	0	0
7/01	0	0	0	0	0	0	0	0	0
7/02	0	0	0	0	0	0	0	0	0
7/03	0	0	0	0	0	0	0	0	0
7/04	0	0	0	0	0	0	0	0	0
7/05	0	0	0	0	0	0	0	0	0
7/06	0	0	0	0	0	0	0	0	0
7/07	0	0	0	0	0	0	0	0	0
7/08	0	0	0	0	0	0	0	0	0
7/09	0	0	0	0	0	0	0	0	0
7/10	0	0	0	0	0	0	0	0	0
7/11	0	0	0	0	0	0	0	0	0
7/12	0	0	0	0	0	0	0	0	0
7/13	0	0	0	0	0	0	0	0	0
7/14	0	0	0	0	0	0	0	0	0
7/15	0	0	0	0	0	0	0	0	0
7/16	0	0	0	0	0	0	0	0	0
7/17	0	0	0	0	0	0	0	0	0
7/18	0	0	0	0	0	0	0	0	0
7/19	0	0	0	0	0	0	0	0	0
7/20	0	0	0	0	0	0	0	0	0
7/21	0	0	0	0	0	0	0	0	0
7/22	0	0	0	0	0	0	0	0	0
7/23	0	0	0	0	0	0	0	0	0
7/24	0	0	0	0	0	0	0	0	0
7/25	0	0	0	0	0	0	0	0	0
7/26	0	0	0	0	0	0	0	0	0
7/27	0	0	0	0	0	0	0	0	0
7/28	0	0	0	0	0	0	0	0	0
7/29	0	0	0	0	0	0	0	0	0
7/30	0	0	0	0	0	0	0	0	0
7/31	0	0	0	0	0	0	0	1	0
8/01	0	0	0	0	0	0	0	1	0
8/02	1	0	0	0	0	1	0	1	0
8/03	1	0	0	0	0	1	0	1	0
8/04	1	0	0	0	1	1	1	1	1
8/05	2	0	1	0	1	1	1	1	1

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Date	1997	1999	2000	2001	2002	2003	2004	2005	2006
8/06	3	0	1	1	1	1	1	2	1
8/07	3	0	1	1	1	2	2	2	1
8/08	4	0	2	1	2	2	3	4	1
8/09	5	0	2	1	2	3	3	5	1
8/10	5	0	3	1	2	5	7	7	1
8/11	6	1	4	1	3	5	7	7	2
8/12	8	1	6	3	3	6	8	9	4
8/13	10	1	14	5	4	6	8	11	4
8/14	12	1	18	6	4	11	9	14	7
8/15	13	2	20	7	7	13	15	16	14
8/16	14	2	22	18	9	14	17	17	18
8/17	14	3	24	27	9	15	19	21	19
8/18	16	5	29	32	10	15	20	22	26
8/19	16	5	31	38	10	16	21	23	28
8/20	20	8	41	44	10	17	23	23	30
8/21	24	10	54	50	10	23	27	24	32
8/22	36	11	58	55	18	26	28	24	34
8/23	38	13	58	60	20	28	30	33	36
8/24	39	14	60	64	21	29	31	33	39
8/25	40	15	63	68	22	37	32	35	41
8/26	43	17	66	71	22	44	33	37	43
8/27	44	19	76	74	24	50	34	38	44
8/28	44	22	86	76	24	53	35	40	50
8/29	45	24	92	80	24	54	39	42	55
8/30	61	25	94	82	25	55	44	47	58
8/31	65	26	95	84	34	64	50	51	60
9/01	70	41	95	87	36	81	62	51	63
9/02	72	49	97	89	37	86	66	51	66
9/03	74	49	98	90	38	86	68	52	70
9/04	75	52	99	91	39	87	71	58	73
9/05	78	53	99	91	45	88	74	62	73
9/06	79	54	99	92	73	90	77	73	77
9/07	81	55	99	92	83	92	80	80	82
9/08	82	60	100	94	88	94	81	83	87
9/09	86	64	100	94	89	94	82	89	89
9/10	90	65	100	95	90	95	85	92	91
9/11	92	65	100	96	91	95	88	93	93
9/12	93	72	100	96	97	96	91	95	94
9/13	94	79	100	96	98	99	93	96	94
9/14	95	89	100	97	99	100	95	97	96
9/15	97	97	100	97	99	100	97	99	97
9/16	98	97	100	98	99	100	98	100	99
9/17	99	98	100	99	100	100	99	100	99
9/18	99	99	100	99	100	100	100	100	99
9/19	100	100	100	99	100	100	100	100	100
9/20	100	100	100	100	100	100	100	100	100

Note: The boxes represent the median passage date and central 50% of the run. All years except 1999, 2002 and 2004 include daily passage estimates. 1998 was excluded from the table because the weir was not operational for most of the season.

Appendix B4.–Daily passage of sockeye and pink salmon and non-salmon species observed at the George River weir, 2006.

Date	Sockeye Salmon	Pink Salmon	Longnose Sucker	Whitefish	Arctic Grayling	Northern Pike	Dolly Varden
6/15	0 [a]	0 [a]	428 [b]	0 [b]	0 [b]	0 [b]	0 [b]
6/16	0	0	1471	0	0	0	0
6/17	0	0	16	0	0	0	0
6/18	0	0	840	0	0	0	0
6/19	0	0	404	0	0	0	0
6/20	0	0	745	0	0	0	0
6/21	0	0	470	0	0	0	0
6/22	0	0	784	0	0	0	0
6/23	0	0	557	0	0	0	0
6/24	0	0	687	0	0	1	0
6/25	0	0	408	0	0	0	0
6/26	0	0	405	0	0	0	0
6/27	0	1	271	0	0	0	0
6/28	0	0	344	0	0	0	0
6/29	0	0	131	0	0	0	0
6/30	0	0	150	0	0	0	0
7/01	0	1	170	0	0	0	0
7/02	0	1	207	0	0	0	0
7/03	0	2	103	0	3	0	0
7/04	0	24	128	0	0	0	0
7/05	0	8	257	0	0	0	0
7/06	0	37	151	0	11	0	0
7/07	0	14	75	4	3	1	0
7/08	0	14	22	2	0	0	1
7/09	1	13	34	0	0	0	0
7/10	1	26	54	4	0	0	0
7/11	3	21	81	1	0	0	0
7/12	0	34	71	1	0	0	0
7/13	0	17	38	5	0	0	0
7/14	2	6	13	3	0	0	0
7/15	1	2	7	2	0	0	0
7/16	0	30	21	3	0	0	0
7/17	1	80	2	2	1	0	0
7/18	1	92	14	0	0	0	0
7/19	4	138	12	2	0	0	0
7/20	1	155	48	0	1	0	0
7/21	1	152	57	2	1	0	0
7/22	2	77	97	1	0	0	0
7/23	4	60	67	1	0	0	0
7/24	2	44	38	2	0	0	0
7/25	2	19	42	1	0	0	0
7/26	2	19	40	0	0	0	0
7/27	3	23	29	0	0	0	0
7/28	2	13	9	0	0	0	0
7/29	3	9	3	3	2	0	0
7/30	1	10	5	0	0	0	0
7/31	3	10	1	0	1	0	0
8/01	0	9	2	0	0	0	0
8/02	9	8	0	0	0	1	0
8/03	6	9	2	0	0	0	0
8/04	9	17	0	2	0	0	0
8/05	10	9	1	0	0	0	0
8/06	6	4	0	0	0	0	0
8/07	3	6	2	0	0	0	0
8/08	5	1	0	2	0	0	0
8/09	5	1	0	0	0	0	0

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Appendix B4.–Page 2 of 2.

Date	Sockeye Salmon	Pink Salmon	Longnose Sucker	Whitefish	Arctic Grayling	Northern Pike	Dolly Varden
8/10	3	2	0	0	0	0	0
8/11	5	1	0	0	0	0	0
8/12	10	2	2	4	0	0	0
8/13	4	0	0	1	0	0	0
8/14	10	1	0	0	0	0	0
8/15	4	0	12	0	0	0	0
8/16	5	0	3	0	0	0	0
8/17	2	0	5	0	0	0	0
8/18	3 [a]	0 [a]	0 [b]	0 [b]	0 [b]	0 [b]	0 [b]
8/19	3 [c]	0 [c]	[d]	[d]	[d]	[d]	0 [d]
8/20	3 [c]	0 [c]	[d]	[d]	[d]	[d]	0 [d]
8/21	2 [c]	0 [c]	[d]	[d]	[d]	[d]	0 [d]
8/22	2 [c]	0 [c]	[d]	[d]	[d]	[d]	0 [d]
8/23	2 [c]	0 [c]	[d]	[d]	[d]	[d]	0 [d]
8/24	2 [c]	0 [c]	[d]	[d]	[d]	[d]	0 [d]
8/25	1 [c]	0 [c]	[d]	[d]	[d]	[d]	0 [d]
8/26	0	0	0	0	0	0	0
8/27	2	0	0	1	0	0	0
8/28	2	1	1	1	0	0	0
8/29	0	1	0	0	0	1	0
8/30	0	0	0	1	1	0	1
8/31	0	2	1	3	0	0	0
9/01	1	1	0	0	1	0	1
9/02	2	0	1	2	1	0	0
9/03	1	0	0	2	1	1	0
9/04	0	1	0	0	0	0	0
9/05	0	0	0	3	1	0	0
9/06	0	0	0	1	1	0	0
9/07	0	0	2	2	0	0	0
9/08	0	1	3	0	1	0	0
9/09	0	0	1	3	1	0	0
9/10	0	2	0	4	0	0	0
9/11	0	0	1	8	0	0	0
9/12	1	0	0	1	0	0	0
9/13	0	0	1	0	0	0	0
9/14	0	1	1	1	0	0	0
9/15	0	0	0	5	0	0	0
9/16	0	0	3	1	0	0	0
9/17	1	0	0	3	1	0	0
9/18	0	0	0	2	1	0	2
9/19	0	0	0	2	0	1	0
9/20	0	0	0	5	0	0	0
Total[e]	164	1,232	10,051	99	33	6	5

[a] The weir was operational for only part of day; passage was estimated for this species.

[b] The weir was operational for only part of day; passage was not estimated for this species.

[c] The weir was not operational due to high water; daily passage was estimated.

[d] The weir was not operational due to high water; daily passage was not estimated.

[e] Due to rounding error associated with estimates, the values in the "total" column are not necessarily the sum of the daily passages from the column above.

Appendix B5.–Daily salmon carcass counts at the George River weir, 2006.

Date	Chinook			Sockeye			Chum			Coho			Pink		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
6/15	0	0	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	0	0
6/17	0	0	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	0	0
6/19	0	0	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	0	0	0
6/21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/24	0	0	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	0	0
6/26	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0
6/27	0	1	1	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	0	0
6/29	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0
6/30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/01	0	0	0	0	0	0	4	0	4	0	0	0	0	0	0
7/02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/03	0	0	0	0	0	0	1	2	3	0	0	0	0	0	0
7/04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/05	0	0	0	0	0	0	8	2	10	0	0	0	0	0	0
7/06	0	3	3	0	0	0	17	6	23	0	0	0	0	0	0
7/07	0	0	0	0	1	1	13	5	18	0	0	0	0	0	0
7/08	0	0	0	0	0	0	14	2	16	0	0	0	0	0	0
7/09	0	0	0	0	0	0	19	7	26	0	0	0	0	0	0
7/10	0	0	0	0	0	0	20	20	40	0	0	0	0	0	0
7/11	0	0	0	0	0	0	27	6	33	0	0	0	0	0	0
7/12	0	0	0	0	0	0	29	16	45	0	0	0	1	0	1
7/13	0	1	1	0	0	0	19	16	35	0	0	0	0	3	3
7/14	0	0	0	0	0	0	32	13	45	0	0	0	0	0	0
7/15	0	2	2	0	0	0	28	18	53[a]	0	0	0	0	0	0
7/16	0	0	0	0	0	0	39	33	72	0	0	0	1	1	2
7/17	0	0	0	0	0	0	61	27	88	0	0	0	6	0	6
7/18	0	0	0	0	0	0	50	17	67	0	0	0	0	0	0
7/19	0	0	0	1	0	1	52	29	81	0	0	0	1	0	1
7/20	0	0	0	0	0	0	54	16	70	0	0	0	0	0	0
7/21	1	0	1	0	0	0	84	45	129	0	0	0	9	2	11
7/22	0	0	0	0	0	0	52	42	94	0	0	0	9	2	11
7/23	0	1	1	0	1	1	48	40	88	0	0	0	2	0	2
7/24	0	4	4	0	0	0	58	45	103	0	1	1	10	5	15
7/25	4	2	6	0	0	0	96	61	157	0	0	0	13	3	16
7/26	3	8	11	0	0	0	59	78	137	0	0	0	5	1	6
7/27	2	3	5	0	0	0	87	66	153	0	0	0	13	10	23
7/28	2	6	8	0	0	0	83	59	142	0	0	0	23	10	33
7/29	7	1	8	0	0	0	99	57	156	0	0	0	65	2	67
7/30	2	10	12	0	0	0	103	73	176	0	0	0	45	30	75
7/31	13	5	18	0	0	0	148	73	221	0	0	0	59	25	84
8/01	3	3	6	0	0	0	50	51	101	0	0	0	25	2	27
8/02	30	2	32	0	0	0	148	88	236	0	0	0	89	7	96
8/03	13	0	13	0	0	0	109	67	176	0	0	0	81	5	86
8/04	25	1	26	0	1	1	107	69	176	0	0	0	77	9	86
8/05	32	0	32	0	0	0	99	60	159	0	0	0	41	22	63
8/06	32	0	32	0	0	0	91	71	162	0	0	0	57	28	85

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Appendix B5.–Page 2 of 2.

	Chinook			Sockeye			Chum			Coho			Pink		
Date	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
8/07	14	5	19	0	0	0	59	81	140	0	0	0	58	13	71
8/08	30	2	32	0	0	0	135	68	203	2	0	2	52	10	62
8/09	21	2	23	0	0	0	76	47	123	0	0	0	21	11	32
8/10	18	0	18	0	0	0	91	40	131	1	0	1	12	9	21
8/11	5	3	8	0	1	1	65	75	140	0	0	0	7	9	16
8/12	8	0	8	0	1	1	132	70	202	0	0	0	10	13	23
8/13	5	1	6	0	0	0	111	63	174	0	0	0	12	12	24
8/14	1	2	3	0	0	0	67	42	109	0	0	0	9	2	11
8/15	8	0	8	0	0	0	107	98	205	0	0	0	17	8	25
8/16	11	0	11	0	2	2	69	99	168	0	0	0	11	7	18
8/17	5	0	5	0	0	0	17	33	50	0	0	0	0	0	0
8/18	14	2	16	0	0	0	55	66	121	0	0	0	5	11	16
8/19[a]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--
8/20[a]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--
8/21[a]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--
8/22[a]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--
8/23[a]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--
8/24[a]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--
8/25[a]	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--	ND	ND	--
8/26	0	0	0	0	0	0	4	3	7	0	0	0	0	0	0
8/27	0	0	0	0	0	0	1	2	3	0	0	0	0	0	0
8/28	1	1	2	0	0	0	3	2	5	0	1	1	0	0	0
8/29	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0
8/30	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
8/31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/03	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
9/04	0	0	0	0	0	0	1	0	1	0	1	1	1	0	1
9/05	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0
9/06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/07	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0
9/08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/09	0	0	0	0	0	0	1	1	2	0	1	1	0	0	0
9/10	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
9/11	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0
9/12	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0
9/13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/15	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
9/16	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
9/17	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
9/18	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
9/19	0	0	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	0	0	0
Total:	311	71	**382**	5	7	**12**	3,008	2,074	**5,089**[b]	5	8	**13**	847	272	**1,119**

[a] Estimates were not made for carcasses during the inoperable period; an unidentified number are known to have washed past the submerged weir during this time.

[b] The value in the total chum salmon column does not equal the sum of the males and females because it includes 7 chum salmon carcasses that washed over the boat gate on 15 July without their sex being determined.

APPENDIX C

Appendix C1.–Daily weather and stream observations at George River weir, 2006.

		Observations by Hour				Daily Totals
		Sky	Temperature		River	Precipitation
Date	Time	Code[a]	Air	Water	Stage (cm)	(mm)[b]
6/15	7:30	4	10	10	60	0.7
6/16	7:30	4	13	11	61	0.6
6/17	7:30	2	7	9	70	12.5
	17:00	3	14	11	72	
6/18	7:30	4	10	10	69	0.4
	17:00	2	20	11	68	
6/19	7:30	5	9	10	67	1.4
	17:00	2	16	11	67	
6/20	7:30	4	11	10	74	5.0
	17:00	3	17	11	72	
6/21	7:30	1	8	10	69	0.0
	17:00	2	19	12	64	
6/22	7:30	1	9	10	62	0.0
	17:00	1	20	14	62	
6/23	7:30	1	8	11	61	0.0
	17:00	1	21	15	60	
6/24	7:30	2	8	11	58	0.0
	17:00	2	23	14	58	
6/25	10:00	1	15	11	57	0.0
	17:00	2	23	14	57	
6/26	7:30	3	10	12	56	0.0
	17:00	3	20	15	55	
6/27	7:30	5	7	11	55	0.0
	17:00	1	21	14	54	
6/28	7:30	4	10	12	52	0.0
6/29	7:30	3	11	11	50	0.0
	17:00	4	13	12	50	
6/30	7:30	4	10	10	50	12.5
	17:00	3	18	13	58	
7/1	10:00	1	15	11	68	0.0
	17:00	1	24	14	67	
7/2	10:00	4	14	12	58	0.0
	17:00	4	17	14	56	
7/3	7:30	4	12	11	54	0.0
	17:00	1	22	14	52	
7/4	10:00	1	17	14	50	0.0
	17:00	1	26	16	50	
7/5	7:15	1	10	13	50	0.0
	17:00	2	26	16	50	
7/6	7:15	1	11	13	49	0.0
	17:00	4	20	15	49	
7/7	7:30	4	11	13	50	10.5
	17:00	4	20	14	52	
7/8	7:30	3	13	12	62	14.0
	17:00	3	21	14	66	
7/9	8:00	1	11	12	64	0.0
	17:00	2	24	14	61	
7/10	7:30	4	13	13	57	0.0
	17:00	2	25	16	55	
7/11	7:30	3	13	13	53	0.0
	17:00	2	23	15	53	
7/12	7:30	2	12	14	52	0.0
	17:00	3	23	16	52	

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		Observations by Hour				Daily Totals
		Sky	Temperature		River	Precipitation
Date	Time	Code[a]	Air	Water	Stage (cm)	(mm)[b]
7/13	7:30	4	13	14	55	0.0
	17:00	4	14	13	54	
7/14	7:30	4	10	11	52	0.9
	17:00	4	12	11	52	
7/15	8:30	4	11	10	53	1.8
	17:00	4	12	10	53	
7/16	9:00	4	11	9	56	5.8
	17:00	3	14	10	60	
7/17	7:30	4	10	9	65	0.0
	17:00	4	14	10	62	
7/18	7:30	4	12	9	57	0.0
	17:00	4	17	12	55	
7/19	7:15	5	10	11	54	0.4
	17:00	3	19	13	53	
7/20	7:30	1	5	11	52	0.0
	17:00	2	23	14	52	
7/21	7:30	1	7	12	50	0.0
	17:00	3	25	15	49	
7/22	8:30	4	13	13	48	0.8
	17:00	2	24	15	48	
7/23	8:30	4	12	13	49	15.2
	17:00	3	21	15	52	
7/24	7:15	4	13	13	52	0.1
	17:00	4	18	15	50	
7/25	7:15	4	11	13	49	6.2
	17:00	4	18	14	53	
7/26	7:15	4	13	12	54	0.1
7/27	7:15	4	11	12	48	0.0
	17:00	3	18	16	49	
7/28	7:15	3	12	11	46	0.0
	17:00	4	16	12	46	
7/29	10:00	4	11	10	46	0.0
	17:00	4	14	12	46	
7/30	10:00	4	10	10	48	3.6
	17:00	3	12	11	49	
7/31	7:15	4	10	10	50	2.0
	17:00	4	11	11	50	
8/1	7:15	4	8	10	49	1.5
	17:00	4	11	10	48	
8/2	7:15	4	9	9	47	5.0
	17:00	3	15	12	47	
8/3	7:15	3	8	10	47	0.0
	17:00	4	17	11	46	
8/4	8:00	4	10	10	46	0.0
	17:00	4	16	12	45	
8/5	8:30	4	11	10	46	3.8
	17:00	4	15	12	46	
8/6	8:30	3	12	10	46	0.9
	17:00	2	20	13	45	
8/7	7:15	4	10	11	45	0.0
	17:00	4	15	11	43	
8/8	7:15	4	10	10	42	0.0
8/9	7:15	4	11	11	42	0.0
	17:00	4	16	12	42	

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Appendix C1.–Page 3 of 4.

		Observations by Hour				Daily Totals
		Sky	Temperature		River	Precipitation
Date	Time	Code[a]	Air	Water	Stage (cm)	(mm)[b]
8/10	7:15	4	12	10	42	4.0
	17:00	4	14	12	42	
8/11	7:30	4	11	10	44	5.9
	17:00	4	11	12	47	
8/12	10:00	4	10	10	53	3.4
	17:00	4	10	10	54	
8/13	10:00	4	10	10	53	1.6
	17:00	4	12	10	52	
8/14	7:30	4	10	9	53	12.0
	17:00	4	14	10	54	
8/15	7:30	4	10	9	60	5.2
	17:00	3	18	11	64	
8/16	7:30	5	10	10	66	0.9
	17:00	3	20	12	66	
8/17	7:30	5	7	11	67	7.6
	17:00	4	16	10	67	
8/18	7:30	4	11	9	76	22.0
	14:00	ND	ND	ND	90	
	17:00	3	15	9	100	
	19:00	ND	ND	ND	106	
	22:00	ND	ND	ND	118	
8/19	9:00	3	5	8	135	2.5
	17:00	3	11	8	138	
8/20	10:00	2	3	6	137	0.0
	18:00	3	11	7	136	
8/21	7:30	5	1	5	132	0.0
8/22	7:30	4	8	6	124	6.5
	17:00	4	11	8	125	
8/23	7:30	4	8	7	125	2.0
	17:00	4	11	7	124	
8/24	7:30	5	3	6	112	0.0
	17:00	3	14	7	108	
8/25	7:30	4	7	7	104	2.0
	17:00	4	14	8	102	
8/26	10:00	4	9	7	98	0.2
	17:00	2	16	8	95	
8/27	10:00	4	9	7	92	0.0
	17:00	4	13	8	90	
8/28	7:30	5	5	8	85	0.0
	17:00	3	17	8	85	
8/29	7:30	5	4	8	82	0.0
	17:00	2	18	9	78	
8/30	7:30	5	1	7	75	0.0
	17:00	3	17	8	73	
8/31	7:30	3	8	7	70	0.0
	17:00	4	13	8	69	
9/1	10:00	3	13	7	65	0.0
	17:00	3	15	8	65	
9/2	10:00	4	8	6	63	0.0
	17:00	3	16	8	62	
9/3	10:00	5	2	6	59	0.0
	17:00	1	18	9	59	

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Appendix C1.–Page 4 of 4.

		Observations by Hour				Daily Totals
		Sky	Temperature		River	Precipitation
Date	Time	Code[a]	Air	Water	Stage (cm)	(mm)[b]
9/4	10:00	1	5	6	57	0.0
	17:00	1	19	9	56	
9/5	10:00	2	6	7	54	0.0
	17:00	2	17	8	54	
9/6	10:00	5	4	7	52	1.6
	17:00	3	16	9	51	
9/7	10:00	4	9	8	52	1.0
	17:00	4	11	8	51	
9/8	10:00	4	10	7	54	6.8
	17:00	3	11	9	54	
9/9	10:00	3	9	7	55	0.3
	17:00	4	14	8	53	
9/10	10:00	3	10	8	51	2.5
	17:00	2	19	10	51	
9/11	10:00	5	7	8	48	0.2
	17:00	3	14	9	48	
9/12	10:00	5	6	8	47	0.0
	17:00	2	17	9	47	
9/13	10:00	5	3	7	46	0.0
	17:00	1	18	9	45	
9/14	10:00	4	11	8	44	3.0
9/15	10:00	3	11	9	47	3.0
	17:00	4	14	9	48	
9/16	10:00	4	12	8	48	1.1
	17:00	3	14	9	47	
9/17	10:00	3	5	7	45	0.0
	17:00	4	14	8	44	
9/18	10:00	3	8	8	43	0.0
	17:00	4	14	9	43	
9/19	10:00	4	7	8	42	0.0
	17:00	3	17	9	42	
9/20	10:00	4	8	8	41	0.0
	17:00	3	15	9	41	
9/21	10:00	4	7	7	41	0.0
	17:00	4	12	8	41	
9/22	10:00	4	9	7	40	0.0
	17:00	4	12	9	40	
9/23	10:00	4	7	7	41	2.0
	17:00	3	9	8	42	
9/24	10:00	5	1	7	40	0.0

Note: ND = no data; n.a. = Not applicable.

[a] Sky condition codes:

0 = no observation

1 = < 1/10 cloud cover

2 = partly cloudy; < 1/2 cloud cover

3 = mostly cloudy; > 1/2 cloud cover

4 = complete overcast

5 = thick fog

[b] Represents the cumulative precipitation in the 24 hours prior to the daily morning observation.

Appendix C2.–Daily stream temperature summary at George River weir from hourly readings logged by Hobo® Water Temp Pro tethered to the stream bottom, 2006.

	Temperature (°C)		
Date	**Avg.**	**Min.**	**Max.**
6/15	11.5	10.1	12.6
6/16	11.2	10.4	12.4
6/17	9.9	8.7	11.0
6/18	10.3	9.3	11.2
6/19	10.3	9.6	11.1
6/20	10.6	9.7	11.6
6/21	10.7	9.5	12.2
6/22	11.6	10.2	13.1
6/23	12.2	10.9	13.5
6/24	11.8	10.6	13.2
6/25	11.8	10.4	13.4
6/26	12.5	11.4	13.8
6/27	12.2	10.5	13.9
6/28	12.8	11.8	13.5
6/29	11.7	11.2	12.9
6/30	10.8	10.0	11.8
7/1	11.2	9.7	13.0
7/2	12.0	11.5	12.7
7/3	12.1	11.0	13.7
7/4	13.4	11.8	15.3
7/5	14.2	12.8	15.7
7/6	14.5	13.6	15.1
7/7	13.4	12.9	14.4
7/8	12.7	11.7	13.4
7/9	12.8	11.4	14.2
7/10	14.0	12.8	15.4
7/11	14.6	13.6	15.9
7/12	14.9	13.8	15.8
7/13	13.3	12.1	15.3
7/14	10.9	10.4	11.9
7/15	9.8	9.4	10.5
7/16	9.2	8.8	9.9
7/17	9.5	9.1	10.0
7/18	10.3	9.2	11.7
7/19	11.8	10.8	13.1
7/20	12.6	11.2	14.1
7/21	13.6	12.3	15.3
7/22	13.9	12.9	15.4
7/23	14.2	13.1	15.3
7/24	13.9	13.3	14.8
7/25	13.0	12.5	13.8
7/26	12.6	11.8	13.3
7/27	12.2	11.5	12.9
7/28	11.4	11.1	12.1
7/29	10.7	10.1	11.3
7/30	10.2	9.7	11.1
7/31	10.3	9.8	10.7
8/1	9.6	9.2	10.1
8/2	9.9	9.2	11.1
8/3	10.2	9.5	10.8
8/4	10.5	9.7	11.3
8/5	10.7	10.3	11.4
8/6	10.9	9.7	12.5

	Temperature (°C)		
Date	**Avg.**	**Min.**	**Max.**
8/7	10.9	10.5	12.4
8/8	10.5	9.7	11.5
8/9	10.7	10.2	11.2
8/10	10.5	10.2	11.0
8/11	10.3	9.8	10.8
8/12	9.9	9.7	10.5
8/13	9.3	9.0	9.7
8/14	9.3	8.7	10.0
8/15	9.9	9.1	11.0
8/16	10.4	9.7	11.1
8/17	9.8	9.3	10.5
8/18	9.0	8.6	9.6
8/19	7.6	7.2	8.5
8/20	6.4	5.9	7.1
8/21	5.8	5.2	6.3
8/22	6.4	6.1	6.8
8/23	6.5	6.3	6.8
8/24	6.4	5.9	7.1
8/25	6.5	6.1	7.0
8/26	6.8	6.3	7.5
8/27	7.3	6.7	8.2
8/28	7.6	7.0	8.2
8/29	7.5	6.9	8.5
8/30	7.3	6.4	8.0
8/31	7.7	7.0	8.4
9/1	7.5	7.0	8.2
9/2	6.9	6.1	7.5
9/3	7.1	6.1	8.1
9/4	7.1	6.1	8.1
9/5	7.1	6.3	7.6
9/6	7.3	6.5	8.2
9/7	7.6	7.4	7.9
9/8	7.6	7.1	8.2
9/9	7.7	7.0	8.1
9/10	8.2	7.4	9.3
9/11	8.5	7.7	9.4
9/12	8.1	7.3	8.9
9/13	7.6	6.6	8.5
9/14	8.0	7.8	8.2
9/15	7.9	7.7	8.1
9/16	7.8	7.5	8.4
9/17	7.4	6.8	8.0
9/18	7.7	7.3	8.2
9/19	8.0	7.4	8.6
9/20	8.0	7.5	8.6
Average:	10.1	9.3	11.0
Minimum:	5.8	5.2	6.3
Maximum:	14.9	13.8	15.9

Appendix C3.–Stream Discharge Measurement at George River weir on 21 June, 2006.

Location: George River Weir

Date: 6/21/2006

Description: 50 meters upstream from weir

Gauge Height: 62

Crew: J. Mauw, R. Stewart, A. Moore

Comments: Water level is within normal range for this date.

Meter Type: AA

Station **Dist.** (m)	Stream **Depth** (m)	Meter **Height** (m)	Substrate Description	**Velocity** (m/sec) Point	Mean Vert.	Mean Cell	Cell Depth (m)	Width (m)	Area (m^2)	Flow (m^3/sec)
0.0	0.00	0.00	Right Bank	0.000						
2.0	0.67	0.27		0.516		0.26	0.34	2.00	0.67	0.17
5.0	0.87	0.35		0.618		0.57	0.77	3.00	2.31	1.31
10.0	1.12	0.45		0.671		0.64	1.00	5.00	4.98	3.21
15.0	1.17	0.47		0.724		0.70	1.15	5.00	5.73	3.99
20.0	1.28	0.51		0.848		0.79	1.23	5.00	6.13	4.81
25.0	1.34	0.54		0.905		0.88	1.31	5.00	6.55	5.74
30.0	1.39	0.56		0.813		0.86	1.37	5.00	6.83	5.86
35.0	1.41	0.56		0.875		0.84	1.40	5.00	7.00	5.91
40.0	1.37	0.55		0.916		0.90	1.39	5.00	6.95	6.22
45.0	1.32	0.53		0.886		0.90	1.35	5.00	6.73	6.06
50.0	1.27	0.51		0.842		0.86	1.30	5.00	6.48	5.59
55.0	1.17	0.47		0.848		0.85	1.22	5.00	6.10	5.15
60.0	1.10	0.44		0.777		0.81	1.14	5.00	5.68	4.61
65.0	1.04	0.42		0.672		0.72	1.07	5.00	5.35	3.88
70.0	0.95	0.38		0.658		0.67	1.00	5.00	4.98	3.31
75.0	0.88	0.35		0.638		0.65	0.92	5.00	4.58	2.96
80.0	0.79	0.32		0.659		0.65	0.84	5.00	4.18	2.71
85.0	0.73	0.29		0.580		0.62	0.76	5.00	3.80	2.35
90.0	0.63	0.25		0.544		0.56	0.68	5.00	3.40	1.91
95.0	0.50	0.20		0.491		0.52	0.57	5.00	2.83	1.46
98.5	0.37	0.15		0.167		0.33	0.44	3.50	1.52	0.50
99.5	0.00	0.00	Left Bank	0.000		0.08	0.19	1.00	0.19	0.02

Avg. Depth: 0.97 m

Avg. Velocity: 0.64 m/sec

Max. Depth: 1.41 m

Max.Velocity: 0.92 m/sec

Total Discharge: 77.8 m^3/sec

Appendix C4.–Stream Discharge Measurement at George River weir on 8 July, 2006.

Location: George River Weir **Date:** 8/7/2006

Description: 50 m upstream from weir **Gauge Height:** 45 cm

Crew: Dan Costello, Michelle Bobby

Comments: Water level is within normal range for this date. **Meter Type:** AA

Station Dist. (m)	Stream Depth (m)	Meter Height (m)	Substrate Description	Velocity (m/sec) Point	Mean Vert.	Mean Cell	Cell Depth (m)	Width (m)	Area (m^2)	Flow (m^3/sec)
2.0	0.42	0.17	Right Bank	0.213						
5.1	0.66	0.26		0.363		0.29	0.54	3.10	1.67	0.48
10.1	0.86	0.34		0.455		0.41	0.76	5.00	3.80	1.55
15.2	0.96	0.38		0.492		0.47	0.91	5.10	4.64	2.20
20.3	1.02	0.41		0.588		0.54	0.99	5.10	5.05	2.73
25.3	1.18	0.47		0.603		0.60	1.10	5.00	5.50	3.28
30.4	1.20	0.48		0.671		0.64	1.19	5.10	6.07	3.87
35.4	1.20	0.48		0.662		0.67	1.20	5.00	6.00	4.00
40.5	1.20	0.48		0.636		0.65	1.20	5.10	6.12	3.97
45.6	1.08	0.43		0.671		0.65	1.14	5.10	5.81	3.80
50.6	1.08	0.43		0.637		0.65	1.08	5.00	5.40	3.53
55.7	1.00	0.40		0.586		0.61	1.04	5.10	5.30	3.24
60.8	0.92	0.37		0.552		0.57	0.96	5.10	4.90	2.79
65.8	0.84	0.34		0.505		0.53	0.88	5.00	4.40	2.33
70.9	0.76	0.30		0.465		0.49	0.80	5.10	4.08	1.98
75.9	0.70	0.28		0.490		0.48	0.73	5.00	3.65	1.74
81.0	0.58	0.23		0.446		0.47	0.64	5.10	3.26	1.53
86.1	0.50	0.20		0.388		0.42	0.54	5.10	2.75	1.15
91.1	0.42	0.17		0.286		0.34	0.46	5.00	2.30	0.78
96.2	0.34	0.14		0.239		0.26	0.38	5.10	1.94	0.51
101.3	0.32	0.13	Left Bank	0.178		0.21	0.33	5.10	1.68	0.35

Avg. Depth: 0.82 m Avg. Velocity: 0.48 m/sec

Max. Depth: 1.20 m Max.Velocity: 0.67 m/sec

Total Discharge: 45.8 m^3/sec

Appendix C5.–Stream Discharge Measurement at George River weir on 26 August, 2006.

Location: George River Weir

Date: 8/26/2006

Description: 50 meters upstream from weir

Gauge Height: 95

Crew: Rob Stewart, Billy Alexie

Comments: Water level is near the upper limit for weir operation.

Meter Type: AA

Station **Dist.** (m)	Stream **Depth** (m)	Meter **Height** (m)	Substrate Description	**Velocity** (m/sec) Point	Mean Vert.	Mean Cell	Cell Depth (m)	Width (m)	Area (m^2)	Flow (m^3/sec)
0.0	0.00	0.00	Right Bank							
1.0	0.37	0.15		0.351		0.35	0.19	1.02	0.19	0.07
5.1	1.06	0.42		0.726		0.54	0.72	4.08	2.92	1.57
10.2	1.34	0.54		0.870		0.80	1.20	5.10	6.12	4.88
15.3	1.45	0.58		1.090		0.98	1.40	5.10	7.11	6.97
20.4	1.51	0.60		1.010		1.05	1.48	5.10	7.55	7.93
25.5	1.65	0.66		1.010		1.01	1.58	5.10	8.06	8.14
30.6	1.67	0.67		1.070		1.04	1.66	5.10	8.47	8.80
35.7	1.72	0.69		1.120		1.10	1.70	5.10	8.64	9.47
40.8	1.69	0.68		1.080		1.10	1.71	5.10	8.70	9.57
45.9	1.67	0.67		1.130		1.11	1.68	5.10	8.57	9.47
51.0	1.61	0.64		1.090		1.11	1.64	5.10	8.36	9.28
56.1	1.50	0.60		1.070		1.08	1.56	5.10	7.93	8.56
61.2	1.44	0.58		1.070		1.07	1.47	5.10	7.50	8.02
66.3	1.35	0.54		0.996		1.03	1.40	5.10	7.11	7.35
71.4	1.30	0.52		0.933		0.96	1.33	5.10	6.76	6.52
76.5	1.22	0.49		0.933		0.93	1.26	5.10	6.43	6.00
81.6	1.12	0.45		0.891		0.91	1.17	5.10	5.97	5.44
86.7	1.04	0.42		0.848		0.87	1.08	5.10	5.51	4.79
91.8	0.96	0.38		0.807		0.83	1.00	5.10	5.10	4.22
96.9	0.85	0.34		0.715		0.76	0.91	5.10	4.62	3.51
100.0	0.79	0.32		0.311		0.51	0.82	3.06	2.51	1.29
102.0	0.00	0.00	Left Bank	0.000		0.16	0.40	2.04	0.81	0.13

Avg. Depth: 1.19 m

Max. Depth: 1.72 m

Avg. Velocity: 0.87 m/sec

Max.Velocity: 1.13 m/sec

Total Discharge: 132.0 m^3/sec

Appendix C6.–Stream Discharge Measurement at George River weir on 29 August, 2006.

Location: George River Weir **Date:** 8/29/2006

Description: 50 meters upstream from weir **Gauge Height:** 78

Crew: Dan Costello, Jay Baumer

Comments: Water level is above average for this date. **Meter Type:** AA

Station Dist. (m)	Stream Depth (m)	Meter Height (m)	Substrate Description	Velocity (m/sec) Point	Mean Vert.	Mean Cell	Cell Depth (m)	Width (m)	Area (m^2)	Flow (m^3/sec)
0.0	0.00	0.00	Right Bank	0.000						
1.0	0.28	0.11		0.292		0.15	0.14	1.02	0.14	0.02
5.1	0.90	0.36		0.661		0.48	0.59	4.03	2.38	1.13
10.1	1.15	0.46		0.757		0.71	1.03	5.05	5.18	3.67
15.2	1.32	0.53		0.797		0.78	1.24	5.05	6.24	4.85
20.2	1.35	0.54		0.879		0.84	1.34	5.05	6.74	5.65
25.3	1.47	0.59		0.885		0.88	1.41	5.05	7.12	6.28
30.3	1.54	0.62		0.935		0.91	1.51	5.05	7.60	6.92
35.4	1.54	0.62		0.879		0.91	1.54	5.05	7.78	7.05
40.4	1.54	0.62		0.996		0.94	1.54	5.05	7.78	7.29
45.5	1.54	0.62		0.933		0.96	1.54	5.05	7.78	7.50
50.5	1.48	0.59		1.040		0.99	1.51	5.05	7.63	7.52
55.6	1.37	0.55		0.912		0.98	1.43	5.05	7.20	7.02
60.6	1.34	0.54		0.961		0.94	1.36	5.05	6.84	6.41
65.7	1.22	0.49		0.900		0.93	1.28	5.05	6.46	6.01
70.7	1.15	0.46		0.933		0.92	1.19	5.05	5.98	5.48
75.8	1.05	0.42		0.828		0.88	1.10	5.05	5.56	4.89
80.8	1.00	0.40		0.729		0.78	1.03	5.05	5.18	4.03
85.9	1.00	0.40		0.748		0.74	1.00	5.05	5.05	3.73
90.9	0.80	0.32		0.667		0.71	0.90	5.05	4.55	3.22
96.0	0.75	0.30		0.582		0.62	0.78	5.05	3.91	2.44
101.0	0.65	0.26		0.346		0.46	0.70	5.05	3.54	1.64
106.1	0.00	0.00	Left Bank	0.000		0.17	0.33	5.05	1.64	0.28

Avg. Depth: 1.06 m Avg. Velocity: 0.72 m/sec

Max. Depth: 1.54 m Max.Velocity: 1.04 m/sec

Total Discharge: 103.0 m^3/sec

APPENDIX D

Appendix D1.–Historical daily Chinook salmon passage at the George River, 1996–2006, during the current target operational period.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
6/15	23 [a]	26	[b]	0 [a]	0 [a]	0 [a]	0 [a]	1 [a]	0 [a]	6	0 [c]
6/16	11 [a]	13 [a]	[b]	0 [a]	0 [a]	0 [a]	0 [a]	0 [a]	1 [a]	3	1
6/17	10 [a]	11	[b]	0 [a]	0 [c]	0 [a]	0 [a]	0 [a]	2 [a]	14	0
6/18	7 [a]	8	[b]	0 [a]	0	0 [a]	0 [a]	4 [a]	2 [a]	12	0
6/19	37 [a]	42	[b]	0 [a]	0	0 [a]	0 [a]	3 [a]	4 [a]	4	0
6/20	0 [a]	0	[b]	0 [a]	0	0 [a]	0 [a]	14 [a]	7 [a]	6	6
6/21	27	17	[b]	0 [a]	0	0 [a]	3 [c]	24 [a]	9 [a]	3	4
6/22	17	18	1 [d]	0 [a]	2	2 [a]	55	30 [a]	8 [a]	56	8
6/23	269	362	3	9 [a]	10	11 [a]	40	44 [a]	4 [a]	21	1
6/24	762	488	4	5 [a]	11	12 [a]	5	10 [a]	2 [a]	106	2
6/25	214	907	14	5 [a]	5	6 [c]	8	163 [a]	7 [a]	72	3
6/26	41	288	44	14 [a]	1	15	30	206 [a]	52 [a]	60	1
6/27	183	514	35	9 [a]	120	16	24	137 [a]	310	143	5
6/28	98	397	170	33 [a]	0	100	43	245 [a]	230	114	41
6/29	91 [c]	566	126	12 [a]	8	305	24	271 [a]	305	392	18
6/30	84	767	164	5 [a]	8	15	420	286 [a]	220	202	191
7/01	1034	456	288	38 [a]	63	43	366	354 [c]	100	108	388
7/02	712 [c]	277	397	12 [a]	416	163	23	513 [c]	25	122	64
7/03	389	584	428	31 [a]	115	8	107	336 [a]	409	404	99
7/04	320	347	287	62 [a]	69	36	39	42 [a]	161	336	589
7/05	280	221	245	33 [a]	48	32	102	360 [a]	539	202	200
7/06	579	294	203	36 [a]	51	531	92	213 [a]	375	92	220
7/07	180	93	33	33 [a]	231	246	138	455 [a]	152	140	440
7/08	122	34	[b]	31 [a]	137	36	127	117	398	61	59
7/09	436	37	[b]	50 [a]	81	70	80	65	194	102	47
7/10	127	29	[b]	95 [a]	15	155	22	17	69	61	155
7/11	376	33	[b]	188 [a]	495	64	142	5	244	111	332
7/12	53	245	[b]	280 [a]	116	610	37	40	240	108	166
7/13	60	31	[b]	128 [a]	10	57	55	59	108	77	32
7/14	127	11	[b]	68	22	113	74	40	99	52	6
7/15	324	65	[b]	206	17	86	29	90	75	86	7
7/16	78	6	[b]	185	146	26	35	11	89	61	207
7/17	67	22	[b]	21	104	45	42	38	86	83	110
7/18	107	42	[b]	58	13	97	22	47	97	43	173
7/19	63	87	[b]	260	219	41	25	72	114	25	168
7/20	49	111	[b]	456	9	88	29	50	66	41	150
7/21	58	83	[b]	43	13	34	27	90	40	23	89
7/22	26	49	[b]	196	41	46	25	12	22	26	37
7/23	29	32	[b]	61	87	17	9	25	40	27	82
7/24	54	7	[b]	161	22	4	18	13	38	31 [e]	19
7/25	34	41	[b]	203	25	12	6	18	29	36	32
7/26	17	18	[b]	159	34	14	11	5	49	6	18
7/27	9 [a]	9	[b]	37	43	16	19	39	16	22	25
7/28	25 [a]	25	[b]	58	10	28	15	11 [a]	20	19	19
7/29	7 [a]	7	[b]	47	11	17	7	9 [a]	6	15	28
7/30	13 [a]	13	18	19	5	5	15	9 [a]	3	14	11
7/31	13 [a]	13	14	24	26	7	6	4 [a]	19	6	14
8/01	4 [a]	4	6	7	13 [c]	6	6	4 [a]	16	9	17
8/02	5 [a]	5	25	37	11 [a]	9	5	4 [a]	14	7	5
8/03	7 [a]	7	[b]	20	13	4	8	3 [a]	13	6	13
8/04	4 [a]	4	[b]	21	5	3	3	5 [c]	8	7	12
8/05	4 [a]	4	[b]	12	6 [a]	2	5	18	5	7	6

-continued-

Appendix D1.–Page 2 of 2.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
8/06	2 [a]	2	[b]	6	3	7	0	12	2	2	2
8/07	3 [a]	3	[b]	4	3	6	0	13	10	5	7
8/08	3 [a]	3	[b]	2	8	9	3	7	7	10	4
8/09	5 [a]	5	[b]	10	0	3	1	5	1	0	4
8/10	1 [a]	1	[b]	0	1	1	3	4	7	7	2
8/11	3 [a]	3	[b]	3	6	2	3	3	4	2	2
8/12	8 [a]	8	[b]	1	6	3	4	3	2	2	5
8/13	5 [a]	5	[b]	7	2	2	1	1	0	2	0
8/14	3 [a]	3	[b]	2	7	0	1	6	3	14	0
8/15	4 [a]	4	[b]	16	5	1	1	1 [c]	2	1	1
8/16	8 [a]	8	[b]	5	2	1	1	1 [a]	6	0	0
8/17	1 [a]	1	[b]	5	0	4	0	1 [a]	3	0	1
8/18	1 [a]	1	[b]	0	1	1	2	1 [c]	4	1	0 [c]
8/19	0 [a]	0	[b]	1	2	2 [a]	0	0	0	1	0 [a]
8/20	3 [a]	3	[b]	4	0	2 [a]	0	0	4	0	0 [a]
8/21	2 [a]	2	[b]	4	0	2 [a]	0	1	1	0	0 [a]
8/22	1 [a]	1	[b]	0	1	2 [a]	1	0	0	0	0 [a]
8/23	0 [a]	0	[b]	0	2	1 [a]	0	0	0	0	0 [a]
8/24	0 [a]	0	[b]	0	0	1 [a]	0	1	2	0	0 [a]
8/25	0 [a]	0	[b]	1	0	1 [a]	0	1	0	0	0 [a]
8/26	0 [a]	0	[b]	1	2	1 [a]	0	0	1	2	0
8/27	0 [a]	0	[b]	2	0	2	0	0	1	1	0
8/28	0 [a]	0	[b]	0	0	1	0	0	0	1	2
8/29	0 [a]	0	[b]	0	1	0	0	0	1	1	0
8/30	0 [a]	0	[b]	1	0	0	0	0	1	1	0
8/31	0 [a]	0	[b]	0	0	0	0	0	0	0	1
9/01	0 [a]	0	[b]	2	0	0	0	0	2	0	0
9/02	0 [a]	0	[b]	0	0	0	0	0	0	0	1
9/03	0 [a]	0	[b]	0	0	0	0	0	0	0	0
9/04	0 [a]	0	[b]	0	0	1	0	0	0	0	1
9/05	0 [a]	0	[b]	1	0	0	0	0	0	0	0
9/06	0 [a]	0	[b]	0	0	0	0	0	0	0	0
9/07	0 [a]	0	[b]	0	0	0	0	0	1	0	0
9/08	0 [a]	0	[b]	1	0	0	0	0	0	0	1
9/09	0 [a]	0	[b]	0	0	0	0	0	0	1	0
9/10	0 [a]	0	[b]	0	0	0	0	0	0	0	1
9/11	0 [a]	0	[b]	0	0	0	0	0	0	0	0
9/12	0 [a]	0	[b]	1	0	0	0	0	0	0	0
9/13	0 [a]	0	[b]	0	0	0	0	0	0	0	0
9/14	0 [a]	0	[b]	0	1	0	0	0	0	0	0
9/15	0 [a]	0	[b]	0	0	0	0	0	0	0	0
9/16	0 [a]	0 [a]	[b]	0	0	0	0	0	0	0	0
9/17	0 [a]	0 [a]	[b]	0	0 [a]	0	0	0	0	1	0
9/18	0 [a]	0 [a]	[b]	0	0 [a]	0	0	0	0	0	0
9/19	0 [a]	0 [a]	[b]	0	0 [a]	0	0	0	0	0	0
9/20	0 [a]	0 [a]	[b]	0	0 [a]	0	0	0 [a]	0	0	0

Note: The sum of daily passages might differ from the cumulative passages reported elsewhere in this report due to rounding errors.

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

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

[c] Partial day count; passage was estimated.

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

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

Appendix D2.–Historical daily chum salmon passage at the George River, 1996–2006, during the current target operational period.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
6/15	1 [a]	0	[b]	0 [a]	0 [a]	0 [a]	0 [a]	4 [a]	6 [a]	5	0 [c]
6/16	2 [a]	2 [a]	[b]	0 [a]	0 [a]	0 [a]	1 [a]	8 [a]	14 [a]	1	0
6/17	3 [a]	2	[b]	0 [a]	0 [c]	0 [a]	1 [a]	13 [a]	63 [a]	7	0
6/18	2 [a]	0	[b]	0 [a]	0	0 [a]	1 [a]	17 [a]	78 [a]	4	2
6/19	5 [a]	2	[b]	0 [a]	0	0 [a]	2 [a]	21 [a]	92 [a]	15	5
6/20	2 [a]	0	[b]	0 [a]	0	0 [a]	1 [a]	26 [a]	45 [a]	2	41
6/21	65	2	[b]	0 [a]	5	17 [a]	11 [c]	48 [a]	138 [a]	8	49
6/22	613	3	1 [d]	0 [a]	6	20 [a]	107	13 [a]	116 [a]	18	158
6/23	1314	35	0	0 [a]	38	126 [a]	58	11 [a]	120 [a]	15	196
6/24	692	52	6	21 [a]	17	56 [a]	23	11 [a]	20 [a]	59	180
6/25	49	43	23	8 [a]	17	56 [c]	124	11 [a]	158 [a]	35	266
6/26	376	49	162	21 [a]	1	10	245	11 [a]	502 [a]	23	226
6/27	508	79	116	29 [a]	90	17	118	61 [a]	883	65	267
6/28	167	34	289	78 [a]	0	39	237	97 [a]	602	61	624
6/29	191 [c]	178	288	78 [a]	4	140	149	82 [a]	567	270	357
6/30	215	204	399	67 [a]	12	7	203	25 [a]	360	228	575
7/01	498	64	634	106 [a]	108	40	175	181 [c]	148	151	1196
7/02	730 [c]	77	388	100 [a]	273	110	34	332 [c]	179	340	735
7/03	961	267	557	117 [a]	128	21	151	244 [a]	543	719	878
7/04	1074	83	605	128 [a]	77	26	37	179 [a]	472	436	1598
7/05	326	174	960	109 [a]	72	68	192	134 [a]	444	350	1707
7/06	606	111	439	164 [a]	218	228	518	166 [a]	685	440	1274
7/07	575	52	123	199 [a]	162	425	339	136 [a]	972	368	959
7/08	629	49	[b]	183 [a]	47	173	186	824	514	508	679
7/09	852	40	[b]	376 [a]	40	319	198	1362	311	430	618
7/10	241	62	[b]	454 [a]	58	349	317	660	305	518	1300
7/11	446	45	[b]	469 [a]	436	546	399	224	467	459	1536
7/12	343	207	[b]	483 [a]	161	600	279	801	272	755	1198
7/13	394	7	[b]	325 [a]	91	429	149	1856	412	597	448
7/14	489	12	[b]	182	41	610	203	2020	381	733	175
7/15	556	158	[b]	194	22	537	276	1539	298	478	318
7/16	232	51	[b]	333	150	325	205	468	182	501	964
7/17	462	236	[b]	327	88	427	154	675	194	497	1509
7/18	514	207	[b]	394	55	502	189	846	311	240	2152
7/19	667	575	[b]	768	144	533	131	1580	308	274	2795
7/20	322	300	[b]	709	18	427	63	1605	197	512	2474
7/21	387	342	[b]	316	41	330	115	1230	268	527	2152
7/22	273	144	[b]	379	87	397	65	1122	208	347	1573
7/23	321	292	[b]	465	172	208	73	1020	258	362	1227
7/24	525	207	[b]	533	116	264	70	588	251	293 [e]	1000
7/25	449	238	[b]	443	76	244	60	749	210	206	830
7/26	508	110	[b]	353	56	337	74	750	229	257	609
7/27	195 [a]	42	[b]	195	47	341	66	761	133	226	670
7/28	130 [a]	176	[b]	292	34	314	44	1307 [a]	118	210	528
7/29	204 [a]	96	[b]	148	28	233	69	1589 [a]	111	157	691
7/30	130 [a]	71	546	65	26	189	44	656 [a]	110	163	437
7/31	95 [a]	133	367	286	63	172	32	603 [a]	108	161	564
8/01	107 [a]	41	295	221	33 [c]	145	36	654 [a]	97	150	360
8/02	74 [a]	28	193	214	23 [a]	180	25	1126 [a]	46	159	314
8/03	101 [a]	35	[b]	216	22	131	34	694 [a]	45	106	429
8/04	80 [a]	70	[b]	166	3	85	27	331 [c]	46	130	499
8/05	59 [a]	50	[b]	137	7 [a]	85	20	602	60	94	359

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Appendix D2.–Page 2 of 2.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
8/06	77 [a]	38	[b]	61	1	103	26	591	36	83	219
8/07	27 [a]	32	[b]	63	3	84	9	587	55	99	268
8/08	27 [a]	33	[b]	82	2	109	9	366	161	147	162
8/09	44 [a]	13	[b]	73	6	75	15	385	71	20	142
8/10	71 [a]	17	[b]	24	3	63	24	338	56	39	102
8/11	41 [a]	25	[b]	22	6	35	14	284	35	32	90
8/12	53 [a]	34	[b]	28	2	41	18	144	41	50	95
8/13	24 [a]	39	[b]	56	17	22	8	227	15	65	80
8/14	24 [a]	32	[b]	34	5	11	8	188	5	81	107
8/15	36 [a]	9	[b]	58	2	13	12	71 [c]	41	41	44
8/16	24 [a]	12	[b]	24	2	19	8	61 [a]	16	18	49
8/17	9 [a]	8	[b]	11	2	14	3	77 [a]	20	52	59
8/18	33 [a]	5	[b]	23	1	38	11	58 [c]	8	14	48 [c]
8/19	15 [a]	6	[b]	25	3	23 [a]	5	43	5	13	43 [a]
8/20	15 [a]	7	[b]	20	7	20 [a]	5	34	3	14	37 [a]
8/21	3 [a]	6	[b]	6	4	18 [a]	1	30	24	21	32 [a]
8/22	24 [a]	0	[b]	7	0	15 [a]	8	35	10	8	26 [a]
8/23	27 [a]	0	[b]	6	1	12 [a]	9	15	12	13	21 [a]
8/24	3 [a]	0	[b]	1	0	10 [a]	1	13	19	7	15 [a]
8/25	9 [a]	2	[b]	5	3	7 [a]	3	3	12	6	10 [a]
8/26	0 [a]	5	[b]	3	1	5 [a]	0	7	6	27	3
8/27	6 [a]	5	[b]	1	1	3	2	3	12	25	5
8/28	0 [a]	1	[b]	4	1	2	0	4	7	25	16
8/29	3 [a]	4	[b]	1	1	1	1	3	9	17	9
8/30	0 [a]	6	[b]	3	1	0	0	1	15	29	7
8/31	18 [a]	9	[b]	7	0	2	6	5	8	17	10
9/01	0 [a]	1	[b]	5	2	0	0	5	18	18	16
9/02	6 [a]	0	[b]	4	0	1	2	4	4	13	8
9/03	0 [a]	4	[b]	2	1	1	0	1	4	19	4
9/04	6 [a]	0	[b]	9	0	1	2	3	2	19	3
9/05	0 [a]	4	[b]	7	1	0	0	2	6	13	2
9/06	3 [a]	1	[b]	8	0	1	1	0	4	20	3
9/07	0 [a]	7	[b]	4	0	1	0	0	5	5	3
9/08	0 [a]	0	[b]	3	0	3	0	0	1	10	3
9/09	0 [a]	0	[b]	4	0	3	0	1	2	19	2
9/10	3 [a]	5	[b]	0	0	0	1	0	0	15	6
9/11	0 [a]	0	[b]	4	0	2	0	0	1	13	0
9/12	6 [a]	0	[b]	0	0	1	2	0	0	4	4
9/13	0 [a]	0	[b]	1	0	1	0	1	0	1	2
9/14	0 [a]	0	[b]	0	0	1	0	0	0	11	3
9/15	0 [a]	0	[b]	1	0	0	0	0	1	10	3
9/16	0 [a]	0 [a]	[b]	1	0	0	0	0	0	2	1
9/17	0 [a]	0 [a]	[b]	0	0 [a]	0	0	0	0	1	1
9/18	0 [a]	0 [a]	[b]	0	0 [a]	0	0	0	0	0	0
9/19	0 [a]	0 [a]	[b]	0	0 [a]	2	0	0	1	0	2
9/20	0 [a]	0 [a]	[b]	1	0 [a]	0	0	0 [a]	0	2	1

Note: The sum of daily passages might differ from the cumulative passages reported elsewhere in this report due to rounding errors.

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

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

[c] Partial day count; passage was estimated.

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

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

Appendix D3.–Historical daily coho salmon passage at the George River, 1996–2006, during the current target operational period.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
6/15	0 [a]	0	[b]	0 [a]	0 [a]	0 [a]	0 [a]	0 [a]	[b]	0	0 [c]
6/16	0 [a]	0 [c]	[b]	0 [a]	0 [a]	0 [a]	0 [a]	0 [a]	[b]	0	0
6/17	0 [a]	0	[b]	0 [a]	0 [c]	0 [a]	0 [a]	0 [a]	[b]	0	0
6/18	0 [a]	0	[b]	0 [a]	0	0 [a]	0 [a]	0 [a]	[b]	0	0
6/19	0 [a]	0	[b]	0 [a]	0	0 [a]	0 [a]	0 [a]	[b]	0	0
6/20	0 [a]	0	[b]	0 [a]	0	0 [a]	0 [a]	0 [a]	[b]	0	0
6/21	0	0	[b]	0 [a]	0	0 [a]	0 [c]	0 [a]	[b]	0	0
6/22	0	0	0 [d]	0 [a]	0	0 [a]	0	0 [a]	[b]	0	0
6/23	0	0	0	0 [a]	0	0 [a]	0	0 [a]	[b]	0	0
6/24	0	0	0	0 [a]	0	0 [a]	0	0 [a]	[b]	0	0
6/25	0	0	0	0 [a]	0	0 [c]	0	0 [a]	[b]	0	0
6/26	0	0	0	0 [a]	0	0	0	0 [a]	[b]	0	0
6/27	0	0	0	0 [a]	0	0	0	0 [a]	0	0	0
6/28	0	0	0	0 [a]	0	0	0	0 [a]	0	0	0
6/29	0 [c]	0	0	0 [a]	0	0	0	0 [a]	0	0	0
6/30	0	0	0	0 [a]	0	0	0	0 [a]	0	0	0
7/01	0	0	0	0 [a]	0	0	0	0 [c]	0	0	0
7/02	0 [c]	0	0	0 [a]	0	0	0	0 [c]	0	0	0
7/03	0	0	0	0 [a]	0	0	0	0 [a]	0	0	0
7/04	0	0	0	0 [a]	0	0	0	0 [a]	0	0	0
7/05	0	0	0	0 [a]	0	0	0	0 [a]	0	0	0
7/06	0	0	0	0 [a]	0	0	0	0 [a]	0	0	0
7/07	0	0	0	0 [a]	0	0	0	0 [a]	0	0	0
7/08	0	0	[b]	0 [a]	0	0	0	0	0	0	0
7/09	0	0	[b]	0 [a]	0	0	0	0	0	0	0
7/10	0	0	[b]	0 [a]	0	0	0	0	0	0	0
7/11	0	0	[b]	0 [a]	0	0	0	0	0	0	0
7/12	0	0	[b]	0 [a]	0	0	0	0	0	0	0
7/13	0	0	[b]	0 [a]	0	0	0	0	0	0	0
7/14	0	0	[b]	0	0	0	0	0	0	0	0
7/15	0	0	[b]	0	0	0	0	0	0	0	0
7/16	1	0	[b]	0	0	0	0	0	0	0	0
7/17	0	0	[b]	0	0	0	0	0	0	0	0
7/18	0	0	[b]	0	0	0	0	1	0	0	1
7/19	1	0	[b]	0	0	0	0	1	0	0	1
7/20	3	2	[b]	0	0	0	0	2	0	0	1
7/21	0	1	[b]	0	0	0	0	8	1	0	4
7/22	0	2	[b]	0	1	0	0	1	0	0	0
7/23	6	0	[b]	0	2	0	0	10	0	0	4
7/24	22	2	[b]	0	0	0	0	5	0	3 [a]	3
7/25	47	2	[b]	0	0	0	0	11	5	0	0
7/26	93	1	[b]	0	5	0	0	19	3	10	0
7/27	[b]	2	[b]	0	4	1	0	22	0	8	2
7/28	[b]	3	[b]	1	0	0	1	12 [a]	0	5	1
7/29	[b]	2	[b]	0	0	0	3	12 [a]	4	8	6
7/30	[b]	3	7	0	0	3	1	12 [a]	2	7	6
7/31	[b]	9	8	0	9	6	1	11 [a]	10	6	6
8/01	[b]	9	14	0	5 [c]	7	2	21 [a]	17	10	11
8/02	[b]	22	23	1	7 [a]	11	9	30 [a]	10	17	4
8/03	[b]	25	[b]	0	11	9	13	23 [a]	6	13	6
8/04	[b]	52	[b]	1	6	3	22	23 [c]	43	7	15
8/05	[b]	41	[b]	12	16 [a]	12	16	62	42	18	25

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Appendix D3.–Page 2 of 2.

Date	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
8/06	[b]	59	[b]	0	23	25	18	98	38	19	7
8/07	[b]	75	[b]	3	25	22	6	156	69	22	14
8/08	[b]	69	[b]	4	119	62	14	113	72	199	8
8/09	[b]	70	[b]	6	5	32	12	507	69	72	8
8/10	[b]	35	[b]	8	53	13	43	340	445	161	25
8/11	[b]	71	[b]	13	116	2	15	186	77	25	67
8/12	[b]	198	[b]	4	245	252	54	304	82	127	218
8/13	[b]	170	[b]	23	909	273	13	146	61	178	21
8/14	[b]	213	[b]	32	480	123	14	1620	57	272	336
8/15	[b]	92	[b]	33	263	187	231	534 [c]	712	108	791
8/16	[b]	44	[b]	70	207	1534	115	376 [a]	316	68	400
8/17	[b]	59	[b]	94	186	1301	22	282 [a]	207	376	129
8/18	[b]	103	[b]	116	558	709	33	105 [c]	155	63	781 [c]
8/19	[b]	70	[b]	68	216	937 [a]	11	216	96	53	254 [a]
8/20	[b]	346	[b]	186	1177	870 [a]	10	353	299	25	249 [a]
8/21	[b]	334	[b]	193	1451	803 [a]	19	2064	489	76	244 [a]
8/22	[b]	1152	[b]	85	435	735 [a]	525	855	168	27	239 [a]
8/23	[b]	131	[b]	186	49	668 [a]	146	671	201	708	234 [a]
8/24	[b]	162	[b]	139	220	601 [a]	48	474	147	46	229 [a]
8/25	[b]	66	[b]	96	273	533 [a]	38	2672	149	155	224 [a]
8/26	[b]	275	[b]	141	310	466 [a]	12	2232	88	176	337
8/27	[b]	64	[b]	206	1228	430	133	2005	162	49	101
8/28	[b]	60	[b]	230	1101	368	23	969	108	184	676
8/29	[b]	17	[b]	198	637	480	2	444	413	150	523
8/30	[b]	1471	[b]	70	244	262	53	396	733	393	368
8/31	[b]	358	[b]	107	97	402	641	2934	672	321	221
9/01	[b]	482	[b]	1296	55	450	106	5659	1487	51	368
9/02	[b]	202	[b]	718	131	190	48	1506	479	2	294
9/03	[b]	161	[b]	72	145	233	65	241	366	36	462
9/04	[b]	151	[b]	185	73	98	102	190	301	536	280
9/05	[b]	261	[b]	113	91	41	372	407	413	292	77
9/06	[b]	58	[b]	108	14	63	1906	634	310	941	430
9/07	[b]	234	[b]	114	0	64	679	801	397	576	535
9/08	[b]	34	[b]	425	10	192	372	392	139	223	529
9/09	[b]	375	[b]	331	11	101	57	212	133	469	280
9/10	[b]	428	[b]	86	3	166	40	148	371	280	203
9/11	[b]	174	[b]	35	14	37	86	231	414	71	247
9/12	[b]	47	[b]	566	3	13	373	59	389	151	81
9/13	[b]	141	[b]	676	2	45	107	1259	222	83	3
9/14	[b]	105	[b]	917	3	82	47	150	267	67	232
9/15	[b]	174	[b]	653	5	35	24	14	245	156	150
9/16	[b]	70 [a]	[b]	60	3	88	22	1	116	64	190
9/17	[b]	70 [a]	[b]	36	3 [a]	143	13	28	94	19	56
9/18	[b]	50 [a]	[b]	145	2 [a]	127	9	7	81	9	9
9/19	[b]	30 [a]	[b]	49	1 [a]	13	4	0	36	3	58
9/20	[b]	22 [a]	[b]	3	0 [a]	75	8	4 [a]	11	6	10
Total	173	9,210	52	8,914	11,262	14,398	6,759	33,280	12,499	8,200	11,296

Note: The sum of daily passages might differ from the cumulative passages reported elsewhere in this report due to rounding errors.

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

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

[c] Partial day count; passage was estimated.

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