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Salmon Escapement Monitoring in the Kuskokwim River, 2013

Annual Report for Project No. 10-304, 12-303, and 12-304

USFWS Office of Subsistence Management

Fisheries Resource Monitoring Program

by

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and

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

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)

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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ABSTRACT

In 2013, the Alaska Department of Fish and Game, in collaboration with other entities, conducted aerial surveys and operated ground based weir projects to monitor salmon escapement throughout Kuskokwim River drainage to provide the data managers need to ensure sustainable fisheries. Aerial surveys were conducted on 13 tributaries (Eek, Kwethluk/Crooked Creek, Kisaralik, Tuluksak, Aniak, Salmon [Aniak], Kipchuk, Holokuk, Oskawalik, Holitna, Cheeneetnuk, Gagaryah, and Salmon [Pitka Fork] rivers) to estimate Chinook salmon *O. tshawytscha* abundance indices. Chinook salmon abundance indices were successfully estimated at Eek River (240 fish), Kwethluk River/Crooked Creek (1,165 fish), Kisaralik River (597 fish), Tuluksak River (83 fish), Aniak River (754 fish), Salmon River (Aniak; 154 fish), Kipchuk River (261 fish), Holokuk River (29 fish), Oskawalik River (38 fish), Holitna River (670 fish), Cheeneetnuk River (138 fish), Gagaryah River (74 fish), and Salmon River (Pitka Fork; 475 fish). In addition, 5 Pacific salmon species Chinook, chum *O. keta*, coho *O. kisutch*, sockeye *O. nerka*, and pink *O. gorbuscha* were monitored at weir projects on the Salmon (Aniak), George, Kogrukluk, Telaquana, Tatlawiksuk, and Takotna rivers. Annual escapements were successfully estimated for Chinook salmon at Salmon (Aniak; 598 fish), George (1,219 fish), Kogrukluk (1,772 fish), Tatlawiksuk (495 fish), and Takotna (94 fish) river weirs. Annual escapements were successfully estimated for chum salmon at Salmon (Aniak; 7,666 fish), George (36,874 fish), Kogrukluk (66,834 fish), Tatlawiksuk (32,277 fish), and Takotna (6,412 fish) river weirs. Annual escapements were successfully estimated for coho salmon at Salmon (Aniak; 2,869 fish), George (13,984 fish), Kogrukluk (23,590 fish), Tatlawiksuk (13,076 fish), and Takotna (1,119 fish) river weirs. Sockeye salmon annual escapement was successfully estimated at Salmon (Aniak; 966 fish), Kogrukluk (7,882 fish), and Telaquana (27,806 fish) river weirs.

Key words Chinook salmon, *Oncorhynchus tshawytscha*, chum salmon, *Oncorhynchus keta*, coho salmon, *Oncorhynchus kisutch,* sockeye salmon, *Oncorhynchus nerka*, Kuskokwim River, Eek River, Kwethluk River, Kisaralik River, Tuluksak River, Aniak River, Salmon River (Aniak), Kipchuk River, Holokuk River, Oskawalik River, George River, Holitna River, Kogrukluk River, Telaquana River, Cheeneetnuk River, Gagaryah River, Tatlawiksuk River, Takotna River, Salmon River (Pitka Fork), aerial survey, resistance board weir, fixed picket weir, escapement, age, sex, length (ASL).

INTRODUCTION

Each year mature Pacific salmon *Oncorhynchus* spp. return to the Kuskokwim River and its tributaries (Figure 1). While formal abundance estimates do not exist for all salmon species returning to the Kuskokwim River, data suggest chum salmon *O. keta* are the most abundant salmon species in the drainage, followed by coho *O. kisutch*, sockeye *O. nerka*, and Chinook *O. tshawytscha* salmon (K. Schaberg, Commercial Fisheries Biologist Kuskokwim Area Research, ADF&G, Anchorage; personal communication). Pink salmon *O. gorbuscha* abundance within the drainage has not been estimated. Kuskokwim River salmon support subsistence, commercial, and sport fisheries that contribute to an annual harvest of approximately 500,000 fish. The subsistence salmon fishery in the Kuskokwim Area is one of the largest and most important in the state and remains a fundamental component of local culture (Brazil et al. 2013).

Monitoring salmon species returning to the Kuskokwim River and its tributaries is important to ensure escapement levels that will result in sustained yields large enough to provide for subsistence, commercial, and sport fisheries. Salmon spawn and rear in most tributaries, throughout the Kuskokwim River drainage, although spawning abundance between tributaries varies (Whitmore et al. 2008; Johnson and Daigneault 2013a, 2013b). Escapement monitoring efforts encompass tributaries over a broad geographic scale within the drainage and focus on Chinook, chum, coho, and sockeye salmon (Figures 1 and 2). Aerial surveys and ground based weirs are the 2 primary methods of monitoring escapement used in the Kuskokwim Area. While aerial surveys provide the most cost-effective means of monitoring salmon escapements throughout the drainage, they are subject to limited reliability and high variability in precision (Burkey et al. 2000). Ground based weir projects provide a more dependable and rigorous approach to escapement monitoring. The relatively high cost of weir operation limits the number of salmon producing tributaries that can be monitored. Therefore, a combination of aerial surveys and ground based weir projects have been used to maximize resources and provide a diverse network of escapement monitoring throughout the Kuskokwim River drainage (Table 1).

Aerial surveys were conducted to count spawning Chinook salmon in 2013 and, as in previous years, the counts serve as an index for escapement. Chum, coho, and sockeye salmon were not surveyed in 2013 due to logistics, cost, and limited usefulness of the information. Many Kuskokwim River tributaries have been surveyed in the past (Molyneaux and Brannian 2006); however, in 2013 a limited set of streams distributed throughout the drainage were surveyed for Chinook salmon abundance, as conditions allowed. Target tributaries were selected based on water clarity, location, Chinook salmon abundance, past survey history, and perceived local importance and interest. Streams surveyed in 2013 included the following: Eek River, Kwethluk River/Crooked Creek, Kisaralik River, Tuluksak River, Aniak River, Salmon River (Aniak drainage), Kipchuk River, Holokuk River, Oskawalik River, Holitna River, Cheeneetnuk River, Gagaryah River, and Salmon River (Pitka Fork drainage).

Ground based weir projects were operated in 2013, similar to previous years, to enumerate escapement and collect age, sex, and length (ASL) information from Chinook, chum, coho, and sockeye salmon. Pink salmon escapement data were also collected at the escapement project sites; however, the smaller body size of pink salmon allowed many of them to pass through the weirs undetected, making a complete count impossible. Tributaries were chosen based on salmon abundance, location, the ability to install and operate a weir, past monitoring history, availability of funding, and perceived local importance and interest. Weir projects were operated on the Salmon (Aniak drainage), George, Kogrukluk, Telaquana, Tatlawiksuk, and Takotna rivers and involved collaboration with other entities including the Kuskokwim Native Association (KNA), National Park Service (NPS), and Takotna Community Association (TCA). In addition to Pacific salmon, many other resident fish species are commonly observed in the monitored tributaries; however, species other than salmon were not enumerated. With the exception of the Salmon (Aniak) and Telaquana river weirs, these projects have been in operation for over 10 years. The Telaquana River weir was implemented in 2010 to fill data gaps in run abundance and stock structure dynamics of sockeye salmon, and the Salmon (Aniak) River weir was reinitiated in 2012 to monitor Chinook and chum salmon stocks after the Aniak Sonar project was discontinued in 2011. Supplemental to Alaska Department of Fish and Game (ADF&G) efforts, the U.S. Fish and Wildlife Service operated salmon weirs on the Kwethluk and Tuluksak rivers in 2013.

The projects discussed in this report provide information necessary for annual monitoring of escapement goals on the Kuskokwim River. In 2013, Chinook salmon sustainable escapement goals existed on the Kisaralik, Aniak, Salmon (Aniak drainage), Holitna, Cheeneetnuk, Gagaryah, and Salmon (Pitka Fork drainage) rivers and were assessed through aerial surveys. Sustainable escapement goals were also in effect on the George and Kogrukluk rivers and were assessed by weir projects (ADF&G 2004; Brannian et al. 2006a; Volk et al. 2009; Conitz et al. 2012; Table 1). In 2013, the Kogrukluk River had sustainable escapement goals for chum, sockeye, and coho salmon (ADF&G 2004; Volk et al. 2009; Conitz et al. 2012; Table 1). The Kwethluk River has established sustainable escapement goals for Chinook and coho salmon (Volk et al. 2009; Conitz et al. 2012; Table 1). In addition, a drainagewide Chinook salmon sustainable escapement goal of 65,000–120,000 fish was established for the Kuskokwim River in

2013. Data collected from ground based escapement monitoring projects and aerial surveys are used annually to update the drainagewide Chinook salmon run reconstruction model to estimate the total Chinook salmon run and escapement (Bue et al. 2012). The escapement from this maximum likelihood model is then used to determine if the drainagewide escapement goal for Chinook salmon was met.

This report only includes results from ADF&G escapement monitoring projects on the Kuskokwim River. It does not include ADF&G escapement monitoring projects in Kuskokwim Bay or data from outside agency escapement monitoring projects on the Kuskokwim River. Data collected to determine age, sex, and length compositions will be reported in the *2013 Salmon age, sex, and length catalog for the Kuskokwim Area*. Information on the Kuskokwim River drainagewide Chinook salmon escapement goal, including 2013 escapement estimates, will be reported in the *2013 Kuskokwim Area Management Report*.

OBJECTIVES

1. Estimate the peak spawning abundance index of Chinook salmon by aerial survey, under good or fair survey conditions between 20 and 31 July, on the following 13 tributaries throughout the Kuskokwim River in 2013:

    - Eek River
    - Kwethluk River/Crooked Creek
    - Kisaralik River
    - Tuluksak River
    - Aniak River
    - Salmon River (Aniak drainage)
    - Kipchuk River
    - Holokuk River
    - Oskawalik River
    - Holitna River
    - Cheeneetnuk River
    - Gagaryah River
    - Salmon River (Pitka Fork drainage)

2. Estimate daily and annual escapement of Chinook, chum, coho, and sockeye salmon using weirs operated in 6 tributaries throughout the Kuskokwim River during the following target operational periods in 2013:

    - Salmon River (Aniak drainage): 15 June–20 September
    - George River: 15 June–20 September
    - Kogrukluk River: 26 June–25 September

- Telaquana River: 3 July–6 August
- Tatlawiksuk River: 15 June–20 September
- Takotna River: 24 June–20 September

3. Collect age, sex, and length data from adult Chinook, chum, coho, and sockeye salmon using weir traps operated in 6 tributaries throughout the Kuskokwim River in 2013, such that total sample sizes are sufficient for estimating age composition.

METHODS

STUDY SITES

The Kuskokwim River is the second largest river in Alaska, draining an area approximately 130,000 km^2, or 11% of the total area of Alaska (Brown 1983). The 19 escapement monitoring projects in the Kuskokwim River basin that are covered in this report span this vast geographic area and the entire drainage (Figures 1 and 2).

The Eek River is the southernmost tributary of the Kuskokwim River. Originating on the northern side of Mount Oratia, which separates the headwaters of the Eek River from the Kanektok River, the river flows northwest for approximately 266 river kilometers (rkm) until joining Eek Channel before reaching the Kuskokwim River (at rkm 13; Dorsey 2011).

The Kwethluk River originates in the Kilbuck Mountains, one of the defining barriers separating Bristol Bay and Kuskokwim River drainages. The river flows northwest for approximately 261 rkm until entering Kuskokuak Slough (at rkm 6), which then flows into the Kuskokwim River (at rkm 131). Crooked Creek (also known as Canyon Creek) is a tributary in the upper reach of the drainage (Buzzell 2010b).

The Kisaralik River originates from Kisaralik Lake in the Kilbuck Mountains and flows northwest for approximately 187 rkm until reaching Kuskokuak Slough (at rkm 35; Buzzell 2010a), which then flows into the Kuskokwim River (at rkm 131).

The Tuluksak River also originates from the Kilbuck Mountains and flows west for 163 rkm until reaching the Kuskokwim River (at rkm 192; Buzzell 2010c).

The Aniak River originates from the Aniak Lake basin in the Kuskokwim Mountains and flows north for approximately 151 rkm until entering the Kuskokwim River (at rkm 307) near Aniak. The Salmon and Kipchuk rivers are tributaries of the Aniak River (Brown 1983).

The Salmon River, part of the Aniak River drainage, originates in the Kilbuck Mountains and flows north for approximately 71 rkm to its confluence with the Aniak River.

The Kipchuk River originates in the Kuskokwim Mountains, several miles northwest of Aniak Lake. The Kipchuk River flows north for approximately 106 rkm until reaching the Aniak River.

The Holokuk River flows northeast, approximately 72 rkm from its origins in the Buckstock Mountains. It joins the Kuskokwim River (at rkm 362) near Napaimute (Brown 1983).

The Oskawalik River originates from streams draining the Chuilnuk Mountains, which separate the Oskawalik River from the Holitna River basin. This river flows north-northwest for approximately 89 rkm until reaching the Kuskokwim River (at rkm 398; Brown 1983).

The George River originates in the northern Kuskokwim Mountains within the middle Kuskokwim River basin. The river flows south for approximately 120 rkm to its confluence with the Kuskokwim River (at rkm 446; Brown 1983).

The Holitna River watershed is one of the largest in the Kuskokwim basin, draining the Kuskokwim, Kiokluk, and Chuilnuk Mountains to the west, and the Shotgun and Nushagak Hills to the south. The Holitna River is formed from the confluence of the Chukowan and Kogrukluk rivers and flows north for approximately 218 rkm until reaching the Kuskokwim River (at rkm 491) near Sleetmute (Brown 1983; ADNR 1988). The Holitna drainage is a highly productive salmon system that supports a large number of spawning salmon compared to other Kuskokwim River tributaries of similar size (Molyneaux and Brannian 2006).

The Kogrukluk River forms in a low plateau that divides the Tikchik Lakes system and Nushagak River basin to the south from the Holitna River basin to the north. From its headwaters, the Kogrukluk River flows north for approximately 80 rkm to its confluence with the Chukowan River to form the Holitna River (Brown 1983).

The Telaquana River originates in the mountains above Telaquana Lake, located in Lake Clark National Preserve. The Telaquana River watershed is bounded by the Neacola Mountains to the east and a low plateau to the south, separating it from the Bristol Bay watershed. From its headwaters, the Telaquana River flows west for approximately 30 rkm before entering Telaquana Lake. From the mouth of the lake, the Telaquana River flows another 50 rkm to its confluence with the Stony River, which then goes on to join the Kuskokwim River (at rkm 536). Telaquana Lake is one of the major lakes present in the Kuskokwim River drainage that provide requisite habitat for lake-spawning sockeye salmon.

The Cheeneetnuk River originates in the foothills of the Alaska Range and flows southwest for approximately 113 rkm before reaching the Swift River (at rkm 27), which continues to flow northwest until joining the Kuskokwim River (at rkm 560; Brown 1983).

The Gagaryah River originates in the Lyman Hills and flows southwest for approximately 100 rkm before joining the Swift River (at rkm 61; Brown 1983).

The Tatlawiksuk River originates in the foothills of the Alaska Range, approximately 24 km by air to the northwest of the Cheeneetnuk River, and flows southwest for 113 rkm before joining the Kuskokwim River (at rkm 563; Brown 1983).

The Takotna River originates in the central Kuskokwim Mountains of the upper Kuskokwim River basin. The Takotna River is about 160 rkm in length (Brown 1983). Formed by the confluence of Moore Creek and Little Waldren Fork, the Takotna River flows northeast and passes the community of Takotna (at rkm 80), before turning southeast near the confluence of the Nixon Fork (at rkm 24), and empties into the Kuskokwim River (at rkm 752) across from McGrath.

The Salmon River, part of the Pitka Fork drainage, originates in a piedmont area and flows northwest for approximately 47 rkm until reaching the Pitka Fork. The river then joins the Middle Fork Kuskokwim River before reaching Big River, which finally flows into the Kuskokwim River (at rkm 827; Brown 1983).

In addition to 5 species of Pacific salmon, there were many other species commonly observed in the monitored tributaries whose presence and abundance varied throughout the drainage. Species other than salmon were enumerated opportunistically and the data were not used for abundance estimates. Other species observed passing through the weirs included Arctic grayling *Thymallus arcticus*, whitefishes *Coregonus* spp., Dolly Varden *Salvelinus malma*, northern pike *Esox lucius*, longnose suckers *Catostomus catostomus*, rainbow trout *O. mykiss*, and lake trout *S. namaycush*.

ESCAPEMENT MONITORING

Aerial Surveys

Aerial surveys focused on Chinook salmon were conducted on 13 tributaries in the Kuskokwim river drainage (Figure 2). Selected tributaries were segmented into several delineated stream reaches, known as index areas (Table 2). Index area start and stop points were designated by geographic coordinates and often coincided with recognizable landmarks. Maps were provided to the surveyor and aircraft pilot to more easily distinguish index areas. Maps were archived in the Arctic, Yukon, Kuskokwim (AYK) salmon database management system (ADF&G 2011). A selection of index areas were identified for each tributary based on consistency of historical success of each index area to develop an index objective for inter-annual comparison (Table 2).

Aerial surveys were conducted with fixed-winged aircraft at an altitude of 150 to 500 ft, dependent on both surveyor and pilot preference. Survey efforts occurred during the period of peak Chinook salmon spawning ground escapement, typically falling between 20 and 31 July. These dates are variable year-to-year and tributary-to-tributary given run timing, water level, and weather constraints; however, ground observations and historical aerial surveys have led managers to believe peak spawning ground escapement are captured during that time. Attempts to survey occurred during a window of a few days when the maximum number of fish was expected to be on the spawning grounds (Brazil et al. 2013). The actual date(s) observations occurred also depended on plane availability and weather conditions. Observers rated survey conditions as being good (rating = 1), fair (rating = 2), or poor (rating = 3) based on criteria related to survey method, weather and water conditions, time of survey, and spawning stage (Schneiderhan 1988).

Ideally, tributaries were to be surveyed 3 times throughout the season to ensure that peak escapement was observed. However, logistical constraints typically limited water bodies to be surveyed only once during the season. The survey that resulted in the highest peak spawning escapement estimate was used as the index. If only 1 survey was conducted on a tributary, it was assumed to be representative of peak spawning escapement.

During the flight the surveyor recorded counts of live and deceased Chinook salmon within each index area on a tally counter. Following observations of an index area, the surveyor recorded the count on survey sheet and zeroed the tally counter in preparation to count the next area. This continued until all of the index areas were surveyed. Survey counts were not adjusted or expanded in any way. Survey counts from each index area were summed to determine the Chinook salmon escapement index. While several index areas may exist and be flown for a tributary, only survey counts from index areas defined by the index objective were used in the final escapement estimate (Table 2). The escapement index was only used if survey conditions were rated good or fair for the entire tributary survey.

Ground Based Weir Projects: Weir Designs

For each project, a fixed picket or resistance board weir design was chosen based on channel and flow characteristics at the project site. A resistance board floating weir is designed to sink beneath flood waters, allowing debris to pass downstream with little obstruction. Resistance board weirs require optimal site conditions such as a nearly level bottom profile and low enough water levels during the installation period to allow crew, working in snorkel gear, to attach weir components to the stream bed. In the Kuskokwim Area, where seasonal flooding occurs, resistance board weirs are preferred; however, not all rivers have conditions that allow for the installation and operation of resistance board weirs. In such cases, fixed picket weirs were employed. Fixed picket weirs have a rigid structure that requires disassembly for debris to pass freely downstream. These weirs are more prone to damage or "washing out" during flood conditions. However, fixed picket weirs can be installed at higher flows and in more variable channel conditions. All weirs utilized a live fish trap design that was capable of freely passing fish or trapping fish to collect data. The live fish trap design was the same at all projects and details can be found in Linderman (2002).

Resistance Board Weir Design

Details of design and materials used to construct the resistance board weirs are described in Tobin (1994) with panel modifications described by Stewart (2002). The weirs were installed across the entire channel following the techniques described by Stewart (2003). The substrate rail and resistance board panels covered the middle 90% of each channel, and fixed weir materials extended the weirs to each bank. Floating and fixed weir lengths were adjusted inseason based upon minor changes in the width and depth of the river. A skiff gate and a downstream passage chute were installed following techniques described in Linderman (2002).

During weir fabrication there were slight modifications in picket spacing of the weir extensions near shore. The Takotna River weir was designed with a weir picket spacing gap of 4.29 cm between each picket, while the Tatlawiksuk and George river weirs had gaps of 3.33 cm between each picket. Both gap designs prevented most adult Pacific salmon from passing through the weirs undetected; however, pink salmon were observed occasionally passing between pickets.

Fixed Picket Weir Design

All fixed picket weirs shared the common trait of being a rigid upright design but varied in their construction and implementation. The basic design and materials used to construct these weirs, depending on the site, included a series of stringers, pickets or panels, and tripods or bipods (Molyneaux et al. 1997). Picket intervals were 6.35 cm, with a gap of 3.65 cm between each pair of pickets (Jasper and Molyneaux 2007). Tripods varied in construction material and were either built from wooden post or schedule 40 steel pipe, fastened together with nuts, bolts, and washers.

Ground Based Weirs: Locations and Operations

Weir projects on the 6 tributaries in the Kuskokwim River drainage (Figure 1) had a target operational period based on historical run timing information. These periods were intended to cover the entire run of the target species (Table 3). The operational plan for each monitoring project specified the weir would be installed and "fish tight" prior to the arrival of salmon migration. However, actual operation dates varied with stream and weather conditions.

Salmon River Weir

The target operational period for the Salmon River weir was set at 15 June through 20 September and focused monitoring on Chinook, chum, coho, and sockeye salmon; however, in 2013 observations of fish passage occurred from 15 June through 15 September (Table 3). The Salmon

River weir was located at lat 61°03'46″N, long 159°11'40″W. The weir was installed approximately 1 km upstream the Salmon River from its confluence with the Aniak River. The average depth at the weir site was 1.25 m. The weir was a fixed picket design that spanned a 35 m channel and incorporated a fish trap and narrow boardwalk. The Salmon River weir design followed the methods of Molyneaux et al. (1997), with modified weir panels that were 203.2 cm in total length. Panels had 15, 1.27 cm nominal schedule 40 aluminum pipes welded into place on 3 pieces of hole-punched aluminum T-bar with a 3.5 cm gap between each pipe, resulting in a total panel width of 84.45 cm. The Salmon River weir was first operated from 2006 to 2009 and was reinitiated in 2012. Daily operations were conducted by 1 ADF&G employee and 1 Kuskokwim Native Association (KNA) employee.

George River Weir

The target operational period for the George River weir was 15 June through 20 September and focused monitoring on Chinook, chum, and coho salmon; however, in 2013 observations of fish passage occurred from 18 June through 19 September (Table 3). The George River weir was a resistance board weir located at lat 61°55'24″N, long 157°41'53″W, approximately 7 rkm upstream of its confluence with the Kuskokwim River. At the weir site, the river channel was about 110 m wide and had a depth of about 1 m during normal summer flow. Due to its proximity to the mouth, the weir accounts for nearly all salmon migrating upstream to spawning habitat within the drainage. The George River weir has been in operation since 1996 through the joint effort of ADF&G and KNA and has served as an index site for the middle Kuskokwim River since operations began (Molyneaux and Brannian 2006). Daily operations were conducted by 1 ADF&G employee and 1 KNA employee.

Kogrukluk River Weir

The target operational period for the Kogrukluk River weir was established as 26 June through 25 September and focused monitoring on Chinook, chum, coho, and sockeye salmon. However, in 2013 fish passage observation began 29 June and ended 10 September (Table 3). The Kogrukluk River weir was located at lat 60°50'28″N, long 157°50'44″W; it has been operated annually since 1976 to monitor Chinook, chum, and sockeye salmon escapements. The weir was a fixed-picket design, spanned a 70 m channel averaging a depth of 1.25 m, and incorporated a fish trap and narrow boardwalk. Details of design and materials used to construct the Kogrukluk River weir are described in Baxter (1981) and tighter picket spacing as described in Jasper (2007). Beginning in 1981, the weir operations were extended to include coho salmon (Baxter 1982). The Kogrukluk River provides an index of salmon spawning populations for the Holitna River drainage. Daily operations were conducted by 2 ADF&G employees.

Telaquana River Weir

While all 5 salmon species have been observed at the weir site, only sockeye salmon returns to the system in considerable numbers; therefore, the Telaquana River weir was operated to encompass only the period of the sockeye salmon run. No predetermined target operational period existed for the project. In 2013, Telaquana River weir was operated from 3 July through 6 August with monitoring focused on sockeye salmon (Table 3). The Telaquana River weir was located at lat 60°57'39″N, long 154°02'40″W and has been operated cooperatively by ADF&G and NPS since 2010. The weir was located approximately 1 km downstream of the Telaquana Lake outlet. Aerial surveys and rafting reconnaissance have indicated that there are no spawning populations of sockeye salmon in the Telaquana River downstream of the weir site. The weir was a fixed-picket design that spanned a 70 m channel and incorporated a fish trap and narrow boardwalk. The average channel depth was approximately 1.2 m with a maximum depth of 2.1 m. The weir had modified tripods, panels and stringers. Stringer pipes were 6.35 cm diameter and each panel used 16 pipes with a 1 inch gap between adjacent pipes; panel width was 75.57 cm. In addition, panels were fabricated in varying lengths (152.4 cm, 203.2 cm and 228.6 cm), where the longer panels were placed in the deepest section of the river. Daily operations were conducted by 1 ADF&G employee and 1 NPS employee.

Tatlawiksuk River Weir

The target operational period for the Tatlawiksuk River weir was 15 June through 20 September and focused monitoring on Chinook, chum, and coho salmon; however, in 2013 observations of fish passage began on 20 June and ended 19 September (Table 3). The Tatlawiksuk River weir was a resistance board weir located at lat 61°56'03″N, long 156°11'33″W; approximately 4.5 rkm upstream from its confluence with the Kuskokwim River. At the weir site, the river measured 64 m wide and 1 m deep during normal summer operations. The weir has been operated annually since 1998 through the joint effort of ADF&G and KNA. Daily operations were conducted by 1 ADF&G employee and 1 KNA employee.

Takotna River Weir

The target operational period for the Takotna River weir was 24 June through 20 September and focused monitoring on Chinook, chum, and coho salmon; however, in 2013 observations ended on 2 September (Table 3). The weir has been installed annually since 2000 at lat 62°58'06″N, long 156°05'54″W, several hundred meters upstream of the Takotna River Bridge near the community of Takotna. The river channel at this site was about 85 m wide and less than 1 m deep during normal summer flow. This site allows for enumeration of spawning salmon in the Takotna River drainage, excluding those in the Nixon Fork tributary. Daily operations were conducted by 1 ADF&G employee and TCA technicians and interns.

Ground Based Weirs: Data Collection and Analysis

Escapement Counts

Escapement counts at all weirs were conducted in shifts of approximately 1 hour long, 4 to 8 times per day, between 0700 and 2400. This schedule was adjusted as needed to accommodate variation in fish behavior and abundance or operational constraints, such as reduced visibility in evening hours late in the season. The live trap was used as the primary means of upstream fish passage. A clear plastic viewing window was placed on the stream surface to improve visual identification of fish entering the trap. Fish were only allowed to pass freely through the weir when an observer was present and opened the passage gate. Delays in fish passage occurred only at night or during ASL sampling. Crew members visually identified all species of fish observed passing upstream of the weir and recorded them on a tally counter. At all project locations, any Pacific salmon that passed through the passage gate were documented.

The weir was inspected daily for holes and cleaned of carcasses and debris. If holes were found, a note was made that there was a potential for missed fish passage. Following each shift, crew members recorded total counts in a logbook and zeroed the tally counter. At the end of each day, total daily and cumulative seasonal counts were recorded in a designated logbook. These counts were reported each morning to ADF&G staff in Bethel.

Missed Escapement Estimates

A variety inoperable periods occurred in which fish could not be counted through the weir, caused by 1) water levels preventing installation, requiring partial disassembly, or prompting removal of the weir; 2) water levels exceeding the top of the weir; 3) holes created from scouring, debris, or wildlife; 4) maintenance requiring partial disassembly of the weir; or 5) the counting gate being left open unattended. Duration of inoperable periods varied from a part of a single day to several days. For partial days of operational impairment, we evaluated each occurrence based on the nature of the problem. For example, if a small hole was found and corrected within a day, and the remainder of that day's escapement count seemed to be a reasonable estimate of minimum escapement for the day, no correction was made for missed escapement. A partial day's count was considered a reasonable estimate of minimum escapement if it fell within the range of daily escapement before and after the partial day or within the range of observed daily variation over a longer period. Also, partial day escapement counts were evaluated based on historical observations of daily escapement occurring during the same period at that project. If the partial day's escapement was outside of these ranges, escapement for that day was estimated as described below. With the exception of uncorrected partial day counts, missing fish counts during all inoperable periods within the target operational period were estimated. However, if more than 40% of the entire run was missed, based on historical run timing, estimates were not created and total annual escapement counts were considered incomplete.

Missed escapement was estimated using a hierarchical Bayesian estimation technique (Adkison and Su 2001). All historical run timing was fitted to a log-normal distribution in which each year's parameters were assumed to come from a common distribution (i.e., hierarchical parameters). Further, it was assumed that distribution of daily run timing follows a log-normal distribution (i.e., log plus 1 transformed count, or ln(daily count +1) was normally distributed).

Let y_{it} be the log plus 1 transformed count of i^{th} year and t^{th} day (y_{it} = ln(daily weir passage +1)); and assume that y_{it} is a random variable from a normal distribution of mean θ_{it} and standard deviation of t-th day, σ_t . Then:

$$y_{it} \sim N(\theta_{it}, \sigma_t^2) \qquad \text{and,} \qquad \theta_{it} = a_i\left(\frac{(\ln(t) - \ln(\mu_i))^2}{b_i^2}\right)$$

where

$\sigma_t^2 > 0$, variance of daily passage of the t^{th} day;

$a_i > 0$, the maximum daily passage of the i^{th} year;

$t \geq 1$, passage date;

$\mu_i > 0$, mean passage date of the i^{th} year; and

$b_i^2 > 0$, variance of run timing of the i^{th} year.

The starting passage date and number and range of years with data varied between projects (Table 4). At upper hierarchical level, annual maximum daily passage (a_i), mean passage date (μ_i), and spread (b_i) were assumed to be a random sample from a normal distribution:

$$a_i \sim N(a_0, \sigma_a^2); \qquad \mu_i \sim N(\mu_0, \sigma_\mu^2); \qquad b_i \sim N(b_0, \sigma_b^2).$$

Prior distributions of the hyper-parameters for a_i, μ_i, and b_i were assumed to be non-informative as:

$$a_0 \sim N(5,100)\ (a_0 > 0); \qquad \mu_0 \sim N(25,100)\ (\mu_0 > 0); \qquad b_0 \sim N(0.5,100)\ (b_0 > 0);$$

$$\sigma_a \sim \text{uniform}(0.1, 10); \qquad \sigma_b \sim \text{uniform}(0.1, 2);$$

$$\sigma_\mu \sim \text{uniform}(0.1, 10); \qquad \sigma_t \sim \text{uniform}(0.1, 10).$$

Markov-chain Monte Carlo methods (WinBUGS v1.4; Spiegelhalter et al. 1999) were used to generate the joint posterior probability distribution of all unknowns in the model. Simulations were generated over 10,000 iterations with the first 5,000 iterations discarded (burn-in period), and samples were taken every 2 iterations. This resulted in 2,500 samples, and the median sample value was used to represent the point estimate of daily missed passage. From those, Bayesian credible intervals (95%) were obtained from the percentiles (2.5 and 97.5) of the marginal posterior distribution (but not reported here). Available historical data limited estimation of missed passage to the dates of each project's target operational period.

Estimates reported represent the total daily estimate. On days with missed escapement, the estimated daily escapement was always reported except when it was less than the observed escapement on partial days of operation. In these scenarios, the estimate was disregarded and observed escapement was considered the minimum escapement estimate. The sum of daily escapement counts and missed escapement estimates that occurred within the target operational period was considered the final estimated annual escapement (Tables 5–8).

Weather and Stream Measurements

Water and air temperatures (°C) were manually measured each day at approximately 0730 and 1700 hours using handheld thermometers. In addition, notations about wind direction, estimated wind speed, cloud cover, and precipitation were recorded. Daily precipitation was measured (mm) using a rain gauge and water levels were measured using staff gauges installed approximately 150 meters from the weirs. The staff gauge was calibrated to a reliable benchmark using a sight or line level. Calibration of the staff gauge was checked periodically to ensure accuracy. As part of the Office of Subsistence Management (OSM) Temperature Monitoring project 08-701, conducted by the Aquatic Restoration and Research Institute[1] (ARRI), Hobo® air and water temperature data loggers were installed at select weirs. Data loggers remained installed at the weir site year-round but were replaced at the beginning of field season and downloaded at the end of field season, ensuring that temperatures were continually monitored. Additional details and results can be found at http://alaska.fws.gov/asm/fisreportdetail.cfm?fisrep=27.

Age, Sex, and Length Sampling

A minimum sample size was determined for each species to achieve 95% confidence intervals of age-sex composition for each estimate no wider than ±10% ($\alpha = 0.05$ and $d = 0.10$; Bromaghin

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

1993). Sample size goals (*n*) were estimated based on 10 age-sex categories for Chinook salmon (*n* = 190), 10 age-sex categories for sockeye salmon (*n* = 190), 8 age-sex categories for chum salmon (*n* = 180), and 6 age-sex categories for coho salmon (*n* = 168). Sample size goals were then increased by 20% to account for unreadable scales or collection errors. This yielded a minimum collection goal for each sample of 230 Chinook, 230 sockeye, 220 chum, and 200 coho salmon.

At projects where the abundance of chum and coho salmon was generally high enough to collect a large sample size in a short period of time, a pulse sampling strategy was employed to ensure adequate temporal distribution. The goal was to collect samples from each major portion of the run (i.e., early, middle, and late). Well-spaced pulse samples are thought to better represent temporal changes in ASL composition than other sampling methods (Geiger and Wilbur 1990). Pulse samples were attempted approximately every 7 to 10 days, and the number of pulses varied by location and species (Table 9). The goal was to collect a sample from each third of the run for coho salmon and from each fifth of the run for chum salmon, due to their typically larger run and longer duration.

The relatively low abundance and inconsistent passage tendencies of Chinook and sockeye salmon at the majority of Kuskokwim River projects made pulse sampling impractical. Instead, samples were collected continuously over the run following a daily collection schedule based on historical run timing information. Daily sample sizes were determined by dividing the season goal in proportion to historical average daily escapements to ensure even distribution across the run.

Salmon were captured for sampling by opening the entrance gate of the live fish trap while the exit gate remained closed for a predetermined amount of time. Conversely, during periods of high fish passage, samplers attempted to capture fish to sample while actively passing and counting all other salmon. This method was often used when sampling Chinook salmon during periods of low Chinook salmon passage or high passage of other species (Linderman et al. 2002). An additional method of capturing fish to sample included waiting at a closed trap until a salmon approached the trap gate. The sampler allowed the salmon into the trap and shut the entry gate after the fish entered. The sampler continued to load the trap in this fashion with the target species, while allowing minimal numbers of other species to enter, thus making sampling time more effective and reducing stress caused by holding and handling time.

Following capture in the live fish trap, crew members used a dip net to capture fish within the trap. To obtain length data and aid in scale collection, fish were removed from the dip net and placed into a partially submerged fish “cradle”. Scales were taken from the preferred area of the fish (INPFC 1963) and transferred to numbered gum cards. Sex was determined through visual examination of the external morphology, focusing on the prominence of a kype, roundness of the belly, and the presence or absence of an ovipositor. Length from mideye to tail fork was measured to the nearest millimeter using a straight-edged meter stick. Sex and length data were recorded on standardized numbered data sheets that corresponded 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 trap was emptied, to ensure no bias was introduced.

After sampling was completed, all ASL data and metadata were copied to Microsoft Excel spreadsheets that corresponded to numbered gum cards. Completed Excel spreadsheets were sent in digital format to the Bethel ADF&G office for processing. The original ASL gum cards, acetates, and paper forms were archived at the ADF&G office in Anchorage. Data were also loaded into the AYK salmon database management system (Brannian et al. 2006b; ADF&G 2011).

RESULTS

AERIAL SURVEYS

Survey Flights

Aerial surveys were flown for all selected tributaries in 2013. All flights occurred during late July with survey conditions rated good except Eek River, which was rated fair (Table 10). With the exception of the Gagaryah, Salmon (Pitka Fork), Cheeneetnuk, and Kwethluk rivers, all survey streams were only flown once. Surveys were conducted for the Gagaryah and Salmon (Pitka Fork) rivers on 21 July and the Cheeneetnuk River on 22 July. Few redds and spawning pairs were observed on those dates, indicating that surveys occurred prior to the peak spawning time. These rivers were resurveyed on 27 July to better observe peak spawning time, resulting in higher estimates that were used as the indices.

Counts from the Kwethluk River fixed wing survey on 27 July were questioned due to a substantial discrepancy with the Kwethluk River weir estimate (T. Elison, Commercial Fisheries Biologist, ADF&G, Anchorage; personal communication). The aerial counts were confirmed by a second survey on 31 July, using a helicopter. Therefore the 27 July fixed wing survey results were considered accurate and accepted as the index estimate (Table 10).

Escapement Indices

Chinook salmon escapement indices were estimated for all tributaries (Table 10). Chinook salmon indices on the Kisaralik and Salmon (Pitka Fork) rivers fell within their established escapement goal bounds. Chinook salmon indices for the Aniak, Salmon (Aniak), Holitna, Gagaryah, and Cheeneetnuk rivers did not meet established escapement goals.

GROUND BASED ESCAPEMENT MONITORING

Weir Operations

Salmon River Weir

The Salmon River weir was operated from 15 June through 15 September in 2013. During this period, the weir was inoperable for 1 day due to installation of the boat gate and for 2 days due to holes in the weir (Tables 5–8). Inclement weather conditions prompted early removal of the weir 5 days before the end of the target operational period.

Weather and stream observations were recorded between 15 June and 16 September (Appendix A1). Water temperature at the weir averaged 9.6°C (range 2°C to 15°C), air temperature averaged 13.1°C (range 3°C to 29°C), and river stage averaged 55 cm (range 51 cm to 70 cm; Figure 3). A total of 140 mm of precipitation was recorded throughout the season.

George River Weir

The George River weir was operated from 18 June through 19 September in 2013. During this period, the weir was inoperable for 19 days due to high water (Tables 5–8). High river stage delayed the installation and caused early removal of the weir.

Weather and stream observations were recorded between 13 June and 20 September (Appendix A2). Water temperature at the weir averaged 10.8°C (range 3°C to 19°C), air temperature averaged 13.0°C (range -6°C to 36°C), and river stage averaged 57 cm (range 33 cm to 103 cm; Figure 4). A total of 197 mm of precipitation was recorded throughout the season.

Kogrukluk River Weir

The Kogrukluk River weir was operated from 29 June through 10 September in 2013. During this period, the weir was inoperable for 20 days due to high water and for 1 day due to repairs (Tables 5–8). High water delayed the installation and caused early removal of the weir.

Weather and stream observations were recorded between 25 June and 20 September (Appendix A3). Water temperature at the weir averaged 9.7°C (range 4.5°C to 17°C), air temperature averaged 13.8°C (range -4°C to 32°C), and river stage averaged 296 cm (range 256 cm to 363 cm; Figure 5). A total of 268 mm of precipitation was recorded throughout the season.

Telaquana River Weir

The Telaquana River weir was operated 3 July through 6 August in 2013. During this period, the weir was inoperable for 2 days due to holes in the weir (Tables 5–8).

Weather and stream observations were recorded between 5 July and 7 August (Appendix A4). Water temperature at the weir averaged 14.3°C (range 9°C to 21°C), air temperature averaged 16.5°C (range 8°C to 26°C), and river stage averaged 66 cm (range 48 cm to 77 cm; Figure 6). A total of 26 mm of precipitation was recorded throughout the season.

Tatlawiksuk River Weir

The Tatlawiksuk River weir was operated from 20 June through 19 September in 2013. During this period, the weir was inoperable for 13 days due to high water and for 1 day due to a hole in the weir (Tables 5–8). High water delayed the installation and prompted early removal of the weir.

Weather and stream observations were recorded between 15 June and 20 September (Appendix A5). Water temperature at the weir averaged 10.2°C (range 1°C to 18°C), air temperature averaged 13.3°C (range -3°C to 32°C), and river stage averaged 58 cm (range 30 cm to 140+ cm; Figure 7). Several times throughout the season the river stage exceeded the staff gauge, providing only a minimum river stage reading for that observation. A total of 269 mm of precipitation was recorded throughout the season.

Takotna River Weir

The Takotna River weir was operated from 24 June through 2 September in 2013. During this period, the weir was inoperable for 1 day due to a hole in the weir. High water made the weir inoperable for 18 days before the end of the target operational period (Tables 5–8).

Weather and stream observations were recorded between 23 June and 22 September (Appendix A6). Water temperature at the weir averaged 11.6°C (range 1°C to 21.6°C), air temperature averaged 13.2°C (range -7°C to 31.2°C), and river stage averaged 75 cm (range 58 cm to 109 cm; Figure 8). On 3 September, the staff gauge used to take river stage readings washed out; therefore, the river stage average and range reflects data observed between 23 June and 2 September. A total of 226 mm of precipitation was recorded throughout the season.

Escapement Monitoring

Chinook Salmon

Annual escapements were successfully estimated for Chinook salmon at the Salmon (598 fish), George (1,219 fish; 95% CI: 1,173–1,276), Kogrukluk (1,772 fish; 95% CI: 1,707–1,864), Tatlawiksuk (495 fish), and Takotna (94 fish) river weirs (Table 5). Missed escapement estimates of 98 fish at the George River (8.0% of escapement) and 106 fish at the Kogrukluk River (6.0% of escapement) were included in the total estimates. No estimates of missed Chinook salmon escapement passing the Salmon, Tatlawiksuk, and Takotna river weirs during inoperable periods were included, and the observed escapements are assumed to be without error. At the Telaquana River weir, 17 Chinook salmon were observed; estimates were not created for any missed escapement (Table 5). Since Chinook salmon are not the focus at Telaquana River weir, the escapement data collected are considered ancillary and not an estimate of annual escapement at the project. The Chinook salmon escapement goals on the George River (1,800–3,300 fish) and on the Kogrukluk River (4,800–8,800 fish) were not met.

Chum Salmon

Annual escapements were successfully estimated for chum salmon at the Salmon (7,666 fish; 95% CI: 7,628–7,703), George (36,874 fish; 95% CI: 36,750–36,986), Kogrukluk (66,834 fish; 95% CI: 66,630–67,056), Tatlawiksuk (32,227 fish; 95% CI: 32,265–32,293), and Takotna (6,412 fish; 95% CI: 6,409–6,426) river weirs (Table 6). Missed escapement estimates of 262 fish at the Salmon River (3.4% of escapement), 1,347 fish at the George River (3.7% of escapement), 2,073 fish at the Kogrukluk River (3.1% of escapement), 29 fish at the Tatlawiksuk River (0.1% of escapement), and 16 fish at the Takotna River (0.2% of escapement) were included in the total estimates. A total of 83 chum salmon were observed passing the Telaquana River weir; estimates were not created for any missed escapement (Table 6). Since chum salmon are not the focus at Telaquana River weir, the escapement data collected are considered ancillary and not an estimate of annual escapement at the project. The upper bound of the Kogrukluk River chum salmon escapement goal (15,000–49,000 fish) was exceeded.

Coho Salmon

Annual escapements were successfully estimated for coho salmon at the Salmon (2,869 fish; 95% CI: 2,801–2,965), George (13,894 fish; 95% CI: 13,015–14,811), Kogrukluk (23,590 fish; 95% CI: 22,824–24,554), Tatlawiksuk (13,076 fish; 95% CI: 12,339–13,974), and Takotna (4,149 fish; 95% CI: 3,393–5,367) river weirs (Table 7). Missed escapement estimates of 127 fish at the Salmon River (4.4% of escapement), 3,328 fish at the George River (24% of escapement), 3,843 fish at the Kogrukluk River (16.3% of escapement), 3,675 fish at the Tatlawiksuk River (28.2% of escapement), and 1,119 fish at the Takotna River (27% of escapement) were included in the total estimates. No coho salmon were observed passing the Telaquana River weir, and no estimates were created for any missed escapement (Table 7). Since coho salmon are not the focus at Telaquana River weir, the escapement data collected are considered ancillary and not an estimate of annual escapement at the project. The lower bound of the Kogrukluk River coho salmon escapement goal (13,000–28,000 fish) was met.

Sockeye Salmon

Annual escapements were successfully estimated for sockeye salmon at the Salmon (966 fish), Kogrukluk (7,882 fish; 95% CI: 7,710–8,174), and Telaquana (27,806 fish) river weirs (Table 8).

Missed escapement estimates of 314 fish at the Kogrukluk River weir (4% of escapement) were included in the total estimate for Kogrukluk. No missed escapement was estimated to have passed the Salmon River weir during inoperable periods. No missed escapement estimates were created for the Telaquana River weir. The observed escapements at the Salmon and Telaquana river weirs are assumed to be without error. Sockeye salmon were observed at the George (150 fish) and Tatlawiksuk (37 fish) river weirs. No sockeye salmon were observed at Takotna River weir. Estimates were not created for any missed escapement at the George, Tatlawiksuk, or Takotna river weirs since sockeye salmon were not the focus at these projects. The Kogrukluk River sockeye salmon escapement goal (4,400–17,000 fish) was achieved.

Non-target Species

In 2013, pink salmon were observed at all projects with the exception of the Telaquana and Takotna river weirs (Appendices B1–B6). In addition, longnose suckers were observed at all projects with the exception of the Kogrukluk River weir. Arctic grayling, Dolly Varden, whitefish, and northern pike were observed at multiple projects, while the Telaquana River weir was the only project to observe lake trout and the Salmon River weir the only project to observe rainbow trout (Appendices B1–B6).

Age, Sex, and Length Collection

Chinook Salmon

Age, sex, and length samples were collected from Chinook salmon through daily sampling at the Salmon (104 fish), George (111 fish), Kogrukluk (136 fish), Tatlawiksuk (143 fish), and Takotna (24 fish) river weirs (Table 9). Age, sex, and length data were not collected for Chinook salmon at the Telaquana River weir. Samples were collected 10 July–2 August at the Salmon River weir, 27 June–28 August at the George River weir, 6 July–26 July at the Kogrukluk River weir, 2 July–28 July at the Tatlawiksuk River weir, and 1 July–28 July at the Takotna River weir. The Chinook salmon sample size goal was not achieved at any project.

Chum Salmon

Age, sex, and length samples were collected from chum salmon through pulse sampling at the Salmon (1,019 fish), George (813 fish), Kogrukluk (1,008 fish), Tatlawiksuk (923 fish), and Takotna (1,136 fish) river weirs (Table 9). Age, sex, and length data were not collected for chum salmon at Telaquana River weir.

At the Salmon River weir, samples were collected in 5 pulses: 7–12 July (236 fish), 17–18 July (181 fish), 22–24 July (196 fish), 28–31 July (230 fish), and 3–11 August (176 fish). Although the target number of pulses was attempted, only 2 of the pulses completed met the sample size goal.

At the George River weir, samples were collected in 5 pulses: 29 June–1 July (63 fish), 4–6 July (81 fish), 12–14 July (220 fish), and 20–23 July (226 fish), and 28 July–2 August (223 fish). The target number of pulses was attempted; however, sample size goals were only achieved for 3 of the pulses.

At the Kogrukluk River weir, samples were collected in 5 pulses: 6–10 July (150 fish), 13–15 July (290 fish), 17–18 July (220 fish), and 21–23 July (220 fish), and 31 July–4 August (128 fish). The target number of pulses was attempted, but sample size goals were only met for 3 pulses.

At the Tatlawiksuk River weir, samples were collected in 4 pulses: 2–4 July (229 fish), 8–10 July (238 fish), 14–88 July (218 fish), and 25–29 July (238 fish). The target number of pulses was not achieved; the sample size goal was met for 3 of the collected pulses.

At the Takotna River weir, samples were collected in 5 pulses: 3–6 July (235 fish), 9–11 July (226 fish), 15–17 July (223 fish), 21–23 July (223 fish), and 28–31 July (229 fish). The target number of pulses and the sample size goal were achieved.

Coho Salmon

Age, sex, and length samples were collected from coho salmon through pulse sampling at the Salmon (320 fish), George (317 fish), Kogrukluk (409 fish), Tatlawiksuk (402 fish), and Takotna (375 fish) river weirs (Table 9). Age, sex, and length data were not collected for coho salmon at Telaquana River weir.

At the Salmon River weir, samples were collected from 19 August through 12 September. Low coho salmon abundance inseason proved difficult for obtaining the large sample sizes required with a pulse sampling strategy. Alternatively, a daily sampling method was implemented inseason to reduce difficulty in meeting sample size goals. Regardless of these efforts, the sample size goal was not achieved for coho salmon.

At the George River weir, samples were collected in 2 pulses: 21–23 August (200 fish) and 31 August–2 September (117 fish). The target number of pulses was not completed. and the sample size goal was only met for 1 pulse.

At the Kogrukluk River weir, samples were collected in 2 pulses: 24–27 August (200 fish) and 4–6 September (209 fish). The target number of pulses was not achieved; however, sample size goals were met for the completed pulses.

At the Tatlawiksuk River weir, samples were collected in 2 pulses: 11–18 August (200 fish) and 30 August–1 September (202 fish). Although the target number of pulses was not completed, the sample size goals were met for the collected pulses.

At the Takotna River weir, samples were collected in 2 pulses: 18–24 August (193 fish) and 28 August–2 September (182 fish). The target number of pulses and sample size goals were not achieved.

Sockeye Salmon

Age, sex, and length samples were collected through daily sampling from the Salmon (193 fish), Kogrukluk (168 fish), and Telaquana (376 fish) river weirs (Table 9). Age, sex, and length data were not collected for sockeye salmon at the George, Tatlawiksuk, and Takotna River weirs. Samples were collected 26 July–19 August at the Salmon River weir, 7 July–26 July at the Kogrukluk River weir, and 9 July–30 July at the Telaquana River weir. The sockeye salmon sample size goal was not achieved at any project.

DISCUSSION

Weather and water conditions were ideal for flying aerial surveys in 2013, allowing for Chinook salmon indices to be estimated for all tributaries (Table 10). The last time all tributaries were successfully surveyed and Chinook salmon indices estimated was in 2004 (Table 11).

Ground-based weir operations in 2013 were also successful. Limited inoperable periods occurred during the Chinook, chum, and sockeye salmon runs; therefore, estimates of missed passage of those species was minimal at all projects. Although high river stage in August and September rendered all weir projects inoperable for some period of time, coho salmon annual escapements were still successfully estimated (Table 3).

The Salmon River weir operated in 2006–2009 as a tag recovery location. In 2012, this project was reinitiated with a focus on monitoring escapement of all observed salmon species, but it experienced operational difficulties that year, and 2013 saw the first successful season of operations for this project. Due to the limited lifespan of the project coupled with operational difficulties, no comparisons were made between the annual escapements and run timings of salmon at this project. Therefore, the discussion below excludes the Salmon River weir.

Chinook salmon escapement indices were below average for all aerial survey projects (Table 11). Indices were the lowest on record for the Eek, Tuluksak, Aniak, and Cheeneetnuk rivers; all other indices were within the historical ranges observed at the projects. The indices for the Kisaralik, Oskawalik, Gagaryah, and Salmon (Pitka Fork) rivers were lower than the previous year's. The Kipchuk, Salmon (Aniak), and Holokuk rivers indices were higher than the previous year. Chinook salmon escapement was the lowest on record at all weir projects (Table 12). Chinook salmon run timings were later than average but within the historical ranges observed (Figure 9).

Due to consecutive years of low Chinook salmon abundance in the Kuskokwim River, managers began the 2013 fishing season with subsistence fishing restrictions surrounding certain tributaries to protect populations (Travis Elison, Commercial Fisheries Biologist, ADF&G, Anchorage; personal communication). Inseason indicators projected that Chinook salmon returns were likely to meet escapement requirements, but the uncertainty of the assessment warranted implementation of subsistence restrictions on the Kuskokwim River beginning in late June. Even with additional fishing restrictions, Chinook salmon escapements were low and escapement goals were only achieved at 2 out of 8 rivers.

Chum salmon escapement was above average at all projects except Tatlawiksuk River weir where it was below average (Table 13). The Kogrukluk River escapement exceeded the upper bound of the established escapement goal by over 15,000 fish. Overall chum salmon run timing appeared to be average to later than average but within the historical ranges observed (Figure 10).

No general pattern in coho salmon escapement was observed in 2013; escapements below, near, and above average were observed at the various projects. Nonetheless, all coho salmon escapements were within the historical ranges observed at each project (Table 14). The escapement goal was met at the Kogrukluk River weir. Coho salmon run timing was average for all projects (Figure 11).

Sockeye salmon escapement was below average at all projects; however, the escapement goal was met at the Kogrukluk River weir (Table 15). The Kogrukluk River sockeye salmon run appeared later than average but was within the historical range observed at the project; the Telaquana River sockeye salmon run was the earliest run timing observed at the project (Figure 12). The Salmon River weir has not successfully enumerated sockeye salmon escapements for more than 3 seasons, making it difficult to describe run timing at the project.

In 2013, the hierarchical Bayesian estimation technique was implemented for all periods when escapement counts were missing, which is an improvement over previous, more subjective methods. This method will be used in the future for calculating missed passage estimates at Kuskokwim River escapement monitoring projects. Because escapement estimates are further used to estimate Kuskokwim River total run and drainagewide escapement estimates, small uncertainties in tributary estimation can become magnified; therefore, a conservative and consistent approach to estimating missed escapement increases confidence in both annual weir escapements and drainagewide estimates.

Kuskokwim River monitoring projects provide salmon escapement data that biologists and managers use to evaluate run strength and species composition. This information is important when making management decisions, and in addition, these data are essential to ensure sustainability of Kuskokwim River salmon. We recommend continued monitoring at these escapement projects and, in addition, implementing an upriver monitoring project in the headwaters. Further recommendations include conducting multiple aerial surveys each year to better evaluate the times of peak Chinook salmon escapement on tributaries already monitored by aerial survey.

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TABLES AND FIGURES

Table 1.–Species monitored and their escapement goal range (if established) at Kuskokwim River escapement monitoring projects, 2013.

Tributary	Monitoring method	Species monitored and escapement goal range (if established)			
		Chinook	Chum	Coho	Sockeye
Eek River	aerial survey	Yes	–	–	–
Kwethluk River/Crooked Creek	aerial survey	yes	–	–	–
Kwethluk River	weir[a]	yes; 4,100–7,500	yes	yes; >19,000	yes
Kisaralik River	aerial survey	yes; 400–1,200	–	–	–
Tuluksak River	aerial survey	yes	–	–	–
Tuluksak River	weir[a]	yes	yes	yes	yes
Aniak River	aerial survey	yes; 1,200–2,300	–	–	–
Salmon River (Aniak)	aerial survey	yes; 330–1,200	–	–	–
Salmon River (Aniak)	weir	yes	yes	yes	yes
Kipchuk River	aerial survey	yes	–	–	–
Holokuk River	aerial survey	yes	–	–	–
Oskawalik River	aerial survey	yes	–	–	–
George River	weir	yes; 1,800–3,300	yes	yes	yes[b]
Holitna River	aerial survey	yes; 970–2,100	–	–	–
Kogrukluk River	weir	yes; 4,800–8,800	yes; 15,000–49,000	yes; 13,000–28,000	yes; 4,400–17,000
Telaquana River	weir	yes[b]	yes[b]	yes[b]	yes
Cheeneetnuk River	aerial survey	yes; 340–1,300	–	–	–
Gagaryah River	aerial survey	yes; 300–830	–	–	–
Tatlawiksuk River	weir	yes	yes	yes	yes[b]
Takotna River	weir	yes	yes	yes	yes[b]
Salmon River (Pitka Fork)	aerial survey	yes; 470–1,600	–	–	–
Kuskokwim River (entire drainage)	Run reconstruction[c]	yes; 65,000–120,000	–	–	–

Note: Dashes indicate species that were not monitored by the project.

[a] The weir on this tributary is operated by the U.S. Fish and Wildlife Service; results for the weir project are not reported in this document. However, ADF&G uses escapement data provided from this weir in Kuskokwim River management and research.

[b] Although the species is monitored at the project, the species is not focused upon due to zero to minimal annual escapement.

[c] Run reconstruction is conducted postseason and uses a model to estimate total return from harvest and escapement monitoring projects.

Table 2.–Index areas and objectives for aerial survey tributaries in the Kuskokwim River drainage, 2013.

Tributary	Index areas	Description/Landmark	Index objective
Eek R.	101 (60.12.47 N, 162.15.91 W)	Confluence w/ Eek Channel	101, 102, 103, 104
	102 (60.07.74 N, 161.34.72 W)	Confluence w/ Middle Fork to Southeast	
	103 (60.10.71 N, 160.40.53 W)	Bend in river after end of Great Ridge	
	104 (60.11.81 N, 160.24.25 W)	Confluence w/ small creek draining Eek Lake	
	STOP (59.59.21 N, 160.12.46 W)	Small fork adj. to old Airstrip (Rainy Cr. upper reach)	
Kwethluk R./Crooked Cr.	101 (60.48.78 N, 161.27.08 W)	Confluence w/ Kuskokwim R.	102, 103, 104
	102 (60.32.27 N, 161.06.23 W)	Three Step Mountain	
	103 (60.17.76 N, 160.57.16 W)	Elbow Mountain	
	104 (60.15.12 N, 160.15.82 W)	Confluence w/ Crooked Cr.	
	STOP (60.17.92 N, 159.56.55 W)	Crooked Cr. confluence w/ Swift Cr.	
Kisaralik R.	101 (60.51.43 N, 161.14.31 W)	Confluence w/ Kuskokwim R.	102, 103
	102 (60.44.52 N, 160.22.75 W)	Confluence w/ Nukluk Cr.	
	103 (60.21.11 N, 159.56.63 W)	Upper falls	
	STOP (60.20.04 N, 159.24.40 W)	Outlet of Kisaralik Lake	
Tuluksak R.	101 (61.03.89 N, 160.40.37 W)	Confluence w/ Fog R. to SW	101
	102 (61.00.59 N, 159.55.49 W)	Confluence w/ Bear Cr. (NYAC Mining Camp)	
	STOP (61.04.35 N, 159.57.14 W)	Confluence w/ Nugget Cr.	
Aniak R.	101 (61.34.49 N, 159.29.35 W)	Confluence w/ Kuskokwim R.	102, 103
	102 (61.20.33 N, 159.13.57 W)	Confluence w/ Buckstock R.	
	103 (61.03.88 N, 159.10.93 W)	Confluence w/ Salmon R. (to West)	
	104 (60.37.44 N, 159.05.20 W)	Start of island adj. to Gemuk Mountain	
	STOP (60.29.28 N, 159.09.28 W)	Outlet of Aniak Lake	
Salmon R. (Aniak)	101 (61.03.88 N, 159.10.93 W)	Confluence w/ Aniak R.	101, 102, 103
	102 (60.57.55 N, 159.23.68 W)	Confluence w/ Dominion Cr.	
	103 (60.52.91 N, 159.31.15 W)	Confluence w/ Eagle Cr.	
	STOP (60.47.11 N, 159.32.85 W)	Confluence w/ Cripple Cr. adj. to landing strip	
Kipchuk R.	101 (61.02.66 N, 159.10.50 W)	Confluence w/ Aniak R.	101, 102, 103
	102 (60.46.67 N, 159.19.14 W)	Confluence w/ small cr. from South at beginning of Horseshoe Canyon	
	103 (60.43.44 N, 159.20.53 W)	Confluence w/ trib. from South at East bend in R.	
	STOP (60.30.83 N, 159.14.37 W)	Lake outlet at end of East Fork in upper reach	

-continued-

Table 2.–Page 2 of 2.

Tributary	Index areas	Description/Landmark	Index objective
Holokuk R.	101 (61.32.15 N, 158.35.35 W)	Confluence w/ Kuskokwim R.	101, 102
	102 (61.26.00 N, 158.27.07 W)	Between Ski Cr. and Gold Run Cr.	
	103 (61.21.93 N, 158.17.54 W)	Confluence w/ Chineekluk Cr.	
	104 (61.16.06 N, 158.16.86 W)	Island at confluence w/ Egozuk Cr.	
	STOP (61.12.89 N, 158.18.45 W)	Confluence w/ Boss Cr.	
	2ND STOP (61.08.62 N, 158.27.39 W)	Upper reach Tri Fork	
Oskawalik R.	101 (61.44.30 N, 158.11.30 W)	Confluence w/ Kuskokwim R.	101, 102, 103
	102 (61.41.40 N, 157.52.47 W)	Confluence w/ 1st large South tributary	
	103 (61.38.79 N, 157.42.71 W)	Confluence w/ 1st large North tributary	
	STOP (61.32.05 N, 157.40.43 W)	Fork adjacent to Henderson Mountain	
Holitna R.	101 (61.00.95 N, 157.41.37 W)	Nogamut	101, 102, 103, 104
	102 (60.58.24 N, 157.40.75 W)	1 mi. above Nogamut adj. to bluff	
	103 (60.57.52 N, 157.41.59 W)	Slough/confluence w/ Kiknik Cr.	
	104 (60.51.24 N, 157.50.22 W)	Kasheglok (downstream of Chukowan/Kogrukluk R. confluence)	
	STOP (60.50.32 N, 157.50.87 W)	Kogrukluk R. weir	
Cheeneetnuk R.	101 (61.48.62 N, 156.00.64 W)	Confluence w/ Swift R.	101, 102
	102 (61.51.57 N, 155.44.49 W)	Major South tributary below 1st major hills	
	STOP (61.57.28 N, 155.18.45 W)	Confluence w/ Shoeleather Cr.	
Gagaryah R.	101 (61.37.42 N, 155.38.61 W)	Confluence w/ Swift R.	101, 102
	102 (61.39.48 N, 155.21.07 W)	Head of island adj. to 1st hills	
	STOP (61.39.30 N, 155.03.41 W)	Major fork adj. to high hills	
Salmon R. (Pitka Fork)	101 (62.53.45 N, 154.34.86 W)	Salmon R. index area 101 start	101, 102, 103, 104
	102 (62.53.37 N, 154.30.49 W)	Salmon R. index area 102/104 start	
	102 STOP (62.55.02 N, 154.17.08 W)	Salmon R. index area 102 stop	
	103 (62.53.11 N, 154.28.93 W)	Salmon R. index area 103 start	
	103 STOP (62.51.62 N, 154.19.82 W)	Salmon R. index area 103 end	
	104 (62.52.03 N, 154.30.27 W)	Salmon R. index area 103 start	
	104 STOP (62.51.00 N, 154.19.28 W)	Salmon R. index area 104 end	

Note: Parenthesis following the index areas is the start point in latitude and longitude (decimal degrees). Index area stop points coincide with the following sequential index area start point unless otherwise distinguished. The last index area of a tributary stop point is designated with STOP. The index objective defines the specific index area(s) that must be to surveyed in order to estimate Chinook salmon abundance.

Table 3.–Target operational periods, actual operational periods, and annual escapements of Chinook, chum, coho, and sockeye salmon at Kuskokwim River weir projects, 2013.

Project	Target operational period	Actual operational period [a]	Annual escapement			
			Chinook	Chum	Coho	Sockeye
Salmon River weir	15 June–20 September	15 June–15 September	598	7,666	2,869	966
George River weir	15 June–20 September	18 June–19 September	1,219	36,874	13,894	150[b]
Kogrukluk River weir	26 June–25 September	29 June–10 September	1,772	66,834	23,590	7,882
Telaquana River weir	3 July–6 August[c]	3 July–6 August	17[b]	83[b]	0[b]	27,806
Tatlawiksuk River weir	15 June–20 September	20 June–19 September	495	32,277	13,076	37[b]
Takotna River weir	24 June–20 September	24 June–2 September	94	6,412	4,149	0[b]

[a] The "actual operational period" is the start and end date of project operations; it does not include any inoperable periods that may have occurred during that timeframe.

[b] Although the species is monitored at the project, the species is not considered focused upon due to 0 to minimal escapement.

[c] No predetermined target operational period exists for the project; instead, the actual operational period is considered the target operational period.

Table 4.–Starting passage dates and passage years used in the hierarchical Bayesian estimation technique for Chinook, chum, coho, and sockeye salmon at Kuskokwim River weir projects, 2013.

	Starting passage date	Weir passage years
Salmon River weir	15 June	2006–2009, 2012–2013
George River weir	15 June	1996–2013
Kogrukluk River weir	26 June	1976–2013[a]
Tatlawiksuk River weir	15 June	1998–2013
Takotna River weir	24 June	2000–2013

[a] Weir passage years are for Chinook, chum, and sockeye salmon only. Coho salmon passage years are 1981–2013.

Table 5.–Daily observed, estimated, and cumulative percent passage of Chinook salmon at Kuskokwim River weir projects, 2013.

Date	Salmon River			George River			Kogrukluk River			Telaquana River			Tatlawiksuk River			Takotna River		
	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%
6/15	0		0	[b]	0	0	[c]			[c]			[b]	0	0	[c]		
6/16	0		0	[b]	0	0	[c]			[c]			[b]	0	0	[c]		
6/17	0		0	[b]	0	0	[c]			[c]			[b]	0	0	[c]		
6/18	0		0	0[d]		0	[c]			[c]			[b]	0	0	[c]		
6/19	0		0	2		0	[c]			[c]			[b]	0	0	[c]		
6/20	0		0	2		0	[c]			[c]			0		0	[c]		
6/21	0		0	0		0	[c]			[c]			0		0	[c]		
6/22	0		0	0		0	[c]			[c]			0		0	[c]		
6/23	0		0	0		0	[c]			[c]			7		1	[c]		
6/24	0		0	0		0	[c]			[c]			10		3	0		0
6/25	0		0	13		1	[c]			[c]			10		5	0		0
6/26	0		0	10		2	[b]	0	0	[c]			5		6	0		0
6/27	0		0	6		3	[b]	0	0	[c]			0		6	0		0
6/28	0		0	7		3	[b]	0	0	[c]			3		7	2		2
6/29	0		0	23		5	0		0	[c]			4		8	0		2
6/30	0		0	4		5	0		0	[c]			0		8	0		2
7/1	2		0	3		6	1		0	[c]			0		8	1		3
7/2	0		0	10		7	1		0	[c]			0		8	0		3
7/3	0		0	2		7	0		0	0			0		8	0		3
7/4	6		1	2		7	6		0	0			10		10	0		3
7/5	6		2	10		8	15		1	0			5		11	0		3
7/6	1[d]		3	2		8	9		2	0[d]			8		13	0		3
7/7	20		6	97[d]		16	28[d]		3	0[d]			13		15	6		10
7/8	43		13	54[d]		20	[b]	35	5	0			8		17	1		11
7/9	16		16	3[e]	98	29	40[d]		8	0			8		18	0		11
7/10	19		19	62[d]		34	61		11	1			11		21	4		15
7/11	45		26	159[d]		47	96		16	0			21		25	1		16
7/12	25		31	150		59	111		23	0			56		36	11		28
7/13	20		34	53		63	70		27	2			16		39	4		32
7/14	12[d]		36	124		74	90		32	0			34		46	1[d]		33
7/15	7		37	16		75	44		34	1			86		64	0		33
7/16	4		38	25		77	60		38	0			19		67	0		33

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Table 5.–Page 2 of 4.

Date	Salmon River			George River			Kogrukluk River			Telaquana River			Tatlawiksuk River			Takotna River		
	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%
7/17	35		44	32		79	61		41	0			33		74	3		36
7/18	56		53	48		83	123		48	0			17		78	7		44
7/19	10		55	36		86	131		55	0			25		83	2		46
7/20	15		57	26		89	82		60	0			25		88	6		52
7/21	21		61	41		92	38		62	0			10		90	3		55
7/22	15		63	21		94	95		68	1			6		91	2		57
7/23	21		67	16		95	113		74	0			4		92	3		61
7/24	22		70	10		96	40		76	0			4		93	5		66
7/25	3		71	11		97	198		87	4			4		93	3		69
7/26	46		79	9		97	70		91	0			3		94	1		70
7/27	17		81	4		98	19		92	0			13		97	1		71
7/28	4		82	8		98	6		93	0			6		98	9		81
7/29	7		83	1		98	1		93	2			1		98	0		81
7/30	6		84	2		99	11		93	2			0		98	3		84
7/31	5		85	1		99	12		94	0			0		98	0		84
8/1	4		86	3		99	10		95	1			5		99	0		84
8/2	5		87	1		99	4		95	2			1		99	0		84
8/3	5		87	3		99	10		95	0			0		99	0		84
8/4	15		90	0		99	2 [d]		96	0			0		99	2		86
8/5	26		94	0		99	2		96	0			0		99	2		88
8/6	3		95	0		99	1 [d]		96	1			0		99	3		91
8/7	9 [d]		96	1		99	[b]	11	96	[c]			1		99	0		91
8/8	7		97	0		99	[b]	9	97	[c]			0		99	3		95
8/9	2		98	1		99	[b]	8	97	[c]			2		100	0		95
8/10	0		98	0		99	[b]	7	98	[c]			0		100	0		95
8/11	4		98	1		100	[b]	6	98	[c]			0		100	0		95
8/12	1		99	2		100	[b]	5	98	[c]			1		100	0		95
8/13	1		99	0		100	[b]	5	99	[c]			0		100	0		95
8/14	1		99	0		100	[b]	4	99	[c]			0		100	0		95
8/15	1		99	0		100	[b]	4	99	[c]			0		100	0		95
8/16	0		99	0		100	[b]	3	99	[c]			0		100	0		95
8/17	0		99	2		100	[b]	3	99	[c]			0		100	2		97

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Table 5.–Page 3 of 4.

Date	Salmon River			George River			Kogrukluk River			Telaquana River			Tatlawiksuk River			Takotna River		
	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%
8/18	1		99	0		100	[b]	2	99	[c]			0		100	0		97
8/19	0		99	0		100	[b]	2	100	[c]			0		100	1		98
8/20	0		99	0		100	[b]	2	100	[c]			0		100	0		98
8/21	0		99	1		100	0 [d]		100	[c]			0		100	0		98
8/22	0		99	0		100	2		100	[c]			0		100	0		98
8/23	0		99	1		100	0		100	[c]			[b]	0	100	0		98
8/24	1		99	0		100	1		100	[c]			[b]	0	100	0		98
8/25	0		99	0		100	1		100	[c]			[b]	0	100	1		99
8/26	0		99	0		100	0		100	[c]			[b]	0	100	0		99
8/27	0		99	0		100	1		100	[c]			0		100	1		100
8/28	0		99	0		100	0		100	[c]			0		100	0		100
8/29	1		100	0		100	0		100	[c]			0		100	0		100
8/30	0		100	0		100	0		100	[c]			0		100	0		100
8/31	0		100	0		100	0		100	[c]			0		100	0		100
9/1	0		100	0		100	0		100	[c]			0		100	0		100
9/2	0		100	0		100	0		100	[c]			0		100	0		100
9/3	0		100	0 [d]		100	0		100	[c]			[b]	0	100	[b]	0	100
9/4	0		100	0 [d]		100	0		100	[c]			[b]	0	100	[b]	0	100
9/5	0		100	0 [d]		100	0		100	[c]			[b]	0	100	[b]	0	100
9/6	0		100	0 [d]		100	0		100	[c]			[b]	0	100	[b]	0	100
9/7	0		100	[b]	0	100	0		100	[c]			[b]	0	100	[b]	0	100
9/8	0		100	[b]	0	100	0		100	[c]			[b]	0	100	[b]	0	100
9/9	0		100	[b]	0	100	0		100	[c]			[b]	0	100	[b]	0	100
9/10	0		100	[b]	0	100	0 [d]		100	[c]			[b]	0	100	[b]	0	100
9/11	1		100	[b]	0	100	[b]	0	100	[c]			0 [d]		100	[b]	0	100
9/12	1		100	[b]	0	100	[b]	0	100	[c]			0		100	[b]	0	100
9/13	0		100	[b]	0	100	[b]	0	100	[c]			0		100	[b]	0	100
9/14	0		100	[b]	0	100	[b]	0	100	[c]			0 [d]		100	[b]	0	100
9/15	0		100	[b]	0	100	[b]	0	100	[c]			0		100	[b]	0	100
9/16	[b]	0	100	[b]	0	100	[b]	0	100	[c]			0		100	[b]	0	100
9/17	[b]	0	100	0		100	[b]	0	100	[c]			0		100	[b]	0	100
9/18	[b]	0	100	0		100	[b]	0	100	[c]			0		100	[b]	0	100

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Table 5.–Page 4 of 4.

Date	Salmon River			George River			Kogrukluk River			Telaquana River			Tatlawiksuk River			Takotna River		
	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%
9/19	[b]	0	100	0		100	[b]	0	100	[c]			0		100	[b]	0	100
9/20	[b]	0	100	[b]	0	100	[b]	0	100	[c]			[b]	0	100	[b]	0	100
9/21	[c]			[c]			[b]	0	100	[c]			[c]			[c]		
9/22	[c]			[c]			[b]	0	100	[c]			[c]			[c]		
9/23	[c]			[c]			[b]	0	100	[c]			[c]			[c]		
9/24	[c]			[c]			[b]	0	100	[c]			[c]			[c]		
9/25	[c]			[c]			[b]	0	100	[c]			[c]			[c]		
Total	598	0		1,121	98		1,666	106		17	-		495	0		94	0	
Annual Esc.	598			1,219			1,772			17			495			94		

Note: Blank cells indicate no data.

[a] Estimate of daily missed passage. On days where a partial day count occurs (i.e. hole discovered midday), the observed passage ("Obs") has been subtracted from the total day estimate to produce the missed passage estimate displayed ("Est").

[b] The weir was not operational; missed passage was estimated using the Bayesian method.

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

[d] Partial day count; observed passage was considered the minimum passage estimate for the day.

[e] Partial day count; missed passage was estimated using the Bayesian method.

Table 6.–Daily observed, estimated, and cumulative percent passage of chum salmon at Kuskokwim River weir projects, 2013.

Date	Salmon River			George River			Kogrukluk River			Telaquana River			Tatlawiksuk River			Takotna River		
	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%
6/15	0		0	[b]	0	0	[c]			[c]			[b]	0	0	[c]		
6/16	0		0	[b]	0	0	[c]			[c]			[b]	0	0	[c]		
6/17	0		0	[b]	0	0	[c]			[c]			[b]	0	0	[c]		
6/18	0		0	0 [d]		0	[c]			[c]			[b]	0	0	[c]		
6/19	0		0	0		0	[c]			[c]			[b]	0	0	[c]		
6/20	0		0	3		0	[c]			[c]			1		0	[c]		
6/21	0		0	11		0	[c]			[c]			6		0	[c]		
6/22	0		0	13		0	[c]			[c]			6		0	[c]		
6/23	0		0	31		0	[c]			[c]			4		0	[c]		
6/24	0		0	30		0	[c]			[c]			18		0	0		0
6/25	0		0	103		1	[c]			[c]			23		0	4		0
6/26	2		0	202		1	[b]	0	0	[c]			47		0	4		0
6/27	1		0	124		1	[b]	0	0	[c]			144		1	13		0
6/28	0		0	154		2	[b]	0	0	[c]			62		1	25		1
6/29	0		0	429		3	3		0	[c]			283		2	10		1
6/30	0		0	116		3	23		0	[c]			122		2	36		1
7/1	2		0	130		4	95		0	[c]			165		3	33		2
7/2	0		0	330		5	71		0	[c]			269		4	89		3
7/3	4		0	75		5	74		0	0			322		5	24		4
7/4	25		0	445		6	154		1	0			544		6	47		4
7/5	82		2	843		8	326		1	1			802		9	127		6
7/6	45 [d]		2	755		10	755		2	0 [d]			856		11	148		9
7/7	113		4	789 [d]		12	578 [d]		3	0 [d]			563		13	206		12
7/8	171		6	1,339 [d]		16	[b]	159	3	0			567		15	270		16
7/9	197		8	185 [e]	1,337	20	1,094 [d]		5	1			617		17	245		20
7/10	333		13	886 [d]		23	2,166		8	0			696		19	275		24
7/11	334		17	1,696 [d]		27	2,481		12	1			1,311		23	190		27
7/12	309		21	1,455		31	2,989		16	0			1,676		28	216		31
7/13	444		27	2,419		38	2,767		21	0			1,759		34	222		34
7/14	79 [e]	260	31	2,576		45	2,102		24	2			1,779		39	227 [d]		38
7/15	192		34	1,885		50	1,939		27	0			1,183		43	226		41
7/16	109		35	863		52	2,480		30	1			1,642		48	210		44

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Table 6.–Page 2 of 4.

Date	Salmon River			George River			Kogrukluk River			Telaquana River			Tatlawiksuk River			Takotna River		
	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%
7/17	308		39	1,289		56	3,540		36	4			2,807		57	176		47
7/18	514		46	2,517		62	4,242		42	10			2,777		65	418		54
7/19	290		50	2,156		68	4,993		49	10			2,065		72	337		59
7/20	349		54	1,516		72	5,183		57	8			1,167		75	264		63
7/21	308		58	1,893		78	4,100		63	4			736		78	358		69
7/22	462		64	1,549		82	6,458		73	3			802		80	195		72
7/23	390		69	1,194		85	5,038		81	1			615		82	319		77
7/24	338		74	683		87	3,419		86	2			547		84	339		82
7/25	102		75	949		89	3,003		90	5			541		85	174		85
7/26	143		77	739		91	1,396		92	0			500		87	109		86
7/27	250		80	754		93	686		93	1			982		90	136		88
7/28	124		82	368		94	223		94	0			657		92	107		90
7/29	175		84	285		95	46		94	2			530		94	113		92
7/30	74		85	240		96	234		94	0			276		94	69		93
7/31	175		87	181		96	550		95	0			318		95	77		94
8/1	111		89	128		97	440		95	3			237		96	41		95
8/2	82		90	131		97	314		96	4			144		97	67		96
8/3	76		91	82		97	291		96	6			127		97	30		96
8/4	154		93	80		98	90 [d]		97	7			166		97	44		97
8/5	110		94	64		98	163		97	4			103		98	37		98
8/6	69		95	79		98	44 [d]		97	3			39		98	27		98
8/7	89 [d]		96	78		98	[b]	332	97	[c]			52		98	9		98
8/8	70		97	74		98	[b]	279	98	[c]			59		98	22		98
8/9	32		98	50		98	[b]	234	98	[c]			57		98	7		99
8/10	22		98	35		99	[b]	197	98	[c]			97		99	12		99
8/11	31		98	55		99	[b]	165	99	[c]			55		99	14		99
8/12	20		99	41		99	[b]	138	99	[c]			64		99	7		99
8/13	30		99	27		99	[b]	116	99	[c]			29		99	6		99
8/14	15		99	49		99	[b]	97	99	[c]			42		99	6		99
8/15	14		100	55		99	[b]	81	99	[c]			24		99	3		99
8/16	1		100	32		99	[b]	68	99	[c]			32		99	1		99
8/17	0		100	58		99	[b]	57	99	[c]			27		100	1		99

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Table 6.–Page 3 of 4.

Date	Salmon River			George River			Kogrukluk River			Telaquana River			Tatlawiksuk River			Takotna River		
	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%
8/18	6		100	38		100	[b]	48	100	[c]			37		100	4		99
8/19	5		100	8		100	[b]	40	100	[c]			20		100	1		99
8/20	7		100	12		100	[b]	33	100	[c]			17		100	3		100
8/21	5		100	15		100	1 [e]	27	100	[c]			18		100	9		100
8/22	2		100	25		100	36		100	[c]			3		100	2		100
8/23	1		100	10		100	47		100	[c]			[b]	7	100	1		100
8/24	3		100	14		100	25		100	[c]			[b]	6	100	1		100
8/25	1		100	13		100	18		100	[c]			[b]	5	100	0		100
8/26	0		100	12		100	20		100	[c]			[b]	5	100	1		100
8/27	0		100	7		100	12		100	[c]			2		100	2		100
8/28	1		100	4		100	10		100	[c]			4		100	0		100
8/29	0		100	9		100	3		100	[c]			0		100	0		100
8/30	0		100	5		100	6		100	[c]			1		100	0		100
8/31	0		100	10		100	5		100	[c]			2		100	0		100
9/1	1		100	5		100	7		100	[c]			2		100	0		100
9/2	0		100	11		100	3		100	[c]			1		100	0		100
9/3	0		100	4 [d]		100	2		100	[c]			[b]	1	100	[b]	2	100
9/4	0		100	4 [d]		100	4		100	[c]			[b]	1	100	[b]	2	100
9/5	0		100	2 [d]		100	6		100	[c]			[b]	1	100	[b]	2	100
9/6	0		100	1 [d]		100	1		100	[c]			[b]	1	100	[b]	1	100
9/7	0		100	[b]	2	100	1		100	[c]			[b]	1	100	[b]	1	100
9/8	1		100	[b]	1	100	2		100	[c]			[b]	1	100	[b]	1	100
9/9	1		100	[b]	1	100	2		100	[c]			[b]	0	100	[b]	1	100
9/10	0		100	[b]	1	100	0 [d]		100	[c]			[b]	0	100	[b]	1	100
9/11	0		100	[b]	1	100	[b]	1	100	[c]			0 [d]		100	[b]	1	100
9/12	0		100	[b]	1	100	[b]	1	100	[c]			0		100	[b]	1	100
9/13	0		100	[b]	1	100	[b]	0	100	[c]			0		100	[b]	1	100
9/14	0		100	[b]	1	100	[b]	0	100	[c]			0 [d]		100	[b]	1	100
9/15	0		100	[b]	1	100	[b]	0	100	[c]			0		100	[b]	1	100
9/16	[b]	1	100	[b]	0	100	[b]	0	100	[c]			0		100	[b]	0	100
9/17	[b]	1	100	0		100	[b]	0	100	[c]			0		100	[b]	0	100
9/18	[b]	0	100	0		100	[b]	0	100	[c]			0		100	[b]	0	100

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Table 6.–Page 4 of 4.

Date	Salmon River			George River			Kogrukluk River			Telaquana River			Tatlawiksuk River			Takotna River		
	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est[a]	%	Obs	Est [a]	%
9/19	[b]	0	100	0		100	[b]	0	100	[c]			0		100	[b]	0	100
9/20	[b]	0	100	[b]	0	100	[b]	0	100	[c]			[b]	0	100	[b]	0	100
9/21	[c]			[c]			[b]	0	100	[c]			[c]			[c]		
9/22	[c]			[c]			[b]	0	100	[c]			[c]			[c]		
9/23	[c]			[c]			[b]	0	100	[c]			[c]			[c]		
9/24	[c]			[c]			[b]	0	100	[c]			[c]			[c]		
9/25	[c]			[c]			[b]	0	100	[c]			[c]			[c]		
Total	7,404	262		35,527	1,347		64,761	2,073		83	-		32,248	29		6,396	16	
Annual Esc.	7,666			36,874			66,834			83			32,277			6,412		

Note: Blank cells indicate no data.

[a] Estimate of daily missed passage. On days where a partial day count occurs (i.e. hole discovered midday), the observed passage ("Obs") has been subtracted from the total day estimate to produce the missed passage estimate displayed ("Est").

[b] The weir was not operational; missed passage was estimated using the Bayesian method.

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

[d] Partial day count; observed passage was considered the minimum passage estimate for the day.

[e] Partial day count; missed passage was estimated using the Bayesian method.

Table 7.–Daily observed, estimated, and cumulative percent passage of coho salmon at Kuskokwim River weir projects, 2013.

Date	Salmon River			George River			Kogrukluk River			Telaquana River			Tatlawiksuk River			Takotna River		
	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%
6/15	0		0	[b]	0	0	[c]			[c]			[b]	0	0	[c]		
6/16	0		0	[b]	0	0	[c]			[c]			[b]	0	0	[c]		
6/17	0		0	[b]	0	0	[c]			[c]			[b]	0	0	[c]		
6/18	0		0	0 [d]		0	[c]			[c]			[b]	0	0	[c]		
6/19	0		0	0		0	[c]			[c]			[b]	0	0	[c]		
6/20	0		0	0		0	[c]			[c]			0		0	[c]		
6/21	0		0	0		0	[c]			[c]			0		0	[c]		
6/22	0		0	0		0	[c]			[c]			0		0	[c]		
6/23	0		0	0		0	[c]			[c]			0		0	[c]		
6/24	0		0	0		0	[c]			[c]			0		0	0		0
6/25	0		0	0		0	[c]			[c]			0		0	0		0
6/26	0		0	0		0	[b]	0	0	[c]			0		0	0		0
6/27	0		0	0		0	[b]	0	0	[c]			0		0	0		0
6/28	0		0	0		0	[b]	0	0	[c]			0		0	0		0
6/29	0		0	0		0	0		0	[c]			0		0	0		0
6/30	0		0	0		0	0		0	[c]			0		0	0		0
7/1	0		0	0		0	0		0	[c]			0		0	0		0
7/2	0		0	0		0	0		0	[c]			0		0	0		0
7/3	0		0	0		0	0		0	0			0		0	0		0
7/4	0		0	0		0	0		0	0			0		0	0		0
7/5	0		0	0		0	0		0	0			0		0	0		0
7/6	0 [d]		0	0		0	0		0	0 [d]			0		0	0		0
7/7	0		0	0 [d]		0	0 [d]		0	0 [d]			0		0	0		0
7/8	0		0	0 [d]		0	[b]	0	0	0			0		0	0		0
7/9	0		0	0 [d]		0	0 [d]		0	0			0		0	0		0
7/10	0		0	0 [d]		0	0		0	0			0		0	0		0
7/11	0		0	0 [d]		0	0		0	0			0		0	0		0
7/12	0		0	0		0	0		0	0			0		0	0		0
7/13	0		0	0		0	0		0	0			0		0	0		0
7/14	0 [d]		0	0		0	0		0	0			0		0	0 [d]		0
7/15	0		0	0		0	0		0	0			0		0	0		0
7/16	0		0	0		0	0		0	0			0		0	0		0

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Table 7.–Page 2 of 4.

Date	Salmon River			George River			Kogrukluk River			Telaquana River			Tatlawiksuk River			Takotna River		
	Obs	Est[a]	%	Obs	Est[a]	%	Obs	Est[a]	%	Obs	Est[a]	%	Obs	Est[a]	%	Obs	Est[a]	%
7/17	0		0	0		0	0		0	0			0		0	0		0
7/18	0		0	0		0	0		0	0			0		0	0		0
7/19	0		0	0		0	0		0	0			1		0	0		0
7/20	0		0	0		0	0		0	0			3		0	0		0
7/21	0		0	0		0	0		0	0			2		0	0		0
7/22	0		0	0		0	0		0	0			2		0	0		0
7/23	0		0	0		0	0		0	0			1		0	0		0
7/24	0		0	1		0	0		0	0			6		0	0		0
7/25	0		0	4		0	0		0	0			3		0	0		0
7/26	0		0	3		0	0		0	0			4		0	0		0
7/27	0		0	2		0	0		0	0			14		0	0		0
7/28	0		0	4		0	0		0	0			20		0	0		0
7/29	0		0	10		0	0		0	0			27		1	0		0
7/30	2		0	3		0	1		0	0			17		1	0		0
7/31	2		0	5		0	3		0	0			27		1	0		0
8/1	6		0	6		0	7		0	0			33		1	0		0
8/2	6		1	2		0	1		0	0			25		1	0		0
8/3	0		1	5		0	8		0	0			26		2	0		0
8/4	5		1	14		0	11 [d]		0	0			25		2	3		0
8/5	10		1	22		1	8		0	0			72		2	4		0
8/6	3		1	22		1	1 [d]		0	0			9		2	5		0
8/7	13 [d]		2	21		1	[b]	0	0	[c]			50		3	0		0
8/8	3		2	18		1	[b]	0	0	[c]			77		3	11		1
8/9	5		2	21		1	[b]	0	0	[c]			92		4	4		1
8/10	3		2	19		1	[b]	0	0	[c]			269		6	5		1
8/11	4		2	75		2	[b]	0	0	[c]			222		8	13		1
8/12	18		3	53		2	[b]	0	0	[c]			365		11	37		2
8/13	13		3	14		2	[b]	0	0	[c]			75		11	25		3
8/14	15		4	14		2	[b]	0	0	[c]			411		14	16		3
8/15	35		5	80		3	[b]	0	0	[c]			457		18	42		4
8/16	0		5	70		4	[b]	0	0	[c]			275		20	58		5
8/17	0		5	834		10	[b]	1	0	[c]			383		23	64		7

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Table 7.–Page 3 of 4.

Date	Salmon River			George River			Kogrukluk River			Telaquana River			Tatlawiksuk River			Takotna River		
	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%
8/18	74		8	63		10	[b]	4	0	[c]			589		27	35		8
8/19	42		9	4		10	[b]	15	0	[c]			612		32	35		9
8/20	21		10	7		10	[b]	42	0	[c]			347		35	89		11
8/21	61		12	727		15	14 [e]	83	1	[c]			1,596		47	55		12
8/22	64		14	1,392		25	510		3	[c]			1,041		55	209		17
8/23	62		16	591		30	773		6	[c]			[b]	765	61	203		22
8/24	59		18	771		35	844		10	[c]			[b]	719	66	327		30
8/25	51		20	253		37	554		12	[c]			[b]	660	71	156		34
8/26	104		24	274		39	405		14	[c]			[b]	596	76	391		43
8/27	95		27	588		43	1,326		19	[c]			480		80	309		51
8/28	68		29	403		46	1,186		25	[c]			402		83	122		53
8/29	235		38	272		48	1,545		31	[c]			483		86	140		57
8/30	75		40	66		48	402		33	[c]			138		87	136		60
8/31	73		43	41		49	1,111		37	[c]			194		89	36		61
9/1	271		52	284		51	3,248		51	[c]			190		90	3		61
9/2	340		64	2,588		69	2,083		60	[c]			231		92	497		73
9/3	104		68	344 [d]		72	1,168		65	[c]			[b]	187	93	[b]	142	76
9/4	84		71	321 [d]		74	1,202		70	[c]			[b]	158	95	[b]	128	80
9/5	60		73	139 [d]		75	904		74	[c]			[b]	133	96	[b]	115	82
9/6	90		76	83 [d]		76	824		77	[c]			[b]	112	97	[b]	102	85
9/7	158		81	[b]	424	79	783		81	[c]			[b]	94	97	[b]	91	87
9/8	167		87	[b]	399	82	495		83	[c]			[b]	79	98	[b]	81	89
9/9	56		89	[b]	374	84	317		84	[c]			[b]	66	98	[b]	71	91
9/10	73		92	[b]	349	87	13 [e]	571	87	[c]			[b]	55	99	[b]	63	92
9/11	25		93	[b]	325	89	[b]	505	89	[c]			4 [e]	42	99	[b]	55	93
9/12	25		93	[b]	302	91	[b]	434	91	[c]			22		99	[b]	49	95
9/13	42		95	[b]	280	93	[b]	372	92	[c]			17		99	[b]	43	96
9/14	15		95	[b]	259	95	[b]	319	94	[c]			10 [d]		100	[b]	37	97
9/15	5		96	[b]	239	97	[b]	272	95	[c]			10		100	[b]	33	97
9/16	[b]	33	97	[b]	220	99	[b]	231	96	[c]			13		100	[b]	28	98
9/17	[b]	29	98	10		99	[b]	196	97	[c]			7		100	[b]	25	99
9/18	[b]	25	99	13		99	[b]	167	97	[c]			8		100	[b]	21	99

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Table 7.–Page 4 of 4.

Date	Salmon River			George River			Kogrukluk River			Telaquana River			Tatlawiksuk River			Takotna River		
	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%
9/19	[b]	21	99	10		99	[b]	141	98	[c]			14		100	[b]	19	100
9/20	[b]	19	100	[b]	157	100	[b]	120	98	[c]			[b]	9	100	[b]	16	100
9/21	[c]			[c]			[b]	101	99	[c]			[c]			[c]		
9/22	[c]			[c]			[b]	85	99	[c]			[c]			[c]		
9/23	[c]			[c]			[b]	72	99	[c]			[c]			[c]		
9/24	[c]			[c]			[b]	61	100	[c]			[c]			[c]		
9/25	[c]			[c]			[b]	51	100	[c]			[c]			[c]		
Total	2,742	127		10,566	3,328		19,747	3,843		0	-		9,401	3,675		3,030	1,119	
Annual Esc.		2,869			13,894			23,590			0			13,076			4,149	

Note: Blank cells indicate no data.

[a] Estimate of daily missed passage. On days where a partial day count occurs (i.e. hole discovered midday), the observed passage ("Obs") has been subtracted from the total day estimate to produce the missed passage estimate displayed ("Est").

[b] The weir was not operational; missed passage was estimated using the Bayesian method.

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

[d] Partial day count; observed passage was considered the minimum passage estimate for the day.

[e] Partial day count; missed passage was estimated using the Bayesian method.

Table 8.–Daily observed, estimated, and cumulative percent passage of sockeye salmon at Kuskokwim River weir projects, 2013.

Date	Salmon River			George River			Kogrukluk River			Telaquana River			Tatlawiksuk River			Takotna River		
	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%
6/15	0		0	[b]			[b]			[b]			[b]			[b]		
6/16	0		0	[b]			[b]			[b]			[b]			[b]		
6/17	0		0	[b]			[b]			[b]			[b]			[b]		
6/18	0		0	0 [c]			[b]			[b]			[b]			[b]		
6/19	0		0	0			[b]			[b]			[b]			[b]		
6/20	0		0	0			[b]			[b]			0			[b]		
6/21	0		0	0			[b]			[b]			0			[b]		
6/22	0		0	0			[b]			[b]			0			[b]		
6/23	0		0	0			[b]			[b]			0			[b]		
6/24	0		0	0			[b]			[b]			0			0		
6/25	0		0	0			[b]			[b]			0			0		
6/26	0		0	0			[d]	0	0	[b]			0			0		
6/27	0		0	0			[d]	0	0	[b]			0			0		
6/28	0		0	0			[d]	0	0	[b]			0			0		
6/29	0		0	0			0		0	[b]			0			0		
6/30	0		0	2			0		0	[b]			0			0		
7/1	0		0	0			5		0	[b]			0			0		
7/2	0		0	0			3		0	[b]			0			0		
7/3	0		0	0			0		0	0		0	0			0		
7/4	0		0	0			10		0	0		0	0			0		
7/5	0		0	1			36		1	0		0	0			0		
7/6	0 [c]		0	1			15		1	0 [c]		0	0			0		
7/7	0		0	2 [c]			10 [c]		1	1 [c]		0	0			0		
7/8	0		0	4 [c]			[d]	83	2	927		3	0			0		
7/9	2		0	0 [c]			122 [c]		4	2,993		14	0			0		
7/10	0		0	1 [c]			284		7	2,214		22	0			0		
7/11	3		1	6 [c]			330		11	3,449		34	0			0		
7/12	2		1	4			455		17	2,334		43	0			0		
7/13	3		1	9			580		25	1,548		48	0			0		
7/14	1 [c]		1	4			308		28	1,146		53	0			0 [c]		
7/15	0		1	8			195		31	791		55	0			0		
7/16	1		1	2			196		33	1,381		60	1			0		

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Table 8.–Page 2 of 4.

Date	Salmon River			George River			Kogrukluk River			Telaquana River			Tatlawiksuk River			Takotna River		
	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%
7/17	4		2	1			403		39	1,456		66	0			0		
7/18	2		2	5			617		46	2,158		73	0			0		
7/19	0		2	10			728		56	1,539		79	0			0		
7/20	3		2	7			696		64	1,514		84	0			0		
7/21	6		3	20			376		69	762		87	0			0		
7/22	12		4	10			570		76	855		90	1			0		
7/23	14		5	13			668		85	548		92	1			0		
7/24	25		8	10			235		88	437		94	0			0		
7/25	4		8	6			398		93	436		95	1			0		
7/26	71		16	1			141		95	191		96	0			0		
7/27	62		22	1			54		95	138		96	0			0		
7/28	31		25	1			9		95	239		97	1			0		
7/29	14		27	1			1		96	271		98	9			0		
7/30	44		31	1			8		96	126		99	3			0		
7/31	14		33	1			23		96	75		99	0			0		
8/1	42		37	1			22		96	100		99	0			0		
8/2	30		40	0			16		96	48		100	0			0		
8/3	53		46	0			12		97	43		100	0			0		
8/4	83		54	0			12 [c]		97	17		100	0			0		
8/5	71		62	3			19		97	27		100	4			0		
8/6	75		70	1			4 [c]		97	42		100	4			0		
8/7	112 [c]		81	0			[d]	39	97	[b]			1			0		
8/8	51		86	0			[d]	33	98	[b]			5			0		
8/9	28		89	0			[d]	28	98	[b]			6			0		
8/10	14		91	0			[d]	24	99	[b]			0			0		
8/11	19		93	1			[d]	20	99	[b]			0			0		
8/12	14		94	1			[d]	17	99	[b]			0			0		
8/13	17		96	0			[d]	15	99	[b]			0			0		
8/14	12		97	1			[d]	12	99	[b]			0			0		
8/15	11		98	1			[d]	10	99	[b]			0			0		
8/16	1		98	2			[d]	9	100	[b]			0			0		
8/17	0		98	2			[d]	8	100	[b]			0			0		

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Table 8.–Page 3 of 4.

Date	Salmon River			George River			Kogrukluk River			Telaquana River			Tatlawiksuk River			Takotna River		
	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%
8/18	4		99	3			[d]	6	100	[b]			0			0		
8/19	3		99	0			[d]	5	100	[b]			0			0		
8/20	5		100	0			[d]	5	100	[b]			0			0		
8/21	1		100	1			0 [c]		100	[b]			0			0		
8/22	0		100	1			0		100	[b]			0			0		
8/23	0		100	0			0		100	[b]			[b]			0		
8/24	1		100	0			1		100	[b]			[b]			0		
8/25	1		100	0			2		100	[b]			[b]			0		
8/26	0		100	0			0		100	[b]			[b]			0		
8/27	0		100	0			0		100	[b]			0			0		
8/28	0		100	0			1		100	[b]			0			0		
8/29	0		100	0			0		100	[b]			0			0		
8/30	0		100	0			0		100	[b]			0			0		
8/31	0		100	0			2		100	[b]			0			0		
9/1	0		100	0			0		100	[b]			0			0		
9/2	0		100	0			0		100	[b]			0			0		
9/3	0		100	0 [c]			0		100	[b]			[b]			[b]		
9/4	0		100	0 [c]			0		100	[b]			[b]			[b]		
9/5	0		100	0 [c]			0		100	[b]			[b]			[b]		
9/6	0		100	0 [c]			1		100	[b]			[b]			[b]		
9/7	0		100	[b]			0		100	[b]			[b]			[b]		
9/8	0		100	[b]			0		100	[b]			[b]			[b]		
9/9	0		100	[b]			0		100	[b]			[b]			[b]		
9/10	0		100	[b]			0 [c]		100	[b]			[b]			[b]		
9/11	0		100	[b]			[d]	0	100	[b]			0 [c]			[b]		
9/12	0		100	[b]			[d]	0	100	[b]			0			[b]		
9/13	0		100	[b]			[d]	0	100	[b]			0			[b]		
9/14	0		100	[b]			[d]	0	100	[b]			0 [c]			[b]		
9/15	0		100	[b]			[d]	0	100	[b]			0			[b]		
9/16	[d]	0	100	[b]			[d]	0	100	[b]			0			[b]		
9/17	[d]	0	100	0			[d]	0	100	[b]			0			[b]		
9/18	[d]	0	100	0			[d]	0	100	[b]			0			[b]		

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Table 8.–Page 4 of 4.

Date	Salmon River			George River			Kogrukluk River			Telaquana River			Tatlawiksuk River			Takotna River		
	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%	Obs	Est [a]	%
9/19	[d]	0	100	0			[d]	0	100	[b]			0			[b]		
9/20	[d]	0	100	[b]			[d]	0	100	[b]			[b]			[b]		
9/21	[b]			[b]			[d]	0	100	[b]			[b]			[b]		
9/22	[b]			[b]			[d]	0	100	[b]			[b]			[b]		
9/23	[b]			[b]			[d]	0	100	[b]			[b]			[b]		
9/24	[b]			[b]			[d]	0	100	[b]			[b]			[b]		
9/25	[b]			[b]			[d]	0	100	[b]			[b]			[b]		
Total	966	0		150	-		7,568	314		27,806	-		37	-		0	-	
Annual Esc.		966			150			7,882			27,806			37			0	

Note: Blank cells indicate no data.

[a] Estimate of daily missed passage. On days where a partial day count occurs (i.e. hole discovered midday), the observed passage (“Obs”) has been subtracted from the total day estimate to produce the missed passage estimate displayed (“Est”).

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

[c] Partial day count; observed passage was considered the minimum passage estimate for the day.

[d] The weir was not operational; missed passage was estimated using the Bayesian method.

Table 9.–Age, sex, and length sample collection at Kuskokwim River weir projects, 2013.

Species	Camp	Sampling strategy	Target number of pulses	Number of pulses attempted	Number of pulses completed [a]	Sample size goal per pulse [b]	Scales per fish sampled	Season total number of samples collected
Chinook	Salmon	Daily	–	–	–	230	3	104
	George	Daily	–	–	–	230	3	111
	Kogrukluk	Daily	–	–	–	230	3	136
	Tatlawiksuk	Daily	–	–	–	230	3	143
	Takotna	Daily	–	–	–	230	3	24
chum	Salmon	Pulse	5	5	2	220	1	1,019
	George	Pulse	5	5	3	220	1	813
	Kogrukluk	Pulse	5	5	3	220	1	1,008
	Tatlawiksuk	Pulse	5	4	3	220	1	923
	Takotna	Pulse	5	5	5	220	1	1,136
coho	Salmon	Pulse[c]	3	1	0	200[d]	3	320
	George	Pulse	3	2	1	200	3	317
	Kogrukluk	Pulse	3	2	2	200	3	409
	Tatlawiksuk	Pulse	3	2	2	200	3	402
	Takotna	Pulse	3	2	0	200	3	375
sockeye	Salmon	Daily	–	–	–	230	3	193
	Kogrukluk	Daily	–	–	–	230	3	168
	Telaquana	Daily	–	–	–	460	3	376

[a] A pulse was considered complete if the sample size goal for the pulse was met.

[b] For species with daily sampling strategies, sample size goal per pulse constitutes the entire season sample size goal, not the daily goal.

[c] The sampling strategy changed from pulse to daily inseason after 1 pulse was attempted.

[d] The sample size goal became 600 fish once strategy changed to daily sampling.

Table 10.–Chinook salmon spawning aerial survey index estimates, Kuskokwim River drainage, 2013.

Tributary	Survey date	Survey rating	Index estimate	Escapement goal range
Eek R.	28 July	Fair (2)	240	[a]
Kwethluk R./Crooked C.	27 July	Good (1)	1,165	[a]
Kisaralik R.	27 July	Good (1)	597	400–1,200
Tuluksak R.	26 July	Good (1)	83	[a]
Aniak R.	25 July	Good (1)	754	1,200–2,300
Salmon R. (Aniak)	26 July	Good (1)	154	330–1,200
Kipchuk R.	25 July	Good (1)	261	[a]
Holokuk R.	26 July	Good (1)	29	[a]
Oskawalik R.	23 July	Good (1)	38	[a]
Holitna R.	23 July	Good (1)	670	970–2,100
Cheeneetnuk R.	27 July	Good (1)	74	340–1,300
Gagaryah R.	27 July	Good (1)	138	300–830
Salmon R. (Pitka Fork)	27 July	Good (1)	475	470–1,600

Note: Survey ratings were based on criteria related to survey method, weather and water conditions, time of survey, and spawning stage (Schneiderhan 1988).

[a] No escapement goal established.

Table 11.–Chinook salmon spawning aerial survey index estimates, Kuskokwim River drainage, 1999–2013.

Year	Eek	Kwethluk R. Crooked C.	Kisaralik	Tuluksak	Aniak	Salmon (Aniak)	Kipchuk	Holokuk	Oskawalik	Holitna	Cheeneetnuk	Gagaryah	Salmon (Pitka)
1999	[a]	[a]	[a]	[a]	[a]	[a]	[a]	18	98	[a]	[a]	[a]	[a]
2000	[a]	[a]	[a]	[a]	714	238	182	42	[a]	301	[a]	[a]	362
2001	[a]	[a]	[a]	[a]	[a]	598	[a]	[a]	186	1,130	[a]	143	1,033
2002	[a]	1,795	1,727	[a]	[a]	1,236	1,615	186	295	1,578	[a]	452	1,255
2003	1,236	2,628	654	94	3,514	1,242	1,493	528	844	[a]	810	1,095	1,241
2004	4,653	6,801	5,157	1,196	5,362	2,177	1,868	306	293	4,051	918	670	1,138
2005	[a]	5,059	2,206	672	a	4,097	1,679	268	582	1,760	1,155	788	1,801
2006	[a]	[a]	4,734	[a]	5,639	[a]	1,618	365	386	1,866	1,015	531	862
2007	[a]	487	692	173	3,984	1,458	2,147	146	[a]	[a]	[a]	1,035	943
2008	[a]	[a]	1,074	[a]	3,222	589	1,061	190	213	[a]	290	177	1,305
2009	[a]	[a]	[a]	[a]	[a]	[a]		390	379	[a]	323	303	632
2010	[a]	[a]	235	[a]	[a]	[a]		108	[a]	587	[a]	62	135
2011	263	[a]	534	[a]	[a]	79	116	20	26	[a]	249	96	767
2012	[a]	[a]	610	[a]	[a]	49	193	9	51	[a]	229	178	670
2013	240	1,165	597	83	754	154	261	29	38	670	138	74	475

Note: Some tributaries may have been surveyed prior to 1999. For additional aerial survey data refer to the Arctic, Yukon, Kuskokwim salmon database management system (http://sf.adfg.state.ak.us/CommFishR3/WebSite/AYKDBMSWebsite/Default.aspx).

[a] Survey was either not flown or did not meet acceptable survey criteria.

Table 12.–Chinook salmon escapement past 5 Kuskokwim River weir projects, 1999–2013.

Year	Salmon River	George River	Kogrukluk River	Tatlawiksuk River	Takotna River
1999	[a]	[b]	5,570	1,490	[a]
2000	[a]	2,960	3,310	810	345
2001	[a]	3,309	9,296	2,010	721
2002	[a]	2,444	10,105	2,237	316
2003	[a]	[b]	11,771	[b]	378
2004	[a]	5,206	19,651	2,833	461
2005	[a]	3,845	21,999	2,918	499
2006	[c]	4,355	19,414	1,700	541
2007	6,220	4,883	[b]	2,061	418
2008	2,376	2,698	9,730	1,071	413
2009	[c]	3,663	9,701	1,071	311
2010	[a]	1,500	5,693	569	178
2011	[a]	1,571	6,890	1,014	148
2012	[b]	2,302	[b]	1,116	228
2013	598	1,219	1,772	495	94

Note: Some projects may have operated prior to 1999. Escapement data for all projects' entirety are archived in the Arctic, Yukon, Kuskokwim salmon database management system (http://sf.adfg.state.ak.us/CommFishR3/WebSite/AYKDBMSWebsite/Default.aspx).

[a] Weir did not operate this year.

[b] Weir experienced operational difficulties; total escapement was not determined.

[c] Season was incomplete due to project priorities; total escapement was not determined.

Table 13.–Chum salmon escapement past 5 Kuskokwim River weir projects, 1999–2013.

Year	Salmon River	George River	Kogrukluk River	Tatlawiksuk River	Takotna River
1999	[a]	11,553	13,820	9,600	[a]
2000	[a]	3,492	11,491	6,965	1,265
2001	[a]	11,601	30,571	23,719	5,411
2002	[a]	6,544	51,570	24,542	4,399
2003	[a]	33,663	23,412	[b]	3,388
2004	[a]	14,408	24,201	21,245	1,633
2005	[a]	14,828	197,723	55,723	6,488
2006	[c]	41,467	180,601	32,303	12,652
2007	25,379	55,843	49,509	83,246	8,874
2008	9,459	29,979	44,978	30,896	5,704
2009	[c]	7,941	84,940	19,975	2,528
2010	[a]	26,154	63,582	36,702	4,057
2011	[a]	44,641	76,386	84,204	8,413
2012	[b]	34,336	[b]	44,572	6,050
2013	7,666	36,874	66,834	32,277	6,412

Note: Some projects may have operated prior to 1999. Escapement data for all projects' entirety are archived in the Arctic, Yukon, Kuskokwim salmon database management system (http://sf.adfg.state.ak.us/CommFishR3/WebSite/AYKDBMSWebsite/Default.aspx).

[a] Weir did not operate this year.

[b] Weir experienced operational difficulties; total escapement was not determined.

[c] Season was incomplete due to project priorities; total escapement was not determined.

Table 14.–Coho salmon escapement past 5 Kuskokwim River weir projects, 1999–2013.

Year	Salmon River	George River	Kogrukluk River	Tatlawiksuk River	Takotna River
1999	[a]	8,914	12,609	3,449	[a]
2000	[a]	11,262	33,135	[b]	3,944
2001	[a]	14,398	19,387	[b]	2,606
2002	[a]	6,759	14,518	11,345	3,982
2003	[a]	33,281	74,605	[b]	7,146
2004	[a]	12,499	27,042	16,410	3,201
2005	[a]	8,200	24,115	7,496	2,209
2006	[c]	11,294	17,011	[b]	5,556
2007	[c]	29,317	27,034	8,686	2,836
2008	11,022	21,931	29,661	11,065	2,807
2009	6,391	12,464	22,981	10,148	2,704
2010	[a]	12,961	13,970	3,521	3,217
2011	[a]	30,028	24,174	12,927	4,062
2012	[c]	15,272	13,697	8,070	1,838
2013	2,869	13,894	23,590	13,076	4,149

Note: Some projects may have operated prior to 1999. Escapement data for all projects' entirety are archived in the Arctic, Yukon, Kuskokwim salmon database management system (http://sf.adfg.state.ak.us/CommFishR3/WebSite/AYKDBMSWebsite/Default.aspx).

[a] Weir did not operate this year.

[b] Weir experienced operational difficulties; total escapement was not determined.

[c] Season was incomplete due to project priorities; total escapement was not determined.

Table 15.–Sockeye salmon escapement past 3 Kuskokwim River weir projects, 1999–2013.

Year	Salmon River	Kogrukluk River	Telaquana River
1999	[a]	5,864	[a]
2000	[a]	2,865	[a]
2001	[a]	8,775	[a]
2002	[a]	4,050	[a]
2003	[a]	9,164	[a]
2004	[a]	6,775	[a]
2005	[a]	37,939	[a]
2006	[b]	60,807	[a]
2007	2,130	16,526	[a]
2008	1,181	19,675	[a]
2009	[b]	23,785	[a]
2010	[a]	13,997	72,020
2011	[a]	8,135	35,105
2012	[c]	[c]	22,994
2013	966	7,882	27,806

Note: Some projects may have operated prior to 1999. Escapement data for all projects' entirety are archived in the Arctic, Yukon, Kuskokwim salmon database management system (http://sf.adfg.state.ak.us/CommFishR3/WebSite/AYKDBMSWebsite/Default.aspx).

[a] Weir did not operate this year.

[b] Season was incomplete due to project priorities; total escapement was not determined.

[c] Weir experienced operational difficulties; total escapement was not determined.

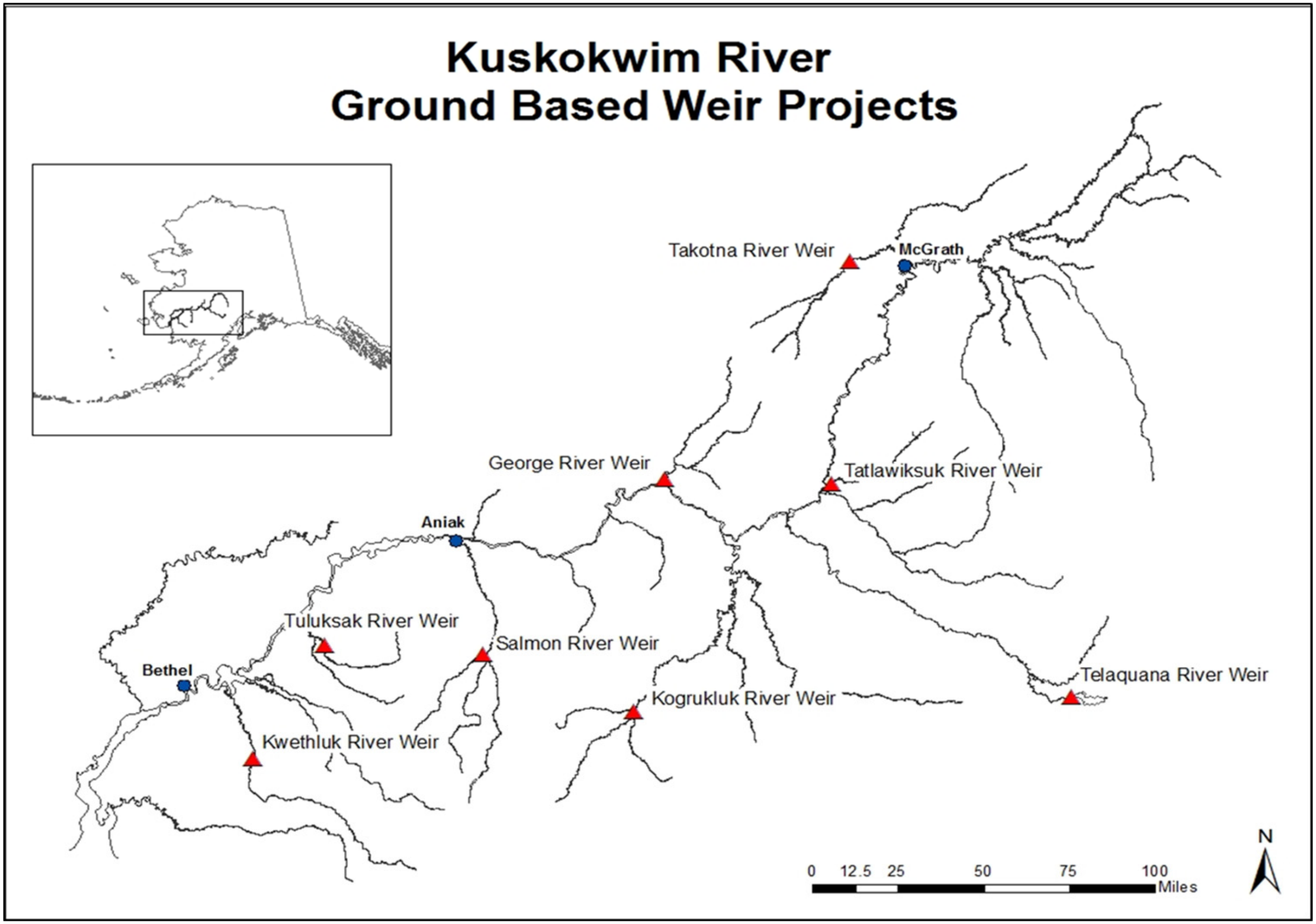

Figure 1.–Kuskokwim River ground based weir escapement monitoring projects, 2013.

Note: Triangles represent weir sites and circles represent communities.

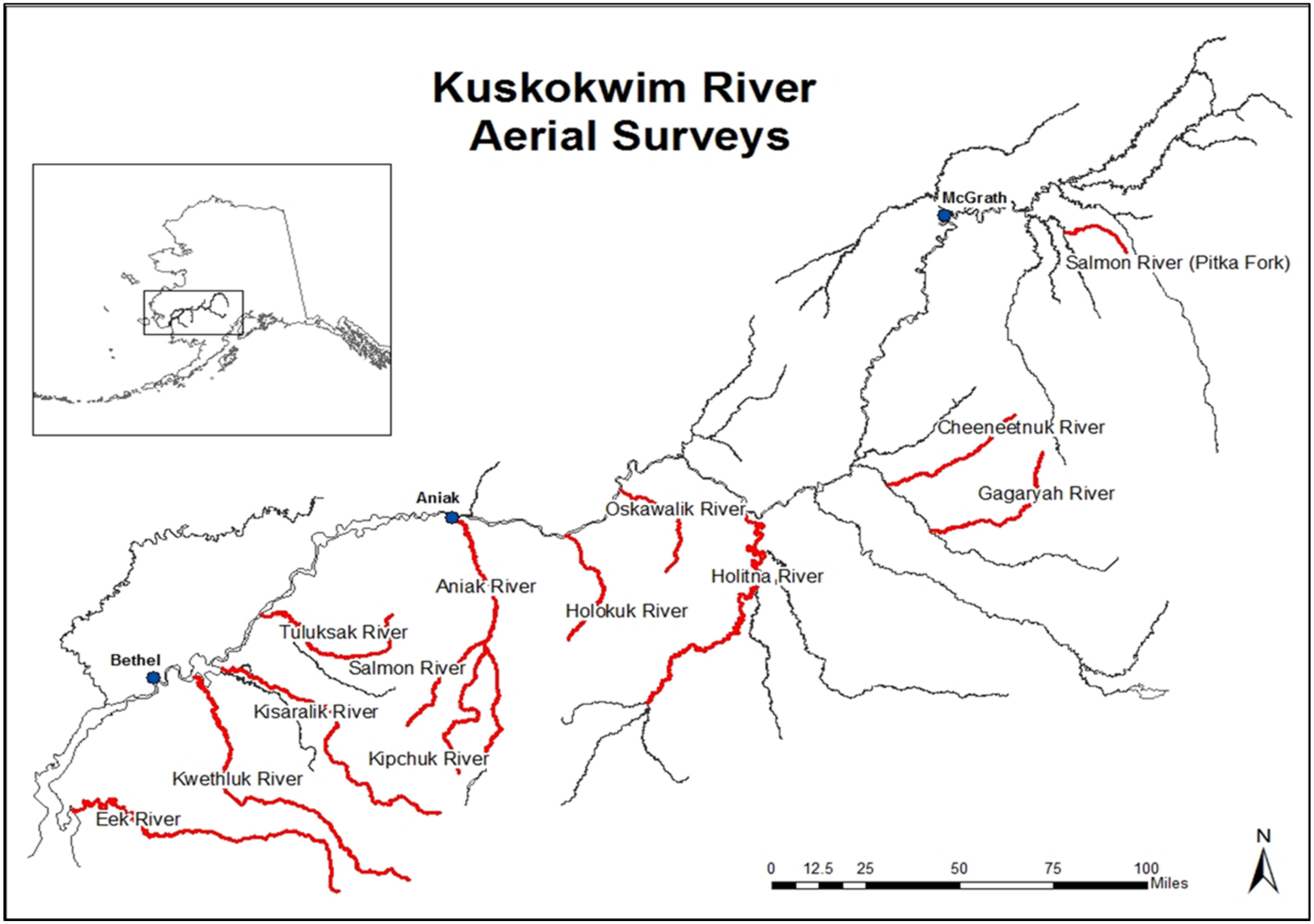

Figure 2.–Kuskokwim River aerial survey tributaries, 2013.

Note: Bolded rivers represent aerial survey sites and circles represent communities.

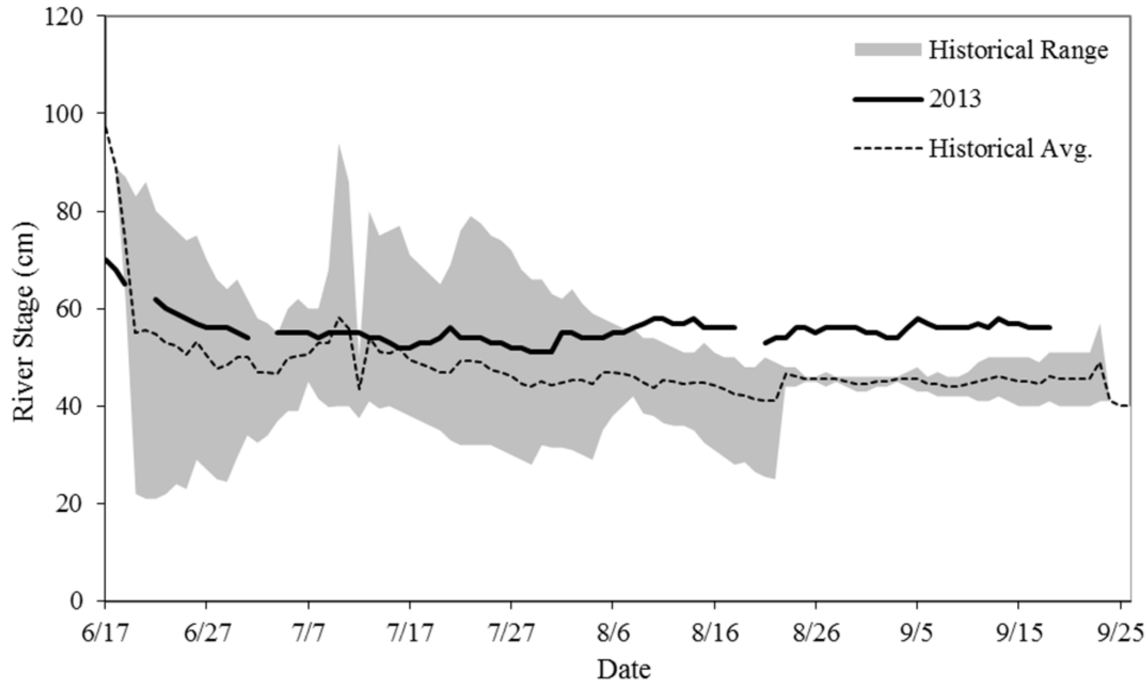

Figure 3.–Daily morning river stage at Salmon River weir in 2013 relative to historical average, minimum, and maximum morning readings, 2006–2009 and 2012.

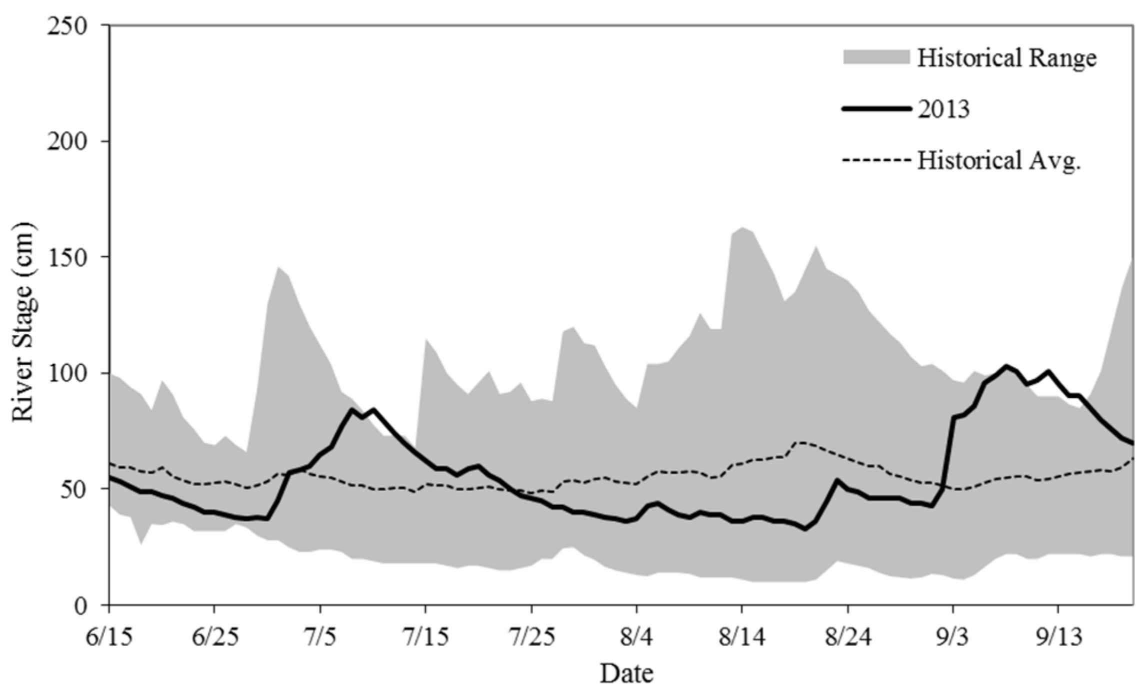

Figure 4.–Daily morning river stage at George River weir in 2013 relative to historical average, minimum, and maximum morning readings from 2000–2012.

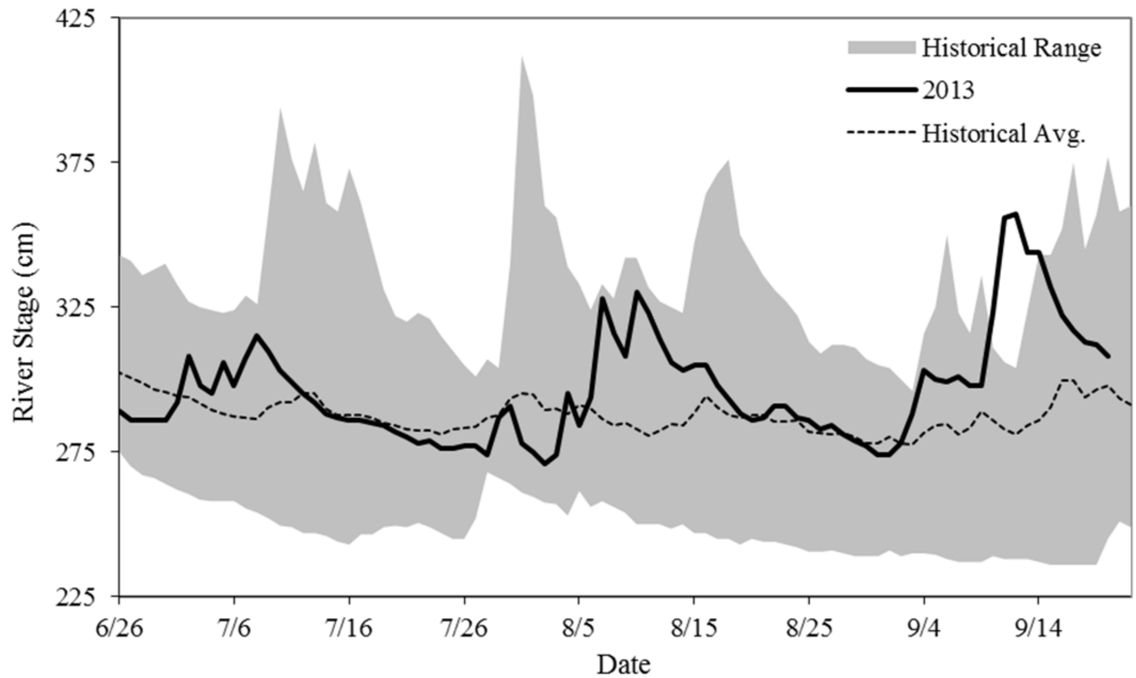

Figure 5.–Daily morning river stage at Kogrukluk River weir in 2013 relative to historical average, minimum, and maximum morning readings, 2002–2012.

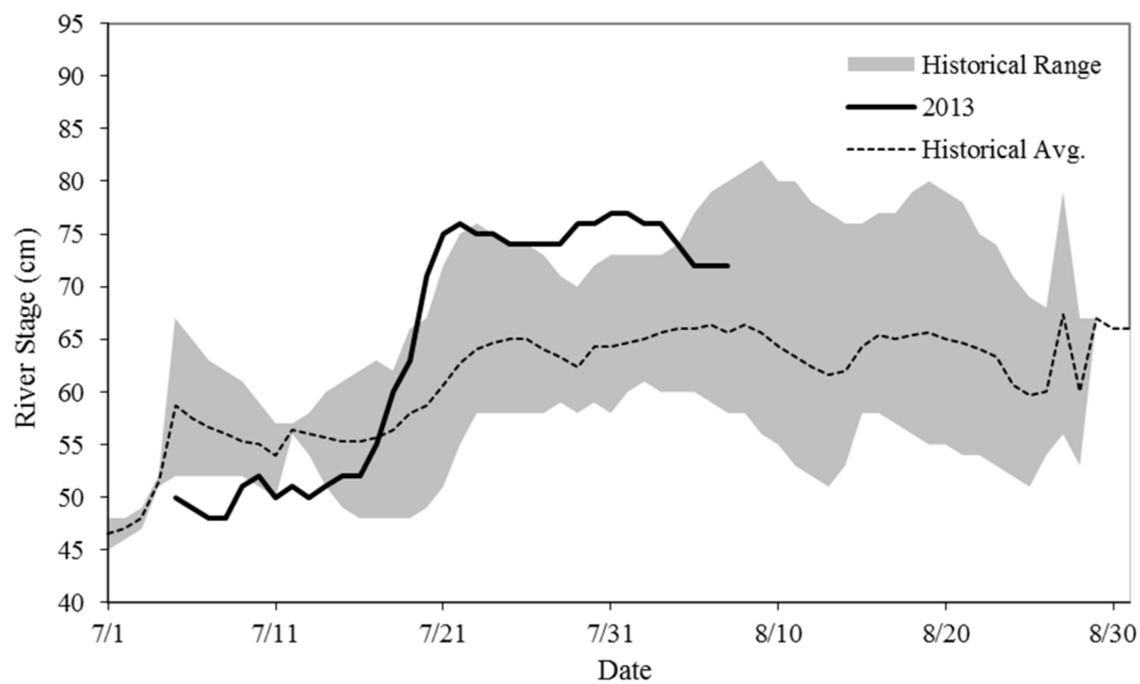

Figure 6.–Daily morning river stage at Telaquana River weir in 2013 relative to historical average, minimum, and maximum morning readings, 2010–2012.

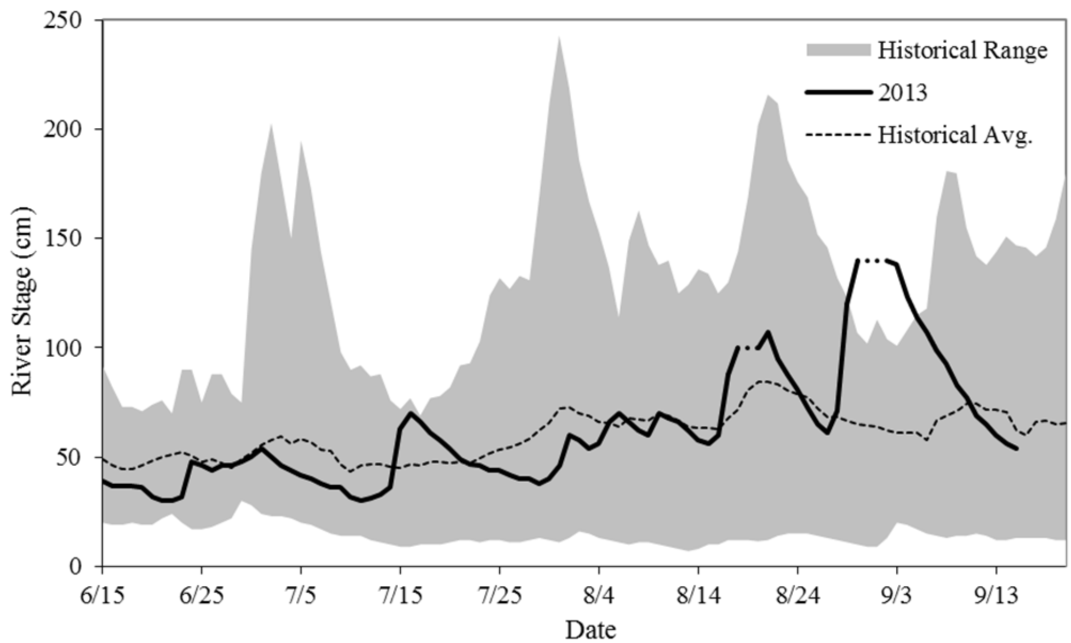

Figure 7.–Daily morning river stage at Tatlawiksuk River weir in 2013 relative to historical average, minimum, and maximum morning readings from 1998–2012.

Note: Dashed breaks in the 2013 readings represent observations when river stage exceeded the staff gauge. Readings represent minimum river stage.

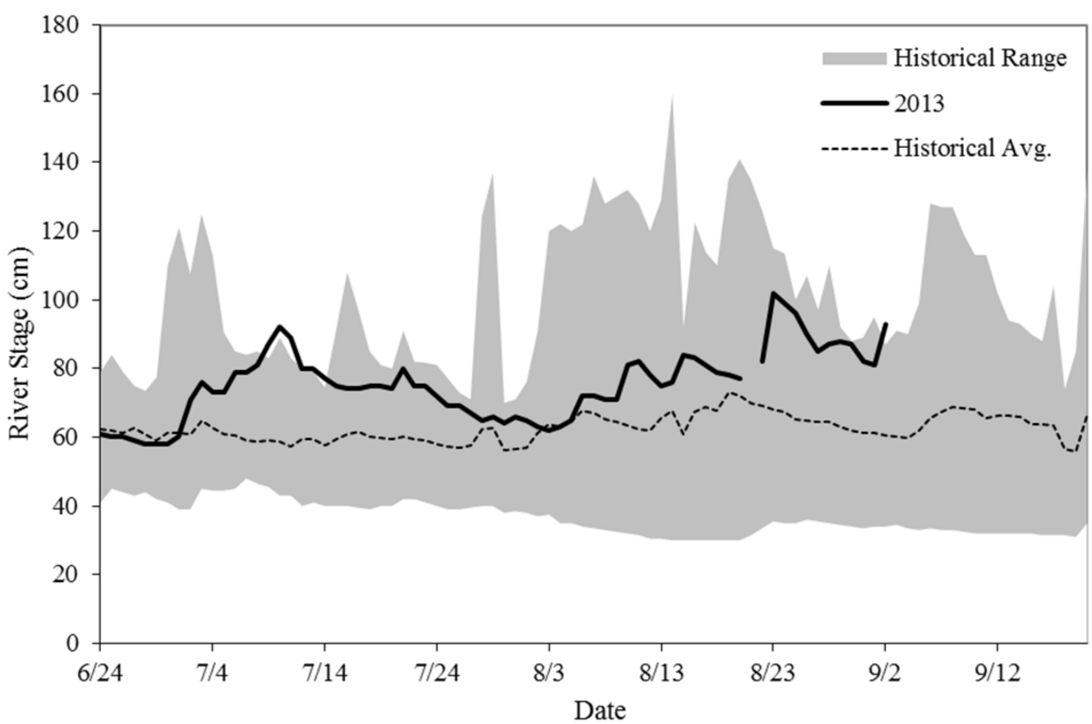

Figure 8.–Daily morning river stage at Takotna River weir in 2013 relative to its historical average, minimum, and maximum morning readings, 2000–2012.

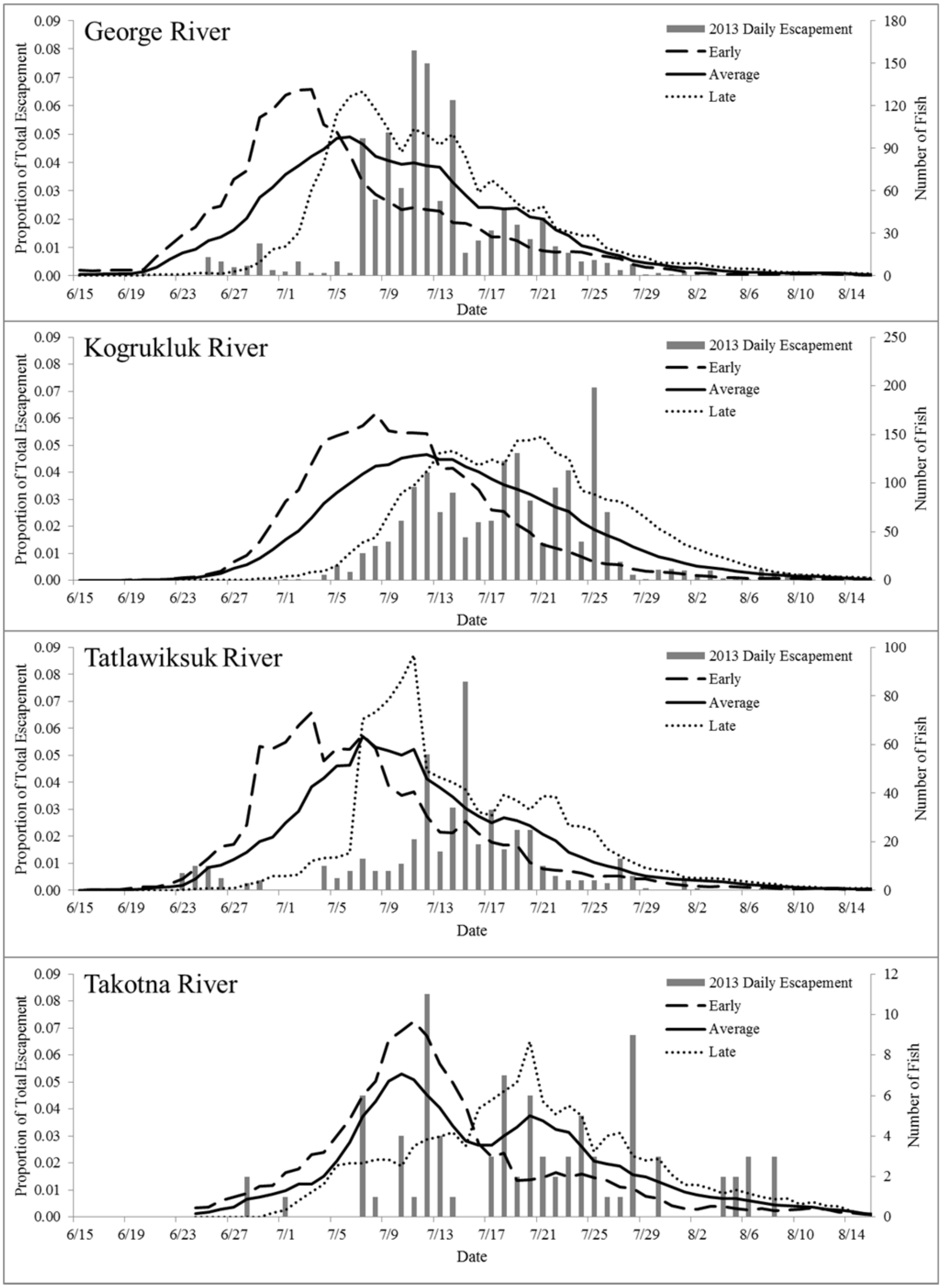

Figure 9.–Early, average, and late run timings and 2013 daily escapements of Chinook salmon at Kuskokwim River weir projects.

Note: Lines represent run timings displayed in proportions of total escapement (left Y-axis); columns represent daily escapements displayed in number of fish (right Y-axis); readers should note differences in proportions and number of fish between projects. Run timings shown are 5 day averages and are derived from all weir escapements available for the project that meet a minimum of 80% observed escapement.

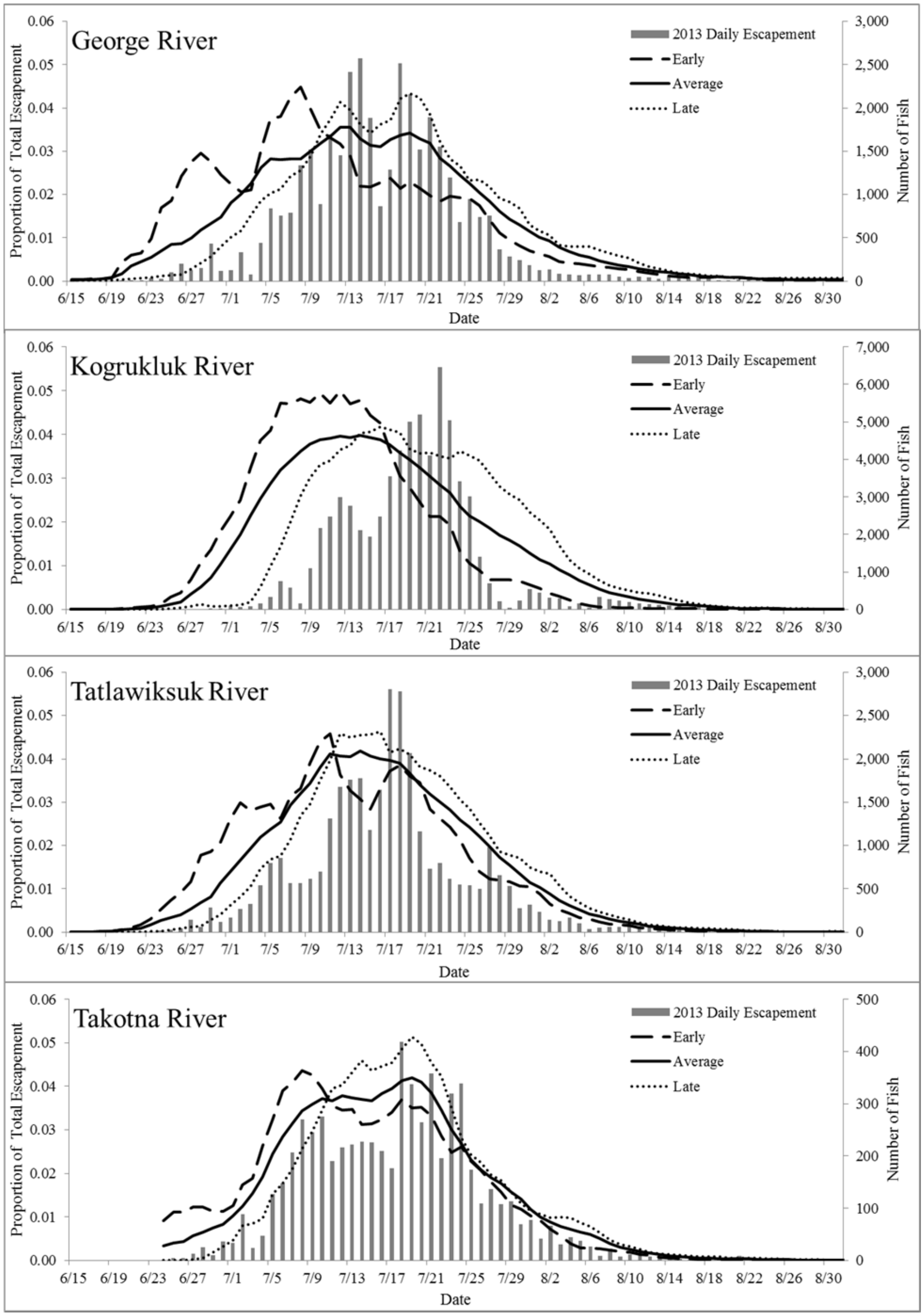

Figure 10.–Early, average, and late run timings and 2013 daily escapements of chum salmon at Kuskokwim River weir projects.

Note: Lines represent run timings displayed in proportions of total escapement (left Y-axis); columns represent daily escapements displayed in number of fish (right Y-axis); readers should note differences in proportions and number of fish between projects. Run timings shown are 5 day averages and are derived from all weir escapements available for the project that meet a minimum of 80% observed escapement.

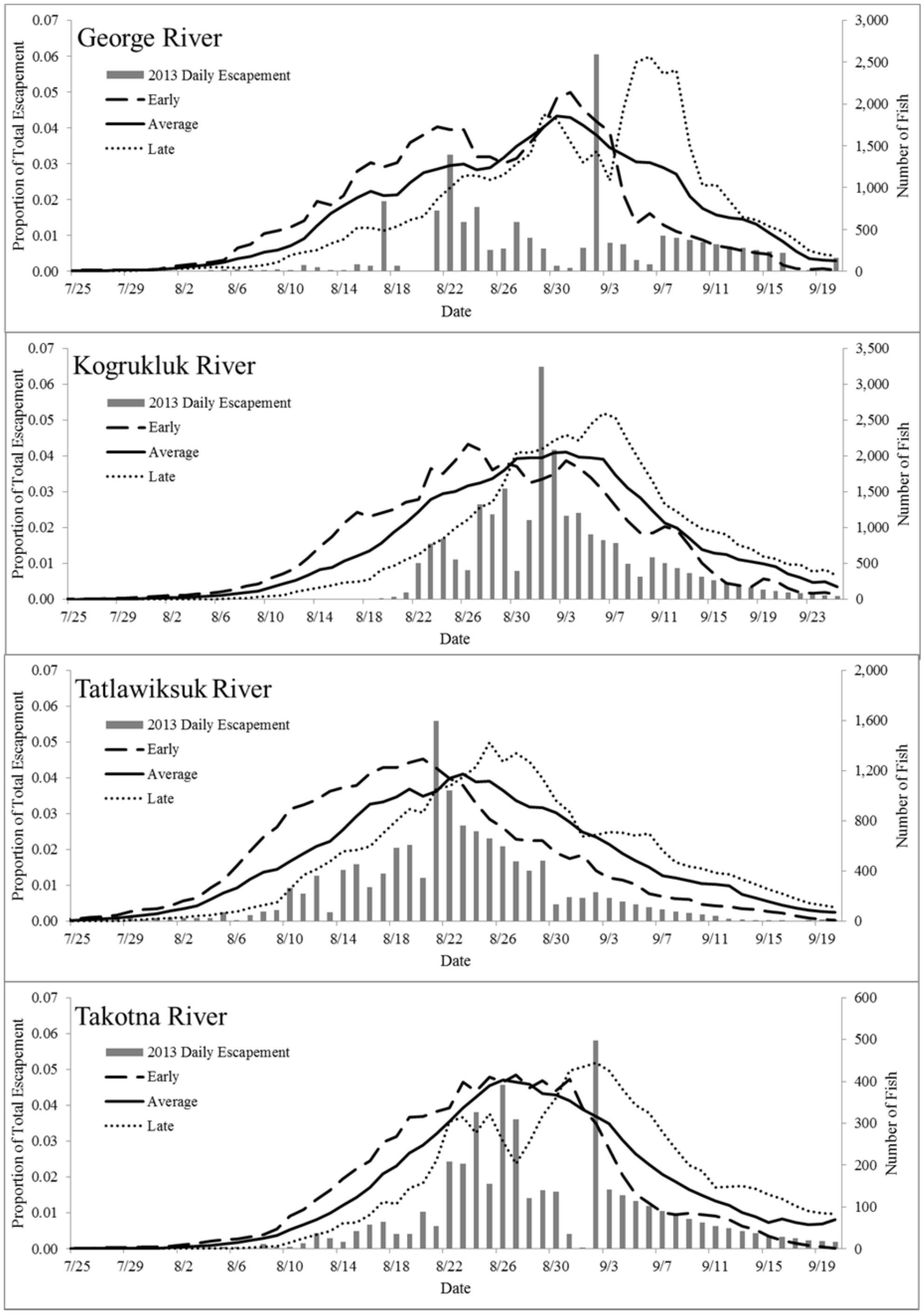

Figure 11.–Early, average, and late run timings and 2013 daily escapements of coho salmon at Kuskokwim River weir projects.

Note: Lines represent run timings displayed in proportions of total escapement (left Y-axis); columns represent daily escapements displayed in number of fish (right Y-axis); readers should note differences in proportions and number of fish between projects. Run timings shown are 5 day averages and are derived from all weir escapements available for the project that meet a minimum of 80% observed escapement.

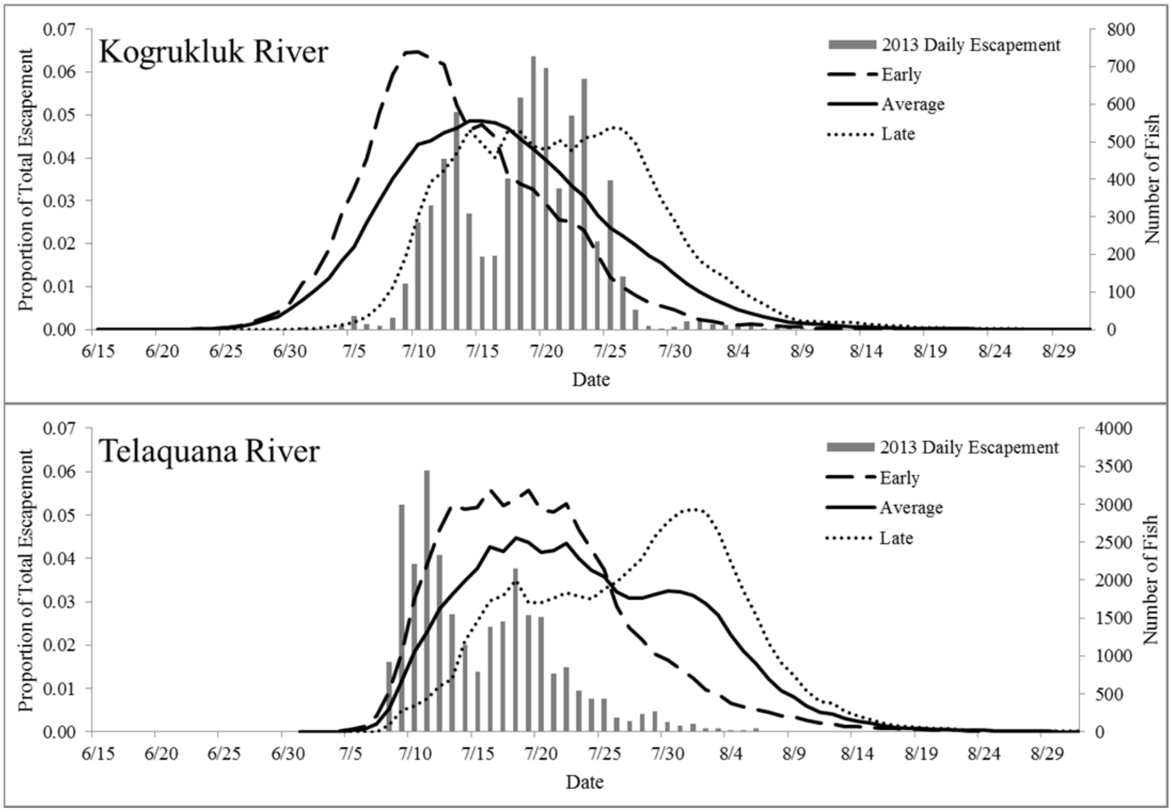

Figure 12.–Early, average, and late run timings and 2013 daily escapements of sockeye salmon at Kuskokwim River weir projects.

Note: Lines represent run timings displayed in proportions of total escapement (left Y-axis); columns represent daily escapements displayed in number of fish (right Y-axis); readers should note differences in proportions and number of fish between projects. Run timings shown are 5 day averages and are derived from all weir escapements available for the project that meet a minimum of 80% observed escapement.

APPENDIX A: WEATHER AND STREAM OBSERVATIONS

Appendix A1.–Daily weather and stream observations at the Salmon River weir, 2013.

		Sky	Precipitation	Temperature (°C)		River	Water
Date	Time	conditions[a]	(mm)	Air	Water	stage (cm)	clarity[b]
6/15	AM	1	0.0	ND	ND	70	1
6/15	PM	ND	ND	ND	ND	ND	ND
6/16	AM	1	0.0	12.0	8.0	68	1
6/16	PM	1	0.0	21.0	9.5	67	1
6/17	AM	1	0.0	16.0	8.0	65	1
6/17	PM	1	0.0	26.5	10.0	64	1
6/18	AM	ND	ND	ND	ND	ND	ND
6/18	PM	2	0.5	ND	ND	ND	ND
6/19	AM	ND	0.0	ND	ND	ND	ND
6/19	PM	3	0.0	17.0	15.0	63	1
6/20	AM	3	0.7	10.0	8.0	62	1
6/20	PM	3	0.0	14.0	10.0	61	1
6/21	AM	3	0.0	9.5	8.0	60	1
6/21	PM	3	0.0	ND	ND	60	1
6/22	AM	4	0.0	9.0	7.5	59	1
6/22	PM	3	0.0	10.5	7.5	58	1
6/23	AM	4	0.0	8.5	6.5	58	1
6/23	PM	3	trace	10.5	8.5	58	1
6/24	AM	2	2.5	12.0	8.0	57	1
6/24	PM	4	0.3	ND	ND	57	1
6/25	AM	1	trace	13.5	8.0	56	1
6/25	PM	2	0.0	22.0	11.0	57	1
6/26	AM	1	0.0	15.5	9.5	56	1
6/26	PM	2	0.0	19.5	11.5	56	1
6/27	AM	1	0.0	9.5	9.5	56	1
6/27	PM	ND	ND	ND	ND	ND	ND
6/28	AM	2	0.0	15.0	9.5	55	1
6/28	PM	3	0.0	20.0	11.5	55	1
6/29	AM	2	0.0	14.0	9.5	54	1
6/29	PM	2	0.0	21.0	11.5	54	1
6/30	AM	3	ND	ND	ND	ND	ND
6/30	PM	ND	ND	ND	ND	ND	ND
7/1	AM	ND	ND	ND	ND	ND	ND
7/1	PM	3	10.5	9.0	10.0	55	1
7/2	AM	4	0.2	7.0	8.0	55	1
7/2	PM	4	2.2	10.5	9.0	54	1

-continued-

Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Water	River stage (cm)	Water clarity[b]
7/3	AM	4	2.5	6.0	8.0	55	1
7/3	PM	4	0.1	9.5	8.0	54	1
7/4	AM	4	3.0	6.0	7.0	55	1
7/4	PM	4	0.1	10.0	7.5	55	1
7/5	AM	4	0.0	7.0	7.0	55	1
7/5	PM	2	0.0	15.0	10.0	54	1
7/6	AM	4	2.2	9.0	8.0	54	1
7/6	PM	4	1.5	11.0	8.5	54	1
7/7	AM	4	3.0	8.0	7.0	55	1
7/7	PM	ND	ND	ND	ND	ND	ND
7/8	AM	4	7.0	7.0	8.0	55	1
7/8	PM	4	0.0	14.0	9.0	55	1
7/9	AM	4	0.0	7.0	7.0	55	1
7/9	PM	2	0.0	15.0	11.0	55	1
7/10	AM	4	0.0	10.0	8.5	55	1
7/10	PM	2	0.0	17.0	12.0	54	1
7/11	AM	1	0.0	11.0	9.0	54	1
7/11	PM	1	0.0	21.0	13.0	54	1
7/12	AM	1	0.0	10.0	10.0	54	1
7/12	PM	1	0.0	23.0	13.5	53	1
7/13	AM	1	0.0	17.0	10.0	53	1
7/13	PM	2	0.0	26.0	13.0	52	1
7/14	AM	2	0.0	15.0	12.0	52	1
7/14	PM	4	0.0	17.0	14.0	52	1
7/15	AM	4	0.1	11.0	10.0	52	1
7/15	PM	ND	ND	ND	ND	ND	ND
7/16	AM	4	0.0	11.0	9.0	53	1
7/16	PM	ND	ND	ND	ND	ND	ND
7/17	AM	4	4.0	12.0	9.0	53	1
7/17	PM	4	0.6	18.0	11.5	53	1
7/18	AM	4	11.0	13.0	9.5	54	1
7/18	PM	2	2.0	20.0	13.0	55	1
7/19	AM	4	0.0	11.0	8.0	56	1
7/19	PM	4	0.0	15.0	10.0	56	1
7/20	AM	4	0.0	14.0	9.0	54	1
7/20	PM	4	0.0	15.0	10.0	54	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Water	River stage (cm)	Water clarity[b]
7/21	AM	4	0.0	10.0	9.0	54	1
7/21	PM	2	0.0	20.0	4.0	54	1
7/22	AM	1	0.0	14.0	9.0	54	1
7/22	PM	1	0.0	14.0	8.0	54	1
7/23	AM	1	0.0	14.0	8.0	53	1
7/23	PM	2	0.0	18.5	14.0	53	1
7/24	AM	2	0.0	12.0	9.0	53	1
7/24	PM	4	0.0	18.0	14.0	52	1
7/25	AM	4	0.0	14.0	10.0	52	1
7/25	PM	ND	ND	ND	ND	ND	ND
7/26	AM	1	0.0	22.0	12.0	52	1
7/26	PM	1	0.0	26.0	15.0	52	1
7/27	AM	1	0.0	19.0	11.0	51	1
7/27	PM	1	0.0	29.0	15.0	51	1
7/28	AM	2	0.0	16.0	11.0	51	1
7/28	PM	1	0.0	23.0	14.0	51	1
7/29	AM	4	0.0	15.0	12.0	51	1
7/29	PM	2	0.0	22.0	14.0	51	1
7/30	AM	3	0.5	13.0	11.0	55	2
7/30	PM	1	0.0	25.0	15.0	55	1
7/31	AM	1	0.0	8.0	11.0	55	1
7/31	PM	1	0.6	23.0	13.0	54	1
8/1	AM	2	0.3	10.0	11.0	54	1
8/1	PM	3	0.0	16.0	13.0	54	1
8/2	AM	3	0.3	13.0	10.0	54	1
8/2	PM	3	0.0	18.0	13.0	54	1
8/3	AM	4	1.0	12.0	11.0	54	1
8/3	PM	4	0.5	17.0	12.0	54	1
8/4	AM	4	4.5	13.0	10.0	55	1
8/4	PM	4	9.0	15.0	11.5	55	1
8/5	AM	4	4.0	12.0	10.0	55	1
8/5	PM	4	1.5	14.0	11.0	56	1
8/6	AM	4	0.1	10.0	11.0	56	1
8/6	PM	3	0.1	15.0	10.0	56	1
8/7	AM	3	0.0	12.0	10.0	57	1
8/7	PM	4	0.0	15.0	10.5	58	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Temperature (°C) Water	River stage (cm)	Water clarity[b]
8/8	AM	4	0.0	13	10	58	1
8/8	PM	4	0.0	13.5	10	58	1
8/9	AM	4	0.0	14	11	58	1
8/9	PM	4	0.3	14.5	10	57	1
8/10	AM	4	0.0	11	10	57	1
8/10	PM	4	0.0	15	10	57	1
8/11	AM	4	3.0	11	10	57	1
8/11	PM	3	0.5	14	10	58	1
8/12	AM	1	1.9	13	10	58	1
8/12	PM	1	0.0	18	11	57	1
8/13	AM	3	0.0	14	10	56	1
8/13	PM	4	0.0	12	10	56	1
8/14	AM	4	0.0	11	9	56	1
8/14	PM	4	0.0	14	10	56	1
8/15	AM	4	4.5	11	10	56	1
8/15	PM	3	0.0	18	11	56	1
8/16	AM	2	0.5	13	10	56	1
8/16	PM	ND	ND	ND	ND	ND	ND
8/17	AM	ND	ND	ND	ND	ND	ND
8/17	PM	ND	ND	ND	ND	ND	ND
8/18	AM	ND	ND	ND	ND	ND	ND
8/18	PM	ND	ND	ND	ND	ND	ND
8/19	AM	4	4.5	10.0	11.0	53	1
8/19	PM	4	1.5	14.0	11.0	54	1
8/20	AM	3	1.5	10.0	10.0	54	1
8/20	PM	4	0.4	14.5	10.0	54	1
8/21	AM	3	4.0	9.5	10.0	54	1
8/21	PM	4	2.0	14.0	10.0	54	1
8/22	AM	3	0.0	9.0	9.0	56	1
8/22	PM	2	0.0	16.0	10.0	56	1
8/23	AM	3	0.0	9.0	9.0	56	1
8/23	PM	3	0.0	14.0	10.0	56	1
8/24	AM	1	0.0	12.0	10.0	55	1
8/24	PM	1	0.0	15.0	10.0	56	1
8/25	AM	4	0.0	8.0	10.0	56	1
8/25	PM	3	0.0	14.0	9.0	56	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C)		River stage (cm)	Water clarity[b]
				Air	Water		
8/26	AM	4	0.0	10.0	8.0	56	1
8/26	PM	4	0.3	14.0	9.5	56	1
8/27	AM	2	0.1	9.0	8.0	56	1
8/27	PM	4	0.0	11.0	10.0	56	1
8/28	AM	3	0.0	9.0	8.0	56	1
8/28	PM	3	0.1	10.0	9.0	56	1
8/29	AM	3	0.0	8.0	10.0	55	1
8/29	PM	2	0.0	15.0	10.0	55	1
8/30	AM	3	0.0	8.0	9.0	55	1
8/30	PM	4	0.0	15.0	9.0	54	1
8/31	AM	4	0.0	7.0	8.0	54	1
8/31	PM	3	0.0	14.0	10.0	54	1
9/1	AM	4	0.0	7.0	7.0	54	1
9/1	PM	4	7.0	14.0	9.0	55	1
9/2	AM	4	4.0	9.0	9.0	56	1
9/2	PM	4	2.2	15.0	10.0	57	1
9/3	AM	3	0.0	10.0	10.0	58	1
9/3	PM	3	1.0	16.0	10.0	56	1
9/4	AM	4	4.0	10.0	10.0	57	1
9/4	PM	3	0.0	13.0	9.0	56	1
9/5	AM	2	0.0	3.0	2.0	56	1
9/5	PM	3	0.1	13.5	8.0	56	1
9/6	AM	4	0.0	7.0	6.0	56	1
9/6	PM	3	0.0	14.0	9.0	56	1
9/7	AM	3	1.1	8.0	7.0	56	1
9/7	PM	4	0.0	10.5	8.5	56	1
9/8	AM	4	3.6	8.0	8.0	56	1
9/8	PM	4	1.9	12.0	9.0	57	1
9/9	AM	4	0.0	8.0	8.0	57	1
9/9	PM	4	0.0	11.0	8.0	56	1
9/10	AM	4	3.0	8.0	7.0	56	1
9/10	PM	4	4.4	11.5	8.0	57	1
9/11	AM	3	4.0	3.0	7.0	58	1
9/11	PM	3	0.4	11.5	8.5	58	1
9/12	AM	4	0.0	7.0	7.0	57	1
9/12	PM	4	0.9	10.0	7.0	57	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C)		River stage (cm)	Water clarity[b]
				Air	Water		
9/13	AM	4	1.0	7.0	7.0	57	1
9/13	PM	4	0.3	14.0	9.0	56	1
9/14	AM	4	0.0	7.0	7.0	56	1
9/14	PM	4	0.0	12.0	8.0	56	1
9/15	AM	4	0.0	4.0	6.0	56	1
9/15	PM	2	0.0	13.0	8.0	56	1
9/16	AM	4	0.0	4.0	7.0	56	1
9/16	PM	2	0.0	11.5	8.0	56	1

Note: ND = no data.

[a] Sky condition codes:
1 = clear or mostly clear; < 10% cloud cover
2 = partly cloudy; < 50% cloud cover
3 = mostly cloudy; > 50% cloud cover
4 = complete overcast
5 = thick fog

[b] Water clarity codes:
1 = visibility greater than 1 meter
2 = visibility between 0.5 and 1 meter
3 = visibility less than 0.5 meter

Appendix A2.–Daily weather and stream observations at the George River weir, 2013.

Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Temperature (°C) Water	River stage (cm)	Water clarity[b]
6/13	AM	2	0.0	ND	ND	61	2
6/13	PM	ND	ND	ND	ND	ND	ND
6/14	AM	1	0.0	20.0	12.0	60	2
6/14	PM	ND	ND	ND	ND	ND	ND
6/15	AM	4	0.0	17.0	13.5	55	1
6/15	PM	2	0.0	24.0	14.0	54	1
6/16	AM	1	0.0	16.0	12.0	53	1
6/16	PM	ND	ND	ND	ND	ND	ND
6/17	AM	1	0.0	22.0	12.0	51	1
6/17	PM	ND	ND	ND	ND	ND	ND
6/18	AM	1	0.0	22.0	15.0	49	1
6/18	PM	1	0.0	36.0	17.0	49	1
6/19	AM	1	0.0	19.0	13.0	49	1
6/19	PM	1	0.0	29.0	16.0	49	1
6/20	AM	1	0.0	18.0	13.0	47	1
6/20	PM	3	0.0	20.0	12.0	46	1
6/21	AM	3	0.0	13.0	12.0	46	1
6/21	PM	3	0.0	16.0	12.0	46	1
6/22	AM	3	0.0	12.0	11.0	44	1
6/22	PM	3	0.0	17.0	12.0	44	1
6/23	AM	4	0.0	12.0	11.0	42	1
6/23	PM	3	0.0	20.0	14.0	41	1
6/24	AM	4	0.0	14.0	12.0	40	1
6/24	PM	ND	ND	ND	ND	ND	ND
6/25	AM	5	4.1	13.0	12.0	40	1
6/25	PM	3	0.0	26.0	16.0	39	1
6/26	AM	1	0.0	17.0	12.0	39	1
6/26	PM	1	0.0	22.0	18.0	39	1
6/27	AM	1	0.0	14.5	15.0	38	1
6/27	PM	1	0.0	25.0	19.0	38	1
6/28	AM	2	0.0	13.0	13.0	37	1
6/28	PM	3	0.0	22.0	17.0	38	1
6/29	AM	3	0.0	16.0	13.0	38	1
6/29	PM	4	0.0	24.0	17.0	38	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Temperature (°C) Water	River stage (cm)	Water clarity[b]
6/30	AM	4	4.2	10.0	14.0	37	1
6/30	PM	4	5.0	10.0	12.0	37	1
7/1	AM	4	10.0	9.0	10.0	45	2
7/1	PM	3	0.6	12.0	10.0	62	3
7/2	AM	4	0.1	9.0	10.0	57	3
7/2	PM	4	0.4	12.0	10.0	63	3
7/3	AM	4	1.0	8.0	10.0	58	3
7/3	PM	4	0.5	11.0	10.0	58	2
7/4	AM	4	3.1	9.0	7.0	60	3
7/4	PM	3	9.0	13.0	10.0	61	2
7/5	AM	3	0.1	9.0	9.0	65	2
7/5	PM	ND	ND	ND	ND	ND	ND
7/6	AM	4	4.0	10.0	8.0	68	2
7/6	PM	4	3.2	11.0	8.5	70	2
7/7	AM	4	2.0	9.0	7.0	77	3
7/7	PM	3	4.4	13.5	8.5	81	3
7/8	AM	4	0.0	10.0	7.5	84	3
7/8	PM	4	0.0	13.0	8.0	85	3
7/9	AM	4	0.5	9.0	7.0	81	3
7/9	PM	3	0.5	15.0	8.5	84	3
7/10	AM	3	0.0	9.0	7.0	84	3
7/10	PM	3	0.0	19.0	9.0	80	3
7/11	AM	1	0.0	7.0	8.0	79	2
7/11	PM	3	0.0	20.5	10.0	78	2
7/12	AM	1	0.0	10.5	10.5	74	2
7/12	PM	1	0.0	20.0	12.5	72	2
7/13	AM	1	0.0	13.0	10.5	70	1
7/13	PM	2	0.0	24.0	15.5	69	1
7/14	AM	3	0.0	16.5	10.0	66	1
7/14	PM	2	0.0	17.5	14.0	64	1
7/15	AM	3	0.1	15.0	13.0	62	1
7/15	PM	4	0.0	15.0	12.0	61	1
7/16	AM	4	2.2	13.0	10.0	59	1
7/16	PM	ND	ND	ND	ND	ND	ND

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Temperature (°C) Water	River stage (cm)	Water clarity[b]
7/17	AM	4	0.0	14.0	10.0	59	1
7/17	PM	ND	ND	ND	ND	ND	ND
7/18	AM	4	0.5	14.0	10.0	56	1
7/18	PM	3	7.0	17.5	11.0	57	1
7/19	AM	4	0.2	12.0	10.0	59	1
7/19	PM	4	0.1	12.5	10.5	60	1
7/20	AM	4	3.4	11.0	9.0	60	1
7/20	PM	3	0.1	14.5	11.0	59	1
7/21	AM	4	0.0	12.0	9.0	56	1
7/21	PM	3	0.0	19.0	12.0	55	1
7/22	AM	1	0.0	16.0	10.0	54	1
7/22	PM	2	0.0	24.0	13.5	53	1
7/23	AM	3	0.0	16.0	12.0	50	1
7/23	PM	3	0.0	21.0	15.0	49	1
7/24	AM	4	0.0	14.5	13.0	47	1
7/24	PM	2	0.0	20.5	15.0	47	1
7/25	AM	4	0.0	15.0	12.5	46	1
7/25	PM	ND	ND	ND	ND	ND	ND
7/26	AM	1	0.0	9.5	11.0	45	1
7/26	PM	1	0.0	25.5	14.5	44	1
7/27	AM	1	0.0	13.0	14.0	42	1
7/27	PM	ND	ND	ND	ND	ND	ND
7/28	AM	1	0.0	16.0	14.0	42	1
7/28	PM	2	0.0	28.0	17.0	41	1
7/29	AM	3	0.0	15.0	16.0	40	1
7/29	PM	ND	ND	ND	ND	ND	ND
7/30	AM	3	0.0	13.0	15.0	40	1
7/30	PM	3	0.0	28.0	18.0	39	1
7/31	AM	3	0.0	12.0	15.0	39	1
7/31	PM	2	0.0	29.0	18.0	38	1
8/1	AM	2	0.0	14.5	15.0	38	1
8/1	PM	4	0.0	22.0	15.5	37	1
8/2	AM	2	0.0	14.5	15.0	37	1
8/2	PM	4	0.0	19.0	16.0	36	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Water	River stage (cm)	Water clarity[b]
8/3	AM	4	2.1	13.0	14.0	36	1
8/3	PM	4	1.1	15.0	15.0	36	1
8/4	AM	4	5.4	14.0	13.0	37	1
8/4	PM	3	7.2	16.5	14.0	39	1
8/5	AM	4	0.4	12.0	12.0	43	1
8/5	PM	4	3.1	15.0	14.0	45	1
8/6	AM	4	0.2	12.0	11.5	44	2
8/6	PM	4	1.0	15.0	12.0	43	2
8/7	AM	2	0.0	9.5	11.0	41	2
8/7	PM	ND	ND	ND	ND	ND	ND
8/8	AM	3	0.1	13.0	12.0	39	1
8/8	PM	ND	ND	ND	ND	ND	ND
8/9	AM	4	3.3	10.0	11.0	38	1
8/9	PM	3	0.7	14.0	11.0	38	1
8/10	AM	4	0.9	12.0	10.0	40	1
8/10	PM	3	0.0	14.5	11.0	40	1
8/11	AM	2	0.3	9.0	10.0	39	1
8/11	PM	ND	ND	ND	ND	ND	ND
8/12	AM	5	0.0	4.0	10.0	39	1
8/12	PM	3	0.0	19.0	14.5	38	1
8/13	AM	5	0.0	7.0	11.0	36	1
8/13	PM	ND	ND	ND	ND	ND	ND
8/14	AM	3	0.1	6.0	11.0	36	1
8/14	PM	4	0.1	14.0	11.5	36	1
8/15	AM	4	0.1	10.0	11.0	38	1
8/15	PM	3	0.1	16.0	14.0	38	1
8/16	AM	5	0.0	9.0	11.0	38	1
8/16	PM	4	1.7	17.0	14.0	37	1
8/17	AM	4	0.2	10.0	12.0	36	1
8/17	PM	3	0.0	20.0	14.5	36	1
8/18	AM	4	0.0	14.0	15.0	36	1
8/18	PM	2	0.0	20.0	16.0	35	1
8/19	AM	4	0.0	8.0	13.0	35	1
8/19	PM	4	0.1	14.0	13.0	35	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Water	River stage (cm)	Water clarity[b]
8/20	AM	4	0.3	12.0	11.5	33	1
8/20	PM	4	0.2	15.0	13.0	34	1
8/21	AM	5	11.0	10.0	12.0	36	1
8/21	PM	4	8.5	14.0	12.0	38	1
8/22	AM	4	4.2	11.0	10.5	45	1
8/22	PM	4	0.5	12.0	10.5	50	1
8/23	AM	3	1.2	9.0	10.0	54	2
8/23	PM	2	0.7	15.0	11.5	54	2
8/24	AM	1	2.5	5.5	8.5	50	2
8/24	PM	1	0.0	15.0	12.0	50	2
8/25	AM	5	0.0	1.0	8.0	49	1
8/25	PM	4	0.0	14.0	11.0	48	1
8/26	AM	4	0.0	9.0	9.0	46	1
8/26	PM	ND	ND	ND	ND	ND	ND
8/27	AM	4	4.8	9.0	9.0	46	1
8/27	PM	3	2.0	14.0	12.0	46	1
8/28	AM	5	0.0	1.0	8.0	46	1
8/28	PM	4	1.3	11.0	10.0	46	1
8/29	AM	1	0.0	-1.0	8.0	46	1
8/29	PM	1	0.1	15.0	17.0	46	1
8/30	AM	5	0.0	2.0	8.0	44	1
8/30	PM	4	0.0	13.0	10.0	44	1
8/31	AM	4	0.0	12.0	9.0	44	1
8/31	PM	4	1.0	10.0	8.0	43	1
9/1	AM	5	2.2	9.5	8.0	43	1
9/1	PM	4	5.4	12.0	9.0	44	1
9/2	AM	4	12.0	13.0	8.0	50	2
9/2	PM	2	1.2	16.0	10.0	60	2
9/3	AM	4	0.1	11.0	9.0	81	3
9/3	PM	4	1.0	14.0	8.0	81	3
9/4	AM	4	4.0	10.0	8.0	82	3
9/4	PM	3	5.1	11.0	9.0	86	3
9/5	AM	3	2.6	5.0	7.5	86	3
9/5	PM	3	0.5	12.0	8.0	89	3

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Water	River stage (cm)	Water clarity[b]
9/6	AM	3	1.2	10.0	8.0	96	3
9/6	PM	4	0.0	14.0	9.0	96	3
9/7	AM	4	2.5	8.0	7.0	99	3
9/7	PM	4	2.0	10.0	7.0	102	3
9/8	AM	5	1.2	4.0	7.0	103	3
9/8	PM	3	1.0	14.0	7.5	103	3
9/9	AM	5	2.2	8.0	6.5	101	3
9/9	PM	4	2.1	14.0	8.0	99	3
9/10	AM	4	2.5	9.0	6.0	95	3
9/10	PM	4	2.2	13.0	8.0	95	3
9/11	AM	4	12.0	6.0	6.0	97	3
9/11	PM	2	0.0	11.0	7.0	100	3
9/12	AM	3	0.0	1.0	5.0	101	3
9/12	PM	4	0.1	9.0	6.0	99	2
9/13	AM	4	1.1	7.0	5.0	95	2
9/13	PM	3	0.4	13.0	8.0	95	2
9/14	AM	4	0.0	6.0	6.0	90	2
9/14	PM	2	0.0	14.0	8.0	94	2
9/15	AM	5	0.0	-2.0	5.0	90	2
9/15	PM	2	0.0	14.0	7.0	88	1
9/16	AM	1	0.0	-4.0	4.0	85	1
9/16	PM	1	0.0	11.0	5.0	83	1
9/17	AM	2	0.0	-6.0	3.0	80	1
9/17	PM	2	0.0	10.0	4.0	80	1
9/18	AM	3	0.0	0.0	3.0	76	1
9/18	PM	4	0.0	3.0	3.0	75	1
9/19	AM	3	0.0	-5.0	3.0	72	1
9/19	PM	4	0.0	5.0	4.0	71	1
9/20	AM	4	0.0	0.0	3.0	70	1
9/20	PM	2	0.0	6.0	4.0	70	1

Note: ND = no data.

[a] Sky condition codes:
1 = clear or mostly clear; < 10% cloud cover
2 = partly cloudy; < 50% cloud cover
3 = mostly cloudy; > 50% cloud cover
4 = complete overcast
5 = thick fog

[b] Water clarity codes:
1 = visibility greater than 1 meter
2 = visibility between 0.5 and 1 meter
3 = visibility less than 0.5 meter

Appendix A3.–Daily weather and stream observations at the Kogrukluk River weir, 2013.

Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Water	River stage (cm)	Water clarity[b]
6/25	AM	1	0.0	12.0	7.5	290	1
6/25	PM	ND	ND	ND	ND	ND	ND
6/26	AM	1	0.0	21.0	10.5	289	1
6/26	PM	1	0.0	26.0	14.0	288	1
6/27	AM	1	0.0	18.0	11.0	286	1
6/27	PM	2	0.0	28.0	14.0	256	1
6/28	AM	3	0.0	17.0	12.0	286	1
6/28	PM	ND	ND	ND	ND	ND	ND
6/29	AM	3	0.0	19.0	11.0	286	1
6/29	PM	3	0.0	21.0	14.0	287	1
6/30	AM	4	2.0	10.0	10.0	286	1
6/30	PM	4	8.0	13.0	12.0	287	1
7/1	AM	4	7.0	10.0	9.0	292	1
7/1	PM	3	1.8	15.0	9.0	297	1
7/2	AM	4	0.6	9.0	8.0	308	2
7/2	PM	4	2.8	13.0	11.0	305	2
7/3	AM	4	0.8	9.0	8.0	298	1
7/3	PM	4	1.7	12.0	8.0	294	1
7/4	AM	4	3.7	10.0	8.0	295	1
7/4	PM	4	3.8	15.0	10.0	303	1
7/5	AM	3	3.2	10.0	8.0	306	2
7/5	PM	4	0.0	15.0	9.0	301	1
7/6	AM	4	3.8	11.0	8.0	298	1
7/6	PM	4	8.7	13.0	10.0	298	1
7/7	AM	4	3.6	9.0	8.0	307	2
7/7	PM	3	1.1	19.0	9.0	315	3
7/8	AM	4	0.6	11.0	9.0	315	3
7/8	PM	2	1.3	17.0	11.0	313	3
7/9	AM	4	0.7	11.0	9.0	310	2
7/9	PM	3	4.4	19.0	9.0	306	2
7/10	AM	4	0.3	7.0	8.0	303	2
7/10	PM	1	0.0	25.0	10.0	301	1
7/11	AM	1	0.0	8.0	8.0	299	1
7/11	PM	1	0.0	27.0	11.0	299	1
7/12	AM	1	0.0	13.0	9.0	295	1
7/12	PM	3	0.0	27.0	10.0	294	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Water	River stage (cm)	Water clarity[b]
7/13	AM	3	0.0	12.0	9.0	292	1
7/13	PM	2	0.0	31.0	14.0	290	1
7/14	AM	2	0.0	14.0	9.0	288	1
7/14	PM	4	0.0	19.0	12.0	287	1
7/15	AM	4	0.0	13.0	8.0	287	1
7/15	PM	ND	ND	ND	ND	ND	ND
7/16	AM	4	0.0	15.0	10.0	286	1
7/16	PM	3	0.0	15.0	8.0	286	1
7/17	AM	4	3.0	14.0	7.0	286	1
7/17	PM	4	0.0	15.0	8.0	286	1
7/18	AM	4	2.0	15.0	7.0	285	1
7/18	PM	3	1.2	18.0	10.0	285	1
7/19	AM	3	0.0	13.0	7.0	284	1
7/19	PM	3	0.0	19.0	10.0	283	1
7/20	AM	3	0.0	13.0	8.0	282	1
7/20	PM	1	0.0	19.0	13.0	280	1
7/21	AM	3	0.0	12.0	7.5	280	1
7/21	PM	2	0.0	21.0	13.0	278	1
7/22	AM	3	0.0	14.0	8.0	278	1
7/22	PM	1	0.0	24.0	14.0	278	1
7/23	AM	2	0.0	10.0	11.0	279	1
7/23	PM	2	0.0	22.0	13.0	278	1
7/24	AM	2	0.0	15.0	10.0	276	1
7/24	PM	1	0.0	25.0	14.0	274	1
7/25	AM	1	0.0	12.0	11.5	276	1
7/25	PM	2	0.0	24.0	14.0	274	1
7/26	AM	1	0.0	10.0	9.0	277	1
7/26	PM	1	0.0	30.0	17.0	274	1
7/27	AM	1	0.0	12.0	12.5	277	1
7/27	PM	1	0.0	32.0	15.0	270	1
7/28	AM	1	0.0	17.0	11.0	274	1
7/28	PM	2	10.2	24.0	15.5	283	1
7/29	AM	1	0.0	15.0	13.0	287	1
7/29	PM	4	1.8	28.0	15.0	287	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Water	River stage (cm)	Water clarity[b]
7/30	AM	4	7.4	15.0	12.0	291	1
7/30	PM	2	0.0	30.0	15.0	273	1
7/31	AM	1	0.0	10.0	12.0	278	1
7/31	PM	2	0.0	25.0	14.0	271	1
8/1	AM	3	0.0	13.0	11.5	275	1
8/1	PM	4	0.0	15.5	13.0	269	1
8/2	AM	4	0.4	14.0	11.0	271	1
8/2	PM	4	0.2	16.0	12.0	269	1
8/3	AM	4	5.0	14.0	11.0	274	2
8/3	PM	4	2.0	18.0	8.0	276	1
8/4	AM	4	3.5	11.5	8.0	295	2
8/4	PM	3	0.0	20.0	12.5	280	2
8/5	AM	4	7.9	11.0	9.0	284	2
8/5	PM	4	8.1	15.0	11.0	288	2
8/6	AM	4	3.2	11.0	8.5	294	2
8/6	PM	4	6.8	14.0	10.0	313	3
8/7	AM	4	0.7	12.5	9.0	328	3
8/7	PM	3	0.0	14.0	11.0	327	3
8/8	AM	4	0.0	12.0	9.0	316	3
8/8	PM	4	2.0	11.5	10.0	313	3
8/9	AM	4	0.4	11.0	8.5	308	3
8/9	PM	4	0.0	13.0	9.5	319	3
8/10	AM	4	1.5	11.0	8.0	330	3
8/10	PM	4	2.1	14.0	10.0	326	3
8/11	AM	1	0.0	10.5	8.5	323	3
8/11	PM	3	0.0	26.0	13.0	323	3
8/12	AM	1	0.0	9.0	8.0	314	3
8/12	PM	3	0.0	21.0	11.0	311	2
8/13	AM	4	1.5	15.0	9.0	306	2
8/13	PM	3	0.4	17.0	11.0	306	2
8/14	AM	4	2.5	11.0	8.5	303	2
8/14	PM	4	2.9	15.0	10.5	303	2
8/15	AM	4	2.8	12.0	9.0	305	2
8/15	PM	4	0.6	18.0	11.5	305	2

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C)		River stage (cm)	Water clarity[b]
				Air	Water		
8/16	AM	4	0.4	11.0	8.0	305	2
8/16	PM	4	0.5	17.0	11.0	303	1
8/17	AM	3	1.8	10.0	8.0	298	1
8/17	PM	3	0.0	18.0	11.5	296	1
8/18	AM	4	0.5	13.0	9.5	293	1
8/18	PM	3	0.0	19.0	12.0	293	1
8/19	AM	4	0.0	10.0	8.0	288	1
8/19	PM	4	1.0	16.0	11.0	287	1
8/20	AM	3	0.4	13.0	9.0	286	1
8/20	PM	4	0.6	17.0	11.0	286	1
8/21	AM	4	10.1	11.0	8.0	287	1
8/21	PM	4	4.2	15.0	10.5	289	1
8/22	AM	3	3.0	12.0	8.5	291	1
8/22	PM	3	0.9	15.0	12.0	291	1
8/23	AM	3	0.0	11.0	8.0	291	1
8/23	PM	2	0.0	14.0	10.0	288	1
8/24	AM	1	0.0	8.0	8.0	287	1
8/24	PM	2	0.0	16.0	10.5	287	1
8/25	AM	3	0.0	5.0	7.0	286	1
8/25	PM	3	0.0	14.0	10.0	284	1
8/26	AM	4	0.0	15.0	8.0	283	1
8/26	PM	4	0.0	17.0	9.0	282	1
8/27	AM	4	0.8	12.0	7.5	284	1
8/27	PM	3	0.0	15.0	9.5	281	1
8/28	AM	4	0.6	8.0	7.0	281	1
8/28	PM	3	2.0	14.0	9.0	281	1
8/29	AM	1	0.3	4.0	7.0	279	1
8/29	PM	2	0.0	17.0	12.0	279	1
8/30	AM	4	0.0	4.0	8.0	277	1
8/30	PM	3	0.0	15.0	10.0	276	1
8/31	AM	4	0.3	8.0	8.0	274	1
8/31	PM	4	0.3	13.0	10.0	274	1
9/1	AM	4	1.6	10.0	9.0	274	1
9/1	PM	4	13.0	13.0	10.0	275	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C)		River stage (cm)	Water clarity[b]
				Air	Water		
9/2	AM	4	3.0	11.0	9.0	278	1
9/2	PM	4	4.9	14.0	11.0	281	1
9/3	AM	4	0.0	10.0	10.0	288	1
9/3	PM	3	0.4	13.0	10.0	300	2
9/4	AM	4	4.4	10.0	10.0	303	2
9/4	PM	2	2.5	16.0	10.0	302	2
9/5	AM	3	3.9	6.0	9.0	300	1
9/5	PM	4	1.0	10.0	9.0	297	1
9/6	AM	3	7.3	6.0	9.0	299	1
9/6	PM	4	0.7	12.0	9.0	302	2
9/7	AM	4	2.5	8.0	8.0	301	1
9/7	PM	4	2.0	10.0	9.0	298	1
9/8	AM	4	1.0	8.0	9.0	298	1
9/8	PM	4	0.0	11.0	9.0	300	1
9/9	AM	4	5.0	10.0	8.0	298	1
9/9	PM	4	2.9	11.5	9.0	299	1
9/10	AM	4	16.0	11.0	8.0	323	3
9/10	PM	4	9.8	11.0	9.0	340	3
9/11	AM	2	11.0	15.0	8.0	356	3
9/11	PM	1	0.0	13.0	9.0	363	3
9/12	AM	4	0.0	10.0	9.0	357	3
9/12	PM	4	2.6	11.0	9.0	348	3
9/13	AM	4	4.5	11.0	8.0	344	3
9/13	PM	2	0.0	13.0	9.0	348	3
9/14	AM	2	0.0	9.0	8.0	344	3
9/14	PM	3	0.0	11.5	9.0	338	3
9/15	AM	1	0.0	1.0	7.5	332	3
9/15	PM	1	0.0	14.0	8.0	328	2
9/16	AM	1	0.0	0.0	7.0	322	2
9/16	PM	1	0.0	13.0	7.5	318	1
9/17	AM	1	0.0	-2.0	7.0	317	1
9/17	PM	1	0.0	11.0	7.0	316	1
9/18	AM	1	0.0	-2.0	6.5	313	1
9/18	PM	1	0.0	8.0	6.0	312	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Temperature (°C) Water	River stage (cm)	Water clarity[b]
9/19	AM	1	0.0	-3.0	5.0	312	1
9/19	PM	2	0.0	10.0	5.0	301	1
9/20	AM	2	0.0	-4.0	4.5	308	1
9/20	PM	1	0.0	10.0	5.0	307	1

Note: ND = no data.

[a] Sky condition codes:
1 = clear or mostly clear; < 10% cloud cover
2 = partly cloudy; < 50% cloud cover
3 = mostly cloudy; > 50% cloud cover
4 = complete overcast
5 = thick fog

[b] Water clarity codes:
1 = visibility greater than 1 meter
2 = visibility between 0.5 and 1 meter
3 = visibility less than 0.5 meter

Appendix A4.–Daily weather and stream observations at the Telaquana River weir, 2013.

Date	Time	Sky conditions[a]	Precipitation (inches)	Temperature (°C) Air	Temperature (°C) Water	River stage (cm)	Water clarity[b]
7/5	AM	3	5.5	9.5	12.0	50	1
7/5	PM	ND	ND	ND	ND	ND	ND
7/6	AM	3	0.2	13.0	12.0	49	1
7/6	PM	ND	ND	ND	ND	ND	ND
7/7	AM	4	0.2	8.0	12.0	48	1
7/7	PM	ND	ND	ND	ND	ND	ND
7/8	AM	4	0.9	10.0	12.0	48	1
7/8	PM	3	0.4	12.0	13.0	51	1
7/9	AM	4	0.6	9.5	12.0	51	1
7/9	PM	ND	ND	ND	ND	ND	ND
7/10	AM	4	0.1	11.0	12.0	52	1
7/10	PM	3	0.0	18.0	12.5	51	1
7/11	AM	1	0.0	15.0	12.0	50	1
7/11	PM	1	0.0	17.0	14.0	51	1
7/12	AM	1	0.0	18.0	12.0	51	1
7/12	PM	2	0.0	22.0	15.5	51	1
7/13	AM	1	0.0	17.5	13.5	50	1
7/13	PM	3	0.0	20.0	14.5	52	1
7/14	AM	1	0.0	18.0	15.0	51	1
7/14	PM	1	0.0	23.5	16.0	51	1
7/15	AM	3	0.0	15.0	12.0	52	1
7/15	PM	4	0.0	13.0	14.0	52	1
7/16	AM	4	0.4	11.0	12.0	52	1
7/16	PM	4	0.2	14.0	12.0	53	1
7/17	AM	4	1.0	12.0	11.0	55	1
7/17	PM	4	2.7	13.0	12.0	58	1
7/18	AM	4	0.6	13.0	12.5	60	1
7/18	PM	4	0.2	16.0	14.0	61	1
7/19	AM	5	1.0	11.0	12.0	63	1
7/19	PM	4	0.8	14.0	11.0	67	1
7/20	AM	4	3.1	10.0	9.0	71	1
7/20	PM	3	0.1	12.0	10.0	75	1
7/21	AM	4	0.0	9.0	9.0	75	1
7/21	PM	2	0.0	18.0	11.5	76	1

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Date	Time	Sky conditions[a]	Precipitation (inches)	Temperature (°C) Air	Temperature (°C) Water	River stage (cm)	Water clarity[b]
7/22	AM	1	0.0	18.0	12.0	76	1
7/22	PM	2	0.0	17.0	12.0	75	1
7/23	AM	3	0.0	15.0	12.0	75	1
7/23	PM	2	0.0	ND	ND	75	1
7/24	AM	3	0.0	16.0	12.5	75	2
7/24	PM	3	0.0	24.0	16.0	74	2
7/25	AM	4	0.0	14.0	13.0	74	2
7/25	PM	2	0.0	22.0	16.0	73	2
7/26	AM	1	0.0	19.0	13.0	74	2
7/26	PM	1	0.0	25.0	16.0	74	2
7/27	AM	1	0.0	22.0	16.0	74	2
7/27	PM	2	0.0	26.0	18.0	74	2
7/28	AM	1	0.2	21.0	17.5	74	3
7/28	PM	3	0.0	26.0	20.0	74	3
7/29	AM	2	0.0	18.0	16.0	76	3
7/29	PM	3	0.0	25.0	19.0	76	3
7/30	AM	1	0.6	19.0	18.0	76	3
7/30	PM	3	0.0	23.0	19.0	76	2
7/31	AM	1	0.1	22.0	19.0	77	2
7/31	PM	2	0.0	25.0	21.0	76	2
8/1	AM	3	0.0	18.0	18.0	77	2
8/1	PM	4	0.0	21.0	19.0	77	2
8/2	AM	3	0.2	17.0	18.0	76	2
8/2	PM	4	0.0	18.0	18.0	76	2
8/3	AM	3	0.0	18.0	16.0	76	2
8/3	PM	4	0.0	15.0	16.0	75	2
8/4	AM	4	2.7	11.0	16.0	74	2
8/4	PM	4	2.9	15.5	16.5	74	2
8/5	AM	4	0.7	11.0	15.5	72	2
8/5	PM	4	0.6	15.5	16.0	73	2
8/6	AM	4	0.2	15.5	14.0	72	2
8/6	PM	4	0.0	16.0	15.0	72	2
8/7	AM	4	0.0	16.0	14.0	72	2
8/7	PM	4	0.0	13.0	14.0	72	2

Note: ND = no data.

[a] Sky condition codes:
1 = clear or mostly clear; < 10% cloud cover
2 = partly cloudy; < 50% cloud cover
3 = mostly cloudy; > 50% cloud cover
4 = complete overcast
5 = thick fog

[b] Water clarity codes:
1 = visibility greater than 1 meter
2 = visibility between 0.5 and 1 meter
3 = visibility less than 0.5 meter

Appendix A5.–Daily weather and stream observations at the Tatlawiksuk River weir, 2013.

Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Temperature (°C) Water	River stage (cm)	Water clarity[b]
6/15	AM	1	0.0	18.0	12.0	47	1
6/15	PM	1	0.0	26.0	15.0	47	1
6/16	AM	1	0.0	18.0	13.0	45	1
6/16	PM	1	0.0	29.0	16.0	45	1
6/17	AM	1	0.0	19.0	14.0	43	1
6/17	PM	ND	ND	ND	ND	ND	ND
6/18	AM	1	0.0	22.0	15.0	41	1
6/18	PM	1	0.0	32.0	18.0	41	1
6/19	AM	1	0.0	17.0	15.0	39	1
6/19	PM	3	0.0	22.0	15.0	39	1
6/20	AM	2	0.0	14.0	13.0	39	1
6/20	PM	2	0.0	22.0	14.0	37	1
6/21	AM	2	0.0	11.0	11.0	37	1
6/21	PM	3	0.2	14.0	12.0	37	1
6/22	AM	1	0.0	16.0	11.0	37	1
6/22	PM	2	0.1	19.0	12.0	37	1
6/23	AM	1	0.4	14.0	10.0	37	1
6/23	PM	ND	ND	ND	ND	ND	ND
6/24	AM	3	0.0	14.0	12.0	36	1
6/24	PM	2	0.0	24.0	13.0	36	1
6/25	AM	5	0.0	10.0	12.0	32	1
6/25	PM	1	0.0	24.0	14.0	32	1
6/26	AM	1	2.9	19.0	13.0	30	1
6/26	PM	1	0.0	25.0	16.0	30	1
6/27	AM	1	2.9	14.0	14.0	30	1
6/27	PM	2	0.0	27.0	17.0	30	1
6/28	AM	1	0.2	12.0	13.0	32	1
6/28	PM	4	0.1	19.0	14.0	36	1
6/29	AM	1	0.0	17.0	13.0	48	2
6/29	PM	3	0.0	22.0	14.0	48	2
6/30	AM	2	0.0	13.0	13.0	46	1
6/30	PM	4	8.0	11.0	12.0	44	1
7/1	AM	4	20.0	10.0	10.0	44	1
7/1	PM	3	2.5	13.0	11.0	44	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Water	River stage (cm)	Water clarity[b]
7/2	AM	4	1.0	9.0	10.0	46	1
7/2	PM	4	3.5	12.0	10.0	46	1
7/3	AM	4	6.0	9.0	9.0	46	1
7/3	PM	4	1.0	12.0	9.0	46	1
7/4	AM	4	10.0	13.0	8.0	48	1
7/4	PM	3	1.0	13.0	9.0	48	1
7/5	AM	3	4.0	12.0	9.0	50	1
7/5	PM	3	0.0	12.0	10.0	50	1
7/6	AM	4	1.0	11.0	10.0	54	2
7/6	PM	4	0.5	13.0	10.0	50	2
7/7	AM	4	4.0	9.0	9.0	50	1
7/7	PM	3	0.0	14.0	10.0	48	1
7/8	AM	4	0.5	11.0	9.0	46	1
7/8	PM	4	0.0	13.0	10.0	46	1
7/9	AM	4	0.0	10.0	9.0	44	1
7/9	PM	4	0.0	12.0	9.0	44	1
7/10	AM	3	0.0	11.0	9.0	42	1
7/10	PM	2	0.0	19.0	12.0	40	1
7/11	AM	1	0.0	16.0	10.0	40	1
7/11	PM	1	0.0	22.0	13.0	38	1
7/12	AM	1	0.0	13.0	11.0	38	1
7/12	PM	1	0.0	25.0	15.0	38	1
7/13	AM	1	0.0	15.0	13.0	36	1
7/13	PM	1	0.0	27.0	16.0	36	1
7/14	AM	1	0.0	18.0	14.0	36	1
7/14	PM	1	0.0	21.0	16.0	34	1
7/15	AM	3	0.0	14.0	10.0	32	1
7/15	PM	ND	ND	ND	ND	ND	ND
7/16	AM	4	0.9	12.0	13.0	30	1
7/16	PM	4	0.0	15.0	13.0	30	1
7/17	AM	4	2.2	12.0	12.0	31	1
7/17	PM	3	0.9	21.0	14.0	32	1
7/18	AM	4	0.1	14.0	12.0	33	1
7/18	PM	4	3.5	12.0	14.0	33	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Water	River stage (cm)	Water clarity[b]
7/19	AM	4	0.0	11.0	12.0	36	2
7/19	PM	4	0.5	11.0	12.0	42	2
7/20	AM	4	1.8	10.0	10.0	63	2
7/20	PM	3	0.4	15.0	11.0	68	2
7/21	AM	4	0.0	9.0	10.0	70	2
7/21	PM	ND	ND	ND	ND	ND	ND
7/22	AM	2	0.0	10.0	10.0	66	1
7/22	PM	2	0.0	24.0	13.0	64	1
7/23	AM	2	0.0	13.0	12.0	61	1
7/23	PM	2	0.0	23.0	14.0	61	1
7/24	AM	3	0.0	15.0	12.0	58	1
7/24	PM	2	0.0	23.0	14.0	57	1
7/25	AM	2	0.0	13.0	13.0	54	1
7/25	PM	4	0.0	19.0	13.0	52	1
7/26	AM	1	0.0	9.0	11.0	49	1
7/26	PM	ND	ND	ND	ND	ND	ND
7/27	AM	1	0.0	10.0	12.0	47	1
7/27	PM	1	0.0	29.0	16.0	49	1
7/28	AM	1	0.0	17.0	12.0	46	1
7/28	PM	2	1.0	23.0	16.0	46	1
7/29	AM	1	0.0	16.0	14.0	44	1
7/29	PM	1	0.0	24.0	16.0	44	1
7/30	AM	1	0.0	19.0	15.0	44	1
7/30	PM	ND	ND	ND	ND	ND	ND
7/31	AM	1	0.0	15.0	14.0	42	1
7/31	PM	ND	ND	ND	ND	ND	ND
8/1	AM	2	0.0	11.0	10.0	40	1
8/1	PM	2	0.0	22.0	16.0	40	1
8/2	AM	2	0.0	14.0	14.0	40	1
8/2	PM	2	0.0	18.0	14.0	40	1
8/3	AM	2	0.0	13.0	13.0	38	1
8/3	PM	2	0.5	14.0	13.0	38	1
8/4	AM	4	15.0	12.0	12.0	40	1
8/4	PM	4	3.0	16.0	13.0	40	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Water	River stage (cm)	Water clarity[b]
8/5	AM	4	1.0	13.0	12.0	46	1
8/5	PM	2	2.0	16.0	12.0	50	1
8/6	AM	4	0.8	13.0	13.0	60	1
8/6	PM	ND	ND	ND	ND	ND	ND
8/7	AM	1	0.5	10.0	10.0	58	1
8/7	PM	2	0.0	22.0	12.0	56	1
8/8	AM	4	0.8	12.0	10.0	54	1
8/8	PM	4	5.0	12.0	11.0	52	1
8/9	AM	4	5.0	10.0	10.0	56	1
8/9	PM	ND	ND	ND	ND	ND	ND
8/10	AM	4	10.0	10.0	10.0	66	1
8/10	PM	2	2.5	16.0	11.0	66	1
8/11	AM	2	0.5	11.0	10.0	70	2
8/11	PM	2	0.0	12.0	12.0	68	2
8/12	AM	2	0.0	10.0	10.0	66	2
8/12	PM	2	0.0	18.0	12.0	64	1
8/13	AM	3	0.0	13.0	10.0	62	1
8/13	PM	3	0.0	23.0	13.0	60	1
8/14	AM	3	7.5	10.0	10.0	60	1
8/14	PM	3	0.0	15.0	12.0	64	1
8/15	AM	4	1.0	11.0	11.0	70	1
8/15	PM	3	0.0	18.0	12.0	70	1
8/16	AM	4	0.0	9.0	10.0	68	1
8/16	PM	2	0.0	18.0	12.0	66	1
8/17	AM	5	2.0	10.0	10.0	66	1
8/17	PM	2	0.0	19.0	11.0	64	1
8/18	AM	3	0.5	13.0	11.0	62	1
8/18	PM	2	0.0	19.0	13.0	62	1
8/19	AM	3	0.0	8.0	10.0	58	1
8/19	PM	4	0.0	14.0	11.0	58	1
8/20	AM	4	3.0	10.0	9.0	56	1
8/20	PM	4	0.3	14.0	10.0	56	1
8/21	AM	4	13.0	11.0	10.0	60	1
8/21	PM	4	12.5	14.0	10.0	66	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C)		River stage (cm)	Water clarity[b]
				Air	Water		
8/22	AM	4	10.2	10.0	10.0	88	2
8/22	PM	4	2.4	13.0	10.0	100	3
8/23	AM	4	1.2	9.0	8.0	100[c]	3
8/23	PM	3	0.6	11.0	8.0	100[c]	3
8/24	AM	1	0.0	10.0	8.0	100[c]	3
8/24	PM	ND	ND	ND	ND	ND	ND
8/25	AM	1	0.3	9.0	7.0	100[c]	3
8/25	PM	4	0.0	15.0	9.0	100[c]	3
8/26	AM	1	0.0	10.0	8.0	107	3
8/26	PM	4	0.0	15.0	9.0	103	3
8/27	AM	4	0.0	8.0	8.0	95	3
8/27	PM	3	3.0	15.0	9.0	93	3
8/28	AM	4	0.4	8.0	7.0	88	3
8/28	PM	4	0.3	13.0	8.0	85	3
8/29	AM	1	0.0	8.0	7.0	81	3
8/29	PM	3	0.0	15.0	8.5	77	3
8/30	AM	3	0.0	4.0	8.0	72	3
8/30	PM	3	0.0	13.0	8.0	69	2
8/31	AM	4	0.0	7.0	6.0	65	2
8/31	PM	4	0.0	11.0	7.0	62	2
9/1	AM	4	2.2	9.0	7.0	61	2
9/1	PM	4	9.8	10.5	7.0	60	2
9/2	AM	4	23.0	11.0	7.0	71	2
9/2	PM	4	10.0	13.0	7.0	83	3
9/3	AM	4	2.2	8.0	6.0	120	3
9/3	PM	4	8.0	9.5	7.0	137	3
9/4	AM	4	4.0	8.0	7.0	140[c]	3
9/4	PM	4	1.8	12.0	7.5	140[c]	3
9/5	AM	4	5.2	6.0	7.0	140[c]	3
9/5	PM	4	0.5	11.0	7.0	140[c]	3
9/6	AM	3	0.0	4.0	6.0	140[c]	3
9/6	PM	4	0.0	9.0	5.0	140[c]	3
9/7	AM	4	2.0	7.0	5.0	140[c]	3
9/7	PM	4	0.4	9.5	6.5	140[c]	3

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Temperature (°C) Water	River stage (cm)	Water clarity[b]
9/8	AM	4	0.0	7.0	5.0	138	3
9/8	PM	4	0.0	10.5	6.5	136	3
9/9	AM	4	1.4	6.0	6.0	123	3
9/9	PM	4	0.5	9.5	6.0	120	3
9/10	AM	4	4.0	8.0	5.5	114	3
9/10	PM	3	4.5	9.5	6.0	111	3
9/11	AM	4	2.5	7.0	6.0	107	3
9/11	PM	3	0.4	9.0	6.5	103	3
9/12	AM	4	0.0	2.0	5.0	99	3
9/12	PM	4	0.3	8.5	5.0	97	3
9/13	AM	4	0.0	7.0	5.0	93	3
9/13	PM	3	0.1	13.0	5.5	88	2
9/14	AM	3	0.0	6.5	5.0	83	2
9/14	PM	3	0.0	11.0	6.5	82	2
9/15	AM	1	0.0	4.0	4.5	77	2
9/15	PM	1	0.0	14.0	6.0	75	2
9/16	AM	1	0.0	3.5	4.0	69	2
9/16	PM	1	0.0	11.0	5.5	67	2
9/17	AM	1	0.0	4.0	3.0	65	2
9/17	PM	2	0.0	5.5	3.5	63	2
9/18	AM	2	0.0	-3.0	1.5	60	2
9/18	PM	1	0.0	4.5	2.5	59	2
9/19	AM	4	0.0	-1.5	1.0	56	2
9/19	PM	2	0.0	2.0	2.5	55	2
9/20	AM	4	0.0	-1.5	2.0	54	2
9/20	PM	2	0.0	ND	ND	53	2

Note: ND = no data.

[a] Sky condition codes:
1 = clear or mostly clear; < 10% cloud cover
2 = partly cloudy; < 50% cloud cover
3 = mostly cloudy; > 50% cloud cover
4 = complete overcast
5 = thick fog

[b] Water clarity codes:
1 = visibility greater than 1 meter
2 = visibility between 0.5 and 1 meter
3 = visibility less than 0.5 meter

Appendix A6.–Daily weather and stream observations at the Takotna River weir, 2013.

Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Water	River stage (cm)	Water clarity[b]
6/23	AM	4	0.0	15.0	ND	60	1
6/23	PM	4	0.0	28.0	ND	60	1
6/24	AM	4	0.0	17.0	14.0	61	1
6/24	PM	4	0.0	26.0	17.0	61	1
6/25	AM	2	1.0	12.0	18.0	60	1
6/25	PM	3	0.0	27.0	18.0	60	1
6/26	AM	2	0.0	19.0	11.0	60	1
6/26	PM	2	0.0	26.0	20.0	59	1
6/27	AM	3	0.0	15.0	19.0	59	1
6/27	PM	2	0.0	18.0	20.0	58	1
6/28	AM	1	0.0	13.0	11.0	58	1
6/28	PM	4	2.5	21.0	18.0	58	1
6/29	AM	3	0.0	16.0	11.0	58	1
6/29	PM	3	0.0	23.0	20.0	58	1
6/30	AM	4	0.0	15.0	17.0	58	1
6/30	PM	4	17.8	13.0	16.0	59	1
7/1	AM	4	7.1	11.0	14.0	60	1
7/1	PM	3	12.7	14.0	15.0	62	1
7/2	AM	4	12.7	10.0	14.0	71	2
7/2	PM	4	0.5	11.0	12.0	76	2
7/3	AM	4	1.3	8.0	11.0	76	2
7/3	PM	4	0.0	12.0	10.0	73	2
7/4	AM	4	3.0	9.0	10.0	73	2
7/4	PM	3	0.8	13.0	10.0	72	1
7/5	AM	4	1.3	9.0	11.0	73	1
7/5	PM	2	0.0	16.0	12.0	74	1
7/6	AM	4	1.5	11.0	10.0	79	2
7/6	PM	4	0.5	14.0	13.0	78	2
7/7	AM	4	0.0	11.0	9.0	79	2
7/7	PM	3	0.0	15.0	11.0	80	2
7/8	AM	4	0.3	11.0	10.0	81	2
7/8	PM	4	2.5	10.0	10.0	82	2
7/9	AM	4	1.8	9.0	9.0	87	2
7/9	PM	4	1.0	13.0	9.0	89	2
7/10	AM	2	0.3	12.0	10.0	92	2
7/10	PM	3	0.0	13.0	10.0	92	2

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C)		River stage (cm)	Water clarity[b]
				Air	Water		
7/11	AM	3	0.0	12.0	10.0	89	2
7/11	PM	3	0.0	18.0	11.0	85	2
7/12	AM	1	0.0	12.0	10.0	80	1
7/12	PM	1	0.0	24.0	15.0	82	1
7/13	AM	1	0.0	13.0	12.0	80	1
7/13	PM	1	0.0	27.0	12.0	80	1
7/14	AM	4	0.0	10.0	14.0	77	1
7/14	PM	2	0.0	14.0	16.0	77	1
7/15	AM	4	0.3	13.0	14.0	75	1
7/15	PM	4	ND	15.0	14.0	75	1
7/16	AM	4	1.3	14.0	13.0	74	1
7/16	PM	4	0.0	15.0	9.0	73	1
7/17	AM	4	0.0	12.0	8.0	74	1
7/17	PM	3	0.0	16.0	14.0	76	1
7/18	AM	4	0.3	14.0	12.0	75	1
7/18	PM	4	5.1	15.0	13.0	75	1
7/19	AM	4	0.5	13.0	12.0	75	1
7/19	PM	4	0.3	15.0	13.0	75	1
7/20	AM	4	2.5	10.0	12.0	74	1
7/20	PM	4	0.3	14.0	12.0	80	2
7/21	AM	4	0.0	13.0	11.0	80	1
7/21	PM	4	0.0	18.0	12.0	79	1
7/22	AM	1	0.0	12.0	12.0	75	1
7/22	PM	1	0.0	23.0	15.0	74	1
7/23	AM	4	0.0	13.0	11.0	75	1
7/23	PM	3	0.0	21.0	16.0	75	1
7/24	AM	2	0.0	13.0	14.0	72	1
7/24	PM	4	0.0	18.0	11.0	72	1
7/25	AM	4	0.0	15.0	15.0	69	1
7/25	PM	1	0.0	23.0	18.0	68	1
7/26	AM	1	0.0	10.0	14.0	69	1
7/26	PM	1	0.0	22.0	18.0	68	1
7/27	AM	1	0.0	12.0	15.0	67	1
7/27	PM	1	0.0	26	19	67	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C)		River stage (cm)	Water clarity[b]
				Air	Water		
7/28	AM	1	0.0	13.1	16.6	65	1
7/28	PM	3	0.5	26.4	19.9	66	1
7/29	AM	1	0.0	13.7	16.3	66	1
7/29	PM	1	0.0	25.6	21.1	66	1
7/30	AM	1	0.0	12.0	12.6	64	1
7/30	PM	1	0.0	31.2	21.6	65	1
7/31	AM	1	5.8	12.5	15.0	66	1
7/31	PM	2	ND	27.6	21.4	65	1
8/1	AM	4	0.8	13.7	16.5	65	1
8/1	PM	2	0.0	23.7	21.5	63	1
8/2	AM	4	0.0	15.5	16.5	63	1
8/2	PM	4	0.0	24.4	20.4	62	1
8/3	AM	2	0.8	13.4	15.2	62	1
8/3	PM	4	0.0	18.4	17.1	62	1
8/4	AM	4	2.5	14.0	13.1	63	1
8/4	PM	4	3.8	14.3	14.9	64	1
8/5	AM	4	1.3	12.5	13.6	65	1
8/5	PM	4	0.3	18.2	14.2	68	1
8/6	AM	4	0.5	12.8	12.9	72	1
8/6	PM	4	0.0	18.6	17.2	73	1
8/7	AM	4	0.0	12.9	12.1	72	2
8/7	PM	2	0.0	23.3	14.7	72	1
8/8	AM	4	4.6	15.0	13.0	71	2
8/8	PM	4	1.0	14.0	13.0	71	2
8/9	AM	4	6.1	9.0	12.0	71	2
8/9	PM	4	1.5	14.0	12.0	74	2
8/10	AM	4	0.8	11.0	11.6	81	2
8/10	PM	4	0.0	16.0	13.0	83	2
8/11	AM	4	0.5	9.0	11.5	82	2
8/11	PM	3	0.0	17.0	13.0	81	2
8/12	AM	1	0.0	13.0	11.0	78	2
8/12	PM	4	0.0	19.0	13.0	76	2
8/13	AM	1.0	0.0	14.0	13.0	75	2
8/13	PM	4	0.0	21.0	15.0	75	2

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Water	River stage (cm)	Water clarity[b]
8/14	AM	2	7.6	11.5	12.0	76	1
8/14	PM	2	0.0	17.0	13.0	80	1
8/15	AM	4	0.3	10.0	12.0	84	2
8/15	PM	4	0.0	15.0	13.0	85	2
8/16	AM	3	1.3	11.0	12.0	83	2
8/16	PM	3	0.0	20.0	13.0	82	2
8/17	AM	4	1.5	12.0	11.0	81	2
8/17	PM	2	0.0	20.0	14.0	87	2
8/18	AM	3	0.3	12.0	13.0	79	1
8/18	PM	1	0.0	20.0	15.0	80	1
8/19	AM	4	0.0	10.0	11.0	78	1
8/19	PM	4	0.0	13.0	12.0	78	2
8/20	AM	4	2.5	11.0	11.0	77	1
8/20	PM	4	0.0	16.0	12.0	78	1
8/21	AM	ND	ND	ND	ND	ND	ND
8/21	PM	4	1.3	22.0	11.5	76	2
8/22	AM	4	10.2	11.0	12.0	82	2
8/22	PM	4	3.8	12.0	ND	90	2
8/23	AM	4	0.8	8.0	9.0	102	2
8/23	PM	4	3.3	13.0	10.0	107	2
8/24	AM	1	0.3	6.0	8.0	99	2
8/24	PM	ND	ND	ND	ND	ND	ND
8/25	AM	1	0.0	2.5	8.5	96	2
8/25	PM	2	0.0	17.0	13.0	96	2
8/26	AM	2	0.0	5.0	9.0	90	2
8/26	PM	2	0.0	17.5	12.0	89	1
8/27	AM	4	0.0	8.0	10.0	85	2
8/27	PM	3	0.8	13.0	10.0	86	2
8/28	AM	4	0.0	8.0	9.0	87	2
8/28	PM	4	0.0	15.0	9.0	87	2
8/29	AM	2	0.0	2.0	3.0	88	2
8/29	PM	2	0.0	15.5	10.5	88	1
8/30	AM	4	0.0	3.5	7.5	87	2
8/30	PM	2	0.0	12.0	11.0	84	1

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Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C) Air	Temperature (°C) Water	River stage (cm)	Water clarity[b]
8/31	AM	4	0.5	5.0	8.0	82	1
8/31	PM	4	3.0	17.0	18.5	82	1
9/1	AM	4	1.0	6.5	7.5	81	1
9/1	PM	4	6.4	6.5	7.5	82	2
9/2	AM	4	38.1	8.0	9.0	93	2
9/2	PM	4	13.7	8.5	7.0	109	2
9/3	AM	4	1.3	8.5	7.0	ND	2
9/3	PM	4	2.3	9.0	ND	ND	3
9/4	AM	4	1.3	8.0	6.0	ND	ND
9/4	PM	ND	1.3	4.0	6.0	ND	ND
9/5	AM	3	1.3	8.0	7.0	ND	3
9/5	PM	2	1.3	10.5	7.0	ND	3
9/6	AM	4	1.5	6.0	7.0	ND	3
9/6	PM	4	0.0	13.0	7.0	ND	3
9/7	AM	4	0.0	9.0	7.0	ND	3
9/7	PM	4	0.3	12.0	7.0	ND	3
9/8	AM	2	0.0	6.5	7.0	ND	3
9/8	PM	4	0.0	13.0	7.0	ND	3
9/9	AM	4	0.0	7.0	7.0	ND	3
9/9	PM	4	1.3	13.0	7.0	ND	3
9/10	AM	4	0.0	5.0	7.0	ND	3
9/10	PM	4	0.0	11.0	7.0	ND	3
9/11	AM	4	4.3	8.0	7.0	ND	3
9/11	PM	4	0.0	10.0	7.5	ND	3
9/12	AM	5	0.0	0.0	5.5	ND	3
9/12	PM	2	0.0	10.0	7.0	ND	3
9/13	AM	4	0.5	6.0	5.5	ND	3
9/13	PM	4	0.3	13.0	7.0	ND	3
9/14	AM	4	2.5	8.0	6.0	ND	ND
9/14	PM	3	0.0	12.0	7.0	ND	ND
9/15	AM	1	0.0	1.0	5.0	ND	2
9/15	PM	1	0.0	15.0	8.0	ND	ND
9/16	AM	1	0.0	8.5	5.0	ND	ND
9/16	PM	1	0.0	15.0	8.0	ND	2

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Appendix A6.–Page 6 of 6.

Date	Time	Sky conditions[a]	Precipitation (mm)	Temperature (°C)		River stage (cm)	Water clarity[b]
				Air	Water		
9/17	AM	4	0.0	-2.0	1.0	ND	2
9/17	PM	1	0.0	12.0	5.0	ND	2
9/18	AM	4	0.0	-1.5	3.0	ND	2
9/18	PM	1	0.0	ND	ND	ND	2
9/19	AM	ND	ND	ND	ND	ND	ND
9/19	PM	2	0.0	ND	ND	ND	ND
9/20	AM	4	0.0	0.0	5.0	ND	ND
9/20	PM	4	0.0	4.0	4.0	ND	2
9/21	AM	ND	ND	ND	ND	ND	ND
9/21	PM	ND	ND	ND	ND	ND	ND
9/22	AM	2	0.0	-7.0	1.0	ND	1
9/22	PM	2	0.0	3.0	2.0	ND	1

Note: ND = no data.

[a] Sky condition codes:
1 = clear or mostly clear; < 10% cloud cover
2 = partly cloudy; < 50% cloud cover
3 = mostly cloudy; > 50% cloud cover
4 = complete overcast
5 = thick fog

[b] Water clarity codes:
1 = visibility greater than 1 meter
2 = visibility between 0.5 and 1 meter
3 = visibility less than 0.5 meter

APPENDIX B: NON-TARGET SPECIES OBSERVATIONS

Appendix B1.–Daily observed passage of non-target species at Salmon River weir, 2013.

Date	Pink Salmon	Longnose Sucker	Arctic Grayling	Dolly Varden	Rainbow Trout	Whitefish
6/15	0	0	0	0	1	0
6/16	0	1	1	3	1	0
6/17	0	1	0	0	0	0
6/18	0	0	0	0	0	0
6/19	0	1	1	0	0	0
6/20	0	0	0	0	0	0
6/21	0	0	1	0	0	0
6/22	0	0	0	0	0	0
6/23	0	0	0	0	0	0
6/24	0	0	0	0	0	0
6/25	0	0	0	0	0	0
6/26	0	5	3	0	0	0
6/27	0	0	0	0	0	0
6/28	0	0	0	0	0	0
6/29	0	0	0	0	0	0
6/30	0	0	0	0	0	0
7/1	0	0	0	0	0	0
7/2	0	0	0	0	0	0
7/3	0	0	0	0	0	0
7/4	0	2	1	0	0	0
7/5	0	4	0	1	0	0
7/6 [a]	0	1	0	0	1	0
7/7	0	3	0	0	1	0
7/8	0	1	0	1	0	0
7/9	2	8	0	0	4	0
7/10	2	13	1	0	0	0
7/11	2	2	2	5	1	0
7/12	0	2	0	1	0	0
7/13	0	2	0	1	1	0
7/14 [a]	1	1	0	2	1	0
7/15	1	1	0	1	0	0
7/16	1	0	0	1	0	0
7/17	0	1	0	1	1	0
7/18	0	0	0	2	1	0
7/19	0	0	0	5	0	0
7/20	2	1	0	6	0	0
7/21	0	0	0	5	0	0
7/22	2	0	0	5	0	0
7/23	0	0	0	7	0	0
7/24	1	0	0	4	0	0
7/25	1	0	0	0	0	0
7/26	1	0	0	0	0	0
7/27	1	0	0	0	3	0
7/28	0	0	0	0	1	0

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Appendix B1.–Page 2 of 3.

Date	Pink Salmon	Longnose Sucker	Arctic Grayling	Dolly Varden	Rainbow Trout	Whitefish
7/29	0	0	0	0	0	0
7/30	0	0	0	0	0	0
7/31	0	0	0	0	1	0
8/1	0	0	0	0	0	0
8/2	0	0	1	1	0	0
8/3	0	0	0	0	0	0
8/4	0	0	0	0	0	0
8/5	0	0	0	1	1	0
8/6	0	0	0	0	1	0
8/7 [a]	0	0	0	6	0	0
8/8	0	0	0	6	0	0
8/9	0	0	0	2	1	0
8/10	0	0	0	3	0	0
8/11	0	0	0	2	0	2
8/12	0	0	0	2	0	0
8/13	0	0	0	0	0	0
8/14	0	0	0	0	0	0
8/15	0	0	0	2	0	0
8/16	0	0	0	0	0	0
8/17	0	0	0	0	0	0
8/18	0	0	0	0	0	0
8/19	0	0	0	0	0	0
8/20	0	0	0	1	0	0
8/21	0	0	0	0	0	0
8/22	0	0	0	0	0	0
8/23	0	0	0	1	0	0
8/24	0	0	0	0	1	0
8/25	0	0	0	0	0	0
8/26	0	0	0	0	0	0
8/27	0	0	0	0	0	0
8/28	0	0	0	0	0	0
8/29	0	0	0	0	0	0
8/30	0	0	0	0	0	0
8/31	0	0	0	0	0	0
9/1	0	0	0	0	0	0
9/2	0	0	0	0	0	0
9/3	0	0	0	0	0	0
9/4	0	0	0	0	0	0
9/5	0	0	0	3	0	0
9/6	0	0	0	1	0	0
9/7	0	0	0	0	0	0
9/8	0	0	0	0	0	0
9/9	0	0	0	2	0	0
9/10	0	0	0	1	0	0

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Appendix B1.–Page 3 of 3.

Date	Pink Salmon	Longnose Sucker	Arctic Grayling	Dolly Varden	Rainbow Trout	Whitefish
9/11	0	0	0	0	0	0
9/12	0	0	0	0	0	0
9/13	0	0	0	0	0	0
9/14	0	0	0	1	0	0
9/15	0	0	0	0	0	0
9/16 [a]						
9/17 [a]						
9/18 [a]						
9/19 [a]						
9/20 [a]						
Total	17	50	11	86	22	2

Note: Blank cells indicate no data.

[a] Partial day count.

Appendix B2.–Daily observed passage of non-target species at George River weir, 2013.

Date	Pink salmon	Longnose sucker	Dolly Varden	Whitefish	Northern pike	Arctic Grayling
6/15 [a]						
6/16 [a]						
6/17 [a]						
6/18 [b]	0	532	0	1	1	0
6/19	0	3,665	1	3	2	0
6/20	0	1,892	0	3	1	0
6/21	0	1,543	0	5	0	0
6/22	0	773	0	3	0	1
6/23	0	1,410	0	6	0	0
6/24	0	885	0	4	2	1
6/25	0	1,780	0	3	1	1
6/26	0	1,180	0	6	0	1
6/27	0	1,832	0	0	0	0
6/28	0	1,334	0	0	0	3
6/29	0	1,625	0	13	0	1
6/30	0	100	0	2	1	0
7/1	0	327	0	0	0	0
7/2	0	161	0	0	0	0
7/3	0	4	0	0	0	0
7/4	0	9	0	0	0	0
7/5	0	3	0	1	0	0
7/6	0	5	0	0	0	0
7/7 [b]	0	0	0	0	0	0
7/8 [b]	0	5	0	1	0	1
7/9 [b]	0	0	0	0	0	0
7/10 [b]	0	0	0	1	0	0
7/11 [b]	0	65	0	0	0	0
7/12	4	97	0	3	0	1
7/13	12	143	0	0	0	0
7/14	14	560	0	1	0	1
7/15	6	419	0	1	0	0
7/16	5	54	0	0	0	0
7/17	2	57	0	4	0	0
7/18	12	17	0	0	0	0
7/19	14	51	0	1	0	2
7/20	11	5	0	0	0	0
7/21	21	5	2	1	0	0
7/22	26	70	0	1	0	1
7/23	37	282	0	2	0	0
7/24	35	353	0	3	0	3
7/25	27	170	0	0	0	0
7/26	11	73	0	0	0	0
7/27	12	46	0	1	0	0
7/28	6	58	0	2	0	0

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Appendix B2.–Page 2 of 3.

Date	Pink salmon	Longnose sucker	Dolly Varden	Whitefish	Northern pike	Arctic Grayling
7/29	5	60	0	0	0	0
7/30	3	52	0	1	0	1
7/31	5	23	0	2	0	1
8/1	1	4	0	0	0	0
8/2	1	7	0	0	0	0
8/3	2	3	0	0	0	1
8/4	1	0	0	1	1	0
8/5	0	4	0	0	0	0
8/6	1	5	0	0	0	0
8/7	0	4	0	0	0	2
8/8	0	2	0	1	0	0
8/9	0	0	0	0	0	1
8/10	1	1	0	0	0	0
8/11	0	0	0	0	0	0
8/12	1	0	0	0	0	0
8/13	0	1	0	0	0	0
8/14	0	0	0	0	0	0
8/15	0	3	0	0	0	1
8/16	0	0	0	0	0	0
8/17	0	3	0	0	0	0
8/18	1	0	0	1	0	0
8/19	0	2	0	0	0	3
8/20	0	5	0	0	0	1
8/21	1	2	0	0	0	4
8/22	0	2	0	0	0	0
8/23	0	3	0	0	0	0
8/24	0	2	0	0	0	0
8/25	0	4	0	0	0	0
8/26	0	7	0	0	0	0
8/27	0	5	0	0	0	0
8/28	0	1	0	0	0	0
8/29	0	3	0	0	0	0
8/30	0	0	0	0	0	0
8/31	0	0	0	0	0	0
9/1	0	0	0	0	0	0
9/2	0	9	0	2	0	0
9/3 [b]	0	0	0	0	0	0
9/4 [b]	0	1	0	0	0	0
9/5 [b]	0	0	0	0	0	0
9/6 [b]	0	0	0	0	0	0
9/7 [a]						
9/8 [a]						
9/9 [a]						
9/10 [a]						

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Appendix B2.–Page 3 of 3.

Date	Pink salmon	Longnose sucker	Dolly Varden	Whitefish	Northern pike	Arctic Grayling
9/11 [a]						
9/12 [a]						
9/13 [a]						
9/14 [a]						
9/15 [a]						
9/16 [a]						
9/17	0	0	0	0	0	0
9/18	0	0	0	0	0	0
9/19	0	0	0	0	0	0
9/20 [a]						
Total	278	21,808	3	80	9	32

Note: Blank cells indicate no data.

[a] Partial day count.

[b] Weir was not operational.

Appendix B3.–Daily observed passage of non-target species at Kogrukluk River weir, 2013.

Date		Pink salmon	Dolly Varden	Whitefish
6/28	[a]			
6/29		0	0	0
6/30		0	2	0
7/1		0	0	0
7/2		0	2	0
7/3		0	1	0
7/4		0	1	0
7/5		0	0	0
7/6		0	4	0
7/7	[b]	0	3	0
7/8	[a]			
7/9	[b]	0	5	0
7/10		0	3	0
7/11		0	1	0
7/12		0	1	0
7/13		0	2	0
7/14		0	2	0
7/15		1	0	0
7/16		1	0	0
7/17		0	2	0
7/18		1	0	0
7/19		1	0	0
7/20		0	0	0
7/21		1	1	0
7/22		0	1	0
7/23		0	0	0
7/24		0	0	0
7/25		2	0	0
7/26		1	0	0
7/27		0	0	0
7/28		0	0	0
7/29		0	0	0
7/30		2	0	0
7/31		1	0	0
8/1		0	0	0
8/2		0	1	0
8/3		1	0	0
8/4	[b]	0	0	0
8/5		0	0	0
8/6	[b]	0	1	0
8/7	[a]			
8/8	[a]			
8/9	[a]			
8/10	[a]			
8/11	[a]			
8/12	[a]			

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Appendix B3.–Page 2 of 2.

Date		Pink salmon	Dolly Varden	Whitefish
8/13	[a]			
8/14	[a]			
8/15	[a]			
8/16	[a]			
8/17	[a]			
8/18	[a]			
8/19	[a]			
8/20	[a]			
8/21	[b]	0	0	0
8/22		0	3	1
8/23		0	7	0
8/24		0	6	0
8/25		0	4	0
8/26		0	6	0
8/27		0	6	0
8/28		0	3	0
8/29		0	1	3
8/30		0	0	1
8/31		0	1	0
9/1		1	7	0
9/2		0	1	0
9/3		0	1	3
9/4		0	0	0
9/5		0	0	3
9/6		0	2	0
9/7		0	2	1
9/8		0	1	0
9/9		0	0	1
9/10	[b]	0	0	0
9/11	[a]			
9/12	[a]			
9/13	[a]			
9/14	[a]			
9/15	[a]			
9/16	[a]			
9/17	[a]			
9/18	[a]			
9/19	[a]			
9/20	[a]			
9/21	[a]			
9/22	[a]			
9/23	[a]			
9/24	[a]			
9/25	[a]			
Total		13	84	13

Note: Blank cells indicate no data.

[a] Partial day count.

[b] Weir was not operational.

Appendix B4.–Daily observed passage of non-target species at Telaquana River weir, 2013.

Date	Pink salmon	Longnose sucker	Arctic Grayling	Whitefish	Northern pike	Lake trout
7/3	0	0	1	0	0	0
7/4	0	33	4	0	3	1
7/5	0	10	2	0	0	0
7/6 [a]	0	6	0	0	0	1
7/7 [a]	0	0	1	1	1	0
7/8	0	32	2	0	0	0
7/9	0	7	2	0	0	0
7/10	0	19	4	0	0	0
7/11	0	29	4	1	0	0
7/12	0	33	4	2	0	0
7/13	0	12	3	1	0	0
7/14	0	0	0	2	0	0
7/15	0	9	2	0	0	0
7/16	0	5	1	1	0	0
7/17	0	30	3	1	0	0
7/18	0	18	4	6	0	0
7/19	0	18	2	1	0	0
7/20	0	28	11	0	0	1
7/21	0	21	4	1	0	0
7/22	0	11	1	0	0	0
7/23	0	3	0	0	0	0
7/24	0	0	0	0	0	0
7/25	0	2	0	0	0	0
7/26	0	0	0	0	0	0
7/27	0	0	0	0	0	0
7/28	0	0	1	0	0	0
7/29	0	1	1	0	0	1
7/30	0	2	0	0	0	0
7/31	0	4	4	0	2	0
8/1	0	7	2	0	0	0
8/2	0	1	1	0	0	1
8/3	0	1	2	0	2	0
8/4	0	0	2	0	2	0
8/5	0	3	3	0	0	0
8/6	0	3	1	0	0	0
Total	0	348	72	17	10	5

[a] Partial day count.

Appendix B5.–Daily observed passage of non-target species at Tatlawiksuk River weir, 2013.

Date	Pink salmon	Longnose sucker	Arctic Grayling	Whitefish	Northern pike
6/15 [a]					
6/16 [a]					
6/17 [a]					
6/18 [a]					
6/19 [a]					
6/20	0	1,009	0	7	0
6/21	0	246	0	1	0
6/22	0	91	0	9	0
6/23	0	116	0	15	0
6/24	0	100	0	13	0
6/25	0	295	0	3	0
6/26	0	534	0	6	0
6/27	0	344	0	6	1
6/28	0	344	0	6	0
6/29	0	172	0	1	0
6/30	0	146	7	4	0
7/1	0	10	4	2	1
7/2	0	3	0	0	0
7/3	0	0	0	0	0
7/4	0	1	0	0	1
7/5	0	9	0	0	0
7/6	0	19	0	1	0
7/7	0	2	0	2	0
7/8	0	1	0	1	0
7/9	0	1	0	0	0
7/10	0	2	0	0	0
7/11	2	36	0	1	0
7/12	0	121	0	0	0
7/13	0	123	0	3	0
7/14	0	29	0	1	0
7/15	0	0	0	0	0
7/16	0	0	0	0	0
7/17	0	0	0	0	0
7/18	0	0	0	0	0
7/19	0	2	0	0	0
7/20	0	0	0	0	0
7/21	0	0	0	0	0
7/22	0	0	0	0	0
7/23	0	1	0	0	0
7/24	0	3	0	0	0
7/25	0	0	0	0	0
7/26	0	0	0	0	0
7/27	0	0	0	0	0
7/28	0	1	0	0	0

-continued-

Date	Pink salmon	Longnose sucker	Arctic Grayling	Whitefish	Northern pike
7/29	0	0	0	0	0
7/30	0	0	0	0	0
7/31	0	3	0	0	0
8/1	0	0	0	0	0
8/2	0	0	0	0	0
8/3	0	0	0	0	0
8/4	0	0	1	0	0
8/5	0	0	0	0	0
8/6	0	0	0	0	0
8/7	0	0	0	0	0
8/8	0	0	0	0	0
8/9	0	0	0	0	0
8/10	0	0	0	0	0
8/11	0	0	0	0	0
8/12	0	0	0	0	0
8/13	0	0	0	1	0
8/14	0	0	0	0	0
8/15	0	0	0	0	0
8/16	0	0	0	0	0
8/17	0	0	0	0	0
8/18	0	0	0	0	0
8/19	0	0	0	0	0
8/20	0	0	0	0	0
8/21	0	0	0	0	0
8/22	0	0	0	0	0
8/23 [a]					
8/24 [a]					
8/25 [a]					
8/26 [a]					
8/27	0	1	0	0	0
8/28	0	0	0	0	0
8/29	0	0	0	0	0
8/30	0	0	0	0	0
8/31	0	0	0	0	0
9/1	0	0	0	0	0
9/2	0	0	0	0	0
9/3 [a]					
9/4 [a]					
9/5 [a]					
9/6 [a]					
9/7 [a]					
9/8 [a]					
9/9 [a]					
9/10 [a]					

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Date	Pink salmon	Longnose sucker	Arctic Grayling	Whitefish	Northern pike
9/11 [b]	0	0	0	0	0
9/12	0	0	0	0	0
9/13	0	0	0	0	0
9/14 [b]	0	0	0	0	0
9/15	0	0	0	0	0
9/16	0	0	0	0	0
9/17	0	0	0	0	0
9/18	0	0	0	0	0
9/19	0	0	0	2	0
9/20 [a]					
Total	2	3,765	12	85	3

Note: Blank cells indicate no data.

[a] Partial day count.

[b] Weir was not operational.

Appendix B6.–Daily observed passage of non-target species at Takotna River weir, 2013.

Date	Longnose sucker	Arctic Grayling	Northern pike	Whitefish
6/24	0	1	0	0
6/25	30	2	0	0
6/26	24	4	1	0
6/27	13	6	0	0
6/28	87	6	0	0
6/29	2	0	0	0
6/30	1	1	0	0
7/1	1	1	0	0
7/2	0	1	0	0
7/3	0	0	0	0
7/4	0	0	0	0
7/5	0	0	0	0
7/6	0	0	0	0
7/7	0	0	0	0
7/8	0	1	0	1
7/9	0	0	0	0
7/10	0	0	0	0
7/11	0	0	0	0
7/12	0	0	0	0
7/13	0	0	0	0
7/14 [a]	0	3	0	0
7/15	0	0	0	0
7/16	0	0	0	0
7/17	0	0	0	0
7/18	0	1	0	0
7/19	2	0	0	0
7/20	0	0	0	0
7/21	1	0	0	0
7/22	0	0	0	0
7/23	0	0	0	0
7/24	0	0	0	0
7/25	0	1	0	0
7/26	0	0	0	0
7/27	0	0	0	0
7/28	0	0	0	0
7/29	0	0	0	0
7/30	0	0	0	0
7/31	0	0	0	0
8/1	0	0	0	0
8/2	0	0	0	0
8/3	0	0	0	0
8/4	0	0	0	0
8/5	0	5	0	0
8/6	0	2	0	0
8/7	0	2	0	0
8/8	0	0	0	0

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Date	Longnose sucker	Arctic Grayling	Northern pike	Whitefish
8/9	0	0	0	2
8/10	1	0	0	0
8/11	0	0	0	0
8/12	0	1	0	0
8/13	0	1	0	0
8/14	0	1	0	0
8/15	0	0	0	0
8/16	0	1	0	0
8/17	0	2	0	0
8/18	0	0	0	0
8/19	0	0	0	0
8/20	0	0	0	0
8/21	0	1	0	0
8/22	0	0	0	0
8/23	0	0	0	0
8/24	0	0	0	0
8/25	0	0	0	0
8/26	0	1	0	0
8/27	0	1	0	0
8/28	0	0	0	0
8/29	0	0	0	0
8/30	0	0	0	0
8/31	0	0	0	0
9/1	0	0	0	0
9/2	0	0	0	0
9/3 [b]				
9/4 [b]				
9/5 [b]				
9/6 [b]				
9/7 [b]				
9/8 [b]				
9/9 [b]				
9/10 [b]				
9/11 [b]				
9/12 [b]				
9/13 [b]				
9/14 [b]				
9/15 [b]				
9/16 [b]				
9/17 [b]				
9/18 [b]				
9/19 [b]				
9/20 [b]				
Total	162	46	1	3

Note: Blank cells indicate no data.

[a] Partial day count.

[b] Weir was not operational.