Regional Operational Plan SF.2A.2021.02

Operational Plan: Sockeye Salmon Escapement Studies at the Russian River

by

Jenny L. Gates

April 2021

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

REGIONAL OPERATIONAL PLAN SF.2A.2021.02

SOCKEYE SALMON ESCAPEMENT STUDIES AT THE RUSSIAN RIVER

by
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SIGNATURE PAGE

Signature Page

Project Title:	Sockeye Salmon Escapement Studies at the Russian River
Project leader(s):	*Jenny L. Gates, Fishery Biologist II*
Division, Region and Area	Sport Fish, Region II, Soldotna
Project Nomenclature:	F-10-35 S-2-07
Period Covered	January 2019 through December 2022
Field Dates:	June 1 through September 11
Plan Type:	Category II

Approval

Title	Name	Signature	Date
Project leader	Jenny Gates		
Biometrician	Pat Hansen		
Research Coordinator	Tim McKinley		

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ABSTRACT

Russian River escapement data has been collected since 1962 and is one of the oldest stock assessment projects in the state of Alaska. During 2019–2022, the Russian River weir will be operated annually from early June through the first week of September. All species of fish seen passing the weir through the fish chute will be enumerated daily. Sampling of sockeye salmon for age, sex, and length data will be done each Friday and the sample size each week will be based on the previous week's fish passage. Sockeye and Chinook salmon spawning downstream of the Russian River weir to the confluence of the Russian River and the Kenai River will be assessed by a foot survey during the fourth week of August. Multiple foot surveys will also be conducted from mid-May to 10 June to assess spawning rainbow trout.

Key words: Russian River, sockeye salmon, Chinook salmon, weir, age, sex, and length composition, foot surveys, rainbow trout, spawning surveys

PURPOSE

This project will continue gathering biological and fishery data obtained from operation of the weir for the historical database of the salmon resources of the Russian River. This database benefits sockeye and Chinook salmon resources by providing information for sound biological management and benefits the angling public by providing for a maximum sustained harvest of sockeye salmon by developing appropriate levels of escapement and determining if escapement goals (EG) are achieved annually (early-run EG range is 22,000–42,000, late-run EG range is 30,000–110,000 fish).

BACKGROUND

The Russian River (Figure 1) supports one of the largest sport fisheries for sockeye salmon (*Oncorhynchus nerka*) in Alaska. Mean effort for recreational anglers during 2008–2017 averaged 51,031 angler-days. Estimates provided by the Alaska Department of Fish & Game, Division of Sport Fish Statewide Harvest Survey (SWHS) for all species (SWHS; http://www.adfg.alaska.gov/sf/sportfishingsurvey/). Mean annual sport harvest of sockeye salmon during this period exceeded 46,000 fish (Table 1). There are 5 main access locations to the Russian River fishery; these include the Russian River Ferry access at the confluence and 4 river access trails, which connect the USFS Russian River Campground with the Russian River (Figure 2).

Russian River sockeye salmon run exhibits a bimodal entry pattern with the modes referred to as the early- and late-runs. Escapement goal (EG) ranges are established for both the early- and late-runs (early-run biological EG = 22,000–42,000 and late-run sustainable EG = 30,000–110,000 fish). The population dynamics of the late-run are not well understood. Early-run sockeye salmon in the Kenai River drainage are almost exclusively of Russian River origin, are harvested primarily in the Russian River area sport fishery, and are easily assessed at the Russian River weir. The late-run, however, is comprised of stocks returning to numerous locations throughout the Kenai River drainage and are harvested in Upper Cook Inlet commercial fisheries, Cook Inlet personal use fishery, Kenaitze educational fishery, mainstem Kenai River sport fishery, and Russian River area sport fishery. A small subsistence harvest also occurs from the waters of the Kenai River adjacent to federal lands and at the Russian River Falls.

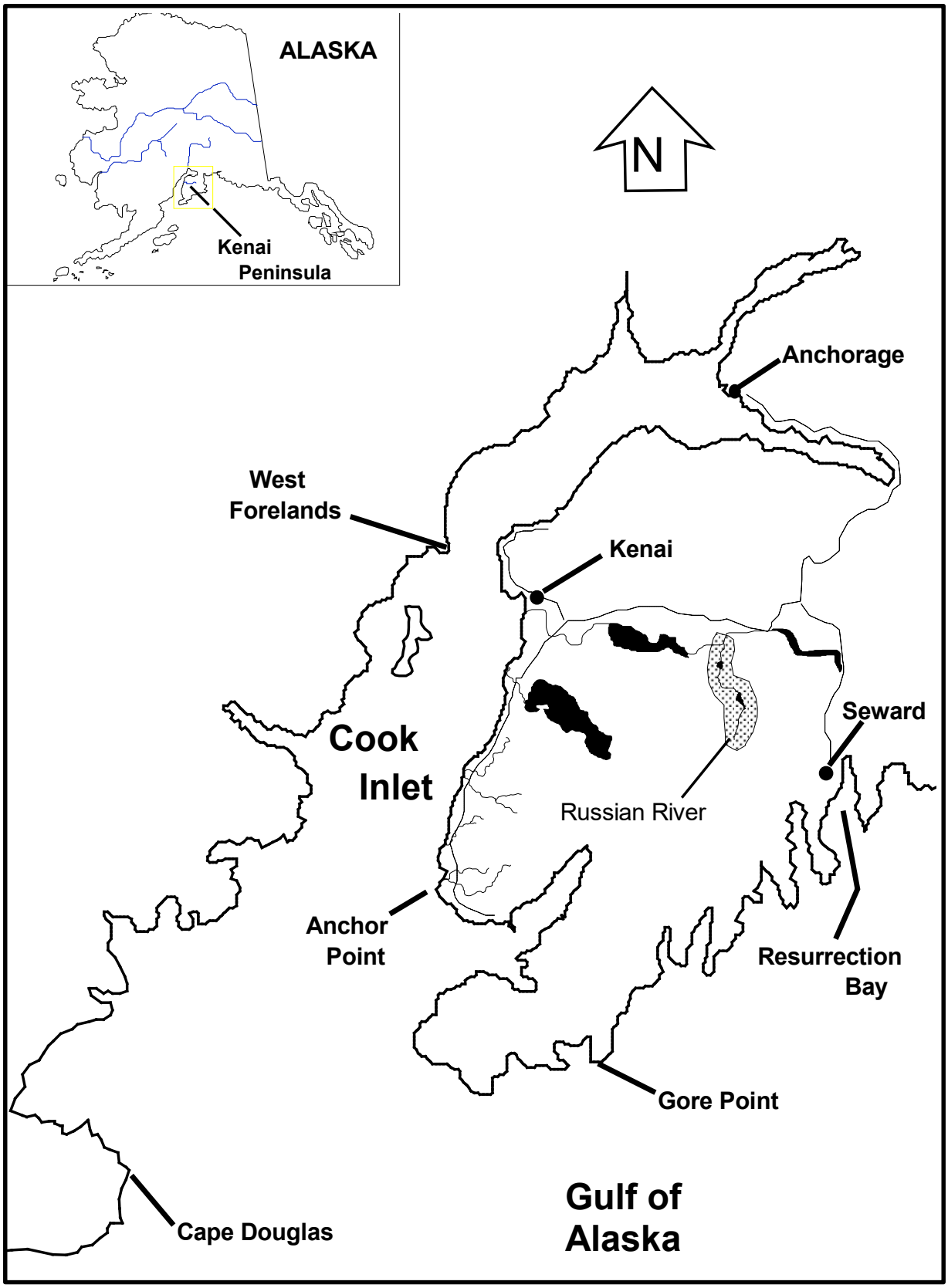

Figure 1.–Location of the Russian River.

Table 1.–Early- (ER) and late-run (LR) Russian River sockeye salmon angler effort, harvest, spawning escapement, local run, and spawners below the weir, 1979–2018.

		Sport harvest [b]		Subsistence harvest [c]		Spawning escapement [d]		Local run [e]	
Year	Effort [a]	ER	LR	ER	LR	ER	LR	ER	LR
1979 [f]	55,000	8,400	26,840	ND	ND	19,749	87,852	28,149	114,692
1980	56,330	27,220	33,500	ND	ND	28,624	83,984	55,844	117,484
1981	51,030	10,720	23,720	ND	ND	21,142	44,523	31,862	68,243
1982	51,480	34,500	10,320	ND	ND	56,106	30,800	90,606	41,120
1983	31,860	8,360	16,000	ND	ND	21,272	33,734	29,632	49,734
1984	49,550	35,880	21,970	ND	ND	28,908	92,659	64,788	114,629
1985	50,770	12,300	58,410	ND	ND	30,605	136,969	42,905	195,379
1986	52,250	35,100	30,810	ND	ND	36,338	40,281	71,438	71,091
1987	113,010	154,200	40,580	ND	ND	61,513	53,932	215,713	94,512
1988	72,030	54,780	19,540	ND	ND	50,406	42,476	105,186	62,016
1989	60,570	11,290	55,210	ND	ND	15,278	138,377	26,628	193,587
1990	84,710	30,215	56,180	ND	ND	25,144	83,434	56,931	139,614
1991	85,741	65,390	31,450	ND	ND	31,660	78,175	97,779	109,625
1992	60,499	30,512	26,101	ND	ND	37,117	62,584	67,629	88,685
1993	58,093	37,261	26,772	ND	ND	39,857	99,259	77,118	126,031
1994	64,134	48,923	26,375	ND	ND	44,872	122,277	93,795	148,652
1995	48,185	23,572	11,805	ND	ND	28,603	61,982	52,175	73,787
1996	50,122	39,075	19,136	ND	ND	52,905	34,691	91,980	53,827
1997	46,914	36,788	12,910	ND	ND	36,280	65,905	73,068	78,815
1998	47,942	42,711	25,110	ND	ND	34,143	113,480	76,854	138,590
1999	64,536	34,283	32,335	ND	ND	36,607	139,863	70,890	172,198
2000	69,864	40,732	30,229	ND	ND	32,736	56,580	73,468	86,809
2001	55,972	35,400	18,550	ND	ND	78,255	74,964	113,655	93,514
2002	68,263	52,139	31,999	ND	ND	85,943	62,115	138,082	94,114
2003	50,448	22,986	28,085	ND	ND	23,650	157,469	46,636	185,554

-continued-

Table 1.–Part 2 of 2.

Year	Effort [a]	Sport harvest [b] ER	Sport harvest [b] LR	Subsistence harvest [c] ER	Subsistence harvest [c] LR	Spawning escapement [d] ER	Spawning escapement [d] LR	Local run [e] ER	Local run [e] LR
2004	60,784	32,727	22,417	ND	ND	56,582	110,244	89,309	132,661
2005	55,801	37,139	18,503	ND	ND	52,903	59,473	90,042	77,976
2006	70,804	51,167	29,694	ND	ND	80,524	89,160	131,691	118,854
2007	57,755	36,805	16,863	380	316	27,298	53,068	64,483	70,247
2008	55,444	42,492	23,680	928	478	30,989	46,638	74,409	70,796
2009	64,518	59,097	33,935	605	369	52,178	80,088	111,880	114,392
2010	39,873	23,412	9,333	615	246	27,074	38,848	51,101	48,427
2011	47,264	22,697	14,412	684	315	29,129	41,529	52,510	56,256
2012	41,152	15,231	15,074	867	461	24,115	54,911	40,213	70,446
2013	59,682	27,162	20,146	768	567	35,776	31,573	63,706	52,286
2014	57,544	35,870	17,864	1,276	496	44,920	52,277	82,066	70,637
2015	55,420	29,997	13,744	989	704	50,226	46,223	81,212	60,671
2016	39,957	13,086	11,543	1,090	580	38,739	37,837	52,915	49,960
2017	49,455	27,109	10,592	1,597	236	37,123	45,012	65,829	55,840
2018	NA	NA	NA	NA	NA	44,110	71,052	NA	NA
Average									
1963–2017	47,830	27,793	20,302			31,869	61,072	59,883	81,460
2008–2017	51,031	29,615	17,032	942	445	37,027	47,494	67,584	64,971

Source: Source: Statewide Harvest Surveys from Mills (1979-1994), Howe et al. (1995, 1996), Alaska Sport Fishing Survey database [Internet]. 1996–present. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited October 2018). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/; other data from Pappas and Marsh (2004); subsistence data from USFWS.

Note: ND = no data collected., n/a = data not yet available.

[a] Effort is angler days of effort in the fishery. 1979-1996 estimated from an inseason creel survey and only measures effort primarily for sockeye from 11 June to 20 August. 1996–2017 estimated from the SWHS and includes effort for the whole year and for other species.

[b] Harvest from 1979 to 1995 estimated from an inseason creel survey. No early- or late-run breakdown available from SWHS prior to 1996. Harvest from 1996 to 2017 estimated from the annual SWHS.

[c] The subsistence fishery started in 2007 and includes Russian River Falls and Upper Kenai dipnet and rod-n-reel; it does not include Moose Range Meadows data.

[d] Prior to 2002, the early-run count did not have a designated end date and generally continued beyond 15 July, sometimes into early August. Beginning in 2002, escapements for the early-run are the number of fish counted passing the weir from its installation in June through 14 July. Escapements for the late-run are the number of fish counted passing the weir from 15 July until the weir is removed after reaching 3 days of <1% of fish passage, which ordinarily occurs prior to 10 September.

[e] Local run is the escapement above weir plus harvest; 1989–1991 includes 60 fish (in 1989) used to test brood source for disease, 1,572 fish (in 1990) and 729 fish (in 1991) used as brood source for stocking in Resurrection Bay.

[f] For data prior to 1979 see Begich et al. (2017).

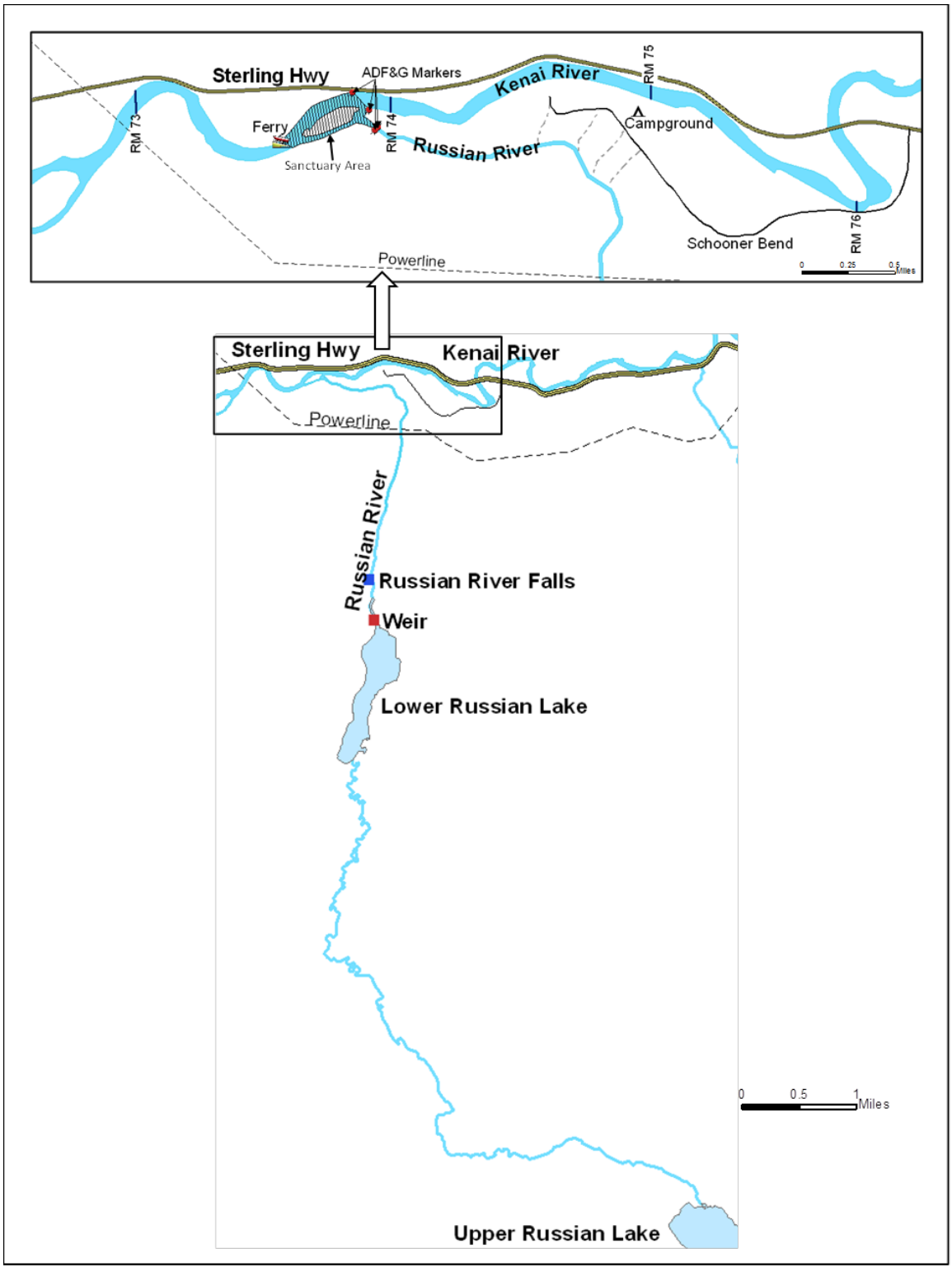

Figure 2.–Map of the Russian River sockeye salmon recreational fishing areas and fishing access locations.

Despite restrictions on the sport fishery, recreational demands on the Russian River sockeye salmon resource have occasionally been greater than the stocks could sustain. The Division of Sport Fish has closed all or part of the fishery on 27 occasions since 1969 to achieve escapement goals. The most recent fishery restriction was in 2010. In subsequent years, the fishery has been liberalized by opening the sanctuary area and by liberalizing the daily bag limit from 3 per day, 6 in possession to 6 per day, 12 in possession from the Russian Fly Fishing Only area downstream to Skilak Lake. These numerous EOs to the sockeye salmon fishery in the Russian River make it one of the most actively managed sport fisheries in Alaska.

This research program was first initiated on the Russian River in 1963 and provides information necessary for inseason management and refinement of management objectives. A weir located at the outlet of Lower Russian Lake is used to enumerate the spawning escapement as well as provide a means to trap fish and collect age, sex, and length information. Since 1997, estimates of harvest have been obtained exclusively from the Division of Sport Fish mail survey with estimates available in the fall of the following year (Table 1). Estimates of sport harvest, inriver run, and the age-sex composition of each run provide information to evaluate spawner-return relationships. These data are necessary to estimate appropriate levels of spawning escapement.

This operational plan covers 4 years: 2019, 2020, 2021, and 2022. The Objectives, Study Design, Data Collection, Data Reduction and Data Analysis will be the same for each of the 4 years.

OBJECTIVES

PRIMARY OBJECTIVES

1) Census the escapements of early-run and late-run sockeye salmon past the Russian River weir.
2) Estimate the age, sex, and age-by-sex compositions of early-run and late-run sockeye salmon spawning upstream of the Russian River weir such that the estimates for each run are within 10 percentage points of the actual values 95% of the time.

SECONDARY OBJECTIVES

1) Index the escapement of Chinook salmon (*Oncorhynchus tshawytscha*) and late-run sockeye salmon spawning between the weir and Russian River Falls and that area downstream of the Russian River Falls extending to the Russian River and Kenai River confluence based on foot survey data collected during the peak spawning periods.
2) Record the number of fish observed for each species passed upstream of the weir.
3) Index the number of spawning rainbow trout from 100 yards above the powerline crossing on the Russian River downstream to the Russian River and Kenai River confluence based on foot survey data collected during the peak spawning period.

METHODS

WEIR PROCEDURES

A weir at the outlet of Lower Russian Lake will be used to census the spawning escapements of sockeye salmon and count other salmon (coho and Chinook salmon) and nongame species that utilize the upper reaches of the drainage. Due to water clarity and low water depth in the Russian River, salmonid species are easily differentiated by weir attendants. Biological samples (age, sex,

and mid eye to tail fork length) of sockeye salmon will be collected at the weir. In addition, weir personnel will collect climatological and river discharge data, operate the Russian River fish pass when necessary, and visually count late-run sockeye salmon that spawn downstream from the weir site.

The weir will be installed and the field camp opened on or about 6 June. The weir site will be staffed by 2 permanent seasonal Fishery Technician IIIs. Several supplemental personnel from the Soldotna office will be assigned to the weir as needed for weir installation, maintenance, scale sampling, etc. Weir operations for the late-run will terminate when the daily count of fish through the weir is less than 1% of the cumulative seasonal count for 3 consecutive days. Historically, this generally occurs in early September. This time period also provides the necessary window for conducting stream surveys for sockeye and Chinook salmon spawning downstream of the weir. Hence, all data collection and winterization of the field camp should be complete by 9 September.

Weir counts by species will be communicated daily by weir technicians using a Garmin InReach Explorer and cellular smartphone by calling or text messaging Soldotna office staff. Sockeye salmon counts will be tabulated and compared with historical migratory timing data to produce inseason estimates of the proportion of each run that has escaped past the weir. These estimates will be used inseason as a management tool to project total escapement by run. The projected estimates will then be used in conjunction with stream survey estimates of sockeye salmon present in the Russian River for making inseason management decisions.

Age, sex, and length data will be collected from samples of sockeye salmon to estimate the age, sex and age-by-sex composition of the escapements from each run. Because the age composition of each run of sockeye salmon may change over time (Carlon and Vincent-Lang 1990; Carlon et al. 1991; Marsh 1992-1998; Nelson et al. 1999; Bethe et al. 2002; Gamblin et al. 2004), proportional weekly sampling will be done to ensure a representative sample. A sample size of 141 (Thompson 1987) is required for each run to meet the objective criteria assuming a scale regeneration rate of 10% (observed 4-6% historically when taking 3 scales per fish, Berkhahn, pers. comm.). Weir technicians will sample sockeye salmon for biological data every Friday. A conservative estimate for the size of each run in 2019 was based on the average of the lowest 2 escapements in the last 6 years: 36,450 sockeye salmon for the early-run and 34,705 for the late-run (Table 1). The sampling fraction is 0.0039 (141/36,450) for the early-run and 0.0041 (141/34,705) for the late-run. Every Friday and the last day of the early-run, 14 July, the number of sockeye salmon that passed through the weir since the previous sample will be multiplied by the appropriate sampling fraction and rounded up to the nearest whole number to obtain the necessary sample size (Table 2). Sampling fractions for 2020, 2021 and 2022 will be recalculated prior to each field season after updating Table 1.

Table 2.–Sampling dates and fraction for Russian River weir, 2019.

Sampling date	Use weir count between these times		Sampling fraction length-age-sex
14 Jun	first fish to pass weir	before sampling on 14 Jun	0.0039
21 Jun	after sampling on 14 Jun	before sampling on 21 Jun	0.0039
28 Jun	after sampling on 21 Jun	before sampling on 28 Jun	0.0039
5 Jul	after sampling on 28 Jun	before sampling on 5 Jul	0.0039
12 Jul	after sampling on 5 Jul	before sampling on 12 Jul	0.0039
14 Jul (2 days)	after sampling on 12 Jul	before sampling on 14 Jul	0.0039
19 Jul (5 days)	after sampling on 14 Jul	before sampling on 19 Jul	0.0041
26 Jul	after sampling on 19 Jul	before sampling on 26 Jul	0.0041
2 Aug	after sampling on 26 Jul	before sampling on 2 Aug	0.0041
9 Aug	after sampling on 2 Aug	before sampling on 9 Aug	0.0041
16 Aug	after sampling on 9 Aug	before sampling on 16 Aug	0.0041
23 Aug	after sampling on 16 Aug	before sampling on 23 Aug	0.0041
30 Aug	after sampling on 23 Aug	before sampling on 30 Aug	0.0041
5 Sep	after sampling on 30 Aug	before sampling on 5 Sep	0.0041

Initial foot surveys of spawning rainbow trout will be conducted in May and early June to index the number of spawning rainbow trout in the lower Russian River. The survey area extends from approximately 100 yards upstream of the power line crossing downstream to the confluence of the Russian River and Kenai River. Surveys will be completed at least two per week beginning after 15 May and extending to 11 June. Typically, the peak index count occurs during the last week in May or the first week in June. These counts serve as a means to review the stock status of spawning rainbow trout in the lower Russian River. Historical records are maintained and may be used to illustrate possible changes in the relative abundance of rainbow trout in the lower Russian River.

Stream surveys may be required inseason to estimate the number of sockeye salmon in the Russian River at several critical periods during the return. If the projected escapement is below the sustainable escapement goal, an estimate of the number of fish actually present in the Russian River would approximate the minimum number of fish expected to pass through the weir if the sport fishery is closed or restricted by Emergency Order. The project leader and field crew leader will visually survey the river if such additional information is required to formulate a management decision.

The number of late-run sockeye salmon spawning downstream from the Russian River Falls will be visually enumerated during stream foot surveys because these fish spawn in the Russian River but do not migrate upstream through the weir. If necessary, 2 surveys will be used to accurately index the spawning escapement in that area of the Russian River. In some years, high water can preclude counts and every effort will be made to obtain an early count to ensure at least a minimum index of the escapement downstream of the falls. The first count will be made on approximately 25 August.

DATA COLLECTION

All salmonid and nongame species passed through the weir will be counted by species. Daily counts and seasonal totals for all species will be recorded and maintained in the weir data logs as well as Soldotna office files. Diel timing of sockeye salmon passage varies, but is usually confined to the morning and evening hours. The field camp has a Garmin InReach Explorer device that uses

satellite messaging and a cellular smartphone for transmitting data to Soldotna office staff. Escapement counts of sockeye salmon and other salmonids will be called in at least once daily (0900 and/or 1500) to the project leader or field crew leader.

Early- and late-run sockeye salmon will be enumerated separately. Early-run fish will be counted from 6 June through 14 July. Late-run sockeye salmon will be counted from 15 July until such time that the daily count is less than 1% of the cumulative seasonal count for 3 consecutive days, usually occurring by early September. Both counts are recorded on a daily weir count form (Appendix A1).

Biological sampling of sockeye salmon will occur every Friday and on 14 July. If necessary, additional staff will assist the weir operator to achieve sampling goals. On a given day that fish are to be sampled, the downstream gate on the weir fish trap will be opened and the upstream gate will remain closed. Fish will be allowed to enter the trap and when sufficient numbers have entered, the downstream gate will be closed, capturing the fish. All fish in the trap will be sampled for age, sex, and length. Sockeye salmon will be restrained utilizing a covered measuring cradle to reduce handling stress during scale (age) sampling. Three scales will be removed from the preferred area (Clutter and Whitesel 1956) using forceps. Scales will be affixed to appropriately labeled gum cards. Sex will be determined by examining the vent and kype. Length will be measured to the nearest five millimeters from mid eye to tail fork. Detailed biological data collection procedures are summarized for the weir technician in Appendix B1. All data will be recorded on the data form provided (Appendix A2).

Climatological and hydrological data will be collected daily and recorded on standard forms (Appendix A1). These data, collected between 0800 and 0900 hours, include rainfall, minimum and maximum water temperatures, minimum and maximum air temperatures, and water depth at the weir. In previous years, stream velocity had been estimated at Russian River and Rendezvous Creek as both contributing to total stream discharge at the Russian River falls. These stream discharge estimates were calculated using the head rod method of measuring flow. In 2003, staff began revising the historical database for stream velocity and discharge. Using a FP-101 Global Flow Probe and following the prescribed methodology, as outlined in Appendices C1–C2, project staff have measured stream velocities and calculated the discharge for Russian River and nearby Rendezvous Creek. The velocity estimates were recorded for half-inch stream depth intervals that were absent from the database for each stream. The newer equipment and methodology have provided project staff with the means to better define the stage-discharge curves for seasonal flow-rates experienced at the Russian River falls. The Russian River transect is located approximately 75 feet upstream of the weir. The Rendezvous Creek transect is located near the junction of the winter trail and the Russian River falls trail.

The fish pass at Russian River Falls provides a means to allow sockeye salmon and other species access to the spawning grounds during periods of high water. Nelson (1978) concluded that discharges of 400 cubic feet per second (cfs) present a significant barrier to fish migration. The fish pass will be opened by the weir attendant upon direction from the project leader when discharge over the falls (Rendezvous Creek plus Russian River) meets or exceeds 400 cfs (coincides with ~ 19 inch water level measurement at the weir staff gauge). Dates and times of opening and closing the fish pass will be recorded on the Hourly Weir Counts data form (Appendix A1).

At the peak of the late-run instream spawning, approximately 25 August, a foot survey count will be conducted to index the number of fish spawning between Russian River weir and the Kenai River confluence. If timing of the count appears to result in an incorrect assessment, subsequent foot surveys may need to be conducted. The index surveys will be made by the project leader along with the field crew leader or other staff.

DATA REDUCTION

Daily escapement counts reported to the Soldotna office will be tabulated inseason and compared to historic run timing data to project the final escapement by run. These data and stream survey counts of sockeye salmon will be used to evaluate possible management actions in order to increase the likelihood of meeting the escapement goals.

Daily escapement counts will be added to linked EXCEL spreadsheets that contain historical daily counts (Early-run files: 2019_ER_Russian_Workbook; Late-run files: 2019_LR_Russian_Workbook). These files will provide graphical and quantitative tools to visually compare the 2019 daily and cumulative escapements with historical values. A final copy of the clean EXCEL files (2019_ER_Russian_Workbook, 2019_LR_Russian_Workbook and LowerRussianSpawners93-19.xls), and the CSV/ASCII scale data files along with the data maps, will be sent to RTS for archiving (Appendix D1).

Data forms containing length and sex data from sampled fish will be returned to the Soldotna office at the end of each week. The forms will be checked by project staff for obvious errors. Scale sample gum cards will accompany each form, and scale impressions from each card will be made on acetate cards. Age interpretations will be made from projections of the acetate scale impressions using a microfiche reader (Clutter and Whitesel 1956). Age determination from the scale impressions will be delineated by the pattern of annuli formed during successive winter months when the circuli of the scales become crowded and finely etched (Clutter and Whitesel 1956). Biological data will be entered on a PC using a comma-delimited file format. The file structure is described in Appendix D1, (2019 Early- and Late-run Russian River Weir Scale Data Map). The electronic data files will be further checked for data entry errors (i.e. checks of impossible dates, location, species, length, age, and length-age relationships).

Final copies of the clean data files, along with the data map, will be stored on the Soldotna LAN server. Following final approval of written reports, the data files and data maps will be archived on the Division of Sport Fish Intranet Docushare collection at *http://docushare.sf.adfg.state.ak.us* (Appendix D1).

DATA ANALYSIS

The proportion of adult sockeye salmon of age, sex, or age-by-sex category g migrating through the weir during run x will be estimated as p_{xg}:

$$\hat{p}_{xg} = \frac{n_{xg}}{n_x} \tag{1}$$

where:

n_{xg} = the number of sockeye salmon sampled belonging to age, sex, or age-by-sex category g, and

n_x = the total number of sockeye salmon sampled[1] at the weir during run x.

The number of salmon of age, sex, or age-by-sex category g passing through the weir will be estimated for run x as follows:

$$\hat{N}_{xg} = N_x \hat{p}_{xg} \tag{2}$$

where

N_x = the total number of sockeye salmon enumerated during run x at the weir.

The variance of $\hat{N}_{xg}$ will be estimated as follows:

$$V\left[\hat{N}_{xg}\right] = N_x^2 V\left[\hat{p}_{xg}\right] \tag{3}$$

where

$$V\left[\hat{p}_{xg}\right] = \frac{\hat{p}_{xg}\left(1-\hat{p}_{xg}\right)}{n_x - 1} \tag{4}$$

Mean length-at-ages and their associated variances will be estimated for each run using standard sample summary statistics (Cochran 1977).

SCHEDULES AND DELIVERABLES

Activity List

Operational plan completed.	1 May	Jenny Gates
Crew leader (FWTIII) on duty.	1 May–15 Sep	Sandee Simons
Weir personnel on duty.	3 Jun–13 Sep	Tom Rhyner
Weir personnel on duty.	3 Jun–13 Sep	Tom Johnson
Weir operational.	5 Jun–10 Sep	
Downstream spawner surveys.	20 Aug–1 Sep	Gates/Simons
Scales read.	1 Aug and 31 Oct	Simons/Key
Annual report submitted.	1 Aug	Gates

Reports

Results from this project will be reported in the annual Federal Aid Performance Report and an Alaska Department of Fish and Game, Division of Sport Fish Fishery Annual Management Report for the North Kenai Peninsula Management Area.

[1] When calculating age composition, the number of sockeye salmon sampled would only include those with legible scales.

RESPONSIBILITIES

List of Personnel and Duties

Jenny Gates, Fishery Biologist II, Project Leader. Supervise and oversee reporting activities of Fish and Wildlife Technician IIIs. Oversee and assist with daily data entry and posting online. Conduct rainbow trout and salmon stream foot surveys. Communicate inseason escapement status with Area Manager. Lead escapement project, provide project support, write annual reports, prepare budget requests and mid-year audits, and write operational plan.

Sandee Simons, Fishery Technician III, Crew Leader. Duties: Relieve weir operators as needed, enumerate salmon, collect biological samples, conduct rainbow and salmon stream surveys, daily contact with crew receiving weir counts and entering into Excel files and posting online, review and edit electronic data files and aging scale samples.

Tom Rhyner, Fishery Technician III, Weir Technician. Duties: Enumerate salmon, collect biological samples, record climatological data, measure and calculate stream flows, operate Russian River Fish Pass, conduct salmon stream surveys.

Tom Johnson, Fishery Technician III, Weir Technician. Duties: Enumerate salmon, collect biological samples, record climatological data, measure and calculate stream flows, operate Russian River Fish Pass, conduct salmon stream surveys.

Pat Hansen, Biometrician III. Duties: Biometric support.

BUDGET SUMMARY FY20

Line 100: Personnel Services (in thousands). Add 3% increase for FY21–22 budgets.

PCN	Name	Title	Dates	MM	Months	Cost/month	Cost
4195	Simons	FT III	07/01/19–09/15/19	2.5	3.5	7.9	27.9
			06/01/20–06/30/20	1.0			
5188	Johnson	FT III	07/01/19–09/10/19	2.3	3.3	7.2	23.9
			06/01/20-06/30/20	1.0			
5219	Rhyner	FT III	07/01/19–09/10/19	2.3	3.3	7.8	25.9
			06/01/20–06/30/20	1.0			
						Total	77.7

Includes premium pay.

Line 200: Travel

Item	Cost
Employee Instate Lodging	0.0
Employee Instate Meals & Incidentals	0.0
Total	0.0

Line 300: Contractual

Item	Cost
Training/Conferences	0.3
Cellular Phone Costs	0.4
Satellite Phone Costs	1.2
Other Repairs	0.5
Marine	0.5
Aircraft Charters	3.5
Total	6.4

Line 400: Commodities

Item	Cost
Food & Non Food Items	2.3
Clothing & Uniforms	1.0
Firearms & Ammunition	0.3
Other Safety	0.2
Bottled Gas	0.3
Parts & Supplies	1.0
Small Tools & Minor Equipment	0.5
Paint & Preservatives	0.2
Other Business	0.8
Total	6.5

Line 500: Equipment

Item	Cost
Total	0.0

GRAND TOTAL $90.6

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APPENDIX A: DATA FORMS

Appendix A1.–Lower Russian Lake hourly weir count form.

LOWER RUSSIAN LAKE HOURLY WEIR COUNTS, _____ _____, 2019

	1st Run	2nd Run			
	Adult	Adult			
Time	Sockeye	Sockeye	Kings	Coho	Remarks (include tag data here also)
00-06					
06-08					
08-10					
10-12					
12-14					
14-16					
16-18					
18-20					
20-22					
22-24					
TOTALS					
Cumulative					

H_2O DEPTH: **COMMENTS:**

***H_2O TEMP:**

***AIR TEMP:**

RAIN:

* note minimum/maximum temperatures. Weather should be recorded by 9 am every day.
Minumum temps are the morning low for todays date, maximum temps are afternoon high for yesterdays date.

Fish Pass: note if open

note times **opened / closed**_____

Appendix A2.–Russian River sockeye salmon age-sex-length sampling form.

RUSSIAN RIVER SOCKEYE SALMON ASL SAMPLING FORM

Collector: ____________________

Date: ____________________

Run: ____________________

Card No.	Fish #	Sex	Length	Age	Notes
	1	M or F			
	2	M or F			
	3	M or F			
	4	M or F			
	5	M or F			
	6	M or F			
	7	M or F			
	8	M or F			
	9	M or F			
	10	M or F			

Card No.	Fish #	Sex	Length	Age	Notes
	1	M or F			
	2	M or F			
	3	M or F			
	4	M or F			
	5	M or F			
	6	M or F			
	7	M or F			
	8	M or F			
	9	M or F			
	10	M or F			

Card No.	Fish #	Sex	Length	Age	Notes
	1	M or F			
	2	M or F			
	3	M or F			
	4	M or F			
	5	M or F			
	6	M or F			
	7	M or F			
	8	M or F			
	9	M or F			
	10	M or F			

APPENDIX B: PROCEDURES SUMMARY FOR THE RUSSIAN RIVER WEIR TECHNICIAN

Daily passage of fish through the weir is more successfully facilitated during the morning and evening hours when the fish seem to be more active and therefore, inclined to migrate through the weir. However, fish may move through the weir at any hour, especially when high numbers are present near the peak of each run. A good indicator that fish are ready to move through the weir is when they are "rattling" the weir pickets by pushing their noses into the spaces between the weir pickets while attempting to swim upstream and causing the pickets to clank and rattle (Marcorelle, pers. comm.). Fish should be allowed to pass through the weir whenever they are actively working to swim through the weir pickets in such a manner.

Adult sockeye salmon, Chinook salmon, coho salmon, and nongame species will be counted by species. Hourly totals will be recorded in the Weir Count form. At the end of each day, the hourly counts and the fish species totals will be recorded on the Weir Count form. Daily contact with the Soldotna office is maintained via Garmin InReach Explorer satellite messaging device utilizing a cellular smartphone. Daily escapement counts and any other pertinent information should be reported at that time.

Climatological data will be recorded every day at approximately 0900 on the Weir Count form. Climatological observations are summarized by date and recorded on the Weir Count form; air maximum and minimum temperatures (°F), water maximum and minimum temperatures (°F), the water gauge height in inches to nearest one-eighth inch, and rainfall in millimeters.

At the beginning of the season, the depth gauge will be calibrated using a line and level. On the north side of the gabion on the cabin side of the river, a green mark has been established at $21^{1}/_{8}$ inches (top of the wire wrap to bottom of the “V”). Stream velocities for Russian River and Rendezvous Creek will be measured using an Fp-101 Global Flow Probe, following the prescribed methodology in Appendices C1–C2. Measurement techniques will be demonstrated by the project leader or field crew leader and standard measurement sites will be placed in the stream channel. Measurements will be taken at half-inch intervals as water depths change. This information provides data points within half-inch intervals and will be used to establish a stage-discharge curve. Record all data on the Stream Discharge form (Appendix C2) and sum the discharge rates (cfs) for both Rendezvous Creek and the Russian River. This will yield a total discharge over the Russian River Falls. When this total discharge approaches 350 cfs, notify the project leader or field crew leader during a standard 0900 contact. Discharge for each stream should be added to the Weir Count form.

Fish pass operation is typically necessary at discharges of about 400 cfs (water level ~19 inches on staff gauge located at the weir). The weir operator will be instructed on proper fish pass operation by the project leader or field crew leader. Date and time will be recorded on the Daily Log when the fish pass is opened and closed.

A minimum of 141 fish will be sampled proportionally from both early- and late-runs for age, sex, and age-by-sex composition estimates. The weir technician(s) will sample sockeye salmon for biological data every Friday and 14 July (last day of the early-run). Every Friday and 14 July, the number of sockeye that passed through the weir since the previous sample will be multiplied by the appropriate sampling fraction and rounded up to the nearest whole number to obtain the necessary sample size (Table 2).

Record data as indicated on the sampling form provided in Appendices A1–A2. Record your name, location, and date. Prepare a corresponding scale gum card by recording the appropriate data on the yellow side of the card. IMPORTANT: the gum card and the data form must both be numbered identically to ensure that the length and sex data is correctly matched with the corresponding scales.

-continued-

When fish are to be sampled, the downstream gate on the weir fish trap will be opened and the upstream gate will remain closed. Fish will be allowed to enter the trap and when sufficient numbers have entered, the downstream gate will be closed, capturing the fish. All fish in the trap will be sampled for the appropriate biological data. Fish will be restrained utilizing a measuring cradle that is partially covered with canvas to secure the head of the sampled fish to reduce handling stress.

Remove 3 scales from each fish and affix them to the gum card. Make sure that the "inner surface" of the scale (toward the inside of the fish) is placed against the gum card.

Scales should be clean before they are affixed to the gum card. Place scales on the gum card with the anterior portion of the scale pointing up. Place the 3 scales from a fish in 3 vertical boxes on the gum card. Boxes 1, 11, and 21 correspond to line 1 (fish 1) on the ASL sampling form, boxes 2, 12, and 22 correspond to line 2 (fish 2) on the ASL sampling form, and so on.

Record mid eye to tail fork length to the nearest 5 millimeters and the sex on the data form.

When sampling is complete, gently place the fish in calm water to allow for recovery. Make sure the fish does not wash downstream onto the weir panels during recovery.

APPENDIX C: STREAM VELOCITY MEASUREMENT

Appendix C1.–Procedures summary for stream velocity measurement.

PROCEDURES SUMMARY FOR STREAM FLOW VELOCITY MEASUREMENT

To turn on flow meter, press right button three times = V ^{AV}

If MX shows instead of AV, scroll with left button until AV appears. Calibration should always be set at 33.31; this must be reset when batteries are changed by pushing left button.

(Other problems check with FP101-FP 201 Global Flow Probe manual in files on shelf in cabin.)

TAKING MEASUREMENTS

1) Make sure propeller turns freely.
2) Face arrow inside prop housing downstream when taking velocity.
3) Scroll with right button until "V" for velocity appears on screen.
4) Push left button to toggle to average (AV) velocities.
5) Take a depth measurement and velocity average at waterline, then at 6' and every 6' thereafter. Begin at cabin side, end at waterline at far side.
6) Note depth and average velocity (bottom number) at each station in write-in-rain book.
7) When taking velocity move probe slowly up and down in water column for 40 seconds to obtain average velocity.
8) Measure depth, remove probe from water, and push both buttons simultaneously to zero velocities. Now you are ready for velocity measurements.

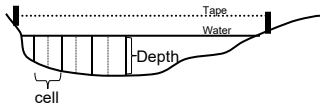
Shut off probe by putting it into "sleep mode". Hold both buttons simultaneously for 8 seconds. Push right button two times until sleep appears on screen.

Transfer measurements to worksheet in black notebook and the Stream Discharge form. Send completed form to Soldotna office to be entered into Discharge 03-19.xls workbook.

*** For Rondy Creek take measurements every 3 feet.**

Appendix C2.–Data form for recording stream velocity measurements.

Stream Discharge Form



Date: _____
Stream: _____
Staff gauge depth: _____
Collector: _____

Cell Boundaries[1]	Location of Depth Measurement[1]	Depth (ft)	Velocity (ft/s)	Cell Width (ft)	Cell Area (ft^2)	Cell Discharge (ft^2/s)	Notes
	-	0	0	-	-	-	Waterline[2]
							Variable cell width [3]
3-9	6			6			
9-15	12			6			
15-21	18			6			
21-27	24			6			
27-33	30			6			
33-39	36			6			
39-45	42			6			
45-51	48			6			
51-57	54			6			
57-63	60			6			
63-69	66			6			
69-75	72			6			
75-81	78			6			
81-87	84			6			
87-93	90			6			
93-99	96			6			
99-105	102			6			
105-111	108			6			
111-117	114			6			
117-123	120			6			
123-129	126			6			
129-135	132			6			
135-141	138			6			
							Variable cell width [3]
		0	0	-	-	-	Waterline[2]
			Totals:	**Strm Width**	**XS Area**	**Discharge**	

[1] Distance (in feet) from left bank.

[2] For the cell boundary, enter the distance from the left bank to the waterline.

[3] For the first and last cells, the cell boundary is the distance from the waterline to the next (or last) cell.
For the cell depth, the measurement is taken midway in the cell.

APPENDIX D: ARCHIVAL DATA MAPS

Appendix D1.–Data archival maps.

The following files will be used for the 2019 early- and late-run Russian River escapement counts and weir scale. From 2020 to 2022 the same data archival procedures will be followed. The filenames will change only to reflect the year in which the data were collected.

2019 Early- and Late-run Russian River Escapement Counts

File	Description
2019_ER_Russian_Workbook.xls	Daily and accumulated early-run sockeye salmon counts and projection model for the Russian River weir, 2019. Regression projection model for early-run sockeye at the Russian River weir.
2019_LR_Russian_Workbook.xls	Daily and accumulated late-run salmon counts, including sockeye, coho and Chinook, and projection model for the Russian River weir, 2019. Regression projection model for late-run sockeye at the Russian River weir.
LowerRussianSpawners93-19.xls	Stream survey for lower river spawners, 2019.

2019 Early- and Late-run Russian River Weir Scale Data Map

	File Name	Description
2019 Early-run	RRWER19.dta	Scale data for early-run (CSV/ASCII file)
2019 Late-run	RRWLR19.dta	Scale data for late-run (CSV/ASCII file)

All files have the same map:

Column Number	Data
3 - 8	Date (year, month, day)
18 - 20	Location Codes (Russian River drainage)
22 - 23	Site Code (confluence or weir)
28 - 30	Species code
59 - 60	Sampler's initial
62	Sex
64 - 67	Length (MF)
97	Scale card number
99 - 100	Scale location on card
102 -103	Age (Fresh, Marine)
105	Age error (R=regenerated, D=dirty, I=inverted, M=missing, A=reabsorbed, U=unreadable)