Regional Operational Plan ROP.SF.2A.2014.16

Karluk River Chinook Salmon Smolt Abundance Feasibility Study, 2014

by

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and

Dan Reed

March 2015

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)

Measures (fisheries)

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

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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Project Title:	Karluk River Chinook Salmon Smolt Abundance Feasibility Study, 2014
Project leader(s):	Tyler B. Polum, Fishery Biologist II
Division, Region and Area	Sport Fish, Region II, Kodiak
Project Nomenclature:	Chinook Salmon Research Initiative
Period Covered	1 April–30 June, 2014
Field Dates:	16 April–30 May, 2014
Plan Type:	Category III

Approval

Title	Name	Signature	Date
Project Leader	Tyler Polum		1/14/14
Area Management Biologist	Dana Tracy		01/19/2014
Biometrician	Daniel Reed		02/03/2014
Research Coordinator	Jack W. Fricker		2-13-2014
Regional Supervisor	James J Hasbrouck		4/17/2014

Chinook Salmon Research Initiative Approval

Title	Name	Signature	Date
Fish and Game Coordinator	Ed Jones		2-18-15
Fisheries Scientist	Robert Clark		2/24/15
Fisheries Scientist	Eric Volk		3/17/15

TABLE OF CONTENTS

LIST OF FIGURES

ABSTRACT

There is a lack of information on the juvenile life stage of Karluk River Chinook salmon, an important indicator stock used by the Department of Fish and Game (ADF&G), Division of Sport Fish, to assess the status of Chinook salmon throughout the state of Alaska. The goal of this project is to assess the feasibility of capturing Chinook salmon smolt emigrating from the lower Karluk River. The purpose of this assessment is to obtain preliminary information on the level of accuracy and precision of abundance estimates that could be obtained from a coded wire tag study of juveniles, which would provide information on annual abundance and marine survival. During four 1-week intervals, a team of 3 technicians will sample the Karluk River between the portage and ADF&G weir sites using minnow traps, recording numbers and lengths of smolt, and stream conditions.

Key words: Chinook salmon, smolt, *Onchorynchus tshawytscha*, abundance, minnow trap, Karluk River.

PURPOSE

The Karluk River Chinook salmon population has historically supported both a large sport fishery as well as significant indirect harvest by the commercial fishery targeting sockeye salmon. There is also indirect subsistence harvest of Karluk River Chinook salmon in the Karluk Lagoon and a targeted, rod and reel subsistence fishery of unknown size in the Karluk River above the lagoon. The average Chinook salmon harvest from 2001 to 2010 was approximately 13,200 fish in the commercial fishery and historically, since 1975, has averaged 9,000 fish (Jackson, et. al. 2012). Since permit reporting started in 1995, an average of 18 fish have been reported harvested in the subsistence fishery (Department of Commercial Fisheries subsistence database) and since 1996, when the Statewide Harvest Survey began, the average harvest in the sport fishery has been about 500 fish, with virtually no harvest since 2007 due to restrictions in the fishery (Jennings et. al., *in prep*). Since 1976, the Karluk River drainage has had an average weir count of 9,200 Chinook salmon; however, in recent years (2004–2013), the weir count has declined to an average of 3,310 Chinook salmon. A biological escapement goal (BEG) has been established for Karluk River Chinook salmon of 3,000 to 7,000 fish.

The Karluk River Chinook salmon stock is 1 of the 12 chosen by the Alaska Department of Fish and Game (ADF&G) as an indicator stock to assess the status of Chinook salmon around the state of Alaska. However, there is a lack of information on juvenile Chinook salmon from Karluk River. To better understand the life-history and processes of migration and survival of Karluk River Chinook salmon, ADF&G Division of Sport Fish (SF) for Region II seeks to conduct a coded wire tag study that estimates the annual abundance and subsequent marine survival of Chinook salmon smolt emigrating from the Karluk River. However, before a full scale coded wire tag project is funded, SF Region II would like to assess the feasibility of capturing emigrating smolt from the lower Karluk River (Figure 1).

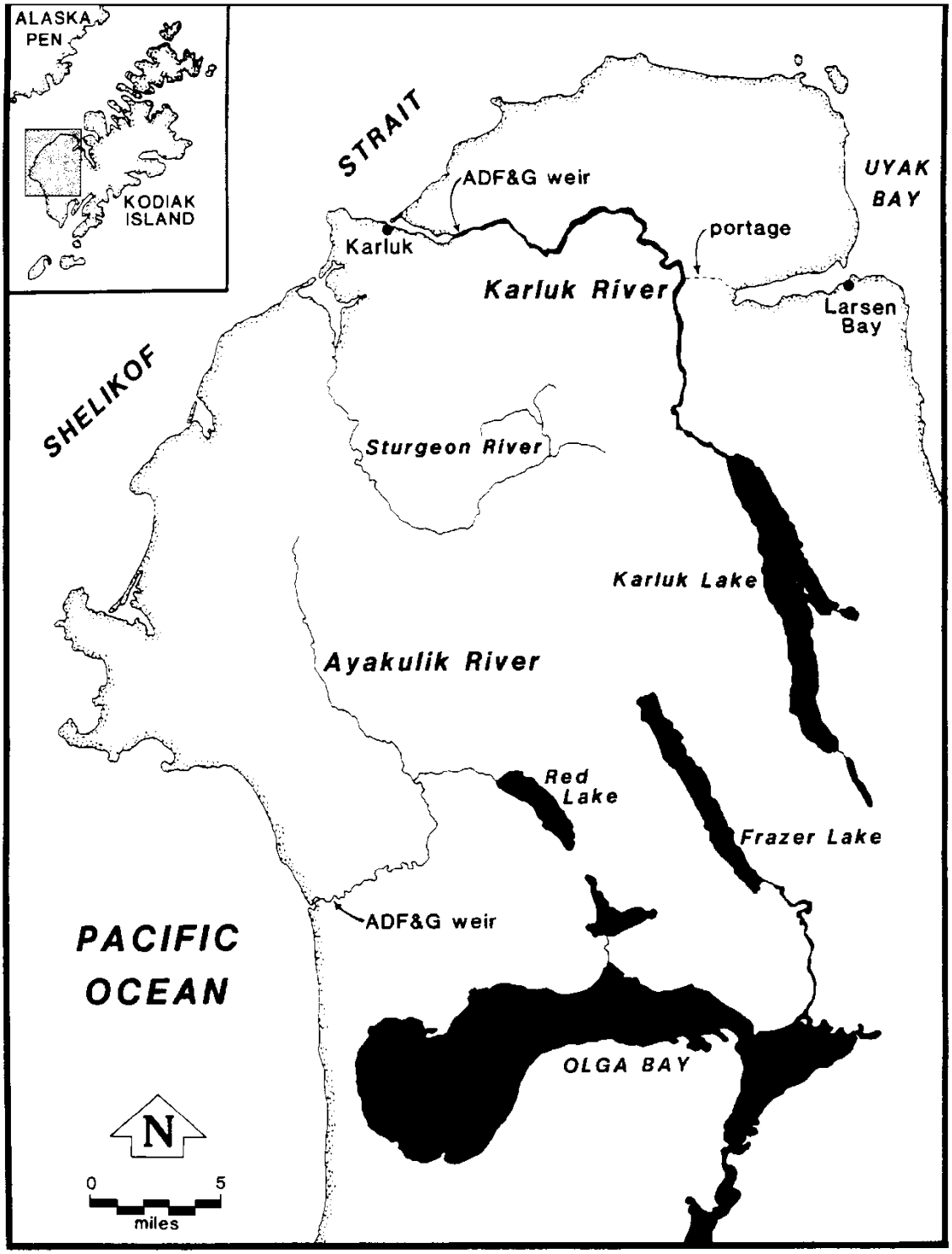

Figure 1.–Map of the Karluk River drainage demarcating the Portage and the ADF&G weir sites, which are the upper and lower bounds of the survey area.

OBJECTIVES

The objectives for 2014 are

1) to capture emigrating Chinook salmon smolt from mid-May to mid-June using minnow traps on the Karluk River from the portage area to the lagoon, and
2) to determine what level of accuracy and precision the abundance estimates could achieve based on the total number of emigrating Chinook salmon smolt captured.

METHODS

Study Area and Design

The Karluk River, located on the southwest end of Kodiak Island (Figure 1), contains 1 of only 2 native populations of Chinook salmon found on the Kodiak Archipelago. From its source at the outlet of Karluk Lake, the Karluk River flows 35.2 river kilometers (22 river miles) to its terminus at Karluk Lagoon. Large portions of the uplands surrounding the Karluk River are currently held in private ownership. At this time, no information is available about the spring emigration of Chinook salmon smolt from the Karluk River. The Division of Commercial Fisheries (CF) operates a sockeye salmon smolt emigration project annually at the lake outlet but does not capture any of the emigrating Chinook salmon. In 2009, ADF&G and Kodiak National Wildlife Refuge conducted a study on the Karluk River to document the location and abundance of rearing juvenile Chinook salmon. Sampling efforts produced minimal results, but indicated that most rearing Chinook salmon were present in the lower Karluk River, below the portage. For this project, 1 team of 3 technicians will sample the Karluk River between the portage and the ADF&G weir site (Figure 1), beginning in late April or early May, in four 1-week intervals with sampling occurring each week in a different section approximately 3 miles long.

The crew will deploy 100 minnow traps (style G-40) baited with salmon roe in each section to be trapped. Traps will be placed opportunistically throughout the section being sampled with attention paid to habitat features that are associated with catches of Chinook salmon smolt. Traps will be fished continuously in each section for 4 consecutive days except during the time it takes to check, bait, and redeploy each trap. Three days will be allowed each week to move the camp and reset traps in each new section.

Camps will be established at the downstream end of each section; the first section will start at the lower end of the portage. Traps and all materials necessary for sampling will be staged at the upstream end of each section. Then the crew will deploy lightweight inflatable boats at the upstream end of the section to check and re-bait traps each day. Traps will be collected on the fourth day of trapping and staged at the upstream end of the next section for redeployment. All camps and staged materials will be protected with lightweight electric fences to prevent bears from damaging them. After completing each section, 2 crew members will set up a new camp at the lower end of the next section to be sampled. The third crewmember will float to the lagoon to get picked up and transported to the portage via floatplane where they will travel back down river with groceries and any other resupply items.

Beach seining will be attempted inriver or in the lagoon if time allows. However, seining for juvenile Chinook salmon in the Karluk River and Karluk Lagoon has not been successful previously. This is probably due to the large numbers of emigrating and rearing sockeye and

coho salmon throughout the drainage and the small runs of Chinook salmon relative to other species. There are also very few areas suitable for juvenile beach seining in the river.

Data Collection

Water temperature and level will be recorded each day. Minnow traps will fish 24 hours per day up to 4 days per week. The total number of Chinook salmon smolt will be enumerated for each trap location and general stream characteristics for each location will be recorded. Catch per unit effort (CPUE) will be tabulated for each trap location. All captured Chinook salmon smolt will be measured for fork length (FL; tip of snout to fork of tail) to the nearest millimeter. If catch rates are too high to practically measure all Chinook salmon smolt, then a subset of smolt will be sampled for length. The number and species of nontarget fish will also be recorded.

Data Reduction

During the fieldwork, all data will be recorded into all-weather field notebooks or on data forms printed on all-weather paper. Following the fieldwork, data will be transferred to an Excel spreadsheet from which all data analysis will be referenced and performed. The electronic files will be submitted upon completion of the final report and placed into the SF Intranet Docushare website; the file name and directory location will be presented in the final report. The spreadsheet will also be archived with the ADF&G Research and Technical Service (333 Raspberry Road, Anchorage, AK 99518) when completed.

Data Analysis

CPUE summary statistics will be calculated for each week-section sampled and by day within each week-section. CPUE by day will be estimated for day i (Cochran 1977) as follows:

$$CPUE_i = \sum_{j=1}^{n_i} c_{j(i)} \Big/ n_i \tag{1}$$

with variance

$$\hat{V}(CPUE_i) = \frac{\sum_{j=1}^{n_i} \left(c_{j(i)} - CPUE_i\right)^2}{(n_i - 1)} \tag{2}$$

where

$c_{j(i)}$ = catch at trap j during day i (j = 1 to n_i), and

n_i = number of trap days for day i .

CPUE statistics for an entire week-section will be calculated using Equations 1 and 2 and substituting counts and trap days for the entire week.

CPUE statistics by day and section will be examined graphically and compared by inspection to evaluate logistical similarities and differences between sections and temporal periods.

CPUE estimates over the 4-week sampling schedule will be expanded over a number of plausible run timing and future sampling effort scenarios to determine the level of accuracy and precision of any future smolt abundance estimates. The Stikine River drainage supports a Chinook salmon

population that averaged 112 smolts per spawner from 1998 through 2002 (Pahlke et al. 2010). Assuming 100 smolts per spawner and an average escapement of 3,000 for Chinook salmon in the Karluk River, the number of smolts annually emigrating from the Karluk River would be 300,000. If approximately 50% of the average adult escapement at the Karluk River weir is sampled annually for age and presence of a coded wire tag, we expect approximately 1,200 adults (age .2 through age .5, assuming 20% of scales sampled for ageing are readable) would be sampled from an entire brood year, allowing calculation of the marked:unmarked ratio. Under this sampling scenario, to obtain smolt abundance estimates with relative precision of 25% at 90% confidence, a total of 10,986 smolt would need to be successfully tagged during emigration (Robson and Regier 1964). Therefore, the likelihood of obtaining this level of precision and accuracy with future abundance estimates will be determined by the total number of smolt captured during the 4-week sampling period in 2014. Currently, sampling levels on the Karluk River are 2% of the Chinook salmon return and are performed by CF personnel at the weir. Sampling efforts at the weir will have to be increased substantially if coded-wire-tagging is performed on Karluk River Chinook salmon smolt. Also, SF personnel would need to be present at the weir site to aid with the increased workload related to recapturing large numbers of adult Chinook salmon for the four years Chinook salmon will return following coded-wire-tagging as juveniles.

Length composition estimates will be calculated as described in Cochran (1977). Stratification will be done postseason to evaluate any temporal and spatial differences in composition; however, all strata will be pooled if sample sizes preclude stratification or there are no significant differences between stratum estimates. The proportion of smolt in each length category will be estimated as follows:

$$\hat{p}_{l,i} = \frac{n_{l,i}}{n_i} \tag{3}$$

where

n_i = the sample size for each time and area stratum *i,*,

$n_{l,i}$ = the subset of that sample composed of smolt in length category *l*, and

$\hat{p}_{l,i}$ = the estimated proportion of the total catch in stratum *i* composed of fish length *l*.

The variance of will be estimated using Goodman's (1960) formula for the variance of a proportion:

$$\hat{Var}\left(\hat{p}_{l,i}\right) = \left(\frac{\hat{p}_{l,i}\left[1 - \hat{p}_{l,i}\right]}{n_i - 1}\right) \tag{4}$$

SCHEDULE AND DELIVERABLES

Results from this project will be summarized in a Fishery Data Series Report; a draft of this report will be submitted to the Research Supervisor by 1 March 2015. The FDS report will

satisfy any requirements from the funding source (CSRI). Probable dates for sampling activities are summarized below.

Date	Action
16–22 April	Crew training, field camp prep
23–29 April	Deploy field camp, begin sampling, if able
30 April–6 May	Deploy field camp, if needed, begin sampling
7–13 May	Sampling
14–20 May	Sampling
21–27 May	Sampling, if needed
28 May–3 June	Take down camp, data organization and reduction
October–November	Data analysis
December–March	Write report

RESPONSIBILITIES

Project Staff	Primary Assignments
Tyler Polum, *Fisheries Biologist II*	Project Leader responsible for supervision of all aspects of the Karluk River Chinook salmon smolt project, managing the project budget and writing the final report.
Vacant, *Fish & Wildlife Technician III*	Crew leader responsible for mobilization, day-to-day project tasks, aspects of field work, and demobilization.
Vacant, *Fish & Wildlife Technician II*	Responsible for mobilization, day-to-day project tasks, all aspects of field work, and demobilization.
Vacant, *Fish & Wildlife Technician II*	Responsible for mobilization, day-to-day project tasks, all aspects of field work, and demobilization.
Dan Reed, *Biometrician III*	Assists with project design and data analysis.
Jack Erickson, *Fishery Biologist IV*	Final report editing and project support.

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