

Regional Operational Plan No. ROP.SF.2A.2023.07

**Operational Plan: Monitoring the Chinook Salmon
Sport Fishery on the Nushagak River Drainage, 2023**

by

Lee K. Borden

June 2023

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



Symbols and Abbreviations

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Weights and measures (metric)		General		Mathematics, statistics	
centimeter	cm	Alaska Administrative Code	AAC	<i>all standard mathematical signs, symbols and abbreviations</i>	
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	alternate hypothesis	H _A
gram	g	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	base of natural logarithm	<i>e</i>
hectare	ha	at	@	catch per unit effort	CPUE
kilogram	kg	compass directions:		coefficient of variation	CV
kilometer	km	east	E	common test statistics	(F, t, χ^2 , etc.)
liter	L	north	N	confidence interval	CI
meter	m	south	S	correlation coefficient	
milliliter	mL	west	W	(multiple)	R
millimeter	mm	copyright	©	correlation coefficient	
		corporate suffixes:		(simple)	r
Weights and measures (English)		Company	Co.	covariance	cov
cubic feet per second	ft ³ /s	Corporation	Corp.	degree (angular)	°
foot	ft	Incorporated	Inc.	degrees of freedom	df
gallon	gal	Limited	Ltd.	expected value	<i>E</i>
inch	in	District of Columbia	D.C.	greater than	>
mile	mi	et alii (and others)	et al.	greater than or equal to	≥
nautical mile	nmi	et cetera (and so forth)	etc.	harvest per unit effort	HPUE
ounce	oz	exempli gratia		less than	<
pound	lb	(for example)	e.g.	less than or equal to	≤
quart	qt	Federal Information Code	FIC	logarithm (natural)	ln
yard	yd	id est (that is)	i.e.	logarithm (base 10)	log
		latitude or longitude	lat or long	logarithm (specify base)	log ₂ , etc.
Time and temperature		monetary symbols		minute (angular)	'
day	d	(U.S.)	\$, ¢	not significant	NS
degrees Celsius	°C	months (tables and figures): first three letters	Jan, ..., Dec	null hypothesis	H ₀
degrees Fahrenheit	°F	registered trademark	®	percent	%
degrees kelvin	K	trademark	™	probability	P
hour	h	United States (adjective)	U.S.	probability of a type I error	
minute	min	United States of America (noun)	USA	(rejection of the null hypothesis when true)	α
second	s	U.S.C.	United States Code	probability of a type II error	
		U.S. state	use two-letter abbreviations (e.g., AK, WA)	(acceptance of the null hypothesis when false)	β
Physics and chemistry				second (angular)	"
all atomic symbols				standard deviation	SD
alternating current	AC			standard error	SE
ampere	A			variance	
calorie	cal			population	Var
direct current	DC			sample	var
hertz	Hz				
horsepower	hp				
hydrogen ion activity	pH				
(negative log of)					
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

REGIONAL OPERATIONAL PLAN NO. ROP.SF.2A.2023.07

**OPERATIONAL PLAN: MONITORING THE CHINOOK SALMON
SPORT FISHERY ON THE NUSHAGAK RIVER DRAINAGE, 2023**

by
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June 2023

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ABSTRACT

This project surveys the Chinook salmon sport fishery on the Nushagak River. Information will be collected on angler-days of effort by type of angler (guided vs. unguided) and gear (bait or no bait), catch and harvest rates of Chinook salmon, as well as age, sex, length, weight, and genetics of Chinook salmon in the sport harvest. Data will be reported to fisheries managers in Dillingham daily, providing real-time information regarding sport fishing success as well as the composition of the harvest. Data collected from onsite surveys will be used to document use patterns and design regulations that will accommodate growth of the sport fishery and maintain angling opportunity. Results will also guide review of current regulations and will be used to assess the effectiveness of current regulations in maintaining compliance with the management plan.

Keywords: Chinook salmon, *Oncorhynchus tshawytscha*, creel survey, Nushagak River, Bristol Bay Management Area

INTRODUCTION

PURPOSE

The Bristol Bay Management Area (BBMA) supports several important Chinook salmon sport fisheries, notably in the Alagnak, Kvichak, Naknek, Nushagak, and Togiak Rivers. The Nushagak and Mulchatna Rivers host the largest and fastest growing Chinook salmon fisheries in the region. Major Alaskan sport fisheries are monitored by the Alaska Department of Fish and Game (ADF&G) Statewide Harvest Survey (<https://www.adfg.alaska.gov/sf/sportfishingsurvey/>; SWHS;), which is an annual mail survey. However, this survey does not give inseason estimates of sport effort, does not give information on sport effort, catch, and harvest at particular locations within a general area, does not assess angler gear, residency, sex, and if guided, nor does it gather biological data from sport harvested fish. Because these are of interest to Chinook salmon management, a creel survey is necessary to collect this information.

BACKGROUND

The Nushagak River is currently managed under the *Nushagak-Mulchatna King Salmon Management Plan* (Alaska Administrative Code 5AAC 06.361). During Chinook salmon runs with “normal” abundance, ADF&G is expected to manage the sport harvest such that it does not exceed 5,000 Chinook salmon annually. The plan outlines projected escapement and inriver run sizes at which restrictions on the commercial fishery may be implemented to reduce the annual harvest or when the fishery may be liberalized to allow the allocation to be exceeded. Triggers to implement restrictions on the sport fishery were removed from the plan at the 2018 Alaska Board of Fish (BOF) meeting pending potential changes to the plan that were anticipated to be adopted at BOF meetings in 2021. COVID-19 postponed the Bristol Bay 2021 BOF meeting until November and December of 2022, at which time the Nushagak River Chinook salmon stock was designated a stock of management concern. At the subsequent Statewide BOF meeting in March 2023, the current action plan (5 AAC 06.361) was adopted by the BOF outlining a rebuilding plan for Nushagak River Chinook salmon. Information gathered from the Nushagak River creel survey will be used as one part of a larger multi-study effort to better understand the Nushagak River Chinook salmon stock.

The current sport fishery regulations stipulate in part an annual bag limit of 4 Chinook salmon 20 inches or longer, only 1 of which may be over 28 inches, and a daily bag limit of 2 Chinook salmon 20 inches or longer, only 1 of which may be longer than 28 inches total length in the Nushagak River drainage (ADF&G Alaska sport fishing regulations summary for Bristol Bay drainages,

2023, https://www.adfg.alaska.gov/index.cfm?adfg=fishregulations.sw_sportfish). For Chinook salmon under 20 inches in length, the daily bag limit is 5 and there is no annual limit. The open season for Chinook salmon is May 1 through July 31 in the Nushagak River downstream from the outlet of the Iowithla River. Upstream of the outlet of the Iowithla River, and including the Iowithla River, the open season is May 1 through July 25.

Data have been collected on the sport fisheries in the Nushagak River drainage and these include the results of the annual ADF&G SWHS and 9 onsite creel surveys conducted in 1985–1987, 1991, 1994, 2000, 2001, 2007, and 2019 (Minard and Morstad 1985; Minard 1987; Minard and Brookover III 1988; Dunaway and Bingham 1992; Dunaway and Fleischman 1995; Dye 2005; Capiello and Dye 2006; L. Borden, Fishery Biologist, ADF&G, Dillingham, unpublished data). Creel surveys conducted by ADF&G in 1997 in the lower reaches of the Nushagak River and middle Mulchatna River were terminated early by a closure of the Chinook salmon fishery. Results of the 1997 surveys were briefly summarized in the 1997 Area Management Report (Minard et al. 1998). Management reports for the Southwest Alaska area document the management of the Nushagak River Chinook salmon sport fishery (Dye and Borden 2018; Borden and Adickes 2022). Information on the commercial and subsistence salmon harvests and salmon escapements into the Nushagak River drainage are collected annually by the ADF&G Division of Commercial Fisheries and published annually in their Regional Information Report (RIR) series.

The Nushagak–Mulchatna sport fishery has demonstrated that regular onsite monitoring is required to assess the latest developments in this popular fishery. Data collected from onsite creel surveys described in this operational plan will be used to document use patterns and design regulations that accommodate growth of the sport fishery and maintain angling opportunity, and these data will be used to review current regulations and assess their effectiveness at maintaining compliance with the management plan. The planned survey will document current levels of effort, catch and harvest rates, biological characteristics of the Chinook salmon harvest, and angler type (unguided vs. guided) and demographics (residency and sex).

OBJECTIVES

The objectives for the 2023 survey of the Chinook salmon sport fishery on the Nushagak River near Portage Creek are as follows:

- 1) Index angler-days of guided, unguided, and total angler effort in the lower Nushagak River from June 15 to July 31.
- 2) Index catch and harvest rates of Chinook salmon and composition of angler-days by gear (bait vs. no bait) and angler type (guided vs. unguided) in the lower Nushagak River from June 15 to July 31.
- 3) Estimate the age, sex, length, and weight compositions of Chinook salmon in the sport harvest, separately and in total, for both guided and unguided anglers in the lower Nushagak River from June 15 to July 31 such that the estimates are within 10 percentage points of the true values 90% of the time.

METHODS

STUDY AREA

The Nushagak River Chinook salmon sport fishery survey will occur on the Nushagak River from Black Point to the lower Ekwok land boundary (LELB) at lat 59°10'25"N, long 157°42'35"W

(Figures 1 and 2). This area will be divided into 3 sublocations: 1) Black Point to the sonar site near Portage Creek (recorded as 001), 2) sonar site near Portage Creek to LELB using west channel (recorded as 002), and 3) Keefer cutoff just downstream of the confluence of Portage Creek to convergence of the channels using east channel (recorded as 003).

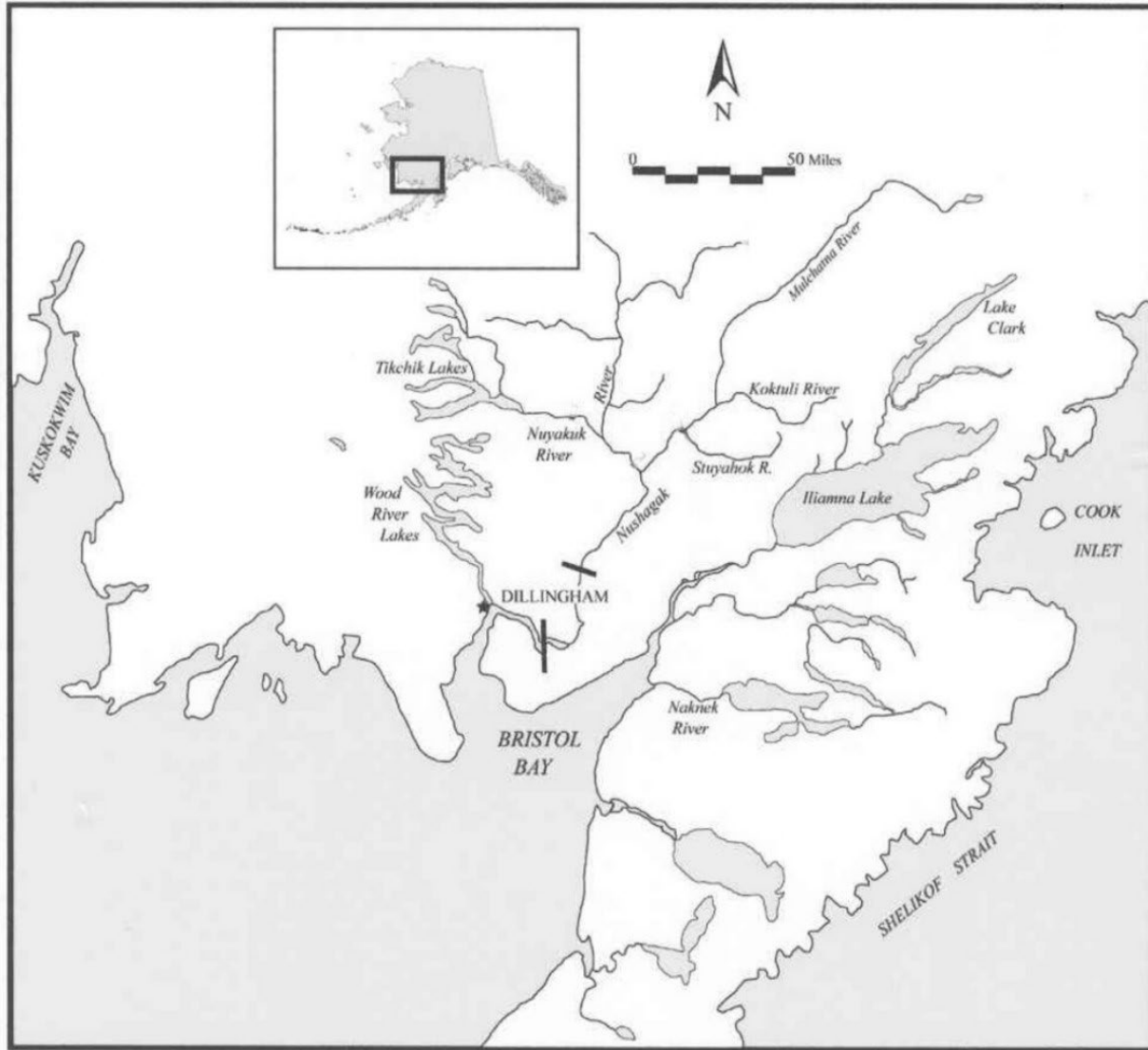


Figure 1.—Nushagak River Chinook salmon study site.

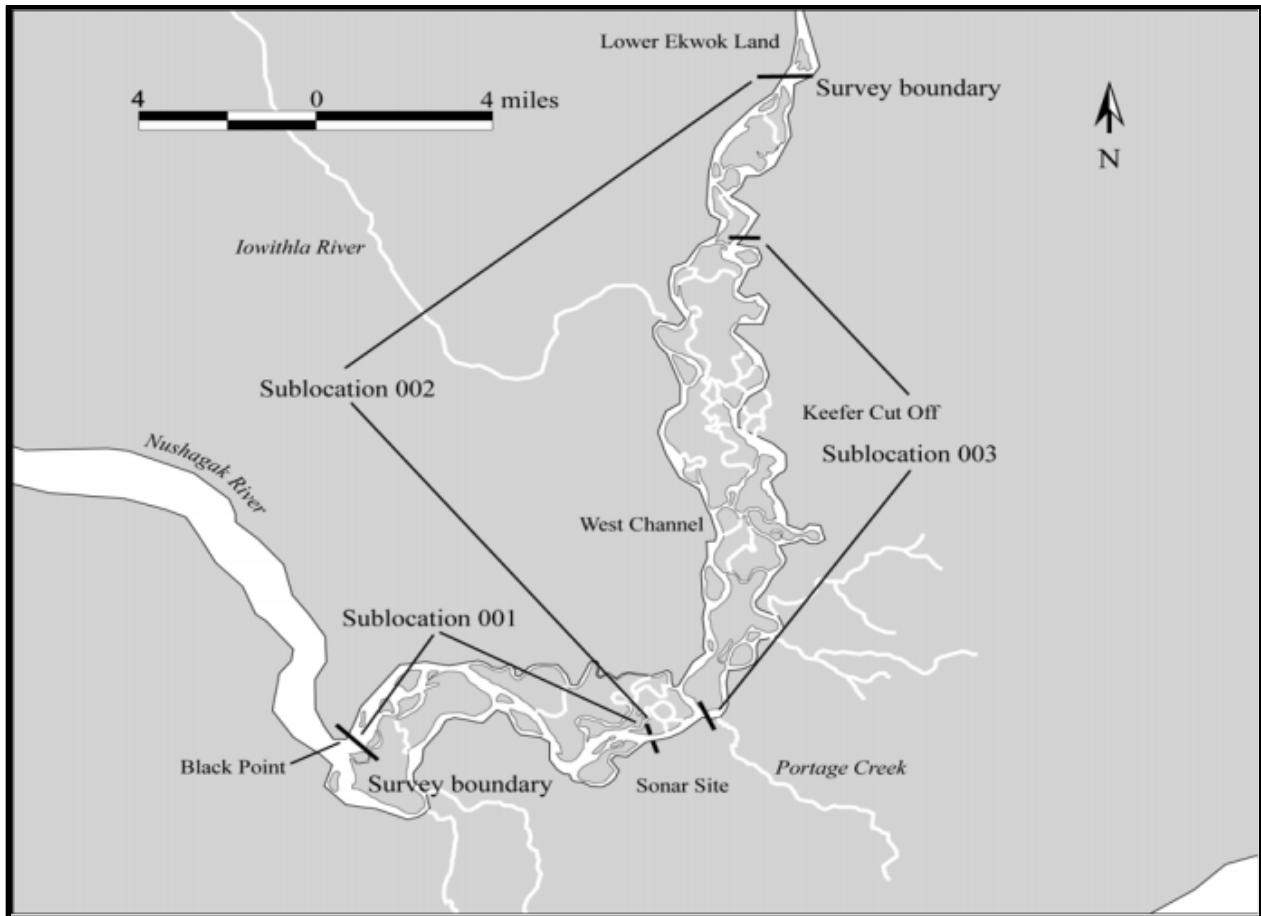


Figure 2.—Nushagak River Chinook salmon study area and sublocations.

STUDY DESIGN

ADF&G Division of Sport Fish (SF) staff will count guided and unguided anglers and interview completed-day anglers (anglers who are done angling for the day). Two staff people will be stationed in the study area to conduct angler counts and interviews. SF staff will also sample harvested Chinook salmon from both guided and unguided anglers in the study area for biological data and edit, summarize, and report the data collected daily. After the season, SF staff will analyze the data and write a report on the results of the study.

This survey will be conducted from approximately June 15 through July 31, 2023. The study design and sampling schedule incorporates seasonal, weekly, and daily peaks in the Chinook salmon sport fishery based on SF and Choggiung Ltd. (a Bristol Bay village corporation) knowledge of the fishery. The survey will be stratified by week (Monday–Sunday). Sampling will take place on Friday through Wednesday of each week.

Angler Effort, Catch and Harvest Rates, and Angler-day Compositions

Only 1 angler count will be conducted during each sample day (Objective 1). All counts will begin at the same time of day (10:00 AM), representing what is thought to be the peak time of angling activity, and will take 1.5–2.5 hours to complete. The counts will not be used to estimate angler effort because all possible count times will not be surveyed. Instead, these counts will provide an unbiased index of angler effort during the days and time sampled if the distribution of angler effort

throughout the sampling day does not vary during the course of the survey. Conversely, if the within-day distribution of angler effort varies during the course of the survey (e.g., anglers shift from morning to evening fishing), then the counts will not be an unbiased index of angler effort.

Completed-day anglers will be interviewed to obtain data on catch and harvest rates and composition (proportion) of angler-days by gear (bait usage) and angler type (guided vs. unguided) (Objective 2). Given the study design, if different types of anglers and (or) anglers with different catch or harvest rates fish during hours when there is no survey, then estimates based on interviews will not be representative of the whole fishery in the lower area.

SF staff will interview completed-day anglers. Locating and identifying completed-day anglers will require coordination among Choggiung Ltd. (the land managers) and SF staff to identify angler camp locations and numbers of individuals present per camp. Interviews will probably be obtained by both roving through the fishery and by stopping during the evening at angler camps. It is unknown what proportion of anglers will be interviewed on a given sampling day. However, it is expected that interviewing as many anglers as possible each day will provide usable data. Close coordination with the Choggiung Ltd. staff should provide an indication of the numbers of anglers in the area and thereby an approximation of the proportion interviewed.

Biological Composition of Harvested Fish

Biological data (age, sex, length, weight, genetics) from Chinook salmon harvested by both guided and unguided anglers will be collected in the lower Nushagak River. Two SF staff will rove the study area on sampling days to collect biological data from all sport-harvested fish they encounter (Objective 3). Data will be reported separately by angler type (guided or unguided). Assuming 15% of the collected scales cannot be aged, at least 120 Chinook salmon harvested by guided anglers and 120 harvested by unguided anglers (total of 240) must be sampled to attain the desired precision of estimates (Thompson 1987). This sampling goal may be difficult but not impossible to attain: 170 harvested Chinook salmon were sampled for biological data in the 2019 study in this same area during a shorter interval of time.

DATA COLLECTION

SF staff will count all active anglers while driving a boat at a safe and constant rate of speed through the study area. Guided and unguided anglers will be visually identified and counted, and these will be recorded separately. Differentiation between guided and unguided anglers during the counts will require the technicians to identify the presence or absence of green ADF&G guide decals on the boat. No stops will be made except at sublocation boundaries to record start and finish times and angler counts. “Active anglers” are individuals handling rods and tackle, repositioning a boat, landing a fish, repairing gear, or assisting another angler. An active angler does not include people solely operating boats or engaged in another activity not associated with angling (e.g., someone who put their gear away to eat lunch). In the rare event of a missed count, the scheduled date and time, sublocation, and reason for the interruption will be recorded on the data collection form.

Angler counts will be considered instantaneous and representative of angler effort when the count is conducted. The starting time for the daily count (10:00 AM) will be strictly observed. The start time was chosen to index angler effort during what is considered the peak time of day of angling activity in each study area. Additional instructions for conducting angler counts, the schedule of sample days, count start times, and detailed instructions for recording and completing the data

forms can be found in Appendix A1. Angler counts, count start and stop times by sublocation, staff initials, and brief observations will be recorded on study area-specific data forms provided by SF (Appendix A2). The sampling schedule can be found in Appendix A3. Periodically throughout the study, the completed and edited forms will be submitted to the principal investigator for review.

Angler counts will be recorded for guided and unguided anglers in each of 3 sublocations (see *Study Area* above, Appendices A1 and A2, Figure 2). Two SF technicians will conduct the counts. One technician will begin at Black Point and count anglers while traveling upstream to the sonar site near Portage Creek. In a separate boat, the other technician will start counting at the sonar site and travel up the west channel to LELB, then proceed downstream and begin counting again from the upper end of the Keefer cutoff downstream to the convergence (“Y”) of the east and west channels near Portage Creek (Figure 2). Both individuals will begin their counts at the same time (10:00 AM).

From June 15 through July 31, SF staff will record the start and stop times and angler counts using the extra sublocation codes provided in Appendix A1. In the rare event of a missed count, the scheduled date and time, sublocation, and reason for the interruption will be recorded on the data form.

Angler Interviews

Angler interviews will be conducted throughout the study area. Only completed-day anglers will be interviewed. Data will be recorded for each angler, not as a group interview. SF staff will record interview type (completed-day), numbers of Chinook salmon kept and released, angler demographics (residency), and gear type (bait vs. no bait). Detailed instructions for conducting interviews and recording data appears in Appendices B1 and B2.

Biological Composition of Harvested Fish

Sport harvested Chinook salmon encountered during each sampling day in the lower river will be sampled by SF staff for age, sex, length, weight, and genetics. Staff will determine whether the sampled fish were harvested by guided or unguided anglers during the angler interview and record them separately by these angler types. When possible, all Chinook salmon retained by an angler or group of anglers will be sampled (i.e., no subsampling of the creel). The sampling design is expected to yield a proportional sample of the harvest throughout the duration of the fishery (i.e., equal proportion of the harvest). The resultant data will be treated as if collected from a simple random sample.

Harvested Chinook salmon will be measured for length to the nearest millimeter from mid eye to tail fork, weighed to the nearest 0.25 or 0.1 kilograms (depending on the level of scale precision), and sex determined from external characteristics (developing kype on males, ovipositor on females). In addition, 3 scales will be removed from the preferred area¹ and mounted on an adhesive-coated card. Standard age determination procedures will be used (see Jearld [1983] for a general description of the principles used). The European system of age designation will be used, where the number of freshwater winter annuli precedes the decimal and the number of marine winter annuli follows. Total age from the brood year is the sum of the 2 numerals plus 1. An axillary fin clip will be taken from each fish sampled.

¹ The left side of the fish approximately 2 rows above the lateral line and on a diagonal line downward from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin (Welanders 1940).

Biological data will be recorded on Nushagak River Chinook Salmon Age-Weight-Length Form, Version 1.2. (Appendix C2). Detailed instructions for collecting and recording the data appear in Appendix C1.

DATA REDUCTION

SF staff will record angler counts and interview data on the data forms provided by ADF&G (Appendices B2 and C2). The crew will examine the forms for completeness and accuracy and will record these data onto the appropriate angler count, interview, or biological data spreadsheet.

Each day, the crew will check for errors in the data and make appropriate corrections to ensure each form is filled out accurately and completely. The forms will be submitted to the principal investigator for review and editing periodically throughout the study.

Each day, the crew will summarize all angler count, angler interview, and biological data collected during the previous day's sampling and relay the information via email or satellite phone to the SF office in Dillingham. Information provided each day will include the following:

- a) the number of guided and unguided anglers counted by sublocation and any counts missed
- b) the number of angler interviews conducted by SF staff, and number of camps missed
- c) summary CPUE data from angler interviews and counts calculated through a pre-programmed Excel spreadsheet
- d) the number of Chinook salmon released and number kept by anglers as reported on the interviews
- e) the number of harvested Chinook salmon sampled for biological data by angler type (guided vs. unguided)

Each SF technician will keep a notebook to record other observations of the fishery. Examples of items to include are the time and date of events that may have influenced accuracy of angler counts or interviews (e.g., motor breakdowns), techniques devised to improve survey accuracy or efficiency, and suggestions for improving the project or equipment. These observations will be summarized in a SF crew leader report at the end of the project.

At the end of the study, the principal investigator will examine all data forms to ensure they are correct and complete. Age data will be directly keypunched into the electronic biological data file. The edited data files will then be emailed or recorded to disk(s) and sent to SF Research and Technical Services for archiving.

DATA ANALYSIS

Angler Effort

As noted above, the single angler count conducted each day represents an index of angler effort. Only a summary of the daily counts by study area, sublocation, and angler type (guided vs. unguided) will be performed.

Angler Interviews

Catch and Harvest Rate

Daily and weekly estimates of catch per unit of effort (CPUE) will be calculated as described below. A unit of effort is defined as a single angler-day. Daily CPUE on the i th day during the h th week will be calculated as follows:

$$cpue_{hi} = \frac{c_{hi}}{n_{hi}} \quad (1)$$

where, c_{hi} equals the number of fish caught (both kept and released) on the i th day during the h th week of the survey, and n_{hi} is the number of complete-day anglers interviewed on the i th day.

Variance of daily CPUE will be estimated as follows:

$$\text{var}(cpue_{hi}) = \frac{\sum_{a=1}^{n_{hi}} (c_{hia} - cpue_{hi})^2}{n_{hi}(n_{hi} - 1)} \quad (2)$$

where c_{hia} is catch of angler a interviewed on day i of week h .

Then the weekly estimate of CPUE is calculated as follows using pooled weekly catch data:

$$cpue_h = \frac{\sum_{i=1}^{m_h} c_{hi}}{\sum_{i=1}^{m_h} n_{hi}} \quad (3)$$

where, m_h equals the number of days sampled in the lower study area during week h of the survey.

Variance of weekly CPUE will be estimated by

$$\text{var}(cpue_h) = \frac{\sum_{i=1}^{m_h} \sum_{a=1}^{n_{hi}} (c_{hia} - cpue_h)^2}{(\sum_{i=1}^{m_h} n_{hi})(\sum_{i=1}^{m_h} n_{hi} - 1)} \quad (4)$$

The standard error (SE) will be estimated as the square root of the variance estimate. Confidence intervals (95%) will be estimated using the percentile bootstrap method (Efron and Tibshirani 1993) to compare CPUE among weeks. Harvest per unit of effort (HPUE) will be estimated similarly, replacing harvest (only fish kept) for catch.

Angler Compositions

The proportion of anglers by type (guided vs. unguided), terminal gear type (bait use) z or angler demographic (residency) z will be estimated as follows:

$$\hat{p}_z = \frac{m_z}{m} \quad (5)$$

where m_z equals the number of the interviewed anglers whose trips are categorized as z , and m equals the total number of classifiable anglers interviewed.

No estimates of the sampling variance will be calculated because these proportions are merely descriptive in nature and cannot be used to make inferences about the fishery.

Assumptions

The assumptions necessary for unbiased point and variance estimates obtained by Equations 1–4 are as follows:

- 1) Interviewed anglers accurately report the number of Chinook salmon kept and released.
- 2) SF staff accurately classify angler demographics and the interviewed anglers accurately report their trip type and terminal gear type (use of bait) during their fishing day.
- 3) Catch rate and duration of fishing trip are independent (DiCostanzo 1956). This is necessary for the roving method of interviewing; anglers with longer fishing trips have a greater probability of being intercepted for interview.
- 4) The distribution of angler effort within the angling day does not vary substantially during the course of the survey (necessary for CPUE to be an unbiased index of fish abundance, and for the single angler count to be an unbiased index of angler effort).

There are no direct ways of evaluating or testing any of the assumptions. For Assumptions 1 and 2, anglers are expected to have a good recollection of the total number of fish kept and released and to accurately report their fishing day characteristics (hours fished, trip duration, etc.) In addition, project staff are expected to accurately record interview data. Assumptions 3 and 4 should be valid if the number of interviews results in a census of completed-day anglers. If the number of interviews does not result in a census of completed-day anglers, then the interviews need to be collected daily in proportion to the total number of anglers present throughout the study. The angler counts can be used as a diagnostic for this. Proportional samples will be realized if the ratio of the angler count to the number of interviews performed on a given day remains stable throughout the study.

Biological Composition of Harvested Fish

The proportion of harvested Chinook salmon of category (age, sex, length, or weight class) u will be estimated as follows:

$$\hat{p}_u = \frac{n_u}{n} \quad (6)$$

where n_u equals the number of sampled Chinook salmon in category u , and n equals the total number of Chinook salmon sampled.

Variance of each proportion will be estimated without the finite population correction factor, since we will not have harvest estimates:

$$\text{var}(\hat{p}_u) = \frac{\hat{p}_u(1 - \hat{p}_u)}{n - 1} \quad (7)$$

Mean length- and weight-at-age of harvested Chinook salmon will be estimated following standard procedures (Sokal and Rohlf 1981: Boxes 4.2 and 7.1, pages 56 and 139). The standard error will be estimated as the square root of the variance estimate.

SCHEDULE AND DELIVERABLES

Dates	Activity	Responsibility
May–Jun	Procurement of equipment	Borden
May–Jun	Hiring of survey technicians	Borden
Jun–Jul	Collection of field data	Survey technicians
Aug–Sep	Editing of data	Borden
Sep	Data processing	Borden
Sep–Oct	Data analysis	Borden, Huang
Dec–Jan	First draft of report	Borden
Feb	Final report (Regional Information Report Series)	Borden

RESPONSIBILITIES

Lee Borden, Area Management Biologist, ADF&G

Duties: Overall project supervisor. Administers the project budget and supervises project design and data analysis. Reviews and updates operational plan. Procures equipment and hires seasonal field staff. Responsible for writing the operational plan and year-end report.

Jiaqi Huang, Biometrician III, ADF&G

Duties: Reviews operational plan, provides sample size determination and estimation procedures, advises project leader regarding statistical procedures and practices, reviews draft report

2 Fish and Wildlife Technicians, ADF&G

Duties: Responsible for the collection of all field data as outlined in the operational plan, including counting and interviewing anglers, and biological sampling. Directly responsible for adhering to sampling schedules, responsible for summarizing and editing data daily. Responsible for operating and maintaining field camp and equipment to ensure proper discharge of field duties.

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APPENDIX A: ANGLER COUNT METHODS AND DATA SHEETS

One angler count per sampling day will be conducted in the survey area described in this plan. Angler counts will begin at the designated starting point and then continue by driving a boat through the length of the study area at a constant rate of speed to the opposite boundary while counting all anglers actively participating in the fishery. Anglers will be identified as guided or unguided (presence or absence of green ADF&G guide decals on boat) and separate counts will be kept for each. Individuals will be counted if changing hooks, repositioning their boat, as well as unhooking a fish or similarly occupied.

Counts should take the minimum time required to run a boat from beginning to end and should commence exactly at the time scheduled below and continue without interruption until arriving at the other boundary. Technicians are allowed a few minutes to stop at each sublocation boundary to record stop time, angler counts, and start time of the count in the next sublocation.

Custom forms for recording daily angler counts in the study area will be provided by ADF&G (Appendix A2).

Counts missed and reasons for missing (motor trouble, other emergency) must be noted on the daily summary sheet and reported on the daily report to survey headquarters.

Each area has been divided into sublocations to assist in describing the distribution of effort and to facilitate angler counting and data recording. The locations are as follows:

Study area: Black Point to Ekwok land boundary.

Location code 003 Sublocation 001: The Nushagak River from Black Point to the Portage Creek sonar site.

Location code 003 Sublocation 002: The Nushagak River west channel from the Portage Creek sonar site upstream to the Lower Ekwok Land Boundary (LELB) approximately lat 59°10'25"N, long 157°42'35"W.

Location 003 Sublocation 003: The Nushagak River, Keefer cutoff (east channel) downstream to the convergence of the channels (the "Y") near Portage Creek Village.

Count Start Times

Starting times for the angler counts must be strictly observed. The starting time for the daily count is 10:00 AM

ADF&G data forms

After the field work has been completed, the data will be recorded on the angler count form in Appendix A2 and then transferred to a Microsoft Excel spreadsheet for analysis.

Appendix A2.–Custom daily angler count form for the lower Nushagak River study area.

15

001 Black Point to Portage sonar site						002 Sonar up W. chan. to Ekwok Land					003 Keefe cutoff to Portage Y						
			Count						Count						Count		
Date	start time	stop time	Guided	Unguided	Total	start time	stop time	Guided	Unguided	Total	start time	stop time	Guided	Unguided	Total		

- 001** Nushagak R. from Black Point to Portage sonar site (Start at 10:00 each sample day)
- 002** Nushagak R. west channel from Portage sonar site upstream to the Lower Ekwok Land Boundary. (Start at 10:00 each sample day)
- 003** Nushagak R., Keefe cutoff (east channel) downstream to the “Y” near Portage Creek Village (follows immediately after 002)

Appendix A3.–Angler count schedule.

Date	Sampled
15 Jun	X
16 Jun	X
17 Jun	X
18 Jun	X
19 Jun	X
20 Jun	
21 Jun	X
22 Jun	X
23 Jun	X
24 Jun	X
25 Jun	X
26 Jun	X
27 Jun	
28 Jun	X
29 Jun	X
30 Jun	X
1 Jul	X
2 Jul	X
3 Jul	X
4 Jul	
5 Jul	X
6 Jul	X
7 Jul	X
8 Jul	X
9 Jul	X
10 Jul	X
11 Jul	
12 Jul	X
13 Jul	X
14 Jul	X
15 Jul	X
16 Jul	X
17 Jul	X
18 Jul	
19 Jul	X
20 Jul	X
21 Jul	X
22 Jul	X
23 Jul	X
24 Jul	X
25 Jul	
26 Jul	X
27 Jul	X
28 Jul	X
29 Jul	X
30 Jul	X
31 Jul	X

**APPENDIX B: ANGLER INTERVIEW METHODS AND
DATA SHEET**

Division of Sport Fish (SF) staff will only interview completed-day anglers. SF staff are expected to coordinate closely with Choggiung Inc. staff to get an approximate enumeration of anglers and identify and locate them for interviews. SF staff are expected to maintain a daily summary and collect the interview data.

Angler interviews must be performed with extreme care to avoid biasing the results. The purpose of the interview is to determine information such as length of time fished, species and numbers of fish kept and released, angler residency and sex, and gear type (bait vs no bait). Most anglers are sincere and eager to help, but often make mistakes, particularly differentiating between species. For accuracy, data obtained from anglers should be observed by the interviewer. For instance, it is often more accurate for a competent interviewer to observe the species and numbers of fish kept than to depend upon the angler's word. This, of course, is not possible for all categories and in many cases the interviewer must assume the angler's information is accurate.

To facilitate accuracy, SF staff will speak directly to each angler whenever possible and will avoid letting a guide or single angler speak for a whole group. At the same time, interviewers will want to develop a good rapport with guides who may in turn help obtain much of the basic information. However, it is best to get catch and harvest information directly from each individual.

When interviewing an angler, SF staff will begin by asking if they are done angling for the day, and if they are NOT, ask them when they will be done and return to interview when their angling-day is complete. If the angler has completed angling for the day, the interviewer will ask for and record the number of fish kept and released by the individual angler for that entire day. It is more accurate to ask for the angler's starting time and times when he (she) took breaks so that total angling time can be computed; interviewers **will not** ask anglers to estimate their total fishing time. For example, if the angler started fishing at 8:00 AM, stopped fishing at noon for lunch, resumed fishing at 1:30 PM, and finally quit fishing for the day at 4:30 PM (when the interview is being conducted), then the interviewer will record by species the number of fish kept and released for the entire 7 hours of fishing. Because the interviewer knows the time of the interview, the time spent fishing is a simple computation. As an expediency while interviewing, an interviewer is encouraged to write start and stop times and numbers and species of fish in white margins above the interview line, then make computations and mark the form later.

Interviewers are expected to interview as many completed-day anglers as possible. No interview will be conducted until an angler has completed their angling-day. Also, interviewers will not let anglers avoid being interviewed unless necessary for the physical safety of the crew. Anglers who avoid interviews may differ from those who do not try to avoid the interview, and therefore resulting data may be biased.

For each day scheduled for angler interviews, at least 1 interview form will be filled out even if no interviews are conducted.

Appendix B2.–Custom angler interview form for the lower Nushagak River study area, Version 1.1.

Nushagak River Angler Interview Form

Page # _____

Date: _____ Sampler(s): _____

Time	Angler Type	Interview SubLoc	Gear Type	Residency	Trip Duration	Total Hrs	Harvest SubLoc	# Chinook Released	# Chinook Harvested	ASL Form #	Scale Card #	Scale #'s	Comments

Angler Type: Guided / Unguided (1/2); Gear Type: Baited / Unbaited (1/2); Residency: Resident (R) / Resident Local (RL) / Non-resident (N) / Non-resident Foreign Citizen (NF); Trip Duration: # of days this trip

**APPENDIX C: BIOLOGICAL DATA SAMPLING METHODS
AND DATA SHEET**

Data Forms

All biological sampling data will be recorded on the provided Nushagak River Chinook Salmon Age-Weight-Length (AWL) Form, Version 1.1 (Appendix C2). All forms will be paginated. For example, page numbers will start with 001 for sampled Chinook salmon harvested in the lower Nushagak River and then continue sequential numbering throughout the season. No more than 32 fish will be recorded on each form, and when scales are taken for age determination, scale cards will refer to the corresponding location, species, and AWL form page number.

Chinook Salmon Length, Weight, Scales, Axillary Clip

Fork length (from mid eye to tail fork) will be recorded for all Chinook salmon to the nearest millimeter (mm).

All Chinook salmon will be weighed to the nearest **0.1 or 0.25 kilogram (kg)** as the precision of the scale allows.

Regardless the size of fish, 3 scales will be taken from the left side, halfway between the lateral line and the posterior end of the dorsal fin. Scales will be placed in a vertical column on a gummed card with the posterior end of the scale pointing towards the bottom of the card and the exterior (rough) side of the scale facing up. Columns on each gum card should be labeled 1 through 16, allowing scales from 16 fish on each gum card. All pertinent data (date, location, card number, samplers) will be recorded on the back of the gum card to reference that gum card to the corresponding AWL Form, Version 1.1.

All Chinook salmon will have the axillary fin clipped and stored via the instructions included with the genetic sampling kit provided by Division of Commercial Fisheries. Finclip number will be recorded on the Nushagak River Chinook Salmon Age-Length Form, Version 1.2 in the space corresponding to the fish sampled.

Tagged Fish

Survey technicians are expected to be on the look-out for tagged fish harvested or captured by anglers. Every opportunity will be used to collect data from tagged fish, whether the fish is killed or released. Technicians will be sure to record finclips and tag numbers on the AWL form and be on the lookout for tagging scars too. This will be a small scar at the left rear base of the dorsal fin and the fin should appear to have been clipped. Fish with apparently clipped fins will be carefully examined for tag scars.

There is no place on the form to record capture location of a tagged fish. Technicians are provided with waterproof notebooks and these may be used to record such data along with date of capture and the tag number.

Nushagak River Chinook Salmon Age-Length Form

SUBLOCATION: _____ SHEET # _____ SAMPLERS: _____
DATE: _____ START TIME: _____ END TIME: _____

No.	Sex	Length	Weight	Card #	Scale #	Clip #
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
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30						
31						
32						

COMMENTS:

Other Species Retained:
Sockeye:

Coho:

Pink:
Chum:
Rainbow:
Pike:
Dolly Varden:
(Tally marks)

Sex: 1-Male 2-Female
Length: MEF in nearest mm
Weight: to the nearest .1 or .25 kilogram (kg) as the scale allows