Regional Operational Plan SF.2A.2015.22

Operational Plan: Upper Cook Inlet Commercial Eastside Set Gillnet Chinook Salmon Harvest Composition Study, 2015

by

Anthony Eskelin

and

Andrew W. Barclay

May 2016

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

Symbols and Abbreviations

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Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Mathematics, statistics

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

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Anthony Eskelin

and

Andrew W. Barclay

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1565

May 2016

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Tony Eskelin,
Alaska Department of Fish and Game, Division of Sport Fish,
43961 K-Beach Rd., Ste. B, Soldotna AK 99669-8276, USA

and

Andrew W. Barclay,
Alaska Department of Fish and Game, Division of Commercial Fisheries, Gene Conservation Laboratory
333 Raspberry Road, Anchorage, AK 99518-1599, USA

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Signature Page

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Approval

Title	Name	Signature	Date
Project Leader	Tony Eskelin		4/10/15
Co-Project Leader	Andy Barclay		4/10/15
Biometrician	Anton Antonovicl		4-10-15
Regional Research Supervisor	Tim McKinley		
Fish and Game Coordinator	Ed Jones		
Fisheries Scientist	James Hasbrouck		
Fisheries Scientist	Eric Volk		

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ABSTRACT

Genetic tissue and age, sex, and length composition information will be collected from harvested Chinook salmon in the Upper Cook Inlet Eastside set gillnet (ESSN) commercial fishery in 2015. The primary goals of the study are to estimate the proportion and harvest of Chinook salmon in the ESSN commercial fishery by reporting group for each temporal and geographic stratum and for the entire 2015 season. The 4 reporting groups to apportion the harvest are as follows: *Kenai River mainstem*, *Kasilof River mainstem*, *Kenai River tributaries*, and *Cook Inlet other*. Age, sex, and length composition will be estimated for each temporal and geographic stratum and for the entire 2015 season.

Key words: Chinook salmon, *Oncorhynchus tshawytscha*, Kenai River, Eastside set gillnet, commercial fishery, ESSN, Upper Cook Inlet, mixed stock analysis, MSA, stock-specific harvest, Chinook Salmon Research Initiative, CSRI.

INTRODUCTION

The Chinook Salmon Research Initiative (CSRI) has chosen Kenai River Chinook salmon as 1 of 12 indicator stocks to assess recent declines in Chinook salmon across the state (ADF&G Chinook Salmon Research Team 2013). There is a lack of stock-specific harvest and age, sex, and length (ASL) composition information from commercial harvests in Cook Inlet, which are needed to more accurately represent harvest rates and production trends. Genetic samples of this stock are also needed to estimate the relative proportions and, along with harvest data, the number of Chinook salmon harvested in the ESSN commercial fishery by temporal and geographical strata and by reporting groups (e.g., Kenai River mainstem or tributary populations). This project will collect and analyze ASL and genetic tissue samples of Chinook salmon harvested in the Upper Cook Inlet (UCI) Eastside set gillnet (ESSN) commercial fishery. The Division of Sport Fish (SF) will be responsible for the collection of genetic tissue samples and ASL data. Tissue samples will be sent to the Division of Commercial Fisheries (CF) Gene Conservation Lab (GCL), which will be responsible for mixed stock analysis (MSA).

BACKGROUND

All five species of Pacific salmon are harvested in UCI. Sockeye salmon (*Oncorhynchus nerka*) make up the majority of the harvest (Shields and Dupuis 2015) but Chinook salmon (*O. tshawytscha*) are also harvested. Recent low Chinook salmon runs in UCI have heightened interest in stock-specific harvest of Chinook salmon in these fisheries. A Chinook salmon genetic baseline that includes representative populations in UCI is available for MSA applications in fisheries using genetic stock identification (GSI) techniques (Barclay et al. 2012). Obtaining information about stock-specific harvest of Chinook salmon is needed to improve understanding of stock productivity, brood table development, and for setting and attaining escapement goals.

Most of the UCI Chinook salmon harvest occurs in the Upper Subdistrict set gillnet fishery of the Central District. This fishery is commonly referred to as the Eastside set gillnet (ESSN) fishery and is located along the eastern shore of Cook Inlet between Ninilchik and Boulder Point (Figure 1). Since 1966, the ESSN fishery has accounted for 65% of all Chinook salmon harvested annually on average in UCI commercial fisheries (Eskelin et. al 2013). The ESSN fishery is composed of 3 sections (Kasilof, Kenai, and East Foreland) and 8 statistical areas (Ninilchik Beach, Cohoe Beach, Kasilof River Special Harvest area [KRSHA], South K-Beach, North K-Beach, Salamatof Beach, and East Foreland (Figure 2). The 2005–2014 average ESSN Chinook salmon harvest is 7,776 fish; however, harvest has declined recently and the recent 3-year average is 1,998 fish. The 3 lowest documented harvests of Chinook salmon in the ESSN fishery were in the past 3 years: 704 fish in 2012, 2,988 fish in 2013, and 2,301 fish in 2014. In 2014, the ESSN fishery was opened for 13 fishing periods in the Kasilof section and for 6 fishing periods in the Kenai and East Foreland sections. In addition, the KRSHA was opened during 17 days. Low Chinook salmon runs and subsequent reduced fishing time has reduced Chinook salmon harvest substantially.

The ESSN Chinook salmon harvest has been sampled by the Department of Fish and Game (ADF&G) for ASL composition information since 1986. In many years, 1 technician would sample harvested Chinook salmon at fish processor receiving sites on regular period openings and opportunistically collect ASL samples. Beginning in 2010, genetic tissue samples were added to the collection effort. With only 1 technician assigned to collect samples, it was difficult to representatively sample all areas of the ESSN fishery during each tide or fishing period. Some areas were targeted for sampling because they were expected to have larger Chinook salmon harvests, while some areas with lower harvest were not sampled as effectively due to time constraints and not being able to sample at receiving sites prior to fish being mixed from all areas at fish processing plants. The sampling effort was increased in 2013 and 2014 with funding from the Chinook Salmon Research Initiative (CSRI) to provide temporally and geographically stratified estimates and more precise estimates by reporting group.

A sufficient number of representative samples were collected in 2010, 2011, 2013, and 2014 to allow for MSA, but not in 2012. Tissues were generally subsampled postseason in proportion to the harvest within 1 or 2 fishing periods and statistical areas. Sample size was insufficient for temporal or geographic stratification in 2010 and 2011, so only seasonal estimates were produced. The increased sampling effort and subsequent higher sampling rate in 2013 and 2014 have allowed for temporal and geographic stratification during those years.

The Kenai River supports 2 genetically divergent population aggregates (Barclay et al. 2012): mainstem- and tributary-spawning populations. Those that spawn in Kenai River tributaries enter the river prior to those that spawn in the mainstem Kenai River, although there is some overlap from late-June to early July (Reimer 2013). The ESSN fishery primarily harvests Chinook salmon bound for the Kenai and Kasilof rivers (Eskelin et al. 2013). Reporting groups were defined based on one or more of the following criteria: 1) the genetic similarity among populations, 2) the expectation that proportional harvest would be greater than 5%, or 3) the applicability to answer fishery management questions. Reporting groups used in the MSA for each year were: "*Kenai River mainstem,*" "*Kasilof River mainstem,*" "*Kenai River tributaries,*" and "*Cook Inlet other.*" The 2010, 2011, 2013, and 2014 composition estimates by reporting group were similar from year to year (Table 1), with the *Kenai River mainstem* reporting group having the greatest average proportional contribution (0.671), followed by *Kasilof River mainstem* (0.314), *Cook Inlet other* (0.011) and lastly, the *Kenai River tributaries* reporting group (0.004). This project in 2015 will be similar to 2013 and 2014 and will include expanded sampling of the Chinook salmon harvest for ASL composition and genetic tissue. A total of 3 technicians will be assigned to sample the ESSN Chinook salmon harvest and will provide coverage of the fishery during every regular period opening and also allow for sampling of most fishing periods that may be opened by emergency order (EO).

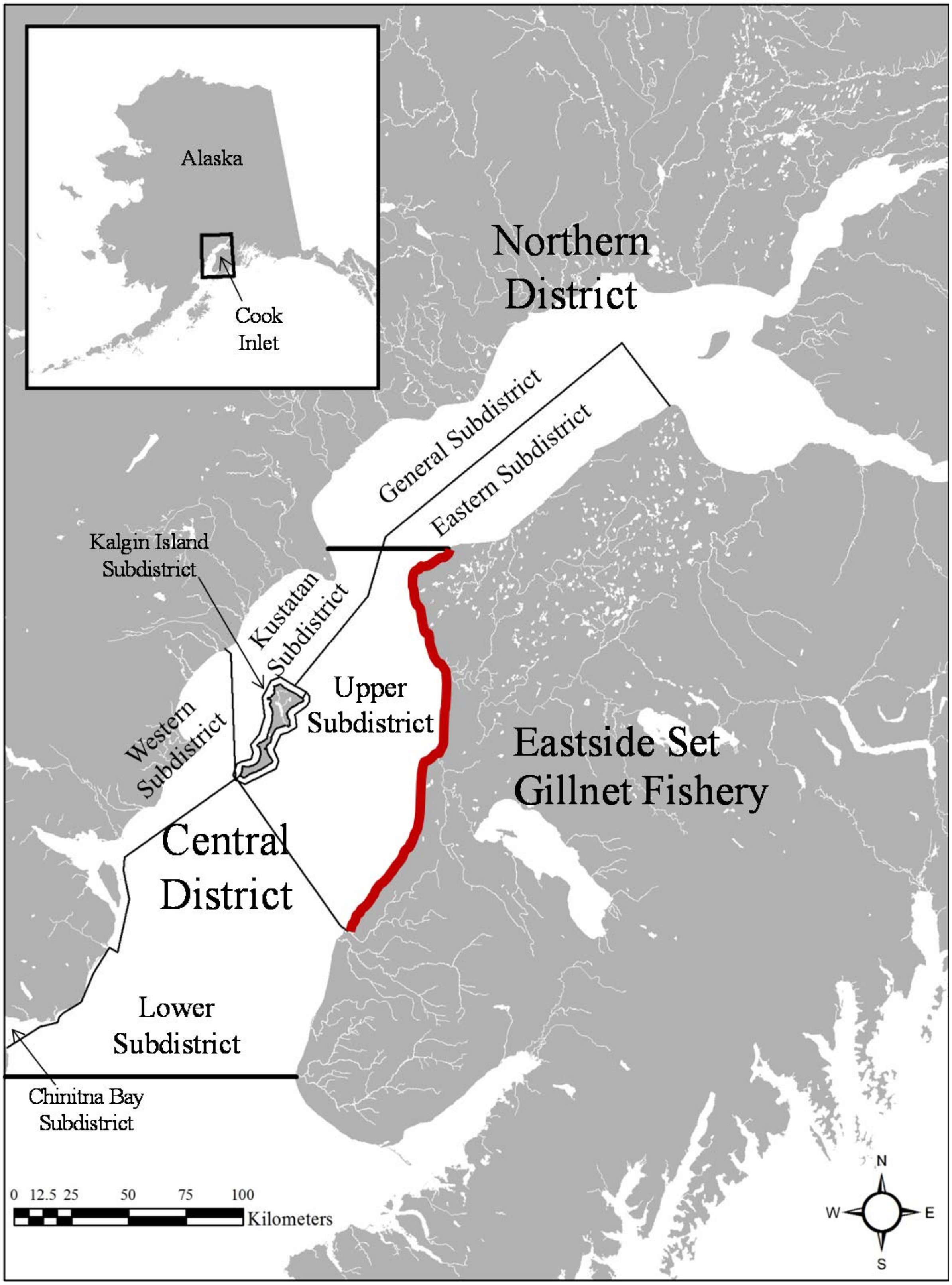

Figure 1.–Map of Upper Cook Inlet commercial fishing districts and subdistricts.

Note: Thick black lines indicate district borders and thin lines indicate subdistrict borders; the thick maroon line near the eastern shore of Cook Inlet denotes the ESSN fishery.

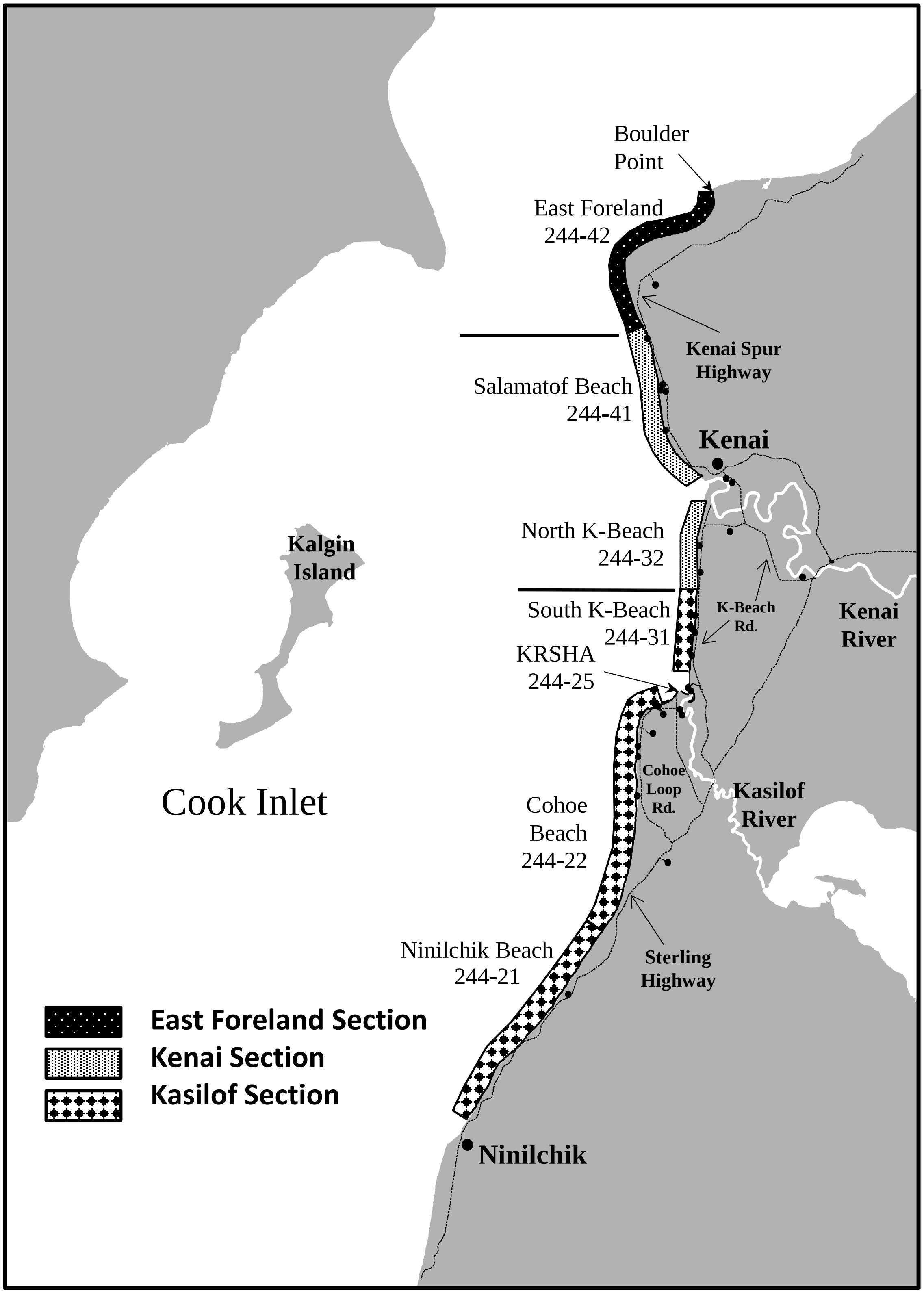

Figure 2.–Map of Upper Cook Inlet Eastside set gillnet commercial fishing statistical areas.

Note: Small circles represent approximate locations of processing plants or receiving sites. KRSHA (244-25) is the Kasilof River Special Harvest Area.

Table 1.–Proportion of Chinook salmon harvested in the ESSN fishery by reporting group for 2010, 2011, 2013, and 2014.

Reporting group	Year	Proportion by year	5%	95%
Kenai River tributaries	2010	0.011	0.001	0.031
	2011	0.001	0.000	0.008
	2013	0.001	0.000	0.010
	2014	0.002	0.000	0.012
	Average	0.004		
Kenai River mainstem	2010	0.643	0.581	0.703
	2011	0.667	0.601	0.733
	2013	0.766	0.727	0.804
	2014	0.609	0.555	0.664
	Average	0.671		
Kasilof River mainstem	2010	0.326	0.271	0.383
	2011	0.330	0.265	0.395
	2013	0.213	0.178	0.250
	2014	0.387	0.333	0.441
	Average	0.314		
Cook Inlet other	2010	0.020	0.003	0.047
	2011	0.002	0.000	0.011
	2013	0.019	0.010	0.030
	2014	0.002	0.000	0.010
	Average	0.011		

OBJECTIVES

PRIMARY OBJECTIVES

1) Estimate the proportion of Chinook salmon harvested in the UCI ESSN commercial fishery by reporting group *(Kenai River mainstem, Kasilof River mainstem, Kenai River tributaries, and Cook Inlet other)* for each temporal and geographic stratum for the season such that the estimated proportions are within 13 percentage points of the true values 90% of the time.
2) Estimate the harvest of *Kenai River mainstem* and *Kasilof River mainstem* Chinook salmon in the UCI ESSN commercial fishery for each temporal and geographic stratum such that the estimates are within 30% of the true value, 90% of the time.
3) Estimate the age composition of the Chinook salmon harvested by the ESSN fishery such that the estimates are within 10 percentage points of the true values 95% of the time.

SECONDARY OBJECTIVES

1. Estimate the harvest of Chinook salmon for the reporting groups *Kenai River tributaries* and *Cook Inlet other* in the UCI ESSN commercial fishery for each temporal and geographic stratum.[1]
2. Sample 35% of the Chinook salmon harvested in the UCI ESSN commercial fishery for tissue, CWTs, scales, sex, and mid eye to tail fork (METF) length.
3. Estimate the sex and length compositions of Chinook salmon harvested in the UCI ESSN commercial fishery overall and for each temporal and geographic stratum.

METHODS

STUDY DESIGN

Regular period openings in the ESSN fishery are from 7:00 AM to 7:00 PM on Mondays and Thursdays. The first scheduled regular period in the Kasilof section (statistical areas 244-21, 244-22, and 244-31) for the 2015 season is Thursday, June 25. The fishery could be opened as early as June 20 dependent on cumulative sockeye salmon passage in the Kasilof River. The first Kasilof section regular period or EO opening and subsequent openings will be sampled. The first scheduled regular period in the Kenai and East Foreland sections (statistical areas 244-32, 244-41, and 244-42) for the 2015 season is Thursday, July 9. All regular fishing periods and up to 2 additional fishing periods opened by EO per week are budgeted to be sampled. If it is foreseen that there will be more than 2 openings by EO in a given week, then the particular openings to be sampled will be chosen from harvest rates and insight from commercial fishery managers based on probable scenarios of future openings. The fishery is scheduled to end August 15, with only regular fishing periods allowed after August 10. The regular period sampling schedule is in Appendix A1.

To collect a representative sample, as many Chinook salmon as possible will be sampled and sampling effort will be distributed appropriately. Each technician will be assigned 1 of 3 areas to sample: receiving sites for 1) Ninilchik–Cohoe beaches, 2) K-Beach (north and south), and 3) Salamatof Beach and East Foreland (Figure 1). Among technicians, sampling areas will probably overlap, and modifications to assigned areas may occur during the season. Inseason analyses of the proportions of the Chinook salmon harvest sampled by beach will be will be used to make modifications to the sampling strategy as necessary. Technicians will begin sampling on the southern end of their sampling area after the first round of deliveries to each buying station. Sampling at the southern end first and moving northward will follow the fish deliveries as they occur to maximize the number of samples collected. This sampling strategy should not introduce bias. If technicians started at the northern beaches and moved south, they would miss samples and have a lower sampling rate due to the later timing of northern deliveries. Chinook salmon will probably be delivered to over 20 receiving sites spread throughout the statistical areas. Technicians will sample during each opening at receiving sites until the fish are transported to processing plants. The day following each fishing period, additional Chinook salmon samples will be collected at a fish processing plant paying premium prices, where fish from all areas are delivered the day following the fishery. A technician will be stationed at that plant to get samples

[1] Based on MSA results from 2010, 2011, and 2013, it is anticipated that Chinook salmon harvest of the reporting groups *Kenai River tributaries* and *Cook Inlet other* will be low (<150 fish) so no precision criteria are set for estimation of these reporting groups. Sample size is driven by Objectives 1 and 2.

as they are delivered so that location of harvest by statistical area can be determined. KRSHA openings will be sampled if opened by EO.

Because the number and location of receiving sites changes each year, the project biologist will develop a list with contact information and a map showing locations to sample that will be distributed to each technician prior to the 2015 season. Technicians will be instructed to sample at receiving sites on their way north up the beach. There will be no set schedule for times to sample at each location. Schedules will depend on tides and the times of fishing periods.

GEOGRAPHIC AND TEMPORAL STRATIFICATION

Proposed temporal and geographic stratification was determined by management criteria and MSA results from 2010, 2011, and 2013 tissue samples. The 2014 tissue samples have yet to be analyzed. Depending on how the fishery is prosecuted and how many samples are collected in 2015, choices for temporal and geographic strata could change, but for planning purposes 5 strata were chosen (Table 2).

Table 2.–Proposed strata for ASL analysis and MSA in 2015.

Stratum number	Temporal stratum	Geographic area
1	25 June – 8 July	Kasilof Section
2	9 – 31 July	Kasilof Section
3	9 – 31 July	Kenai and East Forelands Sections
4	1-15 August	All Sections
5	2015 season	KRSHA

In Stratum 4, the geographic area is “All sections” because sample size in that stratum is likely to be low. There may be more than 5 strata chosen if Chinook salmon harvest and the number of samples collected are sufficient to produce statistically valid results.

Sampling results and chosen temporal and geographic strata from 2013 were used to determine expected harvests and also expected sampling and selection rates for 2015 (Table 3). Samples must be collected to represent the harvest, which is seldom possible, so subsampling of collections is required postseason to ensure equivalent representation of the harvest. In 2014, technicians were able to collect 966 tissue samples, which constituted 47% of the harvest. After subsampling representatively when possible, 471 samples (23% of the harvest) will be used in MSA. The goal for 2015 will be to sample at least 35% of the harvest and to select samples from 24% of the harvest for MSA after subsampling representatively by date and statistical area. Length will be incorporated into the subsample selection such that the length distribution of subsampled fish will be equivalent to the length distribution of fish not selected after subsampling, within each grouping. A grouping will usually be 1–2 days of samples within each geographic stratum.

Table 3.–Reported Chinook salmon harvest, number and proportion sampled, and number and proportion of harvest selected for MSA by temporal and geographic stratum in the Upper Cook Inlet, Eastside set gillnet fishery, 2013.

Dates	Geographic area	Reported harvest	Number sampled	Proportion sampled	Number selected for MSA	Proportion of harvest selected for MSA
27 June–6 July	Kasilof Section	404	162	0.40	162	0.40
8–23 July	Kasilof Section	871	298	0.34	195	0.22
8–23 July	Kenai/East Foreland	1,355	525	0.39	293	0.22
17 July–2 August	KRSHA	358	58	0.16	58	0.16
27 June–2 August	All areas	2,988	1,043	0.35	708	0.24

Proof tests conducted by the GCL demonstrated that with a fishery mixture of 100 samples, we can estimate stock composition for the 4 reporting groups (*Kenai River tributaries*, *Kenai River mainstem*, *Kasilof River mainstem,* and *Cook Inlet other*) within 0.13 of the true values 90% of the time (Barclay et al. *In prep*). These tests followed the same protocol as reported in Eskelin et al. (2013) for baseline evaluation tests; however, instead of using test mixtures with 100% of one reporting group, test mixtures were created with proportions from each reporting group that represented a realistic scenario for what might be expected in these fisheries. Given that there are 3 years of reporting group proportion estimates for the ESSN Chinook salmon harvest, tests were conducted under a realistic scenario for reporting group proportions in ESSN fishery mixtures: 0.02 for *Kenai River tributaries*, 0.58 for *Kenai River mainstem*, 0.38 for *Kasilof River mainstem*, and 0.02 for *Cook Inlet other*.

With this precision of stock composition estimates and an anticipated sample size of 100 fish, we will be able to estimate the harvest of *Kenai River mainstem* and *Kasilof River mainstem* Chinook salmon in the UCI ESSN commercial fishery in each stratum within 30% of the true values 90% of the time.

The objective criterion (± 0.10 with 95% confidence level) for estimating the age composition of Chinook salmon harvested in the ESSN fishery should be achieved with approximately 170 scale samples. To arrive at this sample size, we assumed a worst-case scenario of 25% scale regeneration rate with multinomial proportions of equality among ages (Thompson 1987). We plan to collect substantially more samples in 2015 than in previous years so we will probably achieve a higher precision for the age composition estimates.

DATA COLLECTION

Age, Sex, and Length Sampling

Three scales will be removed from the preferred area of each fish and placed on an adhesive-coated card (Clutter and Whitesel 1956; Welander 1940). Acetate impressions will be made of the scales using a press with 25,000 PSI, and the scale growth patterns will be viewed with a 40× microfiche reader to determine freshwater and marine residence times. Sex will be identified from external morphometric characteristics (i.e., protruding ovipositor on females or a developing kype on males). METF length will be measured to the nearest half-centimeter. Chinook salmon will be sampled for ASL composition without regard to size, sex, length, or location. ASL composition data will be recorded on data sheets (Appendix B1).

Tissue Sampling for MSA

All fish sampled for ASL will also be sampled for tissue suitable for genetic analysis. A 1⅓-cm (half-inch) piece of the axillary process will be removed from each fish and placed in a 2 ml plastic vial filled until the tissue samples are completely submerged with a Sigma[2] reagent grade 95% alcohol buffer solution such that the liquid-to-tissue ratio is approximately 3:1. Sampling instructions are found in Appendix C1. Each plastic vial will be sequentially numbered and vial numbers recorded on data sheets (Appendix B1). All vials will be stored at the Soldotna office until the end of the season and then sent to the GCL for analysis.

CWT Sampling

All sampled Chinook salmon will be examined for an adipose finclip. Technicians will remove the head of any Chinook salmon encountered with an adipose finclip. A cinch strap will be attached to the head and the head will be taken to the ADF&G office for storage in a freezer. All data, including the number of Chinook salmon examined and the number observed missing the adipose fin, will be recorded on a tag recovery form (Appendix D1). The cinch strap number will also be recorded alongside ASL data (Appendix D1) to enable cross-referencing between datasets. Data will be returned to the project leader (Anthony Eskelin). CWT forms and the heads of all adipose finclipped fish will be shipped at the end of the season to the ADF&G Mark, Tag, and Age Laboratory for CWT recovery, determination of stock of origin, and for archiving data.

LABORATORY ANALYSIS

Assaying Genotypes

DNA extraction and genotyping will generally follow the methods described in detail in Barclay et al. (2012). Briefly, genomic DNA will be extracted from tissue samples using a DNeasy 96 Tissue Kit by QIAGEN (Valencia, CA). Fluidigm 192.24 Dynamic Arrays (http://www.fluidigm.com) will be used to screen 40 SNP markers; this differs from the methods of Barclay et al. (2012) where 96.96 Dynamic Arrays were used. The Dynamic Arrays will be read on a Fluidigm EP1 System or BioMark System after amplification and scored using Fluidigm SNP Genotyping Analysis software. Assays that fail to amplify on the Fluidigm system will be reanalyzed on the Applied Biosystems platform. The plates will be scanned on an Applied Biosystems Prism 7900HT Sequence Detection System after amplification and scored using Applied Biosystems' Sequence Detection Software version 2.2.

Genotypes produced on both platforms will be imported and archived in the Gene Conservation Laboratory (GCL) Oracle database, LOKI.

Laboratory Failure Rates and Quality Control

Overall failure rate will be calculated by dividing the number of failed single-locus genotypes by the number of assayed single-locus genotypes. An individual genotype will be considered a failure when a locus for a fish cannot be satisfactorily scored.

Quality control (QC) measures will be used to identify laboratory errors and to determine the reproducibility of genotypes. In this process, 8 of every 96 fish (1 row per 96-well plate) will be

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[2] Product names used in this publication are included for completeness but do not constitute product endorsement.

re-extracted and reanalyzed for all markers by staff not involved with the original analysis. Laboratory errors found during the QC process will be corrected, and genotypes will be corrected in the database. Inconsistencies not attributable to laboratory error will be recorded, but original genotype scores will be retained in the database.

DATA REDUCTION

Technicians will return their genetic vial boxes, scale cards, and field data to the Soldotna office daily and will be responsible for ensuring the recorded data are legible and accurate. The project biologist will ensure all data are returned, are legible, and are entered correctly. All data will be keypunched directly into a master electronic data file. Age data will be entered upon scale reading. CWT forms will be edited to ensure accuracy and mailed to Juneau ADF&G for data entry. A final edited copy of all data files along with a data map will be sent to the ADF&G Research and Technical Services (RTS) for archiving.

DATA ANALYSIS

Baseline and Reporting Groups

The current UCI Chinook salmon genetic baseline used for MSA applications is an update of the baseline reported in Barclay et al. (2012) and includes 62 additional collections and 25 new populations (Barclay et al. *In prep*; Table 4). The updated baseline includes the same set of SNP markers except that locus *Ots_FGF6B* was excluded because of its association with locus *Ots_FGF6A*.

Reporting groups are defined based on 1 or more of the following criteria: 1) the genetic similarity among populations, 2) the expectation that proportional harvest would be greater than 5%, or 3) the applicability to answer fishery management questions. Based on these criteria, reporting groups chosen to apportion the harvest for this study are: "*Kenai River mainstem*," "*Kenai River tributaries*," "*Kasilof River mainstem*," and "*Cook Inlet other*." The *Cook Inlet other* reporting group represents all remaining Cook Inlet Chinook salmon baseline populations not included in the 3 other reporting groups (Table 4 and Figure 3)

To minimize misallocation between MSA reporting groups, the Slikok Creek (a Kenai River tributary) population was removed from the baseline because it is very small and is genetically similar to the Crooked Creek (a Kasilof River tributary) population (Barclay et al. 2012). In addition, Juneau Creek, a Kenai River tributary, was grouped with the *Kenai River mainstem* reporting group due to genetic similarity (Barclay et al. 2012).

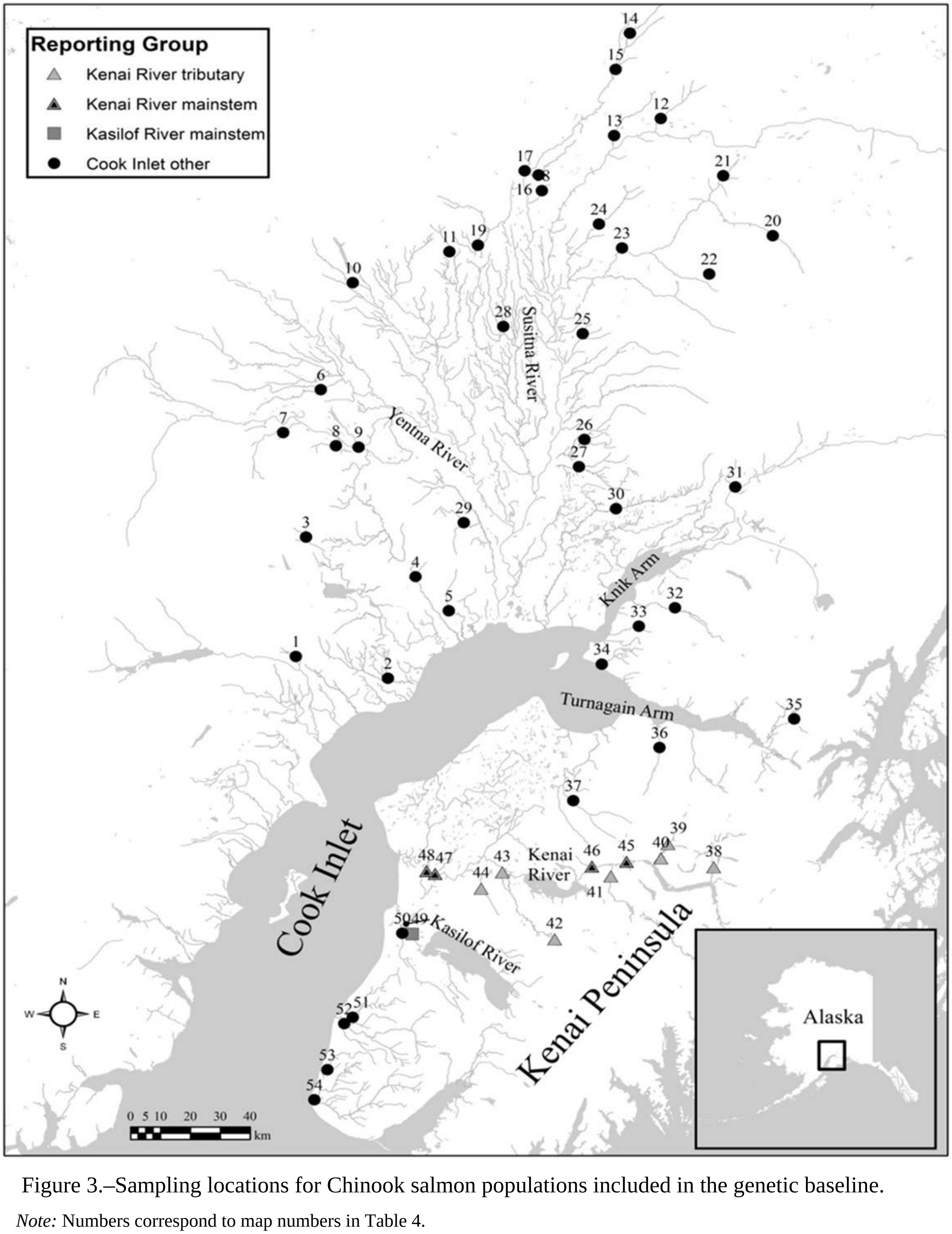

Figure 3.–Sampling locations for Chinook salmon populations included in the genetic baseline.

Note: Numbers correspond to map numbers in Table 4.

Table 4.–Populations of Chinook salmon in the Upper Cook Inlet genetic baseline, including the sampling location, collection years, the number of individuals sampled from each population (*N*), and the reporting groups used for mixed stock analysis of ESSN harvest.

Map no.	Reporting group	Location	Added after baseline[a]	Collection year(s)	*N*
1	Cook Inlet other	Straight Creek		2010	95
2		Chuitna River		2008, 2009	134
3		Coal Creek		2009, 2010, 2011	118
4		Theodore River	X	2010, 2011, 2012	190
5		Lewis River	X	2011, 2012	87
6		Red Creek	X	2012, 2013	111
7		Hayes River	X	2012, 2013	50
8		Canyon Creek	X	2012, 2013	91
9		Talachulitna River		1995, 2008, 2010	178
10		Sunflower Creek		2009, 2011	123
11		Peters Creek	X	2009, 2010, 2011, 2012	107
12		Portage Creek	X	2009, 2010, 2011, 2013	162
13		Indian River	X	2013	79
14		Middle Fork Chulitna River		2009, 2010	169
15		East Fork Chulitna River	X	2009, 2010, 2011, 2013	77
16		Byers Creek	X	2013	55
17		Spink Creek	X	2013	56
18		Troublesome Creek	X	2013	71
19		Bunco Creek	X	2013	98
20		Upper Talkeetna no name	X	2013	69
21		Prairie Creek		1995, 2008	161
22		East Fork Iron Creek	X	2013	57
23		Disappointment Creek	X	2013	64
24		Chunilna Creek		2009, 2012	123
25		Montana Creek		2008, 2009, 2010	213
26		Little Willow Creek	X	2013	54
27		Willow Creek		2005, 2009	170
28		Deshka River		1995, 2005, 2012	303
29		Sucker Creek	X	2011, 2012	143
30		Little Susitna River		2009, 2010	228
31		Moose Creek - Matanuska River		1995, 2008, 2009, 2012	149
32		Eagle River	X	2009, 2011, 2012	77
33		Ship Creek		2009	261
34		Campbell Creek	X	2010	110
35		Carmen River	X	2011, 2012	50
36		Resurrection Creek	X	2010, 2011, 2012	98
37		Chickaloon River		2008, 2010, 2011	128

-continued-

Table 4.–Page 2 of 2.

Map no.	Reporting group	Location	Added after baseline[a]	Collection year(s)	*N*
38	Kenai R. Tributary	Grant Creek	X	2011, 2012	55
39		Quartz Creek		2006, 2007, 2008, 2009, 2010, 2011	131
40		Crescent Creek		2006	164
41		Russian River		2005, 2006, 2007, 2008	214
42		Benjamin Creek		2005, 2006	204
43		Killey River		2005, 2006	255
44		Funny River		2005, 2006	219
45	Kenai R. mainstem	Juneau Creek		2005, 2006, 2007	140
46		Upper Kenai R. mainstem		2009	191
47		Middle Kenai R. mainstem		2003, 2004, 2006	299
48		Lower Kenai R. mainstem	X	2010, 2011	118
49	Kasilof R. mainstem	Kasilof River mainstem		2005	321
50	Cook Inlet other	Crooked Creek		2005, 2011	306
51		Ninilchik River weir		2006, 2010	209
52		Deep Creek		2009, 2010	196
53		Stariski Creek	X	2011, 2012	104
54		Anchor River weir		2006, 2010	249

Note: Map numbers correspond to sampling sites on Figure 3.

[a] "X" indicates populations that have been added since the Barclay et al. (2012) baseline.

Mixed Stock Analysis

The stock composition of the commercial ESSN fishery harvest for each stratum will be estimated using the software package BAYES (Pella and Masuda 2001). BAYES employs a Bayesian algorithm to estimate the most probable contribution of the baseline populations to explain the combination of genotypes in the mixture sample. The final analysis will consist of the results from 5 separate Monte Carlo Markov chains where each chain will begin with different initial values. A random number generator will be used to create the initial values which will sum to 1 over all reporting groups. The Dirichlet prior distribution for the composition parameters in BAYES will be based upon the best available information for each mixture analysis. We believe the best available information for the prior to be the results of MSA of similar mixtures. For the 2015 ESSN mixtures, the best available information will be the stock proportion estimates from the analysis of the 2014 ESSN Chinook salmon samples. The sum of the Dirichlet prior parameters will equal 1, thus minimizing the overall influence of the prior distribution. The chains will be run until convergence is reached (shrink factor less than 1.2) for the 5 chains (Pella and Masuda 2001). The first half of each chain will be discarded in order to remove the influence of the initial values; the rest will be used to estimate the posterior distribution of stock composition proportions. The point estimates of stock composition and the variance of these estimates will be calculated from the mean and standard deviation of the posterior distributions.

Harvest of Chinook salmon by Reporting Group

The number of Chinook salmon $\hat{H}^g$ from reporting group *g* harvested in the commercial ESSN fishery between the first opening (as early as late June) and the last opening (on or before August 15) will be estimated as follows:

$$\hat{H}^g = \sum_{i=1}^{T} \sum_{j=1}^{S} H_{i,j}\, \hat{p}_{i,j}^g \qquad (1)$$

where

$\hat{p}_{i,j}^g$ = estimated proportion of ESSN harvest in time stratum *i* and geographic stratum *j* comprising Chinook salmon from reporting group *g* (*Kenai River mainstem, Kasilof River mainstem, Kenai River tributaries,* or *Cook Inlet other*) and based on Bayesian mixed stock analysis as described in the previous section

$H_{i,j}$ = ESSN Chinook salmon harvest in time stratum *i* and area stratum *j* obtained from fish ticket data

T = number of time strata (prior to 9 July, 9–31 July, and after 31 July)

S = number of geographic strata (Kenai–East Foreland and Kasilof sections)

The $\text{var}(\hat{H}^g)$ will be estimated as follows:

$$\text{var}(\hat{H}^g) = \sum_{i} \sum_{j} (H_{i,j})^2 \,\text{var}(\hat{p}_{i,j}^g) \qquad (2)$$

where $\text{var}(\hat{p}_{i,j}^g)$ will be available from the Bayesian mixed stock analysis (Pella and Masuda, 2001).

Age and Sex Composition of Chinook Salmon in the ESSN Harvest

The age (or sex) proportions of Chinook salmon harvested in the commercial ESSN fishery by sampling stratum will be estimated as follows:

$$\hat{p}_{i,j}^z = \frac{n_{i,j}^z}{n_{i,j}} \qquad (3)$$

where $\hat{p}_{i,j}^z$ is the estimated proportion of salmon of age (or sex) category *z* from sampling stratum (*i*, *j*), $n_{i,j}^z$ equals the number of fish sampled from sampling stratum (*i*, *j*) that were classified as age (or sex) category *z*, and $n_{i,j}$ equals the number of Chinook salmon sampled for age (or sex) determination from sampling stratum (*i*, *j*).

The variance of $\hat{p}_{i,j}^z$ will be estimated as

$$\text{var}\left[\hat{p}_{i,j}^{z}\right]=\left(1-\frac{n_{i,j}}{H_{i,j}}\right)\frac{\hat{p}_{i,j}^{z}\left(1-\hat{p}_{i,j}^{z}\right)}{n_{i,j}-1} \tag{4}$$

where $H_{i,j}$ is the number of Chinook salmon harvested in a sampling stratum (*i*, *j*).

The estimates of harvest by age (or sex) categories in each sampling stratum will be calculated as follows:

$$\hat{H}_{i,j}^{z}=H_{i,j}\,\hat{p}_{i,j}^{z} \tag{5}$$

with its variance estimated as

$$\text{var}\left[\hat{H}_{i,j}^{z}\right]=H_{i,j}^{2}*\text{var}\left[\hat{p}_{i,j}^{z}\right]. \tag{6}$$

The total harvest by age (or sex) category and its variance will then be estimated by summations

$$\hat{H}^{z}=\sum_{i=1}^{T}\ \sum_{j=1}^{S}\hat{H}_{i.j}^{z} \tag{7}$$

and

$$\text{var}\left[\hat{H}^{z}\right]=\sum_{i=1}^{T}\ \sum_{j=1}^{S}\text{var}\left[\hat{H}_{i,j}^{z}\right] \tag{8}$$

where: T = 3 and S = 2 are the number of time and geographic strata respectively.

Finally, the total proportion of the ESSN harvest by age (or sex) category and its variance will be estimated as

$$\hat{p}^{z}=\frac{\hat{H}^{z}}{H} \tag{9}$$

and

$$\text{var}\left[\hat{p}^{z}\right]=\frac{\text{var}\left[\hat{H}^{z}\right]}{H^{2}}. \tag{10}$$

CWT Recoveries

With low numbers of CWT recoveries expected, no direct estimates of CWT recoveries by stock will be made, but the data will be archived with Mark, Tag, and Age Laboratory in Juneau.

SCHEDULE AND DELIVERABLES

Project activities are scheduled as follows:

Dates	Activity
Mid–late June 2015	Hiring and preseason training (Eskelin)
Late June–mid August	ESSN Chinook salmon harvest sampling (3 FWT)
September 2015	Data edited, tissue collection transferred to GCL, and CWT forms and heads mailed to Juneau Mark, Tag, and Age Lab (Eskelin)
	Tissue, age, sex, and length subsamples selected and scales aged (Eskelin)
October 2015	Draft ASL composition estimates completed (Eskelin)
December 2015	Tissues analyzed by GCL and draft MSA results disseminated (Barclay)
January 2016	Harvest estimates completed by temporal, geographic strata, and reporting group (Eskelin and Antonovich)
February 2016	Draft report complete (Eskelin and Barclay)

RESPONSIBILITIES

Principal Investigator

Tony Eskelin, Project Biologist, Fishery Biologist II: Responsible for writing the operational plan, hiring and training personnel, supervision of data collection, collating data, and transferring tissue samples and associated data to Anchorage for MSA, and any CWT heads and data forms to the Mark, Tag and Age lab in Juneau. This position will be responsible for all scale aging. This position will also ensure all data is in proper format and archived with RTS at the completion of the field season and will be primary author on any reporting.

Coprincipal Investigator

Andy Barclay, Gene Conservation Lab, Fishery Biologist III: Responsible for the analysis of tissue samples for MSA and providing estimates to the project biologist and biometrician. This position will be coauthor on FDS reports and memos.

Consulting Biometrician

Anton Antonovich, Biometrician III: Provides guidance on sampling design and data analysis, prepares estimates of harvest of Chinook salmon by reporting group, and assists with preparation of the operational plan and any reports.

Sampling Crew

Jenna Storms, Fish and Wildlife Technician II, 20 June–16 August
Fish and Wildlife Technician II (non-perm), 24 June–16 August
Fish and Wildlife Technician II (non-perm), 24 June–16 August

Responsibilities of these positions include operating State of Alaska vehicles, adhering to sampling schedule, sampling harvested Chinook salmon for ASL and tissue, recording data accurately, and entering data into a computerized database in a timely manner.

BUDGET SUMMARY FY 15

Proposed FY15 and FY16 costs:

Line item	Category	FY15 budget ($K)	FY16 budget ($K)
100	Personal Services	8.5	24.2
200	Travel	–	–
300	Contractual	3.0	28.0
400	Commodities	1.0	2.0
500	Equipment	–	–
Total		8.7	58.5

Funded personnel for FY15:

PCN	Name	Level	Funded Man Months
NP	Vacant	FWT II	0.25
NP	Vacant	FWT II	0.25
114062	Storms, Jenna	FWT II	0.33
Total			0.83

Funded personnel for FY16:

PCN	Name	Level	Funded Man Months
NP	Vacant	FWT II	1.5
NP	Vacant	FWT II	1.5
114062	Storms, Jenna	FWT II	1.5
Total			4.5

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APPENDIX A: PRELIMINARY 2015 CHINOOK SALMON SAMPLING SCHEDULE

Appendix A1.–2015 ESSN Chinook salmon sampling schedule (preliminary).

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
21-Jun	22-Jun	23-Jun	24-Jun	25-Jun	26-Jun	27-Jun
	Training			Regular Period Kasilof section		
28-Jun	29-Jun	30-Jun	1-Jul	2-Jul	3-Jul	4-Jul
	Regular Period Kasilof section			Regular Period Kasilof section		
5-Jul	6-Jul	7-Jul	8-Jul	9-Jul	10-Jul	11-Jul
	Regular Period Kasilof section			Regular Period All Sections		
12-Jul	13-Jul	14-Jul	15-Jul	16-Jul	17-Jul	18-Jul
	Regular Period All sections			Regular Period All Sections		
21-Jul	22-Jul	23-Jul	24-Jul	25-Jul	26-Jul	27-Jul
	Regular Period All sections			Regular Period All Sections		
28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug
	Regular Period All sections			Regular Period All Sections		
4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug
	Regular Period All sections			Regular Period All Sections		
11-Aug	12-Aug	13-Aug	14-Aug	15-Aug		
	Regular Period All sections			Regular Period All Sections		

Note: If there is an EO, up to 2 fishing periods per week will be sampled.

APPENDIX B: 2015 ESSN CHINOOK SALMON SAMPLING FORM

Appendix B1.–2015 ESSN Chinook salmon sampling form.

ESSN Chinook Salmon Sampling Form

Date: ____________

Sampler(s): ________________________

Start Time: _______

End Time: ___________

Card	Scale	Sex	Length	VIAL	Sample Location/Comment	Stat AREA	CWT #	Age
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							

Sex: 1-male 2-female

Length: mid eye to fork-of-tail in nearest 5 mm.

APPENDIX C: INSTRUCTIONS FOR TISSUE SAMPLING

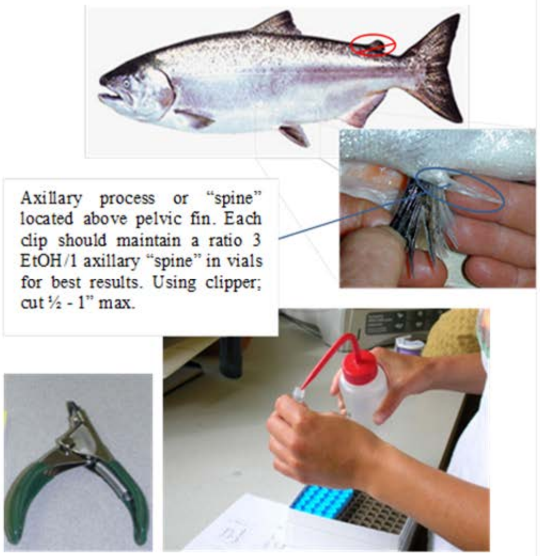
Appendix C1.–Nonlethal sampling of finfish tissue for DNA analysis.

General Information

We use axillary tissue samples from individual fish to determine the genetic characteristics and profile of a particular run or stock of fish or in or reporting group proportions in mixed-stock sampling.

Preservative used: Isopropanol/Methanol/Ethanol (EtOH) preserves tissues for later DNA extraction. Avoid extended contact with skin.

Sampling Method



- Wipe excess water and/or slime off the axillary process "spine" prior to sampling to avoid getting either water or fish slime into the 2.0ml vial (see diagram).
- Prior to sampling, fill the tubes half way with EtOH. Fill only the tubes that you will use for each sampling period. The squirt bottle is for day use only since it will leak overnight when unattended.
- Clip off the axillary "spine" using dog nail clippers or scissors to get roughly a **½ - 1" inch maximum** piece and/or about the size of a small fingernail.
- Place axillary process into EtOH. The ethanol/tissue ratio should be **slightly less than 3:1** to thoroughly soak the tissue in the buffer.
- Top up tubes with EtOH and screw cap on securely. Invert tube twice to mix EtOH and tissue. Periodically, wipe or rinse the clippers with water so not to cross contaminate samples.
- Data to record: Record **each vial number to paired data** information (i.e. location, lat./long., sample date(s), etc.).
- Discard remaining ethanol from the 500ml bottles before shipping. **Tissue samples must remain in 2ml EtOH**, these small quantities require HAZMAT paperwork. Please follow packing instructions for HAZMAT items. Store vials containing tissues at room temperature, but away from heat. In the field: keep samples out of direct sun, rain and store capped vials in a dry, cool location. Freezing not required.

APPENDIX D: CODED WIRE TAG SAMPLING FORM

Appendix D1.–Coded wire tag sampling form.

Alaska Department of Fish and Game
Coded Wire Tag Sampling Form
Commercial Fisheries
South Central, Westward & AYK Regions

Page Info for this Sample Number only! See Instructions

PAGE ____ OF ____ PAGES

CONFIDENTIAL INFORMATION

SAMPLE NUMBER: 1

DATE FIRST CAUGHT: __ - __ - 1

DATE LAST CAUGHT: __ - __ - 1

DATE SOLD (LANDED): __ - __ - 1

DATE SAMPLED: __ - __ - 1

HARVEST TYPE:

11-traditional	21-pnp-fish
12-terminal-area	22-pnp-carcasses
13-exper-area	41-test-run-strength
18-confiscated	42-test-special

SURVEY SITE: ____________

SAMPLE TYPE: random select

SAMPLER: ____________

SAMPLE TIME: begin ____ end ____

CATCHER INFORMATION

PROCESSOR: ____________

BUYING STATION: ____________

ADF&G#: ____________

VESSEL OR OWNER'S NAME: ____________

TENDER? ☐ MULTIPLE TENDERS? ☐

GEAR TYPE: 01-purse seine 02-beach seine 03-drift gillnet 04-set gillnet 08 - fish wheel

AREA INFORMATION (DISTRICT-SUBDISTRICT)

Lower Cook Inlet	Upper Cook Inlet	Kodiak	Kodiak	AYK
231-	244 -	251-	256-	331-
232-	(Invalid Subdistricts 244-20, -30, -40)	252-	257-	334-
241-	245-	253-	258-	OTHER DISTRICTS
248-	246-	254-	259-	______
249-	247-	255-	262-	______

NAME OF PLACE FISHED: ____________

WATER TYPE: saltwater freshwater

ANADROMOUS STREAM# (FRESHWATER-ONLY) ___-___-___-___-___

SAMPLING INFORMATION

THIS BOX IS TO BE COMPLETED ONLY FOR RANDOM SAMPLES

SPECIES (CODE)	TOTAL # FISH CHECKED FOR AD-CLIPS	# AD-CLIPS SEEN	WERE ALL CHECKED?
(410)CHIN			y n
(411)JACK Chinook-ONLY			y n
(420)SOCK			y n
(430)COHO			y n
(440)PINK			y n
(450)CHUM			y n
(540)STHD			y n

HEAD RECOVERY INFORMATION

✓	HEAD NUMBER	SPECIES CODE	LENGTH (mid-eye to fork in mm)	NOTES (about this head)	CLIP	FLESH (Chin. only)

COMMENTS:

T:\FORMS\2011\VISIO\COMCWA2011VSD 03/24/11 01:35