Chignik River Sockeye Salmon Inseason Genetic Stock Identification Operational Plan, 2013

by

M. Birch Foster

April 2013

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

CHIGNIK RIVER SOCKEYE SALMON INSEASON GENETIC STOCK IDENTIFICATION OPERATIONAL PLAN, 2013

by

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April 2013

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This document should be cited as:
*Foster, M. B. 2013. Chignik River sockeye salmon inseason genetic stock identification operational plan, 2013. [*In*] Salmon operational plans for the Chignik Area, 2013. Alaska Department of Fish and Game, Regional Information Report 4K13-05, Kodiak.*

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ABSTRACT

In order to achieve escapement goals for the Black Lake and Chignik Lake sockeye salmon stocks simultaneously, as well as maximize surpluses available to subsistence and commercial harvesters, inseason estimates of the proportion of each stock in the daily escapement to the Chignik River are required. Genetic stock identification can be used to identify the proportion of Black Lake early-run and Chignik Lake late-run fish as they pass Chignik River weir. During 2013, fin clips will be taken from sockeye salmon caught in the Chignik River weir trap and preserved in ethanol. Samples will be expedited to the Gene Conservation Laboratory in Anchorage for inseason analysis.

Key words: Chignik, sockeye salmon, *Oncorhynchus nerka*, genetic stock identification, sampling, Black Lake, Chignik Lake, operational plan.

INTRODUCTION

There are primarily two runs of sockeye salmon that spawn in the Chignik River watershed. The majority of the early run enters the Chignik watershed in June and July and ascends to Black Lake and its tributaries (Narver 1966). The two distinct runs of sockeye salmon in the Chignik River watershed support a valuable commercial fishery as well as a crucial cultural and food resource for five subsistence communities. The late run enters the Chignik watershed between mid June and September and spawns primarily along the beaches and tributaries of Chignik Lake. There is substantial temporal overlap of the two runs each year during late June and early July, and the actual proportion of each run within the overlap is undefined. Inseason management of each stock is required to accurately meet each run's escapement goal in order to protect harvest levels and ensure future run productivity.

In order to achieve escapement goals for the Black Lake and Chignik Lake stocks simultaneously, as well as maximize surpluses available to subsistence and commercial harvesters, Alaska Department of Fish and Game (ADF&G) uses inseason estimates of the proportion of each stock in the weekly escapement to the Chignik River are required. Prior to 1980, time-of-entry relationships based on tagging studies and age groups were employed to divide the catch and escapement between the two runs. From 1980 to 2003, with the exception of 1982, stocks were separated using scale pattern analysis (Witteveen and Botz 2004). Currently, Black Lake early-run escapement is estimated based on escapement through July 4. After July 4, salmon that pass upstream through the weir are assumed to be Chignik Lake late-run fish (Anderson and Nichols 2012).

As part of an Alaska Sustainable Salmon Fund (AKSSF) project, Chignik River sockeye salmon genetic samples were collected at the weir from 2010 to 2012. While the results from 2010 and 2011 were analyzed in 2012, the 2012 samples were analyzed inseason and available within 30–48 hours after the samples were taken. Annually, a total of 11 strata samples of approximately 190 fish with increased sampling intensity during the overlap period (late June to mid July) were collected and used to quantify the contribution of both Black and Chignik lakes sockeye salmon stocks to Chignik River escapement estimates. The genetic tissue (axillary process) was clipped from each salmon and placed in ethanol in an individually labeled cyrotube associated with sex and size. Samples were sent to ADF&G's Gene Conservation Lab (GCL) where genomic DNA was extracted and assayed for 96 sockeye salmon single nucleotide polymorphisms (SNPs).

By using the genetics proportions for 2010–2012, Black and Chignik lakes run timing was modeled using methods similar SPA modeling and run reconstructions (Witteveen and Botz 2004). In 2010 the true halfway point between the runs was July 10, in 2011 the date was July 8 and in 2012 the date was estimated to be July 3. The three years of data do not indicate the July 4 cutoff date between runs is flawed. It does demonstrate variability in the cutoff date and with apparent disregard to relative early- and late-run magnitudes suggesting that inseason genetics would provide solid biological evidence for adaptive inseason management to assure the escapement goals (especially the tight range of the early run) are met. Results for all years are tabulated in Appendix A and depicted in Figure 1 and are also reported in Anderson et al. *In press.*

Annually, ADF&G samples sockeye salmon from the Chignik River escapement for biological characteristics (age, sex, and length; ASL). These samples provide the foundation for preseason run forecasts, escapement goal evaluation, and accurate assignment of the run to stock of origin (run reconstruction). In 2013, in addition to ASL, genetics will be collected during the overlap period to estimate the stock proportions of early- and late-run sockeye salmon passing the weir and will be determined in season to assist management of the fishery.

GOAL

The goal of this project is to collect genetic samples from sockeye salmon escapement at the Chignik River weir that will be used to provide accurate mixed-stock analysis in 2013.

OBJECTIVES

Collect genetic tissue samples from 190 individual sockeye salmon passing the Chignik River weir once every four days during the overlap time period between the early and late run, approximately June 28 through July 13 totaling 5 strata, but may extend to July 17 if necessitated by late timing.

SUPERVISION

Charles Russell is the Assistant Area Management Biologist for the Chignik Management Area and will oversee inseason sampling at the Chignik River weir. He will schedule sampling, ensure data quality, quantity and timeliness, and provide feedback to the sampling crew as well as research staff regarding project progression and quality. M. Birch Foster is a finfish research biologist in the Westward Region and will oversee project progress inseason and along with the Chignik Area Management Biologist, Todd Anderson, analyze stock composition estimates both in and post season.

PROCEDURES

ADF&G currently operates the Chignik River weir to enumerate salmon escapement, and collects ASL data from sockeye salmon on a daily basis to meet inseason weekly goals of 240 sampled fish per week (see Chignik Management Area Salmon Escapement Sampling Operational Plan, 2013; Russell *In press*).

A trap incorporated into the Chignik River weir is used to capture fish for ASL sampling. On days when genetic tissue collection is scheduled to occur (Appendix B1), paired non-lethal tissue samples and ASL samples will be collected from 190 fish by the crew. An axillary process will be clipped from each salmon and placed in ethanol in an individually labeled cryovial (Appendix B2). Scale samples will be collected according to the Chignik Management Area Salmon Escapement Sampling Operational Plan, 2013. All scales will be aged by either the

Chignik Area Management Biologist or the Assistant Area Management Biologist at the Chignik River weir facility, following designation criteria established by Mosher (1968).

All samples will be recorded on the *Chignik Inseason GSI Sampling Form* (Appendix C1). Samplers must be careful to track the fish number on the scale card and the scale card number and make sure they are aligned with the proper cryovial number for fin clip samples.

If escapement numbers decline and there is concern that the minimum sample size will not be achieved, adjustments in sampling efforts should be implemented so that the daily goal of 190 is met. If less than 190 fish are sampled in one day, the remaining sample will be collected the following day. The camera gates installed in the Chignik River weir may be closed during the operation of the fish trap to increase the number of fish captured in the weir's fish trap. At the start of each season, the Asst. Area Management Biologist will train new technicians and review training for returning technicians in ASL and tissue sample collection from sockeye salmon at the Chignik River weir.

In 2013, samples will be shipped via PenPak to the GCL in Anchorage on the day of collection or as soon as possible if weather conditions prevent shipment that day. All sockeye salmon scales, scale cards, and completed digital files (see *Chignik Management Area Salmon Escapement Sampling Operational Plan, 2013* for details) will be delivered to Michelle Moore in Kodiak for analysis and archiving. Data collected as part of this project will be reported in the Chignik Area annual management report.

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FIGURES

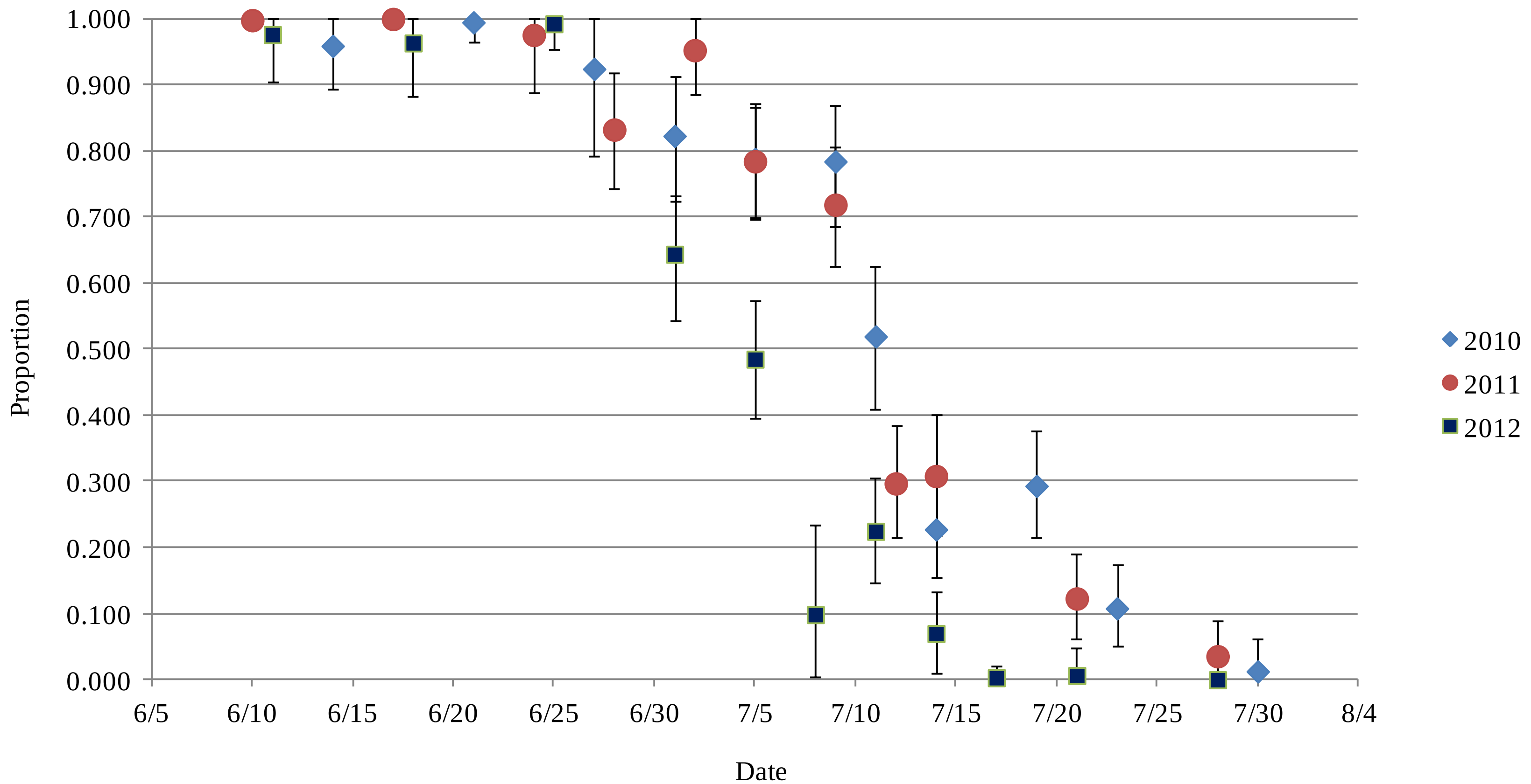

Figure 1.–Proportional genetic estimates of Black Lake stock composition with upper and lower 90% credibility intervals for samples of the escapement through Chignik River weir 2010, 2011, and 2012 using the program BAYES with a sequential prior..

APPENDIX A. CHIGNIK GENETICS DATA

Appendix A1.–Sampling dates, final sample sizes, estimates of stock composition, upper and lower 90% credibility intervals, and standard deviations for samples of the escapement through the Chignik River weir in 11 strata in 2010, 2011, and 2012 using the program BAYES with a sequential prior.

			Black Lake				Chignik Lake			
Year	Stratum	n	Proportion	Lower	Upper	SD	Proportion	Lower	Upper	SD
2010	June 14	190	0.959	0.894	1.000	0.036	0.041	0.000	0.106	0.036
	June 21	189	0.995	0.966	1.000	0.014	0.005	0.000	0.034	0.014
	June 27	189	0.924	0.794	1.000	0.075	0.076	0.000	0.206	0.075
	July 1	189	0.823	0.724	0.912	0.057	0.177	0.088	0.276	0.057
	July 5	190	0.788	0.699	0.871	0.052	0.212	0.129	0.301	0.052
	July 8–9	190	0.784	0.687	0.870	0.056	0.216	0.130	0.313	0.056
	July 11	190	0.519	0.409	0.625	0.066	0.481	0.375	0.591	0.066
	July 14	188	0.227	0.154	0.306	0.046	0.773	0.694	0.846	0.046
	July 18–19	188	0.293	0.214	0.377	0.050	0.707	0.623	0.786	0.050
	July 23	186	0.108	0.052	0.173	0.037	0.892	0.827	0.948	0.037
	July 30	190	0.013	0.000	0.062	0.022	0.987	0.938	1.000	0.022
2011	June 10	188	0.998	0.988	1.000	0.005	0.002	0.000	0.012	0.005
	June 17	188	1.000	1.000	1.000	0.002	0.000	0.000	0.000	0.002
	June 24	188	0.976	0.888	1.000	0.040	0.024	0.000	0.112	0.040
	June 28	190	0.832	0.744	0.918	0.054	0.168	0.082	0.256	0.054
	July 2	190	0.953	0.886	1.000	0.036	0.047	0.000	0.114	0.036
	July 5	190	0.785	0.696	0.866	0.052	0.215	0.134	0.304	0.052
	July 9–10	187	0.719	0.625	0.807	0.055	0.281	0.193	0.375	0.055
	July 12–13	190	0.297	0.214	0.384	0.052	0.703	0.616	0.786	0.052
	July 14	190	0.308	0.217	0.402	0.056	0.692	0.598	0.783	0.056
	July 21	186	0.123	0.062	0.192	0.039	0.877	0.808	0.938	0.039
	July 28	189	0.036	0.000	0.088	0.029	0.964	0.912	1.000	0.029
2012	June 11	188	0.976	0.904	1.000	0.034	0.024	0.000	0.096	0.034
	June 18	190	0.964	0.882	1.000	0.042	0.036	0.000	0.118	0.042
	June 25	189	0.993	0.955	1.000	0.017	0.007	0.000	0.045	0.017
	July 1	190	0.644	0.544	0.733	0.058	0.356	0.267	0.456	0.058
	July 5	187	0.485	0.396	0.574	0.054	0.515	0.426	0.604	0.054
	July 8–9[a]	187	0.099	0.005	0.235	0.071	0.901	0.765	0.995	0.071
	July 11	189	0.225	0.147	0.306	0.048	0.775	0.694	0.853	0.048
	July 14	190	0.070	0.011	0.132	0.036	0.930	0.868	0.989	0.036
	July 17	189	0.003	0.000	0.020	0.009	0.997	0.980	1.000	0.009
	July 21	190	0.006	0.000	0.049	0.018	0.994	0.951	1.000	0.018
	July 28	170	0.000	0.000	0.000	0.001	1.000	1.000	1.000	0.001

[a] Note these estimates were associated with a Gelman-Rubin shrink factor value of 1.42.

Appendix A2.–Comparison of current Chignik River sockeye salmon early- and late-run management strategy (July 4) to total escapement estimated from genetics samples during 2010 to 2012. Note: total estimated run was calculated with the conventional method.

	Early			Estimated	Late		
	Total Est.	Escapement		Halfway	Total Est.	Escapement	
Year	Run	Mgmt.	Genetics	Date	Run	Mgmt.	Genetics
2010	1,201,040	432,535	472,490	10-Jul	1,193,032	311,376	271,421
2011	3,035,795	488,930	521,382	8-Jul	866,388	264,887	232,435
2012	1,571,522	353,441	345,428	3-Jul	1,392,219	358,948	366,961

APPENDIX B. SAMPLING PROCEDURES

Appendix B1.–Proposed sampling dates at Chignik River weir, 2013.

June 2013

S	M	TU	W	TH	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	**27**	*28*	29
30						

July 2013

S	M	TU	W	TH	F	S
	1	2	3	4	**5**	6
7	8	**9**	10	11	12	**13**
14	15	16	**17**	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Note: Sampling dates are represented in bold and highlighted in grey and can be adjusted inseason by management staff if necessitated by apparent timing.

Non-lethal Sampling Finfish Tissue for DNA Analysis

ADF&G Gene Conservation Lab, Anchorage

I. General Information

We use axillary process samples from individual fish to determine the genetic characteristics and profile of a particular run or stock of fish. This is a non-lethal method of collecting tissue samples from adult fish for genetic analysis. The most important thing to remember in collecting samples is that only quality tissue samples give quality results. If sampling from carcasses: tissues need to be as "fresh" and as cold as possible and recently moribund; do not sample from fungal fins.

Sample preservative: Ethanol (ETOH) preserves tissues for later DNA extraction without having to store frozen tissues. Avoid extended contact with skin.

II. Sample procedure:

1. Tissue type: Axillary process; clip one axillary process from each fish (see attached print out).
2. Prior to sampling, fill the tubes half way with ETOH from the squirt bottle. Fill only the tubes that you will use for a particular sampling period.
3. To avoid any excess water or fish slime in the vial, wipe the axillary process dry prior to sampling. Using the dog toe nail clipper or scissors, clip off axillary process (1/2 -1" max) to fit into the cryovial.
4. Place axillary process into ETOH. The ethanol/tissue ratio should be slightly less than 3:1 to thoroughly soak the tissue in the buffer.
5. Top off tubes with ETOH and screw cap on securely. Invert tube twice to mix ETOH and tissue. After each sample, wipe the dog toe nail clippers or scissor blade so not to cross contaminate samples.
6. Data to record: Record each vial number to paired data information.

Discard remaining ethanol from the 500ml bottle before returning samples. Tissue samples must remain in 2ml ethanol after sampling. HAZ-MAT paperwork will be required for return shipment. Store vials containing tissues at cool or room temperature, away from heat in the white sample boxes provided. In the field: keep samples out of direct sun, rain and store capped vials in a dry, cool location. Freezing not required.

III. Supplies included with sampling kit:

1. Clippers – used for cutting the axillary process.
2. Cryovial – a small (2.0ml) plastic vial, pre-labeled.
3. Caps – to prevent evaporation of ETOH.
4. Cryovial box – neon box for holding cryovials while sampling.
5. Ethanol (ETOH) - in bulk Nalgene bottle.
6. Squirt bottle – to fill or "top off" each cryovial with ETOH. Squirt bottle not for ethanol storage.
7. Printout of sampling instructions.
8. Laminated "return address" label.

-continued-

Shipping: HAZMAT paperwork is required for return shipment of these samples and is included in the kit.

Return shipping code: Use today's date

Ship samples to:

ADF&G – Genetics
333 Raspberry Road
Anchorage, Alaska 99518

Lab staff: 907-267-2247
Judy Berger: 907-267-2175
Tyler Dann: 907-267-2201

What to do with the samples after they are done and refreshed:

1. If you are doing paired sampling, label all the vials at the beginning of the season, you may not have time to do it later.
2. Double check the sample information with the log book to ensure accuracy.
3. Make sure all the bottles have internal labels and external port and series numbers (e.g. Chignik 20=CG20).
4. Put into air approved boxes that sampling supplies arrived in. Double bag and heat seal samples.
5. Place an unopened bag of vermiculite on top of sample bottles so that the bottles are held in place but not buried in vermiculite.

APPENDIX C. CHIGNIK SAMPLING FORM

Appendix C1.–The Chignik inseason genetic stock identification sampling form.

Chignik Inseason GSI Sampling Form

Date	Sampling Location	Scale Card	Fish Numbers	Cryotube Numbers	Notes
6/29/2010	Chignik weir trap	15	1-35	421-456	None