Regional Operational Plan SF.3F.2013.09

Operational Plan: Gulkana River Hatchery Contribution to Glennallen and Chitina Subdistrict Sockeye Salmon Harvests

by

Scott H. Maclean

July 2013

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

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

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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The Regional Operational Plan Series was established in 2012 to archive and provide public access to operational plans for fisheries projects of the Divisions of Commercial Fisheries and Sport Fish, as per joint-divisional Operational Planning Policy. Documents in this series are planning documents that may contain raw data, preliminary data analyses and results, and describe operational aspects of fisheries projects that may not actually be implemented. All documents in this series are subject to a technical review process and receive varying degrees of regional, divisional, and biometric approval, but do not generally receive editorial review. Results from the implementation of the operational plan described in this series may be subsequently finalized and published in a different department reporting series or in the formal literature. Please contact the author if you have any questions regarding the information provided in this plan. Regional Operational Plans are available on the Internet at: http://www.adfg.alaska.gov/sf/publications/

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Signature Page

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Project leader(s):	Scott Maclean, Fishery Biologist II Mark Somerville, Fishery Biologist III
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Period Covered	15 May 2013–30 November 2015
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Approval

Title	Name	Signature	Date
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Project leader	Mark Somerville		7-3-2013
Biometrician	Jiaqi Huang		7-8-2013
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PURPOSE

This project details the sampling of sockeye salmon in the Upper Copper River subsistence (Glennallen Subdistrict or GSD) and personal use dip net (Chitina Subdistrict or CSD) fisheries. These samples are needed to estimate the contribution of Gulkana Hatchery fish to the harvest of all sockeye salmon (wild and hatchery) within the upriver fisheries (Figure 1, Botz and Somerville 2011). The overlap in run timing between hatchery and wild stocks and the potential for overexploitation on wild stocks led to an evaluation program to assess the contribution of the hatchery-produced sockeye salmon to the total harvest. In addition to sampling sockeye salmon, Chinook salmon will be sampled to obtain age, sex, and length (ASL) data. The primary purpose for collecting these data are to characterize the composition of the CSD Chinook harvest and use that information in an age-structured model developed for this stock to forecast future returns and evaluate the established escapement goal (Savereide and Quinn 2004). Sport Fish Division is responsible for the collection of the ASL data and otolith samples, which are sent to the Division of Commercial Fisheries (CF) in Cordova. CF is responsible for estimation of the hatchery contribution. Only Sport Fish Division's activities are covered in this operational plan.

OBJECTIVES

The objectives of this study during 2013–2015 are to:

1. Estimate the hatchery stock composition of the GSD and CSD fishery harvests of sockeye salmon by week such that the estimates are within 0.10 of the true proportion 95% of the time;
2. Estimate age and length composition of the GSD and CSD harvests of sockeye salmon in the Copper River such that estimated proportions are within 0.10 of the true proportions 95% of the time; and,
3. Estimate ASL composition of the GSD and CSD harvest of Chinook salmon in the Copper River such that estimated proportions are within 0.10 of the true proportions 95% of the time.

METHODS

STUDY AREA AND SAMPLING DESIGN

Sampling for sockeye and Chinook salmon in the GSD subsistence fishery will occur along the Copper River from the McCarthy Bridge upstream to the village of Chistochina. Sampling for sockeye and Chinook salmon in the CSD fishery will occur along the Copper River from the McCarthy Bridge downstream approximately 4 miles to the confluence of O'Brien Creek with the Copper River.

A stratified sampling design will be used to collect the data necessary to meet the objectives. Stratification will be by time with each stratum being 1 week. Sampling will begin in early June and continue through August.

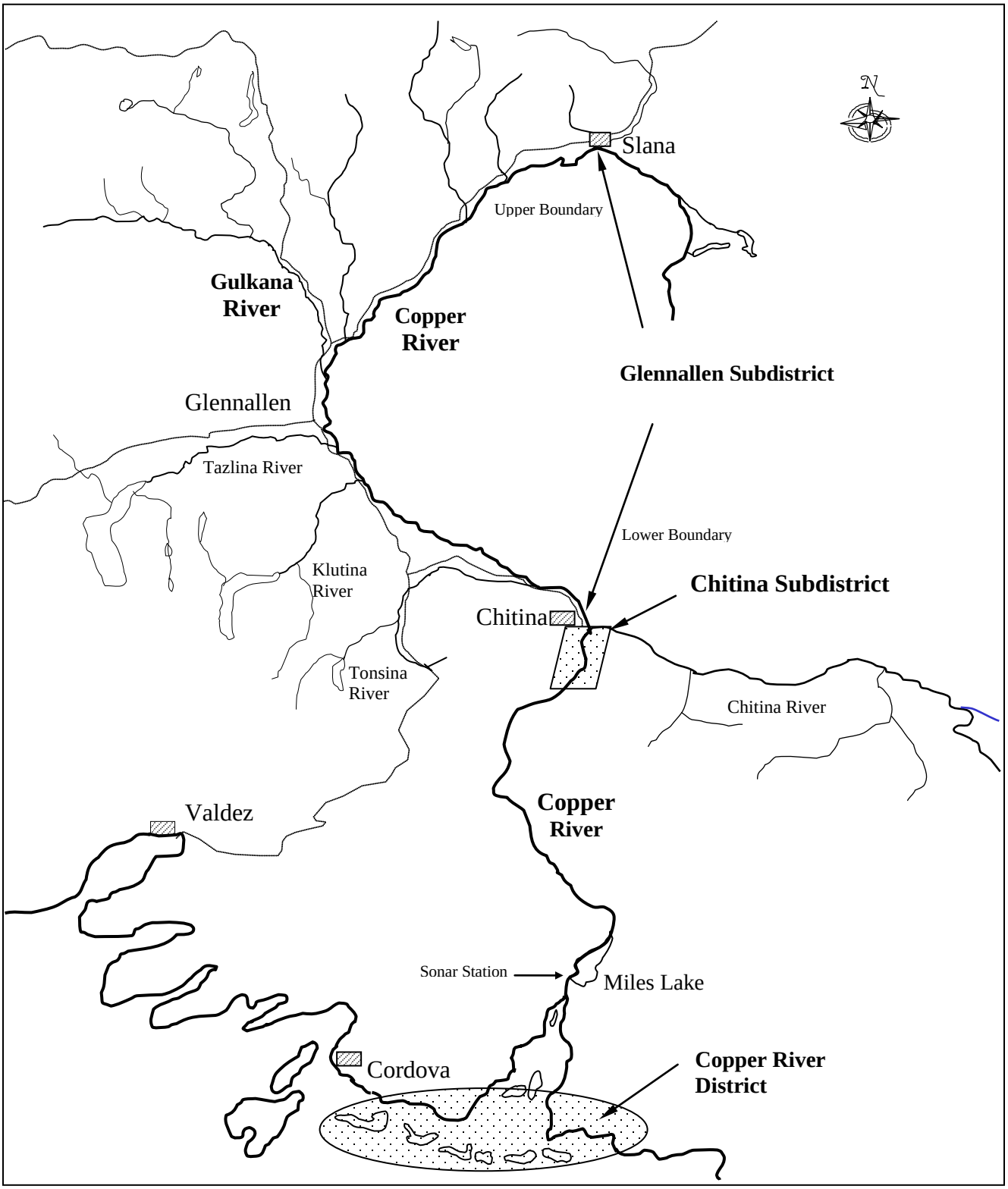

Figure 1.–Map of Copper River drainage demarcating the fishing districts.

Weekly sampling objectives were derived to account for seasonal fluctuations in the proportion of hatchery fish and ASL composition of sockeye salmon in the harvest. To meet the desired precision of the estimated hatchery contribution to the harvest and the ASL compositions of the harvest, a minimum sample of 200 otolith pairs will be collected equally each week between the GSD and CSD fisheries (Table 1). An additional 100 otolith pairs will be collected each week in the CSD when possible to provide consistency with past sample sizes. A weighted sampling plan will be followed for the GSD which roughly mirrors the average annual harvest in each of three river areas: 55 percent of samples between the Chitina/McCarthy Bridge and Tonsina River (B-T), 35 percent upriver of the Tonsina River to Gakona (T-G), and 10 percent between Gakona and Slana (G-S).

Table 1.–Minimum weekly sample sizes by species and subdistrict/subarea.

		Species Total		CSD	GSD		
					B-T	T-G	G-S
Dates	Stat Week	Chinook	Sockeye	Sockeye	Sockeye	Sockeye	Sockeye
6/2–6/8	23	41	200	100	55	35	10
6/9–6/15	24	52	200	100	55	35	10
6/16–6/22	25	41	200	100	55	35	10
6/23–6/29	26	35	200	100	55	35	10
6/30–7/6	27	33	200	100	55	35	10
7/7–7/13	28	23	200	100	55	35	10
7/14–7/20	29	14	200	100	55	35	10
7/21–7/27	30	4	200	100	55	35	10
7/28–8/3	31	2	200	100	55	35	10
8/4–8/10	32	2	200	100	55	35	10
8/11–8/17	33	2	200	100	55	35	10
8/18–8/24	34	1	200	100	55	35	10
8/25–8/31	35	0	200	100	55	35	10
	Total	250	2600	1300	715	455	130

The objective criteria for estimates of Chinook salmon ASL composition in the harvests (Objective 3) were established conservatively for the purpose of applying to an age-structured model to forecast future Chinook salmon returns to the Copper River (Savereide and Quinn 2004). The time series of escapement estimates generated from the model are used for run reconstruction to develop a spawner-recruit relationship for escapement goal analysis. Simulation studies indicate that measurement error in age composition estimates for spawner-recruit analysis is rarely a problem even with large CVs (S. Fleischman, Sport Fish Biometrician, ADF&G, Anchorage; *personal communication*). However, moderate samples of Chinook salmon are easy to obtain while sampling for sockeye salmon and the composition estimates may be used in the future for other purposes (e.g., evaluating changes in age or sex composition or mean length at age over time).

SAMPLING METHODS

Each sample week will begin on Monday and continue through Sunday. Four fishery technicians will be positioned at locations where participants frequently exit the fishing grounds and their work schedule, although adaptive based on fishery openings and stakeholder participation, will be designed to spread sampling over all periods the fisheries are open and all areas where fishing occurs. Due to size of the sampling area a number of fishermen within the GSD subsistence fishery will be used to aid in the collection of sockeye and Chinook salmon samples. Sampling for the hatchery contribution of sockeye salmon will occur in conjunction with the ASL composition sampling. ASL sampling will continue for both Chinook and sockeye salmon until both sampling objectives are met or the workweek ends.

DATA COLLECTION

Otoliths from sockeye salmon will be collected and placed in a coin envelope numbered according to the corresponding field form until the weekly sampling objectives are met. The number on the coin envelope containing otoliths will be entered on the daily otolith collection log adjacent to the date, sampler, and fishery information. At the end of each day, the otoliths will be transferred to a master tray and data from the otolith collection log will be transferred to the otolith sampling form. A tray holds 96 paired sets of otoliths and must be completely filled before using a second tray. Trays need not be separated by week, as tray numbering and sampling forms will identify the collection date. Both right and left otoliths will be removed from the fish and placed in the same well of the tray; if both are not removed from the salmon a bead will be placed in the tray with the single otolith so that the lab knows that one otolith was missing. Identifying labels will be placed on master trays, and sampling forms and trays will be shipped to the processing contractor and examined for strontium marks. Duplicate copies of the sampling forms will be made prior to shipping.

Otoliths collected from the GSD and CSD fisheries for estimating the hatchery contribution and age composition of the upriver harvests will be processed and analyzed according to procedures outlined in the CFD 2011 operational plan (Moffitt 2011).

All Chinook salmon encountered will be sampled for ASL and examined for spaghetti tags and missing adipose fins. Heads from all Chinook salmon missing their adipose fin will be collected, prepared, and sent to the ADF&G Tag Lab in Juneau for CWT analysis. Information from Chinook salmon with a spaghetti tag will be given to the Native Village of Eyak (NVE) for their mark-recapture experiment.

Ages of Chinook salmon will be determined from scale patterns as described by Mosher (1969). Four scales will be removed from the left side of the fish approximately 2 rows above the lateral line along a diagonal line downward from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin (Welander 1940).

Length of all fish sampled will be measured along a diagonal from the middle of the eye to the posterior insertion of the anal fin and, if possible, a second measurement from the middle of the eye to the fork of the caudal fin (MEF) will also be taken. By regulation fishers must remove both tips of the tail (caudal fin), and subsequently the standard MEF measurement is not always possible. Also, fish that have been processed (their heads, tails, and entrails removed) are

frequently encountered and provide no length or sex data. For sockeye salmon sampling, otoliths will not be taken unless at least one length measurement is taken; however, all Chinook salmon scales will be taken even when measuring length or determining gender is not possible. Field data forms will also be used to record the sex of each salmon as determined through examination of external and internal characteristics.

DATA ANALYSIS

Sockeye Salmon Hatchery Contribution

The otolith-derived estimate of the contribution of hatchery h to district-period stratum i, C_{hi} is

$$\hat{C}_{hi} = \frac{o_{hi}}{n_i} N_i \qquad (1)$$

where:

o_{hi} = number of otoliths from hatchery h in sample $n_{i:}$

n_i = number of otoliths sampled from stratum i; and,

N_i = number of fish caught in stratum i.

Otolith-derived estimates of the contribution of hatchery h, C_{Sh}, to all sampled CSD and GSD sockeye salmon, will be calculated as

$$\hat{C}_{Sh} = \sum_{i=1}^{Q} \hat{C}_{hi} \qquad (2)$$

where:

Q = number of recovery strata associated with CSD/GSD fisheries in which otoliths from hatchery h are found.

The contribution of hatchery h to unsampled strata, Cu_h, will be estimated from contribution rates associated with strata sampled from the same district-period openings as the unsampled strata using methods similar to those used for coded wire tags (Riffe et al. 1996):

$$\hat{C}u_h = \sum_{i=1}^{U} \left[Nu_i * \left(\frac{\sum_{j=1}^{S} \hat{C}_{hj}}{\sum_{j=1}^{S} N_j} \right) \right], \qquad (3)$$

where:

U = number of unsampled strata;

Nu_i = number of fish in ith unsampled stratum;

S = number of strata sampled in the period in which the unsampled stratum resides;

C_{hj} = contribution of strontium mark h to the sampled stratum j;and,

N_j = number of fish in jth sampled stratum.

If a fishing period(s) was not sampled (an infrequent occurrence), the harvest from that opening will be treated as unsampled harvest of the subsequent or previous opening in the same district.

An estimate of the contribution by hatchery *h* to all strata, sampled and unsampled, will be calculated by

$$\hat{C}_h = \hat{C}_{Sh} + \hat{C}_{Uh}. \tag{4}$$

The variance estimate of $\hat{C}_h$ is

$$\hat{V}(\hat{C}_h) = \sum_{i=1}^{Q} \frac{N_i^2 o_{hi}}{n_i^2}\left(1 - \frac{o_{hi}}{n_i}\right). \tag{5}$$

The equation (5) assumes that there are few unsampled strata and the variance associated with $\hat{C}_{Uh}$ is negligible.

Sockeye and Chinook Salmon ASL Composition

Stratified estimates of ASL proportions will be calculated as described in Cochran (1977). Stratification will be done post season such that each stratum covers the period over which one quarter of the harvest is taken based on the weekly reported harvest. Stratified estimates will be pooled across stratum if there are no significant differences between stratum estimates. For clarity, the following description and formulae were developed for age composition; however, estimating the sex and length composition is identical:

$$\hat{p}_{a,i} = \frac{n_{a,i}}{n_i} \tag{6}$$

$$\hat{p}_a = \sum_{i=1}^{L} \frac{\hat{H}_i}{H} \hat{p}_{a,i} \tag{7}$$

where n_i is the sample size for each time stratum *i* (e.g., for age composition, the number successfully aged), $n_{a,i}$ the subset of that sample composed of fish of age *a*, $\hat{p}_{a,i}$ the estimated proportion of the harvest in stratum *i* composed of fish of age *a*, and $\hat{p}_a$ the estimated proportion of the seasonal harvest composed of fish of age *a*. The estimator described is stratified by harvest quartile. The harvest-monitoring program does not yield harvest estimates by quartile, $\hat{H}_i$; therefore, weekly reported harvests are used to estimate harvests by quartile as:

$$\hat{p}_{h,i} = \frac{h_i}{h} = \frac{\sum_j h_j}{h} \tag{8}$$

$$\hat{H}_i = \hat{p}_{h,i} H \tag{9}$$

$$\hat{Var}(\hat{H}_i) = H^2 \left(\frac{\hat{p}_{h,i}\left[1 - \hat{p}_{h,i}\right]}{h - 1} \right) \tag{10}$$

where h_i is the reported harvest for statum i, and h_j is the weekly reported harvest, h is the seasonal reported harvest, and H is the seasonal harvest estimated with insignificant error. A large fraction of the estimated harvest is reported (e.g., 86% in 2002); however, a population correction factor is not included in equation (10) in order to guard against associating an inappropriately small variance estimate with a non-random sample.

The variance of these estimates of age proportions will be estimated using Goodman's (1960) formula for the exact variance of a product:

$$\hat{Var}(\hat{p}_a) = \frac{1}{H^2} \hat{Var}\left(\sum_{i=1}^{L} \hat{H}_i \hat{p}_{a,i} \right) \tag{11}$$

$$= \frac{1}{H^2} \left[\sum_{i=1}^{L} \left[\hat{p}_{a,i}^2 \hat{Var}\left(\hat{H}_i\right) + \hat{H}_i^2 \hat{Var}\left(\hat{p}_{a,i}\right) - \hat{Var}\left(\hat{H}_i\right) \hat{Var}\left(\hat{p}_{a,i}\right) \right] + 2 \sum_{i} \sum_{<} \sum_{k} \hat{Cov}\left(\hat{H}_i \hat{p}_{a,i}, \hat{H}_k \hat{p}_{a,k}\right) \right] \tag{12}$$

where:

$$\hat{Var}\left(\hat{p}_{a,i}\right) = \left(\frac{\hat{p}_{a,i}\left[1 - \hat{p}_{a,i}\right]}{n_i - 1} \right). \tag{13}$$

The estimated age compositions for stratum i and k, $\hat{p}_{a,i}$ and $\hat{p}_{a,k}$, are independent as are the estimated stratum harvests $\hat{H}_i$, and the age composition estimates for stratum i, $\hat{p}_{a,i}$; however, the weekly harvests for strata i and k, $\hat{H}_i$ and $\hat{H}_k$, are dependent in that they are distributed as a multinomial. Working out the covariance term in equation (12) yields:

$$\hat{Var}(\hat{p}_a)$$

$$= \frac{1}{H^2} \left[\sum_{i=1}^{L} \left[\hat{p}_{a,i}^2 \hat{Var}\left(\hat{H}_i\right) + \hat{H}_i^2 \hat{Var}\left(\hat{p}_{a,i}\right) - \hat{Var}\left(\hat{H}_i\right) \hat{Var}\left(\hat{p}_{a,i}\right) \right] + 2 \sum_{i} \sum_{<} \sum_{k} \hat{p}_{a,i} \hat{p}_{a,k} \hat{Cov}\left(\hat{H}_i, \hat{H}_k\right) \right] \tag{14}$$

Uncertainty in the harvest estimate does not affect the estimated variance for the composition estimates as can be seen by the following: The uncertainty in H can be accounted for by replacing equation (9) with:

$$\hat{H}_i = \hat{p}_{h,i} \hat{H} \,. \tag{15}$$

The variance of the estimates of age proportions then becomes:

$$\hat{Var}(\hat{p}_a) = \hat{Var}\left(\frac{1}{\hat{H}}\sum_{i=1}^{L}\hat{H}_i\hat{p}_{a,i}\right) = \hat{Var}\left(\frac{1}{\hat{H}}\sum_{i=1}^{L}\hat{p}_{h,i}\hat{H}\hat{p}_{a,i}\right) = \hat{Var}\left(\sum_{i=1}^{L}\hat{p}_{h,i}\hat{p}_{a,i}\right), \quad (16)$$

which is not dependent on $\hat{H}$.

COMPLIANCE DATA

Field personnel will contact fishers during the course of collecting ASL samples. Samplers will also perform fisher contacts during periods when they are not actively sampling. During each contact, samplers will record the contact location, permit number, fishing license number or driver's license number (depending on which fishery the fisher is participating in), last name, the species and number of fish they have harvested, gear used, and any violations they observe. If a violation is observed the sampler will educate the fisher of the nature of the violation and why such a requirement is necessary for the continued management of the fishery. The permit information and violation will be passed onto the Alaska Wildlife Troopers, as part of the next day's update to the Crew Leader, for their records. If a violation is particularly egregious the AWT troopers will be contacted as soon as practical through the Area Management Biologist.

SCHEDULE AND DELIVERABLES

Schedule

- June–August 2013–2015: Sampling salmon
- October 2013–2015: Data analysis
- November 2015: End of project expenditures
- May 2016 Final Report to AKSSF

Deliverables

Data forms containing lengths and scale cards will be sent to the Commercial Fisheries Division project leader in Cordova every 2 weeks for analysis and summarization. Data forms containing the daily number of sockeye salmon otoliths and Chinook salmon scales collected will be summarized in an Excel spreadsheet. The master spreadsheet will be archived with the ADF&G Research and Technical Service (333 Raspberry Road, Anchorage, AK 99518) when completed and an appendix listing the filename and location will be provided in the final report. Annual reports in 2013 and 2014 will be submitted to AKSSF and will be written in Microsoft Word®. A State of Alaska Fishery Data Series Report detailing project findings from all 3 years will be written following the final year of the project. Printed copies of the final report will be made available on request and electronic copies will be accessible by the public via the ADF&G website.

RESPONSIBILITIES

Project Fisheries Biologist III	Assist in supervising project as needed.
Project Fisheries Biologist II	Supervise project and training, assist in field sampling as needed. Send sampling summary and otoliths to Cordova bi-weekly.
Fish and Wildlife Tech. III	Crew leader, supervise and conduct daily sampling activities and training of new personnel in sampling procedures. Summarize the weekly sampling results.
Fish and Wildlife Tech. IIs/College Intern	Conduct daily sampling activities and assist in the completion of weekly sampling results.

REFERENCE CITED

Botz, J., and M. A. Somerville. 2011. Management of salmon stocks in the Copper River, Report to the Alaska Board of Fisheries: December 2-7, 2011, Valdez, Alaska. Alaska Department of Fish and Game, Special Publication No. 11-13, Anchorage.

Cochran, W. G. 1977. Sampling Techniques, 3rd edition. John Wiley. New York.

Goodman, L. A. 1960. On the exact variance of products. Journal of the American Statistical Association 55:708-713.

Moffitt, S. 2011. Operational plan: Thermal and Strontium chloride marked otoliths recovery and analysis. Alaska Department of Fish and Game, Anchorage.

Mosher, K. H. 1969. Identification of Pacific salmon and steelhead trout by scale characteristics. U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries. Circular 317. Washington D.C.

Riffe, R., S. Gehlback, D. Evans and B. Bue. 1996. Coded-wire tag recoveries from pink salmon in Prince William Sound fisheries, 1995. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A96-20, Anchorage.

Savereide, J. W. and T. J. Quinn II. 2004. An age-structured assessment model for Chinook salmon (Oncorhynchus tshawytscha). Canadian Journal of Fisheries and Aquatic Sciences. 61(6):974-985.

Welander, A. D. 1940. A study of the development of the scale of Chinook salmon Oncorhynchus tshawytscha. Masters Thesis. University of Washington, Seattle.

APPENDIX A

Appendix A1.–An example of the sampling schedule when the Chitina subdistrict fishery is open continuously.

Time	Monday	Tuesday	Wednesday	Thursday	*Friday*	Saturday	Sunday
0600						A	A
0700						A	A
0800	A				B	A	A
0900	A		B	B	B	A/C	A/C
1000	A	A	B	B	B	A/C	A/C
1100	A	A	B	B	B	A/C	A/C
1200	A	A	B	B	B/C	A/C	A/C
1300	A	A	B	B	B/C	A/B/C	A/C
1400	A/C	A	B	B	B/C	A/B/C	A/C
1500	A/C	A	B	B	B/C	A/B/C	A/C
1600	A/C	A	B	B	B/C	A/B/C	A/C
1700	C	A	B	B	B/C	B/C	C
1800	C	A	B	B	C	B/C	C
1900	C	A	B	B	C	B/C	C
2000	C	A			C	B	
2100	C				C	B	
2200	C					B	
2300						B	
2400							
	Hours						
	A = 7.5	A = 10	C = 10	B= 10	B = 10	A = 10	A = 10
	C = 7.5				C = 10	B = 10	
						C = 10	C = 10

Note: The above schedule includes a one hour "lunch" break. On days which 7.5 hours are indicated a half hour must be deducted from the start or end times. Adjust the schedule as needed to accommodate weather, charter boat schedule, and fishing pressure.

- The crew leader (A) should use between 3 and 6 hours of their shift on Monday to review sampling books, restock sampling kits, review scale and otolith samples, sampling sheets, compile grocery and supply lists, enter data on Excel spreadsheet and deliver data to Glennallen office. Crew member B should use approximately half of their shift on Monday to complete removal of otoliths from collected heads and transfer previously removed otoliths from coin envelopes to master trays.

-Flexibility is the key to meeting sampling objectives.

-You must work 37.5 hours within a Monday–Sunday period or personal leave will be used to fill out the week. Any overtime must have prior approval by the project leader.

Appendix A2.–An example of the sampling schedule when the Chitina Subdistrict fishery is open for 60 hours (Friday 8 AM–Sunday 8 PM).

Time	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
0600						A	A
0700						A	A
0800	A/B/C				A	A	A/B
0900	A/B/C				A	A	A/B
1000	A/B/C				A/B	A/B	A/B/C
1100	A/B/C				A/B	A/B	A/B/C
1200	A/B/C				A/B/C	A/B/C	A/B/C
1300					A/B/C	A/B/C	A/B/C
1400					A/B/C	A/B/C	A/B/C
1500					A/B/C	A/B/C	A/B/C
1600					A/B/C	A/B/C	A/B/C
1700					A/B/C	A/B/C	A/B/C
1800					A/B/C	B/C	B/C
1900					A/B/C	B/C	B/C
2000					B/C	B/C	C
2100					B/C	B/C	C
2200					C	C	
2300					C	C	
2400							
	Hours						
	A = 4.5				A = 11	A = 11	A = 11
	B = 4.5				B = 11	B = 11	B = 11
	C = 4.5				C = 11	C = 11	C = 11

Note: The above schedule includes a one hour "lunch" break. On days which 4.5 hours are indicated a half hour must be deducted from the start or end times. Adjust the schedule as needed to accommodate weather, charter boat schedule, and fishing pressure.

- The crew leader (A) should use between 3 and 6 hours of their shift on Monday to review sampling books, restock sampling kits, review scale and otolith samples, sampling sheets compile grocery and supply lists, enter data on Excel spreadsheet and deliver data to Glennallen office.

- Flexibility is the key to meeting sampling objectives.

- You must work 37.5 hours within a Monday–Sunday period or personal leave will be used to fill out the week. Any overtime must have prior approval by the project leader.

APPENDIX B

Appendix B1.–Otolith sampling form.

Alaska Department of Fish and Game

Otolith Sampling Form
Upper Copper River

Sample Number 1 3 D O _ _ _

*****ONLY 1 DATE & DATA SHEET PER SAMPLE NUMBER*****

Harvest Type: Personal Use or Subsistence Species: sockeye

Sample Type: grab Sample Time: Begin Time: _____ End Time: _____

Subdistrict (circle): CSD or GSD: BT, TG, GS Survey Site:_____

Sampler(s): _____

Date Sampled: _____ **Date Caught:** _____ **Stat Week:**_____

Otolith Recovery Information

Total # sampled: ____ Please indicate single otoliths or no otoliths where necessary

	1	2	3	4	5	6	7	8	9	10	11	12
A												
B												
C												
D												
E												
F												
G												
H												

Comments

Appendix B2.–Sockeye salmon sampling form.

2013 Upper Copper River ASL Data: Sockeye

Sample Number (Tray #) _____ **Gear type (circle one):** DN or FW

Dates: _____ **Stat Wk:** _____ **Subdistrict (circle):** CSD or GSD: B-T, T-G, G-S

Row: A Date:				**Row: B Date:**				**Row: C Date:**				**Row: D Date:**			
Location Code:				**Location Code:**				**Location Code:**				**Location Code:**			
Fish	Sex	Length (mm)		Fish	Sex	Length (mm)		Fish	Sex	Length (mm)		Fish	Sex	Length (mm)	
No.	M/F	ME-**Fork**	ME-**A.Fin**	No.	M/F	ME-**Fork**	ME-**A.Fin**	No.	M/F	ME-**Fork**	ME-**A.Fin**	No.	M/F	ME-**Fork**	ME-**A.Fin**
1				1				1				1			
2				2				2				2			
3				3				3				3			
4				4				4				4			
5				5				5				5			
6				6				6				6			
7				7				7				7			
8				8				8				8			
9				9				9				9			
10				10				10				10			
11				11				11				11			
12				12				12				12			

Row: E Date:				**Row: F Date:**				**Row: G Date:**				**Row: H Date:**			
Location Code:				**Location Code:**				**Location Code:**				**Location Code:**			
Fish	Sex	Length (mm)		Fish	Sex	Length (mm)		Fish	Sex	Length (mm)		Fish	Sex	Length (mm)	
No.	M/F	ME-**Fork**	ME-**A.Fin**	No.	M/F	ME-**Fork**	ME-**A.Fin**	No.	M/F	ME-**Fork**	ME-**A.Fin**	No.	M/F	ME-**Fork**	ME-**A.Fin**
1				1				1				1			
2				2				2				2			
3				3				3				3			
4				4				4				4			
5				5				5				5			
6				6				6				6			
7				7				7				7			
8				8				8				8			
9				9				9				9			
10				10				10				10			
11				11				11				11			
12				12				12				12			

ME-Fork: **Mid-eye to fork of tail.** ME-A.Fin: **Mid-eye to posterior insertion point of anal fin.**

Appendix B3.–Chinook salmon sampling form.

2013 Upper Copper River ASL Data: Chinook

Dates: ______________ **Stat Wk:**__________ **Gear type (circle):** DN or FW

Subdistrict (circle): CSD or GSD: B-T, T-G, G-S

Card:	Date:			**Card:**	Date:			**Card:**	Date:			**Card:**	Date:		
Location Code:				**Location Code:**				**Location Code:**				**Location Code:**			
Fish	Sex	Length (mm)		Fish	Sex	Length (mm)		Fish	Sex	Length (mm)		Fish	Sex	Length (mm)	
No.	M/F	ME-**Fork**	ME-**A.Fin**	No.	M/F	ME-**Fork**	ME-**A.Fin**	No.	M/F	ME-**Fork**	ME-**A.Fin**	No.	M/F	ME-**Fork**	ME-**A.Fin**
1				1				1				1			
2				2				2				2			
3				3				3				3			
4				4				4				4			
5				5				5				5			
6				6				6				6			
7				7				7				7			
8				8				8				8			
9				9				9				9			
10				10				10				10			

Card:	Date:			**Card:**	Date:			**Card:**	Date:			**Card:**	Date:		
Location Code:				**Location Code:**				**Location Code:**				**Location Code:**			
1				1				1				1			
2				2				2				2			
3				3				3				3			
4				4				4				4			
5				5				5				5			
6				6				6				6			
7				7				7				7			
8				8				8				8			
9				9				9				9			
10				10				10				10			

Card:	Date:			**Card:**	Date:			**Card:**	Date:			**Card:**	Date:		
Location Code:				**Location Code:**				**Location Code:**				**Location Code:**			
1				1				1				1			
2				2				2				2			
3				3				3				3			
4				4				4				4			
5				5				5				5			
6				6				6				6			
7				7				7				7			
8				8				8				8			
9				9				9				9			
10				10				10				10			

Card:	Date:			**Card:**	Date:			**Card:**	Date:			**Card:**	Date:		
Location Code:				**Location Code:**				**Location Code:**				**Location Code:**			
1				1				1				1			
2				2				2				2			
3				3				3				3			
4				4				4				4			
5				5				5				5			
6				6				6				6			
7				7				7				7			
8				8				8				8			
9				9				9				9			
10				10				10				10			

ME-Fork: Mid-eye to fork of tail. **ME-A.Fin:** Mid-eye to posterior insertion point of anal fin.

Appendix B4.–Explanation of the location codes for salmon sampling areas.

LOCATION CODES:						
SOUTH OF THE CHITINA / McCARTHY BRIDGE			3-34	for fed permits -- below bridge		
NORTH OF THE CHITINA / McCARTHY BRIDGE			3-33			
CHITINA AIRPORT			3-28			
Confluence of Lower Tonsina & Copper			3-20			
OLD EDGERTON HWY			3-4.5			
SOUTH OF KLUTINA			1-97			
Klutina/Copper Conf			1-99			
COPPER CENTER			1-100,	1-101,	1-102	
SILVER SPRINGS			1-104			
WOLF POINT			1-105			
TAZLINA (Old School/Church Road)			1-109,	1-112		
TAZLINA TERRACE			1-110			
COPPERVILLE			1-111,	1-127		
GULKANA AIRPORT			1-119			
GULKANA VILLAGE			1-126,			
GAKONA POST OFFICE			2-3			
GAKONA			2-4, 2-5, 2-8, 2-15			
CHISTOCHINA			2-33			
SLANA, NABESNA			2-61			
The Highway codes are:	1 = Richardson Highway…then the mile post					
	2 = Tok Cut-Off…then the mile post					
	3 = Edgerton Highway…then the mile post					