GSI Sample Size Requirements for In-river Run Reconstruction of Alsek Chinook and Sockeye Stocks

By

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For

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INTRODUCTION

Since 1976, weir counts by the Department of Fisheries and Oceans (DFO) in co-operation with the Champagne-Aishihik First Nation (CAFN) have been made on the Klukshu River, part of the Alsek River system (see Figure 1). Sockeye salmon weir counts at Kluckshu, in conjunction with sockeye catch rate information from the test fishery at Dry Bay and genetic stock identification (GSI) of tissue samples taken at the Dry Bay commercial and test fisheries, were used to estimate the Alsek population in 2005 and 2006 (Waugh and Stark 2008a, 2008b). A similar study was conducted on the 2007 Chinook salmon run (Waugh and Stark 2008c). Results were encouraging in all three projects and it is hoped that similar programs will be feasible to assess the system-wide returns of Alsek Chinook and sockeye in the future. Below, these projects will be reference as the 2005, 2006 and 2007 Alsek studies.

The objective of the current study is to develop a sampling strategy (statistically valid) which includes methods of calculations (captured in a report summary and Excel spreadsheet) and the precision expected based on various sample sizes and stock contribution levels for the apportionment of Alsek Chinook and sockeye abundance into the requisite stocks (i.e., Klukshu and others) which, in conjunction with the Klukshu weir counts, will provide the foundation for assessing returns to the Alsek River.

METHODS

All the methodologies developed here are applicable to both Chinook and sockeye salmon in the Alsek system. The determination of sample size required to achieve the desired precision (power) at a prescribed confidence level requires that the estimation methodology be specified. Because catch is known and it is assumed that all stocks are equally vulnerable (i.e., the catch has the same stock composition as the fish that escape the fishery), only the estimation of the aggregate system escapement from the fishery need be considered. The population size can be obtained simply by adding on the catch to the escapement estimate.

Estimation Model

The available information for the estimation of aggregate escapement is as follows (also, Table 1 contains a summary of all notations used in this report):

E_k – the weir count on the Kluckshu River
p_i – proportion of Kluckshu stock in the GSI sample in week i
S_i – standard deviation of the Kluckshu stock proportion in week i
w_i – weight of the system run at the fishery in week i (the catch rate of the Dry Bay test fishery)

The GSI tissue samples (axillary appendage) from the Dry Bay test fishery were analyzed by the DFO Salmon Genetics Laboratory (Nanaimo). Klucksu stock proportion and standard deviations were estimated following Pella and Masuda (2001) by the Nanaimo laboratory.

Under the assumptions that all stocks are equally vulnerable and the run timing at Dry Bay is reflected by the catch rate in the test fishery, then the weekly proportion of the Kluckshu fish (v_i) is:

(1) $$v_i = \frac{w_i p_i}{\sum_i w_i p_i} \ .$$

Assuming minimal in-river mortality (from the Dry Bay fishery to the Kluckshu weir), the number of Kluckshu fish escaping in any week is the weir count times the weekly proportion of Kluckshu fish ($E_K \cdot v_i$). An estimate of aggregate weekly escapement ($\hat{E}_i$) is made by expanding the Kluckshu escapement by the associated stock composition, i.e.,

(2) $$\hat{E}_i = \frac{E_K v_i}{p_i} = E_K \frac{w_i}{\sum_i w_i p_i} \ .$$

Note that the Kluckshu stock proportion in the numerator cancels out for any particular week *i*. The aggregate escapement for the season ($\hat{E}_T$) is then,

(3) $$\hat{E}_T = E_k \frac{\sum_i w_i}{\sum_i w_i p_i} = \frac{E_k}{\sum_i w_i^* p_i} \ ,$$

where

$$w_i^* = \frac{w_i}{\sum_i w_i} \ ,$$

and where w_i^* is the standardized catch rate or proportion of the aggregate run available in week *i*. Standardizing the run distribution simplifies the calculations and helps to illustrate that the weekly aggregate escapement estimates are fractions of the seasonal total and do not depend directly on the weekly Kluckshu stock proportions. Statistically, the weekly escapement estimates should be viewed as a fraction of the aggregate total estimate, i.e.,

$$\hat{E}_i = w_i^* \hat{E}_T \ .$$

Since the Kluckshu weir count is known, the only random variables in the aggregate estimate are the run distribution (w^*) and the Kluckshu stock (p) proportions found in the denominator of equation (3). Because the two proportions are independent, the variance of their product sum (denominator of equation 3) is:

$$\text{(4)}\qquad \begin{aligned} \text{Var}\left\{\sum_i w_i p_i\right\} &= \sum_i (w_i^*)^2\,\text{Var}(p_i) + \sum_i \left[p_i^2 \text{Var}(w_i^*) + 2\sum_{j<i} p_i p_j \text{Cov}(w_i^*, w_j^*) \right] \\ &= \sum_i (w_i^* S_i)^2 + \sum_i \left[p_i^2 \frac{w_i^*(1-w_i^*)}{n_w} - 2\sum_{j<i} p_i p_j \frac{w_i^* w_j^*}{n_w} \right] \end{aligned}.$$

The second part of equation (4) is obtained by assuming that the run distribution proportions (w^*) have a multinomial distribution with a sample size of n_w (the number of fish taken by the test fishery over the season). In practice, the first summation term in equation (4) will be much larger than the second summation term, i.e.,

$$\sum_i (w_i^* S_i)^2 >> \sum_i \left[p_i^2 \frac{w_i^*(1-w_i^*)}{n_w} - 2\sum_{j<i} p_i p_j \frac{w_i^* w_j^*}{n_w} \right].$$

This inequality is caused by: (1) the negative correlation between the run distribution proportions (the w^* must sum to 1.0), (2) the sample size n_w is much larger than the number of fish sampled for GSI processing each week, and (3) the standard deviation of the Klukshu stock proportion (S_i) is inflated by misidentification errors. Empirically, using the values reported by Alsek studies, the first term is at least 200 times larger. The implication is that the run distribution proportions can be effectively treated as known quantities (i.e., constants) instead as random variables.

Using the Klukshu stock proportion as the only source of variation and an approximation from the first order Taylor series expansion (Kendall et al. 1998), the estimate of the variance of aggregate escapement is:

$$\text{(5)}\qquad \text{Var}(\hat{E}_T) \approx E_K^2 \frac{\text{Var}\left\{\sum_i w_i^* p_i\right\}}{\left(\sum_i w_i^* p_i\right)^4} \approx \sum_i (w_i^* S_i)^2 \left[\frac{\hat{E}_T}{\sum_i w_i^* p_i}\right]^2,$$

and standard deviation,

$$\text{(6)}\qquad \text{SD}(\hat{E}_T) \approx \sqrt{\sum_i (w_i^* S_i)^2}\,\frac{\hat{E}_T}{\sum_i w_i^* p_i}.$$

Confidence intervals can be calculated as:

$$\widehat{E}_T \pm z_\alpha \cdot \mathrm{SD}(\widehat{E}_T)$$

where z_α is the standard normal deviate at α confidence level.

The standard deviation for the weekly aggregate estimate is a simple fraction of the seasonal total (see equations 2 and 3), i.e.,

(7) $$\mathrm{SD}(\widehat{E}_i) = w_i^* \cdot \mathrm{SD}(\widehat{E}_T) \ .$$

Sample Size Requirements

In order to specify sampling requirements an understanding must be gained of how variation in the Kluckshu stock proportion responds to changes in sample size. The current procedure for calculating the standard deviation of the Kluckshu stock proportion applies a Bayesian model with an informative Dirichelet prior distribution, all available Alsek baseline data and Gibbs sampling to generate the posterior distribution following Pella and Masuda (2001). This complex procedure is necessary to account for assignment error that is specific to the stock and the proportion of the stock in the GSI sample. The duplication of this procedure in an Excel spreadsheet is not feasible. Instead, a simple approximation is developed here that uses the standard deviation output from the Bayes procedure to mimic the response to sample size and the Kluckshu stock proportion.

We start by observing that, by definition, the weekly Kluckshu stock proportion must exhibit a binomial distribution; however, the associated variation has an unknown effective sample size smaller than the number of tissue samples submitted for GSI. We assume that the factor that adjusts the GSI sample size to obtain the Bayes computed standard deviation is a linear function of the Kluckshu stock proportion, which implies the regression model:

(8) $$\frac{p_i(1-p_i)}{n_i S_i^2} = a_0 + a_1 p_i + \varepsilon \ ,$$

where n_i is the sample size of fish submitted for GSI, a_0 and a_1 regression coefficients and ε the additive error. The coefficients were estimated through simple linear regressions. For sockeye, the 2005 and 2006 studies were combined (a total of 9 weeks). For Chinook, only 4 weeks (data points) were available from the 2007 study.

It has long been recognized that the most efficient sampling design for a stratified population is to sample at random in proportion to the population in each strata (Fisher 1935). Therefore, assuming a random sample can be obtained each week in proportion to the run distribution, the effective sample size each week is then,

(9) $$(\widehat{a}_0 + \widehat{a}_1 p_i) n_i = (\widehat{a}_0 + \widehat{a}_1 p_i) w_i^* n \ ,$$

where n is the total size of the GSI sample submitted over the season. The target variance with a specified precision (percentage of the aggregate escapement, y) and confidence level can be then equated to the estimated variance (equation 5) using a binomial distribution for the Kluckshu proportion and effective sample size per equation (9), thus

$$\left(\frac{\hat{E}_T}{\sum_i w_i^* p_i}\right)^2 \sum_i \frac{(w_i^*)^2 p_i (1-p_i)}{w_i^* (\hat{a}_o + \hat{a}_1 p_i) n} = \left(\frac{\hat{E}_T y}{z_\alpha}\right)^2 ,$$

and then simplifying and solving for n yields:

$$(10) \qquad \hat{n} = \left(\frac{z_\alpha}{y \sum_i w_i^* p_i}\right)^2 \sum_i \frac{w_i^* p_i (1-p_i)}{\hat{a}_0 + \hat{a}_1 p_i} .$$

Note that Kluckshu escapement does not affect the required sample size when precision (power) is expressed as a fraction of the aggregate escapement.

Kluckshu escapement, run distribution and Kluckshu stock proportions measured in the three Alsek studies were used to determine sample size (equation 9) and subsequent estimates of escapement and associated variation under various precision levels. The calculations were captured in an Excel spreadsheet with a macro (code listed in Appendix A) to estimate the required sample size based on a prescribed precision and confidence level.

RESULTS AND DISCUSSION

The coefficients for converting the number of fish sampled for GSI analysis to the effective sample size are listed in Table 2 and the regression plots are provided in Figures 2 and 3. Only the probability level for the Chinook a_1 coefficient is not significant (P = 0.93, note that in Figure 3 the regression line is essentially horizontal). These plots also indicate that the relatedness of stocks is different for sockeye and Chinook salmon.

Sample size estimates and subsequent variation calculations are illustrated in Tables 3, 4 and 5 where each Table is based on the 2005, 2006 and 2007 Alsek study, respectively. The Tables were generated with the accompanying Excel spreadsheet assuming stratified random sampling and a precision at 95% confidence with a total sample size identical to that observed in each of the studies (i.e., perfectly executed sampling).

All required inputs for the Excel spreadsheet (see Tables 3, 4, or 5) are in red font and the output from the macro "EstSample" (the sample size estimate) is in blue. All the other cells (black font) have been calculated from the red and blue. Column-2 has the test fishery run distribution weights (catch-per-unit-effort) and column-3 the expected Kluckhsu stock proportions. Up to 8 weeks or strata of data can be input. The run distribution for the entire Alsek season should be entered – if there are no Kluckshu fish then that period can be amalgamated into a single strata If there are fewer weeks then the excess weeks must be zero padded (e.g., see Tables 4 and 5).

The remaining inputs can be found in the lower half of the spreadsheet. The "Kluckshu Escape" row is for the weir count at Kluckshu. As noted above, the entry has no effect on the estimation of required sample size but does impact the aggregate escapement estimate and the percentage that should be sampled. The desired confidence (usually set to 90 or 95%) and precision (percent of the aggregate escapement estimate) entries control the magnitude of the confidence interval. The two entries in the "Effect. Sample Coeff." row are the two coefficients that reduce the number of GSI tissue samples to the effective sample size.

All of the inputs (in red font) are used by the macro "EstSample" to compute the required sample size (equation 10) that is printed at the "Total" row and column-6 (blue font). The column-4 (Run Standard) output simply standardizes column-2 for the distribution of seasonal totals (estimated escapement, required sample size, estimated standard deviation of escapement) into week or strata. The total escape estimate (column-5) is computed from equation (3) and the associated standard deviation (column-10) from equation (6).

The major assumptions for the estimation of aggregate escapement, associated variance and subsequent sample size requirements at specified levels of precision and confidence were:

1. Equal vulnerability of capture. Migration behaviour and size differences of returning stocks may cause unequal vulnerability of stocks to the test or commercial fisheries. Estimates are likely sensitive to violation.
2. Minimum in-river mortality. Computationally, straight-forward to adjust the weir counts for any suspected mortality. Impacts the aggregate escapement estimate and fraction to be sampled.
3. Functional relationship (linear assumed here) between sample size adjustment to obtain effective sample size and the Kluckshu stock proportion. New baseline GSI data may alter or change the functional relationship (e.g., non-linear or non-stationary).

The stochastic approximations used to derive the variance of aggregate escapement should hold for the range of data collected (weir count, test fishery catch, stock proportions) in the Alsek River system.

LITERATURE CITED

Fisher, R.A. 1935. The design of experiments. Oliver and Boyd, Edinburgh.

Kendall, M., A, Stuart, and J.K. Ord. 1998. Advanced Theory of Statistics, 6th edition, Volume 1. Arnold, London.

Pella, J. and M. Masuda. 2001. Bayesian methods for analysis of stock mixtures from genetic characteristics. Fishery Bulletin, 99:151-167.

Waugh, B. and S. Stark. 2008a. Population estimate for Alsek River sockeye salmon in 2005. Prepared by Stock Assessment Division, DFO Yukon for the Pacific Salmon Commission, Northern Fund.

Waugh, B. and S. Stark. 2008b. Population estimate for Alsek River sockeye salmon in 2006. Prepared by Stock Assessment Division, DFO Yukon for the Pacific Salmon Commission, Northern Fund.

Waugh, B. and S. Stark. 2008c. Population estimate for Alsek River chinook salmon in 2007. Prepared by Stock Assessment Division, DFO Yukon for the Pacific Salmon Commission, Northern Fund.

Table 1. Variable definitions.

Variable	Definition
a_0	intercept coefficient for the conversion of number sampled for GSI to effective sample size
a_1	Klucksshu proportion coefficient for the conversion of number sampled for GSI to effective sample size
$\widehat{E}_i$	estimate of aggregate escapement for week *i*
E_k	the weir count on the Klukshu River
$\widehat{E}_T$	estimate of aggregate escapement for the season
p_i	proportion of Klukshu stock in the GSI sample in week *i*
S_i	standard deviation of the Klukshu stock proportion in week *i*
n_i	sample size for GSI taken in week i
n	sample size for GSI taken during the season
n_w	number of fish taken by the Dry Bay test fishery during the season
v_i	standardized Klukshu run distribution at the fishery in week *i*
w_i	weight of the system run at the fishery in week *i* (the catch rate of the Dry Bay test fishery)
w_i^*	standardized aggregate run distribution at the fishery in week *i*
z_α	standard normal deviate at α confidence level

Table 2. Coefficients for converting number sampled for GSI to effective sample size for sockeye and Chinook salmon.

	Data	a_0		a_1	
Species	**Points**	**Est.**	**P-level**	**Est.**	**P-level**
Sockeye	9	0.253	0.003	1.677	0.002
Chinook	4	0.342	0.005	-0.005	0.931

Table 3. Alsek sample size requirement using the 2005 sockeye study to obtain precision that refects the 2005 sample size.

Required input values are in **red font**

Output of required GSI sample using the "EstSample" macro in **blue font**

Week	Run Weight	Kluckshu Prop.	Run Standard	Escape	Required Sample	Effective Sample	SD Prop	SD wp	SD Escape
1	**34.69**	**0.005**	0.075	4,351	28	7.2	0.026	0.002	1,379
2	**55.37**	**0.001**	0.120	6,943	44	11.2	0.007	0.001	2,200
3	**46.29**	**0.001**	0.100	5,805	37	9.4	0.010	0.001	1,839
4	**85.25**	**0.024**	0.185	10,691	68	20.0	0.034	0.006	3,388
5	**67.00**	**0.065**	0.145	8,402	54	19.4	0.056	0.008	2,663
6	**93.60**	**0.106**	0.203	11,738	75	32.2	0.054	0.011	3,720
7	**64.38**	**0.111**	0.140	8,073	51	22.6	0.066	0.009	2,558
8	**14.46**	**0.220**	0.031	1,813	12	7.2	0.155	0.005	575
Total	461.03		1.000	57,817	**368**			0.018	18,322

Kluckshu Escape	**3373**						**Confidenence Interval**	
Desired Confidence	**95%**			% Sample =	0.6%		**Low**	**High**
Desired Precision	**62.1%**			Precision =	62.1%			
Effect. Sample Coeff.	**0.253**	**1.677**					21,907	93,727

col: 1	col: 2	col: 3	col: 4	col: 5	col: 6	col: 7	col: 8	col: 9	col: 10

Table 4. Alsek sample size requirement using the 2006 sockeye study to obtain precision that refects the 2006 sample size.

Required input values are in **red font**

Output of required GSI sample using the "EstSample" macro in **blue font**

Week	Run Weight	Kluckshu Prop.	Run Standard	Escape	Required Sample	Effective Sample	SD Prop	SD wp	SD Escape
1	42.62	0.023	0.118	5,784	62	18.0	0.035	0.004	463
2	70.38	0.277	0.195	9,552	102	73.1	0.052	0.010	764
3	86.08	0.306	0.239	11,683	125	95.5	0.047	0.011	935
4	132.91	0.334	0.369	18,039	192	156.4	0.038	0.014	1,443
5	28.32	0.280	0.079	3,844	41	29.6	0.083	0.006	307
6	0.00	0.000	0.000	0	0	0.0	0.000	0.000	0
7	0.00	0.000	0.000	0	0	0.0	0.000	0.000	0
8	0.00	0.000	0.000	0	0	0.0	0.000	0.000	0
Total	360.31		1.000	48,901	522			0.022	3,912

Kluckshu Escape	13455						Confidenence Interval	
Desired Confidence	95%			% Sample =	1.1%		Low	High
Desired Precision	15.7%			Precision =	15.7%			
Effect. Sample Coeff.	0.253	1.677					41,234	56,569

col: 1	col: 2	col: 3	col: 4	col: 5	col: 6	col: 7	col: 8	col: 9	col: 10

Table 5. Alsek sample size requirement using the 2007 Chinook study to obtain precision that refects the 2007 sample size.

Required input values are in **red font**

Output of required GSI sample using the "EstSample" macro in **blue font**

Week	Run Weight	Kluckshu Prop.	Run Standard	Escape	Required Sample	Effective Sample	SD Prop	SD wp	SD Escape
1	0.101	0.518	0.101	179	35	12.0	0.144	0.015	20
2	0.299	0.440	0.299	529	104	35.4	0.083	0.025	60
3	0.399	0.264	0.399	706	138	47.2	0.064	0.026	81
4	0.201	0.464	0.201	356	70	23.8	0.102	0.021	41
5	0.000	0.000	0.000	0	0	0.0	0.000	0.000	0
6	0.000	0.000	0.000	0	0	0.0	0.000	0.000	0
7	0.000	0.000	0.000	0	0	0.0	0.000	0.000	0
8	0.000	0.000	0.000	0	0	0.0	0.000	0.000	0
Total	1.000		1.000	1,770	346			0.044	202

Kluckshu Escape		677						**Confidenence Interval**	
Desired Confidence		95%			% Sample =	19.6%		**Low**	**High**
Desired Precision		22.4%			Precision =	22.4%			
Effect. Sample Coeff.		0.342	0					1,373	2,166
col: 1	col: 2	col: 3	col: 4	col: 5	col: 6	col: 7	col: 8	col: 9	col: 10

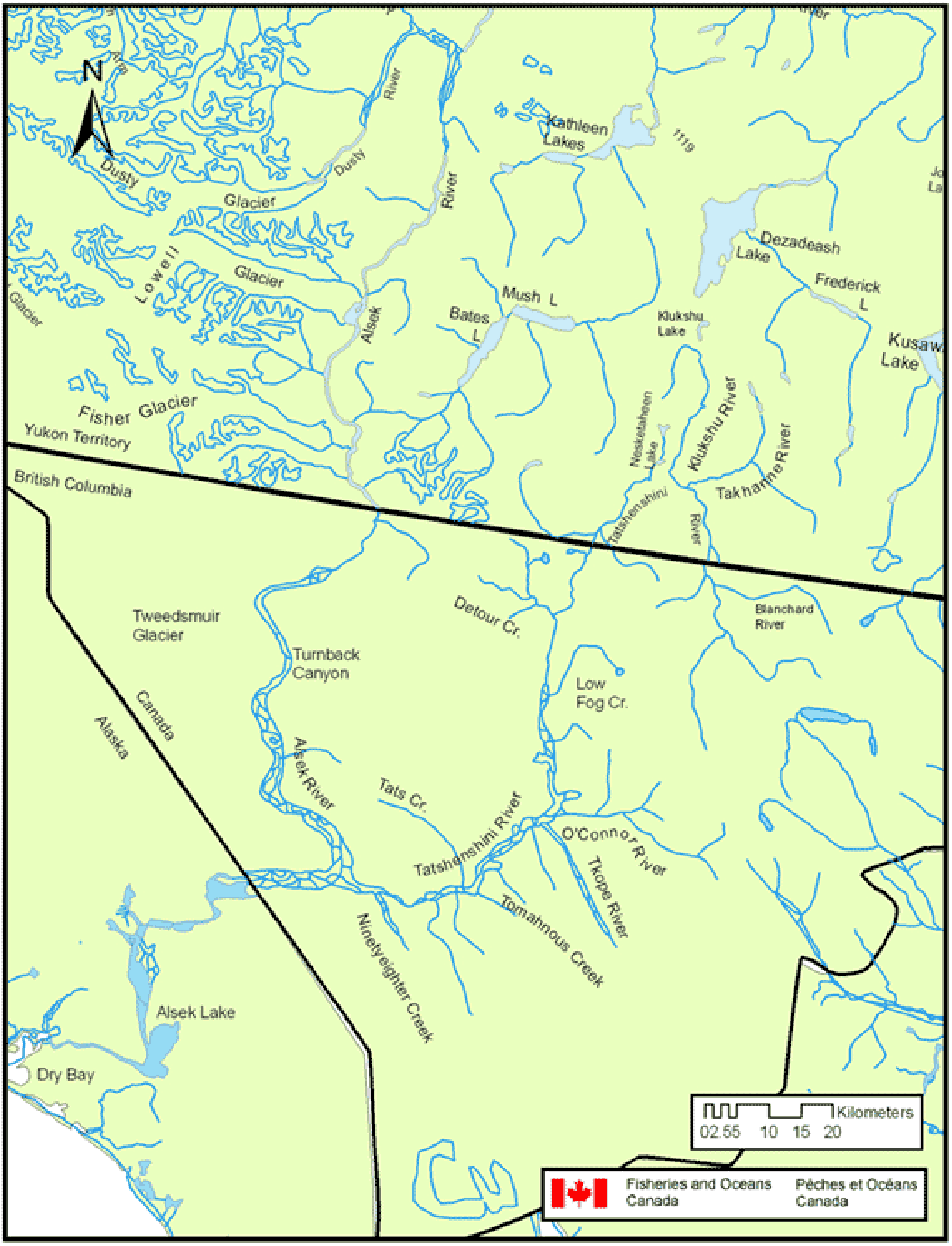

Figure 1. Alsek drainage map.

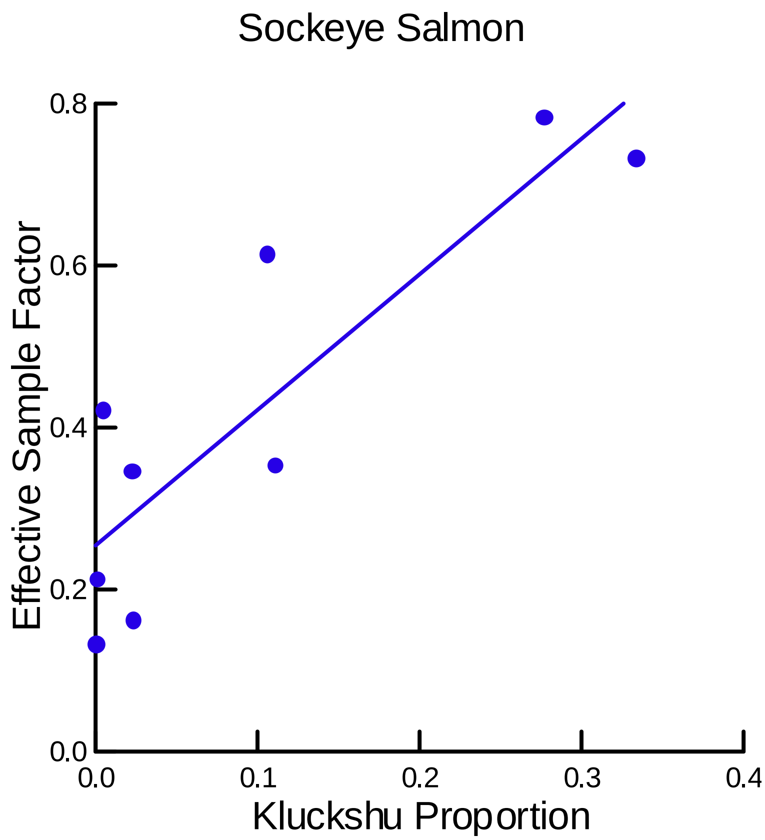

Figure 2. Regression of weekly Kluckshu stock proportion on effective sample factor for sockeye salmon (2005 and 2006 studies combined).

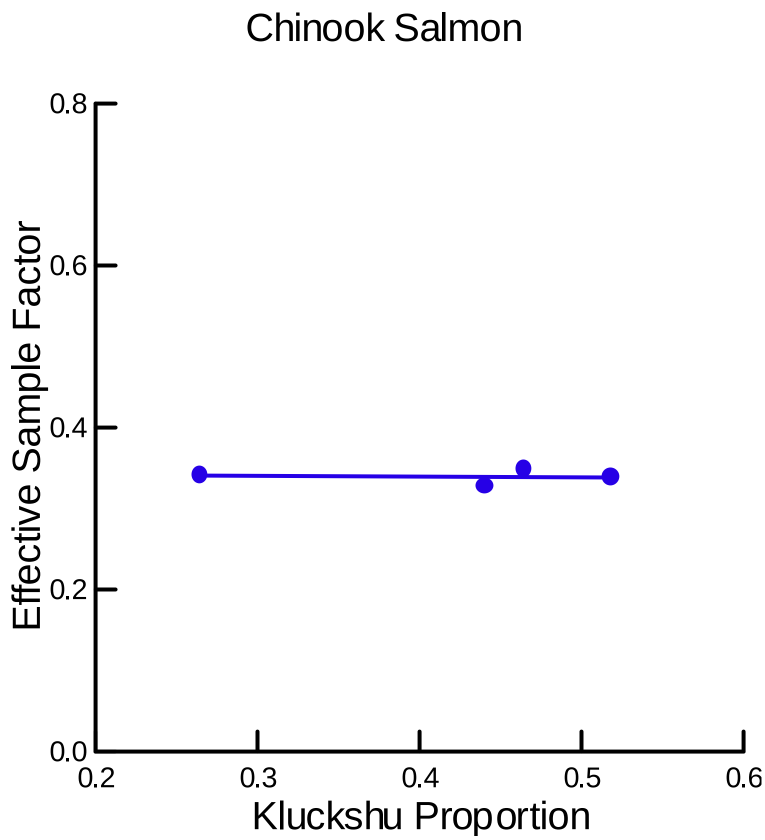

Figure 3. Regression of weekly Kluckshu stock proportion on effective sample factor for Chinook salmon (2007 Study).

APPENDIX A – Program Listing for Macro EstSample

```
'GSI Size Requirements for In-river Run Reconstruction of Alsek River Chinook and Sockeye Stocks

'Code version 1.0 dated April 6, 2010 by
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'Victoria, BC  V8X 4R1
'Tel: 250-727-6992
'Email: bill@gazey.com

Const nweeks = 8    'number of weeks that Kluckshu is in the fishery
Dim p(nweeks)       'proportion of Kluckshu by week in the fishery
Dim w(nweeks)       'weight of run by week (on input does not need to sum to 1)
Dim ecoef(2)        'effective sample size coefficients using linear function (1=constant, 2=coefficient for proportion)

Sub EstSample()

'activate the input/output worksheet
Worksheets("EstSample").Activate

'read in run weights and Kluckshu proportion
sumw = 0
With Range("prop")
   For i = 1 To nweeks
      w(i) = .Cells(i, 1)
      sumw = sumw + w(i)
      p(i) = .Cells(i, 2)
   Next i
End With

'read in the controls
With Range("control")
   KluckEsc = .Cells(1, 1)
   conf = .Cells(2, 1)
   prec = .Cells(3, 1)
   ecoef(1) = .Cells(4, 1)
   ecoef(2) = .Cells(4, 2)
End With

'standardize the run weights to probabilities (sum to 1)
For i = 1 To nweeks
   w(i) = w(i) / sumw
```

```
Next i

'product sum of run and Kluckshu proportions (wp)
sumwp = 0
For i = 1 To nweeks
    sumwp = sumwp + w(i) * p(i)
Next i

'total escapement estimate
TotalEsc = KluckEsc / sumwp

'target standard deviation
alpha = (1 - conf) / 2 + conf
z = WorksheetFunction.NormSInv(alpha)
s = TotalEsc * prec / z

'interim sum (variance for wp when divided by effective sample size correction)
varwp = 0
For i = 1 To nweeks
    temp = w(i) * p(i) * (1 - p(i))
    correct = ecoef(1) + ecoef(2) * p(i)
    If correct > 1# Then correct = 1#      'effective sample size can't get bigger
    varwp = varwp + temp / correct
Next i

'required sample size
Range("GSI") = (TotalEsc / sumwp / s) ^ 2 * varwp

End Sub
```

APPENDIX B – FINANCIAL SUMMARY

Project Budget Form

Name of Project: ____________________

ELIGIBLE COSTS	TOTAL BUDGET	OTHER FUNDING	PSC N. FUND GRANT AMOUNT

Labour

Wages & Salaries

Position	# of crew	# of work days	hrs per day	rate per hour	Total (In-kind & cash + PSC Amount)	In-Kind & Cash	PSC Amount
Senior Fisheries Technician (DFO)	1	5	7.5	48.55	1,821	1,821	
Senior Fisheries Biologist (DFO)	1	2	7.5	55.49	832	832	
Person Days (# of crew x work days)				sub total	2,653	2,653	

Labour - Employer Costs (percent of wages subtotal amount)

	rate	0%		sub total			

Subcontractors & Consultants	# of crew	# of work days	hrs per day	rate per hour			
W.J. Gazey	1	13.7	8	86.88	9,522		9,522
Insurance if applicable	rate	0%					
				sub total	9,522		9,522

Volunteer Labour	# of crew	# of work days	hrs per day				
Skilled							
Un-skilled							
Insurance if applicable	rate	0%					
				sub total			

Total Labour Costs	12,175	2,653	9,522

Site / Project Costs	Detail (use additional page for details if needed)			
Travel (do not include to & from work)				
Small Tools & Equipment				
Site Supplies & Materials				
Equipment Rental				
Work & Safety Gear				
Repairs & Maintenace				
Permits				
Technical Monitoring				
Other site costs				
	Total Site / Project Costs			

ELIGIBLE COSTS				BUDGET	OTHER FUNDING	CONTRIBUTION FUNDING
Training (e.g Swiftwater, bear aware, electrofishing, etc).				Total (PSC + In-kind + cash)	In-Kind & Cash	PSC Amount
Name of course	# of crew	# of days				
			Total Training Costs			

Overhead / Indirect Costs (not to exceed 20% of PSC Amount)		Total (PSC + In-kind + cash)	In-Kind & Cash	PSC Amount
Office space; including utilities, etc.				
Insurance				
Office supplies				
Telephone & long Distance				
Photocopies & printing				
Other overhead costs GST		476		
	Total Overhead Costs	476		476

Capital Costs / Assets **Detail (use additional page for details if needed)**

Assets are things of value that have an initial cost of $250 CAN or more and which can be readily misappropriated for personal use or gain or which are not, or will not be, fully consumed during the term of the project.

Capital Costs / Assets	Detail	Total (PSC + In-kind + cash)	In-Kind & Cash	PSC Amount
	Total Capital Costs			
	Project Total Costs	12,651	2,653	9,998

Budget Summary

(PSC + in-kind + cash)

Total Labour Costs	12,175
Total Site / Project Costs	
Total Training Costs	
Total Overhead Costs	476
Total Capital Costs	
Project Total	12,651