2014 Alsek Sockeye Salmon Run Reconstruction Using Genetic Stock Identification

(A project funded through the Northern Fund of the Pacific Salmon Commission)

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TABLE OF CONTENTS

List of Figures

List of Appendices

Introduction

The Alsek River originates in the Yukon Territory, Canada, and flows in a southerly direction into the Gulf of Alaska, southeast of Yakutat, Alaska (Figure 1). Alsek River sockeye salmon (*Oncorhynchus nerka*) are caught primarily in U.S. commercial and subsistence set gillnet fisheries in the lower Alsek River and in aboriginal and recreational fisheries in Canada. Small harvests of Alsek sockeye are probably taken in marine commercial gillnet fisheries near Yakutat. These populations are managed jointly by Canada and the U.S. through a sub-committee of the Pacific Salmon Commission (PSC) as part of the Canada/U.S. Pacific Salmon Treaty (PST) adopted in 1985 (TTC 1999). Historically, the status of sockeye salmon has been evaluated by monitoring escapement trends of what were assumed to be two principal sockeye stocks within the drainage: Klukshu River and Nesketaheen Lake sockeye salmon.

Prior to 2000, the Alsek River sockeye salmon return was largely unknown (a mark-recapture study was conducted in 1983 by ADF&G) because stock assessment projects to determine system-wide escapements had not yet been fully developed. Escapements were known only for the Klukshu River. An escapement goal was originally developed for the Klukshu River in 2000 but very little else was known about the magnitude of run sizes and system wide production capacity. In 2000, a pilot project was initiated to determine the feasibility of assessing the drainage wide escapement for sockeye salmon using mark-recapture. After achieving the objectives of the 2000 study, the program was continued from 2001 through to 2004. Since then, the other assessments of the total sockeye return to the Alsek were made from 2005 to 2006 and 2011 to 2014 using genetic stock identification (GSI). A revised escapement goal for Klukshu and a system wide goal for the Alsek was adopted in 2013.

Since 1976, weir counts by the Fisheries and Oceans Canada (DFO) in co-operation with the Champagne-Aishihik First Nation (CAFN) have been made on the Klukshu River. Recently, sockeye salmon weir counts at Klukshu, in conjunction with sockeye catch rate information from the commercial fishery at Dry Bay plus GSI of tissue samples taken in the Dry Bay commercial fishery, were used to estimate the Alsek sockeye population in 2005 and 2006 (Waugh and Stark 2008a&b). The results were encouraging; a project recommendation was made by the Northern Fund Committee (PSC) in 2008 to develop a sampling strategy (statistically valid) which would include methods of calculations and the precision expected based on various sample sizes and stock contribution levels for the apportionment of Alsek sockeye abundance into the requisite stocks (i.e. Klukshu and others) which, in conjunction with the Klukshu weir counts, would provide the foundation for reconstructing the sockeye return to the Alsek River. The project was completed by W. J. Gazey Research with funding from the Northern Fund ("*GSI Sample Size Requirements for In-river Run Reconstruction of Alsek Chinook and Sockeye Stocks, W. J. Gazey, April 2010"*). Gazey's analysis provided a model with which to determine the required sample sizes needed to reconstruct the Alsek sockeye returns to achieve a desired precision at a prescribed confidence level.

The 2009-2018 Transboundary chapter of the Pacific Salmon Treaty (PST) tasked the Parties and the Transboundary Technical Committee (TTC) to explore methods to determine in-river abundance for Alsek sockeye salmon. Further, the Transboundary Panel, as noted in the "*Pacific Salmon Commission Transboundary Panel Strategic Salmon Plan, March 2009*", has committed to develop and implement abundance-based management regimes for Alsek River sockeye which includes estimates of total abundance. The project proposed for 2014 was designed to meet the objectives set out in the PST and the Panel's strategic salmon plan. Subsequently, funding was

secured through the Northern Fund of the Pacific Salmon Commission to analyze tissue samples collected from the U.S. commercial fishery in Dry Bay for the purpose of reconstructing the 2014 Alsek sockeye salmon return.

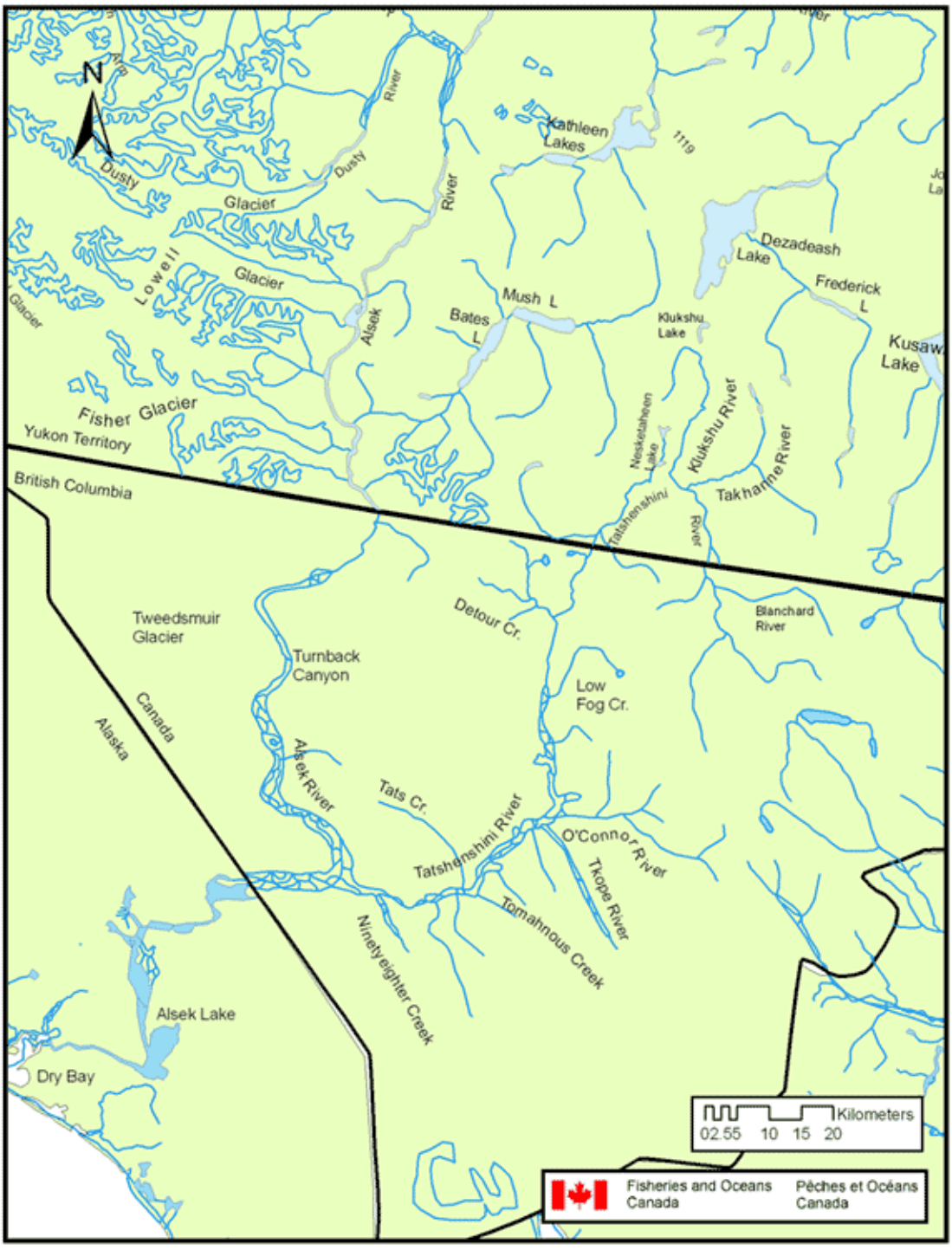

Figure 1. Alsek River drainage map.

Objectives

The following objectives are expected to be achieved from the collection and analysis of sockeye salmon tissue samples taken in the U.S. Dry Bay commercial fishery for 2014:

- Collection of fishery performance data and tissue samples (up to 750) from the Alsek sockeye salmon commercial fishery (Dry Bay, Alaska);
- GSI analysis of tissue samples collected in the Dry Bay commercial fishery;
- Run reconstruction of the 2014 Alsek sockeye return at the desired precision (25%) within a 95% confidence level;
- Assessment of the Klukshu River sockeye salmon contribution to the drainage wide escapement within the Alsek River.

Methodology

DNA Collection and Analysis

Approximately 750 Alsek River sockeye salmon tissue samples (severed axillary appendages) were to be collected from the 2014 U.S. commercial fishery catch located in Dry Bay, Alaska from the beginning of June to the middle of August. The samples were to be sent to Terry Beacham (DFO Salmon Genetics Laboratory) for GSI analysis to develop weekly contributions of Klukshu River and other sockeye stocks to the commercial sockeye catch. The DNA analysis was to be conducted as per Withler et al (2000).

Run Reconstruction

Run reconstruction methodology was to be followed using the model detailed in "*GSI Sample Size Requirements for In-river Run Reconstruction of Alsek Chinook and Sockeye Stocks, W.J. Gazey, April 2010"*. Sockeye salmon weir counts at Klukshu, in conjunction with sockeye catch rate information from the commercial fishery at Dry Bay and GSI of tissue samples taken in the Dry Bay commercial fishery, were to be used to estimate the 2014 Alsek River sockeye salmon population.

Results

DNA Collection and Analysis

A total of 663 sockeye tissue samples (axillary appendages) from the Dry Bay commercial fishery were received from the Alaska Department of Fish and Game and shipped to Terry Beacham (DFO – Genetics Lab) for analysis in the fall of 2014. A total of 599 samples were analyzed and results were received from the DFO genetics lab in January of 2015. Sample analysis was roughly apportioned based on the run timing observed during the 2014 U.S. commercial sockeye fishery. Samples were collected beginning in statistical week 23 (starting June 1st) and completed in week 32 (ending August 4th).

Run Reconstruction

The total Alsek sockeye run for 2014 was estimated to be 121,961 (above Dry Bay escapement plus the Dry Bay catches; Appendix 1). The above Dry Bay escapement was estimated to be 88,233 (95% CI = 69,508 – 106,958, SD = 9,554). This resulted in an estimated 28% harvest rate in the combined fisheries located in Dry Bay (catch = 33,668). The Klukshu stock contributed a total of 13,288 sockeye (approximately 15%) to the total Alsek sockeye escapement.

Discussion and Recommendations

As detailed in Gazey 2010, 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 Klukshu stock proportion. New baseline GSI data may alter or change the functional relationship (e.g., non-linear or non-stationary).

Literature Cited

Gazey, W. J. 2010. GSI Sample Size Requirements for In-river Run Reconstruction of Alsek Chinook and Sockeye Stocks. Pacific Salmon Commission, Vancouver, British Columbia.

Withler, R.E, Le, K.D., Nelson, R.J., Miller, K.M., and Beacham, T.D. 2000. Intact genetic structure and high levels of genetic diversity in bottlenecked sockeye salmon, Oncorhynchus nerka, populations of the Fraser River, British Columbia, Canada. Can.J. Fish. Aquatic Sci. 57: 1985–1998.

Appendices

Appendix 1. Population estimate for the 2014 Alsek sockeye salmon using GSI analysis and expansion of the Klukshu weir count. Model developed by W.J. Gazey Research, 2010.

GSI Run Reconstruction for the Alsek River - Sockeye 2014

Required input values are in **red font**

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

Week	Run Weight	Klukshu Prop.	Run Standard	Escapement Above Dry Bay	"Actual" Sample	Effective Sample	SD Prop	SD wp	SD Escape
1 (23)	**0.097**	**0.002**	0.097	8,584	80	20.5	0.009	0.001	929
2 (24)	**0.123**	**0.002**	0.123	10,889	74	18.9	0.010	0.001	1,179
3 (25)	**0.193**	**0.007**	0.193	17,046	76	20.1	0.019	0.004	1,846
4 (26)	**0.106**	**0.036**	0.106	9,351	100	31.3	0.033	0.004	1,013
5 (27-28)	**0.148**	**0.234**	0.148	13,060	75	48.4	0.061	0.009	1,414
6 (29)	**0.157**	**0.359**	0.157	13,810	80	68.4	0.058	0.009	1,495
7 (30-33)	**0.176**	**0.309**	0.176	15,491	114	87.9	0.049	0.009	1,677
Total	1.000		1.000	**88,233**	**599**			0.016	9,554

Klukshu Above Dry Bay	**13,288**			Confidence Interval
Desired Confidence	**95%**	% Sample =	0.7%	Low: 69,508
Desired Precision	**25%**	Precision =	21.2%	High: 106,958
Effect. Sample Coeff.	**0.253**	**1.677**		

Effective sample size coefficients based on 2005-2007 studies:

Sockeye	0.253	1.677
Chinook	0.342	-0.005

15.1% Klukshu comp.

Total Run: 121,961

Financial Summary

Project Budget Form

Name of Project: 2014 Alsek Sockeye Run Reconstruction Using GSI

ELIGIBLE COSTS					TOTAL PROJECT 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	Actual Expenditures	Variance
Project Authority (DFO Bi-4)	1	1	7.5	42	316	316			
Biologist (DFO Bi-3)	1	1	7.5	39	293	293			
Senior Technician (DFO EG-5)	1	10	7.5	35	2,618	2,618			
Financial Officer (DFO As-2)	1	1	7.5	30	225	225			
Fisheries Technician	1	10	7.5	32	2,400	2,400			
Person Days (# of crew x work days)		13		**sub total**	5,852	5,852			
Labour - Employer Costs (percent of wages subtotal amount)									
	rate	20%		**sub total**	1,170	1,170			
Subcontractors & Consultants	# of crew	# of work days	hrs per day	rate per hour					
Insurance if applicable	rate	0%							
				sub total					
Volunteer Labour	# of crew	# of work days	hrs per day						
Skilled									
Un-skilled									
Insurance if applicable	rate	0%							
				sub total					
			Total Labour Costs		7,022	7,022			
Site / Project Costs	**Provide details in the space below (use an additional page if needed)**								
Travel (do not include to & from work)									
Small Tools & Equipment									
Site Supplies & Materials	lab suples (to cover 500 samples)				12,750		12,750	12,750	-
Equipment Rental									
Work & Safety Gear									
Repairs & Maintenace									
Permits									
Technical Monitoring									
Other site costs									
			Total Site / Project Costs		12,750		12,750	12,750	-

Project Budget Form (continued)

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**	**Actual Expenditures**	**Variance**
Name of course	# of crew	# of days					
		Total Training Costs					
Overhead / Indirect Costs							
Office space; including utilities, etc.			800	800			
Insurance							
Office supplies			100	100			
Telephone & long Distance			100	100			
Photocopies & printing							
Indirect/overhead costs							
(If the PSC contribution to Indirect costs exceeds 20% of the total PSC grant							
you will be required to submit back-up documentation justifying the expense).							
Other overhead costs							
		Total Overhead Costs	1,000	1,000			
Capital Costs / Assets	**Provide details in the space below (use an additional page if needed)**						
Assets are things of value that have an initial cost of $250 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.							
		Total Capital Costs					
		Project Total Costs	20,772	8,022	12,750	12,750	-

Project Balance	12,750
Hold Back (not deposited)	1,275
Owed to DFO	1,275

Budget Summary
(PSC + in-kind + cash)

Total Labour Costs	7,022
Total Site / Project Costs	12,750
Total Training Costs	-
Total Overhead Costs	1,000
Total Capital Costs	-
Project Total	20,772