

2016 Alsek River Sockeye Salmon Run Reconstruction Using Genetic Stock Identification

Project NF-2016-NI-44

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October 2017

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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 likely taken in marine commercial gillnet fisheries near Yakutat.

Alsek sockeye populations are managed jointly by Canada and the United States (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 (PSC 2014). Prior to 2000, other than a mark-recapture study conducted in 1983 by Alaska Department of Fish and Game (ADF&G), Alsek River sockeye salmon returns were largely unknown because stock assessment projects to determine system-wide escapements had not yet been fully developed. The status of sockeye salmon was historically evaluated by monitoring escapement trends of what were assumed to be the two principal sockeye stocks within the drainage: Klukshu River and Nesketahen Lake sockeye salmon.

Escapements were only known for the Klukshu River, where weir counts by the Fisheries and Oceans Canada (DFO) in co-operation with the Champagne-Aishihik First Nation (CAFN) have been conducted since 1976. The first escapement goal for Klukshu River was developed in 2000, (Clark and Etherton 2000) but very little else was known about the magnitude of run sizes and system wide production capacity. Also 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, this program was continued from 2001 through to 2004.

Following that, in 2005 and 2006, assessments of the total sockeye return to the Alsek River were made using sockeye salmon weir counts at Klukshu, in conjunction with sockeye catch rate information from the commercial fishery at Dry Bay, plus genetic stock identification (GSI) of tissue samples taken in the Dry Bay commercial fishery, (Waugh and Stark 2008a&b). The results were encouraging, and in 2008 a project recommendation was made by the PSC Northern Fund Committee to develop a statistically valid sampling strategy 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). This sampling strategy, in conjunction with the Klukshu weir counts, would provide the foundation for reconstructing sockeye returns to the Alsek River. The project was completed by W. J. Gazey Research with funding from the Northern Fund and the final report titled ("*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 Gazey Model has been used since 2011 to provide Alsek River system-wide sockeye population estimates. A revised escapement goal for Klukshu River and an Alsek River system-wide escapement goal were adopted in 2013 (PSC 2015).

The 2009-2018 Transboundary chapter of the 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 of the PSC, 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. This 2016 project was designed to meet the objectives set out in the PST and the Panel’s strategic salmon plan and funding was secured through the Northern Fund of the PSC to analyze tissue samples collected from the U.S. commercial fishery in Dry Bay for the purpose of reconstructing the 2016 Alsek sockeye salmon return.

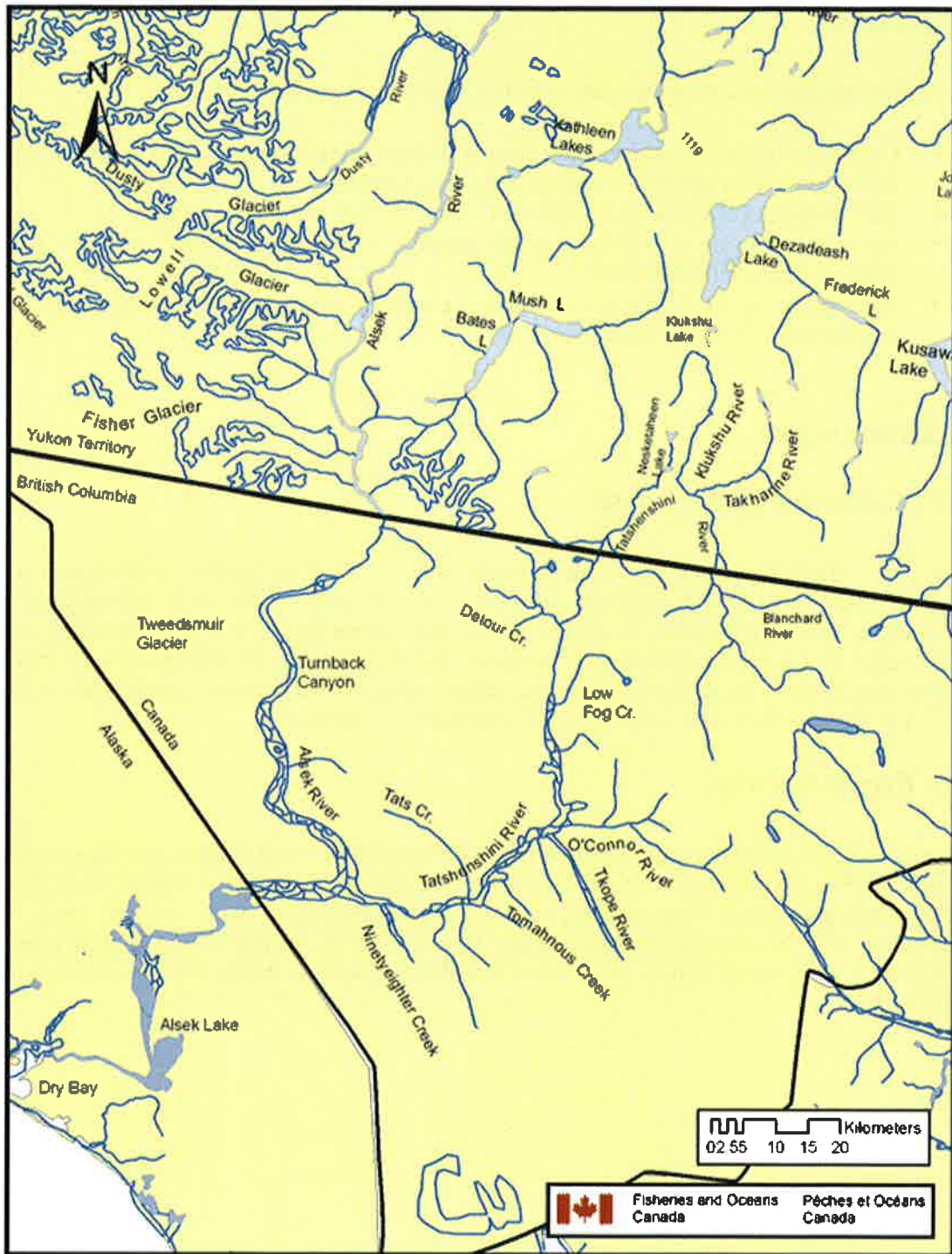


Figure 1. Alsek River drainage map.

Objectives

The following objectives were expected to be achieved by this project in 2016:

- 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 2016 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

Up to 750 Alsek River sockeye salmon tissue samples (severed axillary appendages) were collected from the 2016 U.S. commercial fishery catch located in Dry Bay, Alaska from the beginning of June to the middle of August. The samples were sent to Dr. Terry Beacham at the DFO Molecular Genetics Laboratory in Nanaimo, British Columbia for GSI analysis to develop weekly contributions of Klukshu River and other sockeye stocks to the commercial sockeye catch. The DNA analysis was conducted as per Withler et al (2000).

Run Reconstruction

Run reconstruction methodology followed 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 counts from the Klukshu weir, in conjunction with sockeye catch rate information from the commercial fishery at Dry Bay and GSI results from tissue samples taken in the Dry Bay commercial fishery, were used to estimate the 2016 Alsek River sockeye salmon population.

Results

DNA Collection and Analysis

A total of 611 sockeye tissue samples (axillary appendages) were collected from the Dry Bay commercial fishery by ADF&G (Table 1). Samples were collected beginning in statistical week 24 (starting 7 July) and completed in week 32 (ending 4 August), roughly apportioned based on the run timing observed during the 2016 U.S. commercial sockeye fishery. Samples were shipped to Dr. Terry Beacham at the DFO Molecular Genetics Laboratory in Nanaimo, British Columbia for analysis in the winter of 2016/17. All 611 samples were analyzed and results were received in March of 2017.

Table 1. Alesek River sockeye salmon commercial catch and GSI samples by a subset of key statistical weeks, Dry Bay, Alaska, 2016.

Stat Week	Sockeye Catch	Sockeye Samples Obtained	Sockeye Samples Analyzed
24	136	12	12
25	799	40	40
26	1067	80	80
27	809	80	80
28	1196	120	120
29	1161	79	79
30	365	80	80
31	684	80	80
32	284	40	40
Total	6,501	611	611

Run Reconstruction

The total Alesek River sockeye run for 2016 was estimated to be 66,465 (above Dry Bay escapement plus the Dry Bay catches; Appendix 1). The above Dry Bay escapement was estimated to be 59,651 (95% CI = 43,558 – 75,743, SD = 8,211). This translates to an estimated 10% harvest rate by the combined fisheries located in Dry Bay (catch = 6,814). The Klukshu stock contributed a total of 8,206 sockeye (approximately 14%) to Alesek River sockeye escapement.

Discussion

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 Kluksu stock proportion. New baseline GSI data may alter or change the functional relationship (e.g., non-linear or non-stationary).

Budget

As presented in the Financial Summary in Appendix 2, the total cost of the project was \$14,250 which was under the budgeted amount of \$15,000. The goal of 750 samples was not achieved in the Dry Bay fishery in 2016 with only 611 samples obtained. Of the total cost, expenditures of Northern Funds amounted to \$13,500, as the project reporting was not completed in a timely fashion and the 10% holdback was not received from Pacific Salmon Commission.

Literature Cited

Clark, J.H. and P. Etherton. 2000. Biological Escapement Goal for Kluksu River System Sockeye Salmon. Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau, Alaska. Regional Information Report No. 1J00-24.

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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 2016 Alsek River sockeye salmon using GSI analysis and expansion of the Klukshu River weir count. Model developed by W.J. Gazey Research, 2010.

GSI Run Reconstruction for the Alsek River - Sockeye 2016

Required input values are in red font

Week	Run Weight	Klukshu Prop.	Run Standard	Escapement Above Dry Bay	"Actual" Sample	Effective Sample	SD Prop	SD wp	SD Escape
24	0.025	0.004	0.025	1,498	12	3.1	0.034	0.001	206
25	0.101	0.002	0.101	6,052	40	10.2	0.013	0.001	833
26	0.145	0.011	0.145	8,620	80	21.8	0.023	0.003	1,187
27	0.137	0.145	0.137	8,170	80	39.7	0.056	0.008	1,125
28	0.202	0.101	0.202	12,078	120	50.8	0.042	0.009	1,662
29	0.214	0.248	0.214	12,790	79	52.9	0.059	0.013	1,761
30	0.093	0.228	0.093	5,529	80	50.9	0.059	0.005	761
31	0.077	0.243	0.077	4,605	80	52.9	0.059	0.005	634
32-44	0.005	0.396	0.005	309	40	36.6	0.081	0.000	43
Total	1.000		1.000	59,651	611			0.019	8,211

Klukshu Above Dry Bay	8,206								
Desired Confidence	95%					% Sample =	1.0%		Confidence Interval
Desired Precision	25%					Precision =	27.0%		Low High
Effect. Sample Coeff.	0.253	1.677						43,558	75,743

Effective sample size coefficients based on 2005-2007 studies:
 Sockeye 0.253 1.677
 Chinook 0.342 -0.005

13.8% Klukshu comp.

Total Run: 66,465

Appendix 2. Financial Summary

Fisheries and Oceans Canada - PSC Project Budget Financial Report

Name of Project and PSC#:

Alsek River Sockeye GSI Run Reconstruction, 2016 (NF-2016-NI44)

EXPENDITURES

Labour					
DFO Employee Salaries and Benefits					
Position	Expenditures		Approved Budget	Total Expenditure	Variance
DFO BI-2					
Fisheries Technician					
			\$ -		
Total Expended	\$ -	Total Budget	\$ -	\$ -	\$ -
Subcontractors & Consultants					
Contract	Contract Amount Expended		Approved Budget	Total Expenditure	Variance
Tahltan First Nation					
Air Charter					
Boat Charter					
Total Expended	\$ -	Total Budget	\$ -	\$ -	\$ -
Total Labour Summary			\$ -	\$ -	\$ -
Site / Project Costs					
Item	Amount Expended		Approved Budget	Total Expenditure	Variance
Travel					
Small Tools & Equipment					
Lab Supplies & Materials	\$ 14,250.00		\$ 15,000.00		
Equipment Rental					
Work & Safety Gear					
Repairs & Maintenance					
Permits					
Other costs					
Total Expended	\$ 14,250.00	Total Budget	\$ 15,000.00	\$ 14,250.00	\$ 750.00
Total Site / Project Summary			\$ 15,000.00	\$ 14,250.00	\$ 750.00
Training Costs					
Item	Amount Expended		Approved Budget	Total Expenditure	Variance
Name of course					
Total Expended	\$ -	Total Budget	\$ -	\$ -	\$ -
Total Training Summary			\$ -	\$ -	\$ -

Fisheries and Oceans Canada - PSC Project Budget Financial Report

Overhead / Indirect Costs					
Item	Amount Expended		Approved Budget	Total Expenditure	Variance
Office space, including utilities, etc.					
Insurance					
Office supplies					
Telephone & long Distance					
Photocopies & printing					
Indirect/overhead costs					
Administration and financial management					
(If the PSC contribution to indirect costs exceeds 20% of the total PSC grant submission of back-up documentation justifying the expense is required).					
Total Expended	\$ -		Total Budget	\$ -	
Total Overhead / Indirect Summary			\$ -	\$ -	\$ -

Capital Costs / Assets (Value > \$250.00)					
Item	Amount Expended		Approved Budget	Total Expenditure	Variance
Total Expended	\$ -		Total Budget	\$ -	
Total Capital Cost / Asset Summary			\$ -	\$ -	\$ -

Financial Report

Categories	Approved Budget (PSC Grant)	Project Expenditures	Variance
Labour	\$ -	\$ -	\$ -
Site / Project Costs	\$ 15,000.00	\$ 14,250.00	\$ 750.00
Training	\$ -	\$ -	\$ -
Overhead / Indirect Costs	\$ -	\$ -	\$ -
Capital Costs / Assets	\$ -	\$ -	\$ -
TOTAL	\$ 15,000.00	\$ 14,250.00	\$ 750.00

PST Project Funding Grant Advance Amount Received	\$ (13,500.00)
PST Project Funding Grant Amount Remaining to be Paid	
Difference Between Grant Amount and Project Expenditures	\$ (750.00)

Missed deadline - Not received

Project Manager Name Aaron Foo's

Project Manager Signature [Signature]

Date 06 March 2018

DFO Responsibility Center Manager Name [Signature]

DFO Responsibility Center Manager Signature [Signature]

Date Mar. 6/18