

# **2017 Alsek River Sockeye Salmon Run Reconstruction Using Genetic Stock Identification**

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DFO 57375

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## TABLE OF CONTENTS

List of Figures .....	ii
List of Appendices .....	ii
Introduction .....	3
Objectives .....	5
Methodology .....	5
DNA Collection and Analysis .....	5
Run Reconstruction .....	5
Results .....	5
DNA Collection and Analysis .....	5
Run Reconstruction .....	6
Discussion .....	6
Budget Summary .....	7
Acknowledgements .....	7
Literature Cited .....	7
Appendices .....	9

## LIST OF FIGURES

Figure 1. Alesek River drainage map .....	4
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## LIST OF APPENDICES

Appendix 1 Population estimate for the 2017 Alesek River sockeye salmon using GSI analysis and expansion of the Klukshu River weir count. Model developed by W.J. Gazey Research, 2010.....	10
Appendix 2. Financial Summary .....	11

## LIST OF TABLES

Table 1 Alesek River sockeye salmon commercial catch and GSI samples by statistical week, Dry Bay, Alaska, 2017. ....	6
Table 2 Alesek River sockeye salmon escapement, 2000–2006, 2012–2016 (PSC In Prep) .....	7

## Introduction

The Alsek River originates in the Yukon Territory, Canada, and flows in a southwesterly direction through British Columbia and 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. A limited number of Alsek sockeye are harvested in marine commercial gillnet fisheries near Yakutat.

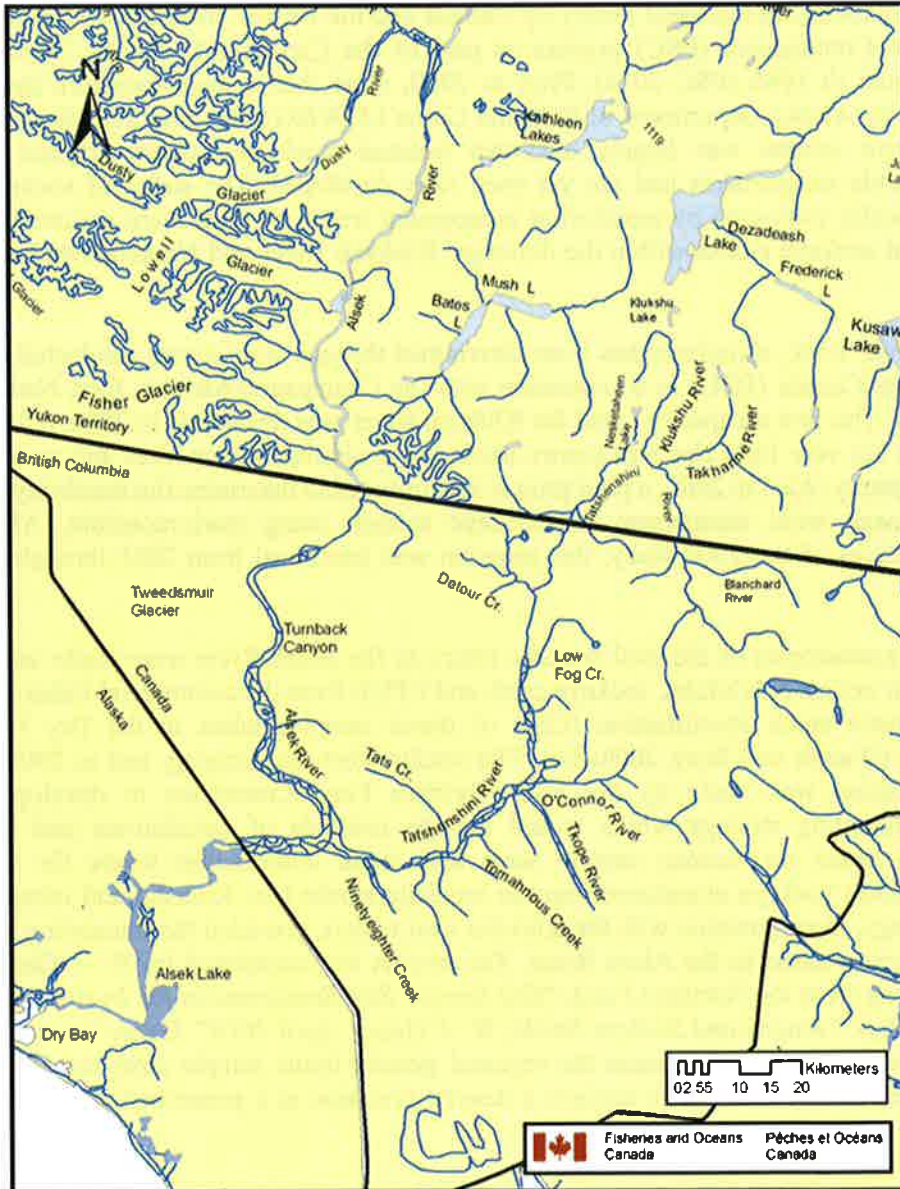
Alsek sockeye populations are managed jointly by Canada and the United States (U.S.) through the Pacific Salmon Commission (PSC) process as part of the Canada/U.S. Pacific Salmon Treaty (PST) adopted in 1985 (PSC 2014). Prior to 2000, other than a mark-recapture study conducted in 1983 by Alaska Department of Fish and Game (ADF&G), the total abundance of Alsek River sockeye salmon was 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.

For the Klukshu River stock, abundance has been determined through weir counts conducted by Fisheries and Oceans Canada (DFO) in co-operation with the Champagne-Aishihik First Nation (CAFN) 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.

In 2005 and 2006, assessments of the total sockeye return to the Alsek River were made using sockeye salmon weir counts at Klukshu, sockeye catch and CPUE 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, provided 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, "*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 genetic tissue 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 by DFO 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 recommended by the PSC and adopted by the U.S. and Canada 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 inriver abundance for Alsek sockeye salmon. Through the “*Pacific Salmon Commission Transboundary Panel Strategic Salmon Plan, March 2009*”, the PSC committed to develop and implement abundance based management regimes for Alsek River sockeye which includes estimates of total abundance. This 2017 project was designed to meet the objectives set out in the PST and the Transboundary Panel’s strategic salmon plan and funding was secured through the Northern Endowment Fund to analyze tissue samples collected from the U.S. commercial fishery in Dry Bay for the purpose of reconstructing the 2017 Alsek sockeye salmon return.



**Figure 1. Alsek River drainage map.**

## Objectives

The following objectives were expected to be achieved by this project in 2017:

- 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 2017 Alsek sockeye run 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*

A target of 750 Alsek River sockeye salmon tissue samples (severed axillary appendages) were collected in proportion to the run from the 2017 U.S. commercial fishery catch in Dry Bay, Alaska from the beginning of June to the middle of August. Samples were composited by statistical week and sent to be analyzed at the DFO Molecular Genetics Laboratory in Nanaimo, British Columbia. Genetic stock identification (GSI) was conducted as per Withler et al (2000) to determine the weekly genetic stock composition of the commercial sockeye catch, including the weekly proportion of Klukshu River stock.

### *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, sockeye catch and CPUE data 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 2017 run of Alsek River sockeye salmon.

## Results

### *DNA Collection and Analysis*

A total of 471 sockeye tissue samples (axillary appendages) were collected from the 2017 Dry Bay commercial fishery by ADF&G (Table 1). Samples were collected beginning in statistical week 23 (starting 4 June) and completed in week 31 (ending 5 August), apportioned based on the run timing observed during the 2017 U.S. commercial sockeye fishery. Note that no samples were collected in the last 10 weeks of the fishery as limited fishing activity occurred. Samples were shipped to the DFO Molecular Genetics Laboratory in Nanaimo, British Columbia for analysis in the winter of 2017/18. All 471 samples were analyzed and results were received in February of 2018.

**Table 1 Alsek River sockeye salmon commercial catch and GSI samples by statistical week, Dry Bay, Alaska, 2017.**

<b>Stat Week</b>	<b>Sockeye Catch</b>	<b>Sockeye Samples Obtained</b>	<b>Sockeye Samples Analyzed</b>
23	269	20	20
24	284	20	20
25	635	40	40
26	927	156	156
27	734	0	0
28	309	81	81
29	337	80	80
30	389	0	0
31	866	74	74
32-33	129	0	0
34-42	4	0	0
<b>Total</b>	<b>4,883</b>	<b>471</b>	<b>471</b>

### ***Run Reconstruction***

The terminal Alsek River sockeye run for 2017 was estimated to be 107,100 salmon. This is comprised of the estimated inriver run above the Dry Bay fishery of 102,186 (95% CI = 57,832 – 146,540), and the Dry Bay fishery harvest of 4,914 (Table 2 and Appendix 1). This translates to an estimated 5% harvest rate by the combined fisheries located in Dry Bay.

The Kluksu stock contributed a total of 4,355 sockeye (approximately 4.3%) to the 2017 Alsek River inriver run above the Dry Bay fishery.

### **Discussion**

The 2017 Alsek River inriver sockeye run was estimated above the recent six year average estimated using GSI methods, however 2017 was the one of the lowest stock proportions on record for the Kluksu stock at 4.3% (Table 2).

**Table 2 Alsek River sockeye salmon, 2000–2006, 2012–2016 (PSC In Prep)**

Year	Above Dry Bay	CI		Canadian Harvest	Spawning Escapement	U.S. Harvest	Total Terminal Run	Above Dy Bay
	Inriver Run Estimate	Lower	Upper					Percent Klukshu
2000	37,887	23,410	52,365	745	37,142	9,668	47,555	14.6%
2001	31,164	23,143	39,185	1,177	29,987	14,067	45,231	31.1%
2002	95,427	55,893	134,961	2,255	93,172	17,150	112,577	25.3%
2003	103,507	74,350	132,664	2,795	100,712	39,874	143,381	31.9%
2004	83,703	39,566	127,841	2,122	81,581	18,254	101,957	16.8%
2005	57,817	21,907	93,727	594	57,223	7,857	65,674	5.5%
2006	48,901	41,234	56,569	1,327	47,574	10,338	59,239	27.1%
2011	86,009	72,970	99,049	2,110	83,899	24,501	110,510	26.6%
2012	78,384	64,311	92,456	1,786	76,598	18,474	96,858	24.2%
2013	84,279	16,466	152,091	508	83,771	7,619	91,898	5.1%
2014	88,233	69,508	106,958	1,140	87,093	33,728	121,961	15.1%
2015	64,793	47,474	82,111	1,084	63,709	16,215	81,008	19.2%
2016	59,651	43,558	75,743	815	58,836	6,814	66,465	13.8%
2017	102,186	57,832	146,540	644	101,542	4,914	107,100	4.3%
Averages								
11-16	76,891			1,240	75,651	17,892	94,783	17.3%

The 2000-2004 estimates are based on a mark-recapture study and the 2005-2006 estimates was based on GSI analysis and the expansion of the Klukshu River weir count. The 2000-2004 estimates are based on a mark-recapture study; starting in 2005 estimates based on GSI analysis and the expansion of the Klukshu River weir count.

In 2017 we were unable to meet all of the project objectives. We fell short of the targeted 750 sockeye tissue samples (n=471) for genetic analysis due to a less active than usual Dry Bay commercial fishery, partially due to management actions taken in the sockeye fishery to address Chinook salmon conservation concerns. We were able to analyze all 471 samples, but the Alsek River sockeye return estimate did not achieve the desired 25% precision, coming in at 43%. This is likely due to the lower sample size in combination with the low proportion of Klukshu stock in the samples.

## Budget Summary

The Northern Endowment Fund allocation of \$15,750 was fully expended. The acceptance of this report by the Pacific Salmon Commission is intended to allow the release of the 10% holdback of allocated funds (\$1,575). A budget summary of expenditures can be referenced in Appendix 2.

## Acknowledgements

Nicole Zeiser of ADF&G was instrumental in this project by coordinating and collecting the samples in Dry Bay, Alaska, thank you to her as well as the ADF&G Genetics Lab for forwarding the samples. Much appreciation to John Candy and crew at the DFO Molecular Genetics Lab in Nanaimo, B.C. for processing the samples in a timely manner.

## Literature Cited

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## **Appendices**

Appendix 1 Population estimate for the 2017 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 2017**

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	Dry Bay Comm. Catch	Harvest Rate
23	0.051	0.006	0.051	5,254	20	5.3	0.034	0.002	1,164	269	0.05
24	0.054	0.006	0.054	5,547	20	5.3	0.035	0.002	1,228	284	0.05
25	0.121	0.002	0.121	12,402	40	10.2	0.013	0.002	2,747	635	0.05
26	0.195	0.017	0.195	19,916	156	44.0	0.020	0.004	4,411	927	0.04
27	0.171	0.041	0.171	17,521	0	0.0	0.000	0.000	3,880	734	0.04
28	0.072	0.065	0.072	7,376	81	29.3	0.045	0.003	1,634	309	0.04
29	0.071	0.186	0.071	7,240	80	45.2	0.058	0.004	1,603	337	0.04
30	0.068	0.125	0.068	6,964	0	0.0	0.000	0.000	1,542	389	0.05
31	0.182	0.025	0.182	18,605	74	21.9	0.034	0.006	4,120	866	0.04
32-44	0.013	0.025	0.013	1,361	0	0.0	0.000	0.000	301	133	0.09
Total	1.000		1.000	<b>102,186</b>	<b>471</b>			0.009	22,630	<b>4,883</b>	<b>0.05</b>

Klukshu Above Dry Bay	<b>4,355</b>		
Desired Confidence	95%	% Sample =	0.5%
Desired Precision	25%	Precision =	43.4%
Effect. Sample Coeff.	<b>0.253</b>		
		Confidence Interval	
		Low	57,832
		High	146,540

Effective sample size coefficients based on 2005-2007 studies:

Sockeye	0.253	1.677
Chinook	0.342	-0.005

4.3% Klukshu comp.

**Total Run: 107,100**

Appendix 2. Financial Summary

Fisheries and Oceans Canada - PSC Project Budget Financial Report

Name of Project and PSC#:

**Alsek River Sockeye GSI Run Reconstruction, 2017 (NF-2017-lxx)**

EXPENDITURES

<b>Labour</b>					
<b>DFO Employee Salaries and Benefits</b>					
Position	Expenditures		Approved Budget	Total Expenditure	Variance
DFO BI-2			\$ 2,700.00		
			\$ 540.00		
Fisheries Technician			\$ 1,200.00		
			\$ 240.00		
			\$ -		
			\$ -		
<b>Total Expended</b>	<b>\$ -</b>	<b>Total Budget</b>	<b>\$ 4,680.00</b>	<b>\$ -</b>	<b>\$ 4,680.00</b>
<b>Subcontractors &amp; Consultants</b>					
Contract	Contract Amount Expended		Approved Budget	Total Expenditure	Variance
Tahltan First Nation					
Air Charter					
Boat Charter					
<b>Total Expended</b>	<b>\$ -</b>	<b>Total Budget</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>
<b>Total Labour Summary</b>			<b>\$ 4,680.00</b>	<b>\$ -</b>	<b>\$ 4,680.00</b>
<b>Site / Project Costs</b>					
Item	Amount Expended		Approved Budget	Total Expenditure	Variance
Travel					
Small Tools & Equipment					
Lab Supplies & Materials	\$ 15,750.00		\$ 11,070.00		
Equipment Rental					
Work & Safety Gear					
Repairs & Maintenance					
Permits					
Other costs					
<b>Total Expended</b>	<b>\$ 15,750.00</b>	<b>Total Budget</b>	<b>\$ 11,070.00</b>	<b>\$ 15,750.00</b>	<b>\$ (4,680.00)</b>
<b>Total Site / Project Summary</b>			<b>\$ 11,070.00</b>	<b>\$ 15,750.00</b>	<b>\$ (4,680.00)</b>
<b>Training Costs</b>					
Item	Amount Expended		Approved Budget	Total Expenditure	Variance
Name of course					
<b>Total Expended</b>	<b>\$ -</b>	<b>Total Budget</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>
<b>Total Training Summary</b>			<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>

# 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)					
<b>Total Expended</b>	<b>\$ -</b>	<b>Total Budget</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>
<b>Total Overhead / Indirect Summary</b>			<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>

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

## Financial Report

Categories	Approved Budget (PSC Grant)	Project Expenditures	Variance
Labour	\$ 4,680.00	\$ -	\$ 4,680.00
Site / Project Costs	\$ 11,070.00	\$ 15,750.00	\$ (4,680.00)
Training	\$ -	\$ -	\$ -
Overhead / Indirect Costs	\$ -	\$ -	\$ -
Capital Costs / Assets	\$ -	\$ -	\$ -
<b>TOTAL</b>	<b>\$ 15,750.00</b>	<b>\$ 15,750.00</b>	<b>\$ -</b>

PST Project Funding Grant Advance Amount Received	\$ (14,175.00)
PST Project Funding Grant Amount Remaining to be Paid	\$ (1,575.00)
Difference Between Grant Amount and Project Expenditures	\$ -

Project Manager Name

Aaron Foss

Project Manager Signature

[Signature]

Date

06 March 2018

DFO Responsibility Center Manager Name

Bill White

DFO Responsibility Center Manager Signature

[Signature]

Date

Mar-6/18