

# **2018 Alsek River Sockeye Salmon Run Reconstruction Using Genetic Stock Identification**

Project NF-2018-I-14  
DFO CA #57375

Final Report  
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## 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 2019). 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 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 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 Alek 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 Alek 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 2018 Alek sockeye salmon return.

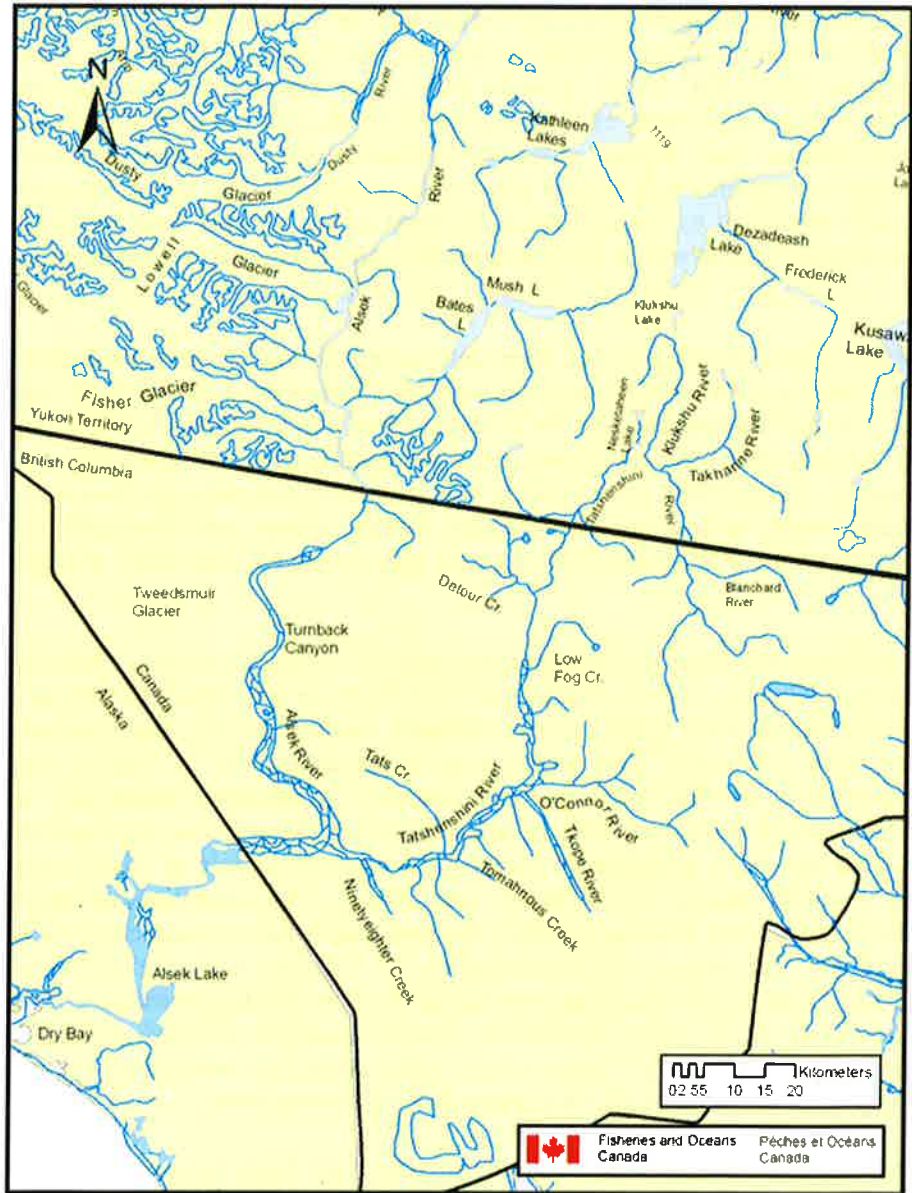


Figure 1. Alek River drainage map.

## Objectives

The following objectives were proposed for this project in 2018:

- 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 2018 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 to be collected in proportion to the run from the 2018 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 analyzed at the DFO Molecular Genetics Laboratory (MGL) 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 River, 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 2018 run of Alsek River sockeye salmon.

## Results

### *DNA Collection and Analysis*

There were significant restrictions placed on the U.S. Alsek River Dry Bay commercial sockeye fishery in 2018 due to salmon conservation concerns. The initial opening was delayed to SW 25 due to Chinook salmon concerns, and significantly reduced inseason due to low sockeye abundance. The directed sockeye fishery was only open for a total of 5.5 days in 2018, and the total harvest of 1,363 sockeye was 10% of average. In spite of the much reduced fishery, ADF&G samplers were able to collect a total of 330 sockeye tissue samples (axillary appendages) from the fishery (Table 1). Samples were collected beginning in statistical week 25 (starting 17 June) and completed in week 32 (ending 05 August), apportioned based on catch. Note that no samples were collected in SW 27 or SW 29, or in the last 9 weeks of the commercial fishery as limited fishing activity occurred. Samples were shipped to the DFO MGL in Nanaimo, British Columbia

for analysis in the winter of 2018/19. All 330 samples were analyzed and results were received in February of 2019.

**Table 1 Alsek River sockeye salmon commercial catch and GSI samples by statistical week, Dry Bay, Alaska, 2018.**

<b>Stat Week</b>	<b>Sockeye Catch</b>	<b>Sockeye Samples Obtained</b>	<b>Sockeye Samples Analyzed</b>
23			
24			
25	59	10	10
26	322	50	50
27			
28	397	120	120
29			
30	471	110	110
31	86	28	28
32	22	12	12
33-41	6		
<b>Total</b>	<b>1,363</b>	<b>330</b>	<b>330</b>

### ***Run Reconstruction***

The terminal Alsek River sockeye run for 2018 was estimated to be 21,381 salmon. This is comprised of the estimated inriver run above the Dry Bay fishery of 19,928 (95% CI = 17,086 – 22,770), and the Dry Bay fishery harvest of 1,453 (Table 2 and Appendix 1). This translates to an estimated 6.8% harvest rate by the combined fisheries located in Dry Bay.

The Klukshu stock contributed a total of 7,143 sockeye (approximately 35.8%) to the 2018 Alsek River inriver run above the Dry Bay fishery.

### **Discussion**

The 2018 Alsek River inriver sockeye run estimate was below the recent seven year average using GSI methods, however 2018 was the one of the highest stock proportions on record for the Klukshu stock at 35.8% (Table 2).

**Table 2 Alesk River sockeye salmon, 2000–2006, 2012–2018 (PSC, In Prep)**

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.

Year	Above border Run	CI		Canadian Harvest	Spawning Escapement	U.S. Harvest	Total Inriver Run	Spawning Escapement Percent Klukshu
	Estimate	Lower	Upper					
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	24.8%
2012	78,384	64,311	92,456	1,786	76,598	18,474	96,858	22.4%
2013	84,279	16,466	152,091	508	83,771	7,619	91,898	4.5%
2014	88,233	69,508	106,958	1,140	87,093	33,728	121,961	13.9%
2015	64,793	47,474	82,111	1,084	63,709	16,215	81,008	17.8%
2016	59,651	43,558	75,743	815	58,836	6,814	66,465	12.6%
2017	102,186	57,832	146,540	622	101,564	4,914	107,100	3.7%
2018	19,928	17,086	22,770	0	19,928	1,453	21,381	35.8%
Averages								
11-17	80,505			1,152	79,353	16,038	96,543	14.2%

In 2018 we were unable to fully meet all of the project objectives, but still conducted a successful project. We fell short of the targeted 750 sockeye tissue samples (n=330) for genetic analysis due to the restrictive Dry Bay commercial sockeye fishery, but were able to analyze all 330 samples, and the 2018 Alesk River sockeye run estimate did achieve the desired <25% precision at the 95% confidence level, coming in at 14.3%.

## Budget Summary

The Northern Endowment Fund allocation to DFO of \$15,750.00 was not fully expended. Total expenditures of NEF funds amounted to \$6,660.00 which is \$9,090.00 under budget. This is due to not obtaining the target number of genetic samples. The 10% holdback of \$1,575.00 is not required from the PSC, and once the final project report is accepted by the PSC, DFO will issue a refund of \$7,515.00 of unspent advance monies. 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 Sara Gilk-Baumer and the ADF&G Genetics Lab for forwarding the samples on to the DFO Molecular Genetics Lab (MGL) in Nanaimo, B.C.. Much appreciation to John Candy and crew at the MGL for processing the samples in a timely manner. Thanks to Kayla Mohns and Colleen Claggett for financial administrative support.

## Literature Cited

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## **Appendices**

Appendix 1 Population estimate for the 2018 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 2018**

Required input values are in red font  
 Output of required GSI sample using the "EstSample" macro in blue font

Week	Run <sup>1</sup> 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			0.000	0	0	0.0	0.000	0.000	0		
24			0.000	0	0	0.0	0.000	0.000	0		
25	0.029	0.232	0.029	568	10	6.4	0.167	0.005	41	59	0.09
26	0.156	0.108	0.156	3,102	50	21.7	0.067	0.010	226	322	0.09
27			0.000	0	0	0.0	0.000	0.000	0		
28	0.432	0.484	0.432	8,604	120	127.8	0.044	0.019	626	397	0.04
29			0.000	0	0	0.0	0.000	0.000	0		
30	0.205	0.520	0.205	4,083	110	123.7	0.045	0.009	297	471	0.10
31	0.075	0.239	0.075	1,491	28	18.3	0.100	0.007	108	86	0.05
32	0.096	0.017	0.096	1,907	12	3.4	0.070	0.007	139	22	0.01
33-41	0.009		0.009	173	0	0.0	0.000	0.000	13	6	0.03
Total	1.000		0.991	19,928	330			0.026	1,450	1,363	0.06

Klukshu Above Dry Bay	<b>7,143</b>		
Desired Confidence	95%	% Sample =	1.7%
Desired Precision	25%	Precision =	14.3%
Effect. Sample Coeff.	0.253		1.677
Confidence Interval		Low	High
		17,086	22,770

Effective sample size coefficients based on 2005-2007 studies:

Sockeye	0.253	1.677
Chinook	0.342	-0.005

35.8% Klukshu comp.

**Total Run: 21,381**

Appendix 2. Financial Summary

Fisheries and Oceans Canada - PSC Project Budget Financial Report

Name of Project and PSC#:

**Alsek River Sockeye GSI Run Reconstruction, 2018 (NF-2018-I14)**

EXPENDITURES

Labour					
DFO Employee Salaries and Benefits					
Position	Expenditures		Approved Budget	Total Expenditure	Variance
<b>Total Expended</b>	<b>\$ -</b>	<b>Total Budget</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>
Subcontractors & Consultants					
Contract	Contract 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 Labour Summary</b>			<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>
Site / Project Costs					
Item	Amount Expended		Approved Budget	Total Expenditure	Variance
Travel					
Small Tools & Equipment					
Lab Supplies & Materials	\$ 6,660.00		\$ 15,750.00		
Equipment Rental					
Work & Safety Gear					
Repairs & Maintenance					
Permits					
Other costs					
<b>Total Expended</b>	<b>\$ 6,660.00</b>	<b>Total Budget</b>	<b>\$ 15,750.00</b>	<b>\$ 6,660.00</b>	<b>\$ 9,090.00</b>
<b>Total Site / Project Summary</b>			<b>\$ 15,750.00</b>	<b>\$ 6,660.00</b>	<b>\$ 9,090.00</b>
Training Costs					
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>Total Budget</b>	\$ -	\$ -	\$ -
<b>Total Overhead / Indirect Summary</b>			\$ -	\$ -	\$ -

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

## Financial Report

Categories	Approved Budget (PSC Grant)	Project Expenditures	Variance
Labour	\$ -	\$ -	\$ -
Site / Project Costs	\$ 15,750.00	\$ 6,660.00	\$ 9,090.00
Training	\$ -	\$ -	\$ -
Overhead / Indirect Costs	\$ -	\$ -	\$ -
Capital Costs / Assets	\$ -	\$ -	\$ -
<b>TOTAL</b>	<b>\$ 15,750.00</b>	<b>\$ 6,660.00</b>	<b>\$ 9,090.00</b>

<b>PST Project Funding Grant Advance Amount Received</b>	<b>\$ (14,175.00)</b>
<b>PST Project Funding Grant Amount Remaining to be Paid</b>	<b>\$ -</b>
<b>Difference Between Grant Amount and Project Expenditures</b>	<b>\$ 7,515.00</b>

Project Manager Name Aaron Foos

Project Manager Signature 

Date 04 April 2019

DFO Responsibility Center Manager Name William Waugh

DFO Responsibility Center Manager Signature 

Date April 4 / 19