

# Taku Sockeye Genetic Stock Identification (GSI) 2016 Collection, 2014 and 2015 Analysis

*(A study supported by the Northern Fund under the auspices of the Pacific Salmon Commission)*

PSC NF-2016-I-46  
Project DFO 57894

Final Report  
March 2017

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## Executive Summary

*This report documents the results of the Stock Composition of Taku Sockeye Inriver Fisheries project supported by the Northern Fund of the Pacific Salmon Commission.*

A total of \$57,180 Cdn of Northern Fund monies were used to carry out the collection of DNA samples from Taku River sockeye (*Oncorhynchus nerka*) fisheries in 2016 and conduct the DNA analysis from samples collected in 2014 and 2015. A total of 1,856 tissue samples were collected from sockeye salmon harvested in the Taku River commercial fishery between the dates of June 22 and September 24, 2016. The total number of samples obtained exceeded the minimum required by a substantial margin. There were 980 and 1,338 tissue samples analyzed that were collected in 2014 and 2015, respectively.

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# 1.0 Introduction

**Objective:** Collection of genetic stock identification samples (GSI) from Taku inriver commercial fisheries in 2016 and analysis of tissue samples from 2014 and 2015 for the following purpose and goals.

**Purpose:** Determination of reliable post-season estimates of the weekly stock compositions for sockeye salmon in the Taku inriver commercial fisheries.

**Goal:** Processing of DNA samples collected from sockeye salmon for microsatellite/major histocompatibility complex loci and possibly single nucleotide polymorphism (SNP) loci.

Improved inseason stock specific management of Transboundary River salmonids is required to meet stock specific spawning goals and harvest shares. The techniques available at this time for sockeye include scale pattern analysis (SPA) and brain parasite prevalence, each of which has significant drawbacks and has limited inseason utility. While this project will focus on collection of samples for post-season estimates of weekly stock compositions, the long term goal is to have inseason capability. In addition, improved stock composition estimates will permit the compilation of stock recruitment data which could be used to establish stock specific escapement targets.

This proposal addresses one of the top priorities of the Transboundary Panel for 2009 Northern Fund Proposals; namely “*projects that improve the in-season stock identification for Alsek, Stikine and Taku chinook and sockeye salmon*”. Although we are not yet at the point of conducting inseason stock identification, post season analysis of samples collected over time will provide insight into what stocks would be expected to be migrating through the fisheries at different times.

This proposal directly addresses the following strategic objective of the Northern Fund:

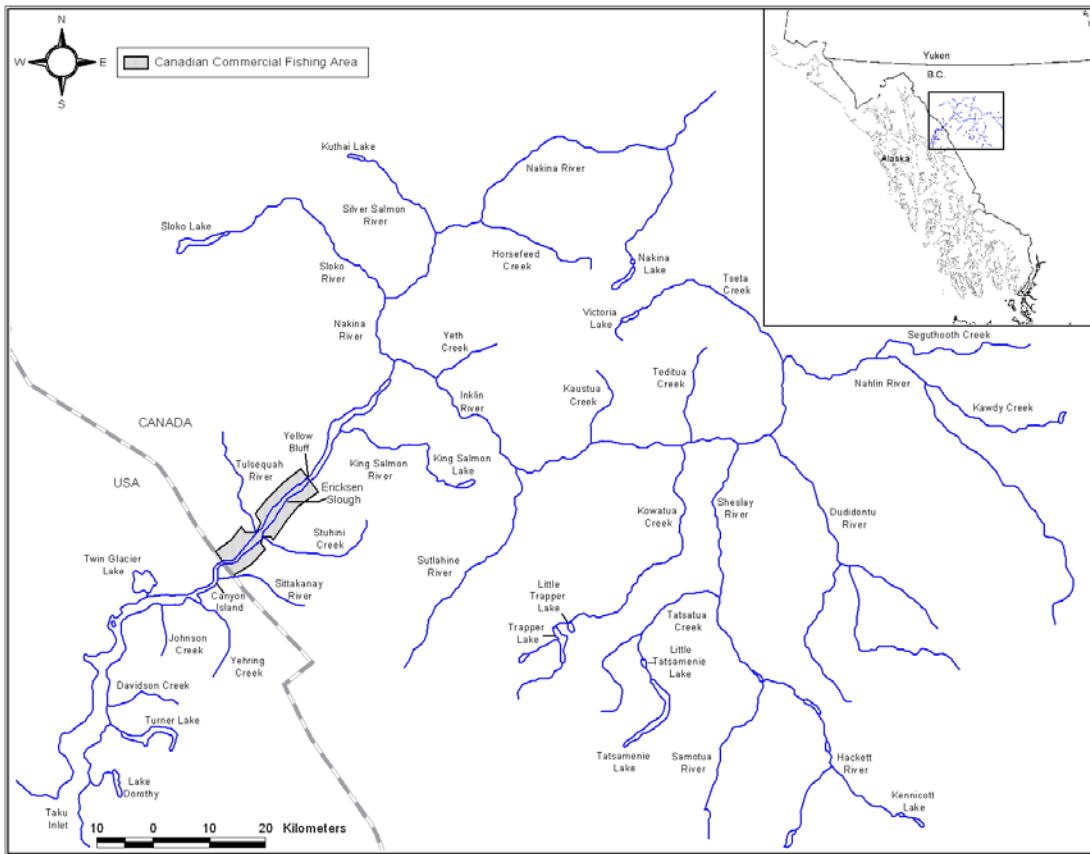
- “*improve the Parties ability to better manage the stocks and fisheries in the region (e.g. by developing methods to more accurately estimate inseason run sizes; to improve stock assessment capability; and to acquire the necessary information in a more timely fashion).*”;

**Detailed Objectives:** Collection of tissue samples from sockeye in order to determine stock compositions in Taku inriver commercial fisheries such that the estimated proportion of a given stock is accurate within 10%, 90% of the time.

The following stocks are of interest:

## **Taku sockeye**

1. Tatsamenie Lake
2. Taku Lakes Other
3. Taku River Type



**Figure 1. The Taku River drainage in British Columbia and Southeast Alaska.**

## 2.0 Methods

### Sampling

Following the sampling protocol developed by the Transboundary Technical Committee (see Pacific Salmon Commission report TCTR (07)-02), axillary appendages were excised from sockeye harvested in Taku inriver commercial fishery and preserved in alcohol. The following parameters were used in the selection of sample size to ensure an adequate sample was retained for the analysis:

*Probability of a Type 1 error (a): 0.05*

*Absolute Precision (p): +/- 0.125*

The current Transboundary Technical Committee standards are:

*Probability of a Type 1 error (a): 0.1*

*Absolute Precision (p): +/- 0.10*

The sample targets are sufficient for the revised standards on a bi-weekly basis. Attempts were made to exceed the targets.

**Table 1. Weekly sample targets.**

	<b>Number of stocks</b>	<b>Potential maximum weekly catch (N)<sup>1</sup></b>	<b>Minimum sample<sup>2</sup></b>	<b>Target sample (n)</b>
<b>Taku sockeye</b>	3	5,000	113	125

<sup>1</sup> Based on professional judgment and historic catches – note that requisite sample size (n) does not vary with population size (N) except in cases where there is a finite population correction i.e.  $n/N$  in greater than 0.1.

<sup>2</sup> Based on Tortora, R.D. 1978. A note on sample size estimation for multinomial populations. Amer. Statistician 32: 100-102.

Two field crews of two technicians each were involved in the sample collection on the Taku River beginning in early May. Sockeye sampling took place from the mid-June until mid-September. There were bi-weekly re-supply / crew change events for the duration of the project. On the Taku River, samples were obtained primarily from two landing stations, Cranberry and Mosquito Point. Samples were stored in ethyl alcohol, in 125 or 150 ml bottles with the required shipping and handling information. Samples are to be shipped to the Molecular Genetics Lab at the Pacific Biological Station for storage and eventual analysis.

#### Analysis

The analysis results was used to establish genetic profiles for all salmon included in the survey and to estimate weekly stock composition in the Taku in-river commercial fisheries in 2014 and 2015 such that the estimated proportion of a given stock is accurate within 10%, 90% of the time. This was based on 2-3 stock groupings as follows.

#### **Taku sockeye**

1. Tatsamenie Lake
2. Taku Lakes Other
  - Trapper, Kuthai, and King Salmon
3. Taku River Type
  - Mainstem

Tissue samples from approximately 113 sockeye for each week of the commercial fishery were processed for microsatellite markers using a DNA sequencer in the Molecular Genetics Laboratory (MGL) at the Pacific Biological Station in Nanaimo, British Columbia.

Primers for all microsatellites to be employed already exist, and thus were available to be applied to all samples. The number of fish surveyed for microsatellites was easily within the capacity of the PBS Molecular Genetics Laboratory (MGL) to attain. Laboratory management ensured that microsatellite analyses were completed in a timely manner. It was assumed that sufficient differentiation was available among baseline populations to enable mixed-stock analysis to be viable. The Molecular Genetics Lab at the Pacific Biological Station in Nanaimo has demonstrated in the literature that differentiation has been observed among baseline sockeye populations in the Taku River.

### 3.0 Results and Discussion

#### *Sockeye salmon tissue collection 2016*

Collection of tissue samples from sockeye salmon commenced on June 21, 2016 (statistical week 26) and concluded on September 6, 2016 (week 37) occurring over 12 weeks of fishing. A total of 1,856 tissue samples were obtained, amounting to 5% of the 37,302 sockeye caught (Table 2.). The goal of 113 samples was exceeded for each week of the directed sockeye fishery (weeks 26-33).

Sampling continued for four more weeks after the directed sockeye fishery closed (week 34, starting August 20) as sockeye were being landed as bycatch in the directed coho fishery. The goal of 125 samples was exceeded for each week (weeks 34-37).

The total number of samples obtained more than doubled the minimum anticipated (875, based on seven weeks of fishing).

**Table 2. Catches of sockeye salmon and associated tissue samples collected in the Taku River commercial fishery for 2016 by statistical week.**

	Stat Week	Sockeye Catch	Sockeye DNA Obtained
Test/assessment Chinook	19		
	20		
	21		
	22		
	23	1	1
	24	0	
	25	0	
Directed Sockeye	26	450	155
	27	2,014	150
	28	2,727	150
	29	3,462	150
	30	1,469	150
	31	3,689	150
	32	5,671	150
	33	6,384	150
Directed Coho	34	5,212	150
	35	3,538	150
	36	2,179	150
	37	497	150
	38	9	
	39		
	<b>Total</b>	<b>37,302</b>	<b>1,856</b>

The totals for tissue samples analyzed from sockeye salmon in the Taku River commercial fishery are summarized in Table 3 for 2014 and 2015. There were 980 and 1,338 samples analyzed in 2014 and 2015 respectively.

**Table 3. Catches of sockeye salmon and associated tissue samples analyzed in the Taku River commercial fishery in 2014 and 2015 by statistical week.**

	Stat Week	2014			2015		
		Sockeye Catch	Sockeye Samples Obtained	Sockeye Samples Analyzed	Sockeye Catch	Sockeye Samples Obtained	Sockeye Samples Analyzed
Test/assessment Chinook	19						
	20						
	21						
	22						
	23	3	1				
	24	0					
	25	1,215	200	91	6		
Directed Sockeye	26	1,495	200	88	653	200	111
	27	1,094	200	92	751	200	109
	28	2,311	200	107	586	200	108
	29	1,854	200	98	1,109	200	106
	30	3,163	200	106	3,317	200	101
	31	2,445	200	64	4,862	200	112
	32	2,799	200	111	1,598	200	133
	33	178	152	111	1,686	200	128
Directed Coho	34	600	200	112	1,622	200	111
	35	330	200		2,286	200	121
	36	148	139		1,161	200	198
	37	13	8		116	91	
Test Coho	38						
	39						
	<b>Total</b>	<b>17,648</b>	<b>2,299</b>	<b>980</b>	<b>19,753</b>	<b>2,291</b>	<b>1,338</b>

Weekly stock contributions for sockeye salmon in the Taku River commercial fishery are found in Table 4 for 2014 and Table 5 for 2015.

In 2014, mainstem sockeye (stocks other than the four lake stocks) comprised an average weekly contribution of 64.6%, followed by Taku Lakes other (29.0%) comprised of Trapper, Kuthai, and King Salmon and Tatsamenie (6.3%).

In 2015, mainstem sockeye (stocks other than the four lake stocks) comprised an average weekly contribution of 75.2%, followed by Taku Lakes other (23.2%) comprised of Trapper, Kuthai, and King Salmon and Tatsamenie (1.6%).



**Table 4. Weekly sockeye stock composition in the Taku River commercial fishery based on GSI, 2014.**

Statistical Week	Stock		
	Tatsamenie Lake	Taku Lakes Other Trapper, Kuthai, King Salmon	Taku River Mainstem
25	1.3%	67.8%	30.9%
26	0.2%	61.5%	38.3%
27	0.6%	68.8%	30.7%
28	11.3%	34.6%	54.1%
29	0.8%	25.7%	73.6%
30	1.2%	10.2%	88.6%
31	4.3%	3.5%	92.2%
32	12.2%	13.7%	74.1%
33	11.8%	3.9%	84.2%
34	19.7%	0.7%	79.6%
<b>Average</b>	<b>6.3%</b>	<b>29.0%</b>	<b>64.6%</b>

**Table 5. Weekly sockeye stock composition in the Taku River commercial fishery based on GSI, 2015.**

Statistical Week	Stock		
	Tatsamenie Lake	Taku Lakes Other Trapper, Kuthai, King Salmon	Taku River Mainstem
26	0.0%	38.0%	62.0%
27	0.3%	33.7%	66.0%
28	0.0%	48.3%	51.7%
29	0.1%	28.9%	71.0%
30	3.8%	31.7%	64.5%
31	1.0%	20.1%	78.8%
32	0.0%	24.9%	75.0%
33	0.6%	12.1%	87.3%
34	4.7%	10.9%	84.4%
35	1.7%	3.2%	95.1%
36-37	5.3%	3.0%	91.7%
<b>Average</b>	<b>1.6%</b>	<b>23.2%</b>	<b>75.2%</b>

## 4.0 Budget and Project Operations

Scheduling and operations went as planned.

As presented in Appendix A, the expenditure of Northern Funds amounted to \$57,180. The 10% holdback of \$5,718 is anticipated once the final project report is accepted by the Pacific Salmon Commission.

A summary of PSC Fund expenditures in relation to budgeted amounts is as follows:

<b>Description</b>	<b>Budget</b>	<b>Expenditure</b>	<b>Balance</b>
Labour Costs-Air Charter	7,680	7,560	120
Site/Project Costs	4,300	4,420	(120)
Training Costs	0	0	-
Overhead Costs	45,200	45,200	0
Capital Costs	0	0	-
<b>Grand Total</b>	<b>\$ 57,180</b>	<b>\$ 57,180</b>	<b>\$ 0</b>

## 5.0 Conclusion

The project objectives were achieved, with the number of tissue samples collected from sockeye salmon in 2016 on the Taku River was in excess of the minimum required.

Tissue samples collected from sockeye salmon in the Taku in-river fisheries were analyzed for GSI and weekly contributions by species and drainage for 2014 and 2015 were established. Fishery managers in both Canada and the U.S. will benefit by being able to identify the timing and exploitation rates of specific sockeye stocks through the Taku River. Improved management will benefit stakeholders in both Canada and the U.S. Although results from this project will be retrospective, they have the potential to continue to lay the groundwork for the use of genetic stock identification as an inseason management tool.

## 6.0 Acknowledgements

Kirstie Falkevitch, Tori Knutson, Mathieu Ducharme and Sean Stark of DFO conducted the fishery sampling supported by this funding. Individuals fishing commercially and/or for Taku Wild captured sockeye salmon. The Molecular Genetics Laboratory (MGL) at the Pacific Biological Station in Nanaimo, British Columbia conducted the tissue analysis. Colleen Claggett and Julie Bradford (DFO) assisted with the financial administration and accounting for this project.

## 7.0 Appendices



## **Appendix A: Financial Summary**

# Project Budget Form

**Name of Project:** Taku Sockeye GSI 2016

<b>ELIGIBLE COSTS</b>	<b>TOTAL BUDGET</b>	<b>OTHER FUNDING</b>	<b>PSC N. FUND GRANT AMOUNT</b>
<b>Labour Wages &amp; Salaries</b>			

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
DFO Stock Assessment Biologist Bi-3	1	3	7.5	45.00	1,013	1,013			-
DFO Stock Assessment Biologist Bi-2	1	6	7.5	36.00	1,620	1,620			-
DFO Fishery Technician EG-4	1	70	7.5	32.00	16,800	16,800			-
DFO Fishery Technician EG-3	1	70	7.5	29.00	15,225	15,225			-
									-
									-
									-
Person Days (# of crew x work days)					<b>sub total</b>	34,658			-

**Labour - Employer Costs ( percent of wages subtotal amount )**

rate	20%	<b>sub total</b>	6,932	6,932	-	-	-
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Subcontractors & Consultants	# of crew	# of work days	hrs per day	rate per hour	Total	In-Kind & Cash	PSC Amount	Actual Expenditures	Variance
Air charter		6	1.6	\$800	7,680		7,680	7,560	120
									-
									-
Insurance if applicable									-
									-
					<b>sub total</b>	-	7,680	7,560	120

Volunteer Labour	# of crew	# of work days	hrs per day	rate per hour	Total	In-Kind & Cash	PSC Amount	Actual Expenditures	Variance
Skilled									-
Un-skilled									-
Insurance if applicable									-
					<b>sub total</b>				-

<b>Total Labour Costs</b>	49,269	41,589	7,680	7,560	120
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**Site / Project Costs** Detail (use additional page for details if needed)

Travel (do not include to & from work)	vehicle fuel - Atlin; meals & incid.	3,922	3,922	-	-
Small Tools & Equipment					
Site Supplies & Materials	preservative, containers, provisions, etc	2,200		2,200	2,315 (115)
Equipment Rental					
Work & Safety Gear					
Repairs & Maintenance	boats, generators, communications equip, etc	1,100		1,100	1,300 (200)
Permits					
Technical Monitoring					
Other site costs	boat fuel (4 drums of fuel at \$250 ea)	1,000		1,000	805 195
	<b>Total Site / Project Costs</b>	8,222	3,922	4,300	4,420 (120)

**Project Budget Form (continued)**

ELIGIBLE COSTS				BUDGET	OTHER FUNDING	CONTRIBUTION FUNDING		
				Total (PSC + In-kind + cash)	In-Kind & Cash	PSC Amount	Actual Expenditures	Variance
<b>Training (e.g Swiftwater, bear aware, electrofishing, etc).</b>								
Name of course	# of crew	# of days						-
safety and health training	2	2	300	1,200	1,200		-	-
								-
								-
<b>Total Training Costs</b>				<b>1,200</b>	<b>1,200</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Overhead / Indirect Costs (not to exceed 20% of PSC Amount)</b>								
Office space; including utilities, etc.								-
Insurance								-
Office supplies				200	200			-
Telephone & long Distance				1,500	1,500			-
Photocopies & printing								-
Other overhead costs				45,200		45,200	45,200	-
								-
								-
<b>Total Overhead Costs</b>				<b>46,900</b>	<b>1,700</b>	<b>45,200</b>	<b>45,200</b>	<b>-</b>
<b>Capital Costs / Assets</b>				<b>Detail (use additional page for details if needed)</b>				
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.								
<b>Total Capital Costs</b>								-
<b>Project Total Costs</b>				<b>105,591</b>	<b>48,411</b>	<b>57,180</b>	<b>57,180</b>	<b>0</b>

**Budget Summary**

(PSC + in-kind + cash)		1st payment	\$ 51,462.00
		10% holdback	\$ 5,718.00
		<b>Total</b>	<b>\$ 57,180.00</b>
<b>Total Labour Costs</b>	Total		49,269
<b>Total Site / Project Costs</b>			8,222
<b>Total Training Costs</b>			1,200
<b>Total Overhead Costs</b>			46,900
<b>Total Capital Costs</b>			-
<b>Project Total</b>			<b>105,591</b>

## **Appendix B: Photographs**



Photograph 1. Drift gillnet fishing, transboundary river.



Photograph 3. Fish landing station, Taku River, from float plane.





Photograph 4. Landing fish, transboundary river.