Collection and Analysis of Yukon River DNA Baseline Samples in Alaska and Canada-Canadian Collections 2013

CRE-78-13

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Abstract

The goal of this project is to increase the accuracy and refinement of the genetic baselines for Chinook and fall chum salmon for the Yukon River. This is accomplished through the identification of locations either not represented or under-represented in the genetic baslines and the subsequent collection of tissue samples from salmon in these areas and providing the samples to the agencies for inclusion into their genetic baselines. Although sampling occurred in both the Alaskan and Canadian sections of the Yukon River in 2013, only the sampling conducted in the Canadian section of the river is included in this report. Low Chinook abundance in the Canadian section of the Yukon River and contracting delays resulted in cancelling of two sampling contracts. Chinook tissue collection did occur in conjunction with pre-existing DFO projects and another R&E project, the Mainstem Teslin River Sonar (CRE-01-13). In total 184 Chinook samples were collected, predominately from the Teslin Tributary. The low Chinook return allowed for an opportunity to sample fall chum. Collections include samples from the mainstem Yukon River, the mainstem Teslin River and Kluane Lake for a total of 448 fall chum tissue samples.

This year's objective of collecting 200 tissue samples was exceeded.

Introduction

Genetic Stock Identification (GSI) is used by researchers and fishery managers to identify the stock of origin, in mixed stock samples. The first step is to obtain a genetic baseline. Tissue (genetic) samples are obtained from each stock in a representative manner, with each stock being present. If stocks are missing or not adequately represented, the missing stock may be allocated to another stock during the GSI analysis.

GSI analysis requires a mixed stock sample, which can be obtained from any migration corridor that is not directly below a headwater spawning area. GSI will provide an estimate of each stock represented in the sample. This is particularly useful for fishery managers, and can be used to determine stock timing and stock status by using GSI estimates in conjunction with abundance estimates and presence/absence of stocks. This is currently done yearly at Pilot Station and Eagle Sonar. This technique is not limited to adult salmon and has been applied to studies on freshwater juveniles, smolts and ocean stages. There is even an example of GSI being used to identify illegally harvested salmon. Improving and maintaining the Yukon River Chinook and fall chum genetic baselines makes all of this possible.

Objectives

Objective 1: To collect baseline Chinook and chum samples in Canada with the priority being Chinook samples. Samples are collected to address baseline deficiencies which are deemed priorities by the Joint Technical Committee (JTC) Genetics Sub-Committee in conjunction with environmental conditions and logistical constraints and opportunities.

Objective 2: Inclusion of the samples into the existing ADF&G and DFO baselines.

Methods

Populations targeted for tissue samples were selected based on the Joint Technical Committee (JTC) Genetics Sub-Committee's priorities for Canada (Appendix A), in-season factors and logistical constraints and opportunities. In-season factors included water levels, turbidity, run abundance, weather and a narrow window of opportunity for sampling each stock.

Tissue samples were predominately collected from live fish or recently deceased (red gilled) fish to ensure DNA is usable. A portion of the right and left axillary appendage was removed from each fish sampled using guillotine clippers. Each axillary clip was placed in a labelled pair of sample vials containing 95% ethyl alcohol. The right and left axillary appendage from a single fish are kept paired so duplicate individuals are not assayed in any one baseline. The paired sample vials facilitates the sharing of all DNA samples between the U.S. and Canada's genetic laboratories. Tissue sample vials were labelled with collection location, date, fish number, and names of samplers. The collection of samples was generally conducted by consultants; their methods are described in greater detail in their attached reports (Appendix E, F & G). The proportion of ethyl alcohol to tissue ratio was at least 3:1 to ensure the preservation of the tissue. All samples were 'refreshed' with ethanol when submitted to DFO Whitehorse.

The tissue samples were submitted to DFO's genetics lab for processing and inclusion in the mircrosatellite baseline, with the second sample in the pair being submitted to ADF&G's genetics lab in December.

Results

Chinook

The focus of tissue collections was to be on Chinook salmon in 2013. However, the low run abundance resulted in a shift of focus to fall chum to ensure adequate cost benefit (number of samples to cost) and to avoid any added stress to an already poor Chinook salmon run. Some Chinook samples were collected in conjunction with other projects: DFO staff collected several samples while obtaining eggs for the Salmon Stewardship Coordinators for Yukon Schools (CRE-02-13) and also sampled the Nordenskiold River. Four tissue samples were collected from the Klondike River on August 1st (Appendix B), five samples from the Swift River, in the Teslin Drainage, on August 28th (Appendix D) and nine samples were collected from the Nordenskiold River on August 23rd (Appendix C).

Mainstem Teslin River Chinook were sampled as part of the Mainstem Teslin Sonar Project (CRE-01-13) Age, Sex and Length (ASL) collections y B. Mercer and Associates. A carcass pitch was conducted on the mainstem Teslin River over seven days from August 31 - September 2 and through September 6 - 9. Carcasses and moribund fish were recovered on the mainstem Teslin River from Johnsons Crossing to a point approximately 20 km upstream of the sonar site. The first trip yielded few carcasses (2). As occurred in 2012, the first trip preceded the significant die off period. The second pitch yielded 218 samples for a season total of 220. A total of 166 tissue samples were collected for GSI analysis. Tissue samples, scale cards, and an electronic copy of the ASL data were submitted to DFO Whitehorse on completion of the project. For more detailed data, please refer to CRE-01-13's final report, available at http://yukonriverpanel.com/salmon/.

Fall chum

Fall chum tissue sampling was initiated due to the low abundance of Chinook salmon. Chum sampling can be difficult if freezing temperatures are encountered during the sampling events. In 2013 the fall was relatively mild which allowed for more ice free access to the Yukon River than normal which resulted in more open sloughs for sampling and better conditions for the samplers.

Kluane Lake

J. Wilson & Associates conducted a tissue sample collection on October 23rd and 28th at Kluane Lake. A total of 115 samples were obtained (Appendix E).

Mainstem Teslin River

White Mountain Environmental Consulting conducted sampling near Boswell and Miller Creek on the mainstem Teslin River for fall chum, resulting in 121 and 13 samples, respectively (Appendix F). The

sampling occurred from October 18th to 22nd. Of considerable note, a Coho salmon was encountered during this sampling period, the first record of a Coho in the Teslin River.

Mainstem Yukon River

Can-Nic-A-Nick Environmental Sciences sampled fall chum on the mainstem Yukon River near Minto and near the Tatchun River Confluence from October 11th to October 15th. Ninety-eight samples were collected from the Minto area and 101 samples from the Tatchun area for a total of 199 tissue samples (Appendix G).

Sample Site	Tributary	Samples Obtained	Species
Teslin Mainstem	Teslin River	166	Chinook
Swift River	Teslin River	5	Chinook
Nordenskiold	Nordenskiold River	9	Chinook
Klondike River	Klondike River	4	Chinook
Boswell	MainstemTeslin River	121	Chum
Millar Creek	MainstemTeslin River	13	Chum
Minto	Mainstem Yukon River	98	Chum
Tatchun	Mainstem Yukon River	101	Chum
Kluane Lake	White River	115	Chum

Table 1- Genetic tissue samples obtained from the Yukon River in 2013 for inclusion into DFO's and ADF&G's Genetic Baseline database.

Discussion

Environmental Conditions

During the Chinook and fall chum sampling periods, environmental conditions were mostly favourable although freezing temperatures (still considered mild for this time of year) were encountered during the fall chum season. Water levels were generally low, with low turbidity which allowed for good visibility and detection of carcasses and prevented flushing of the carcasses.

Run Abundance

The Chinook run size was low and the spawning escapement goal for the mainstem Yukon River was not met which affected our sampling plan. Chinook sampling was conducted in conjunction with other projects to mitigate concerns for the low return which also helped make the sampling more cost effective. Chinook samples were obtained primarily from brood stock collection and the Teslin Sonar's ASL project. The focus pre-season was to be on Chinook sampling but in the face of the low Chinook return, this was shifted to fall chum in response to the above concerns.

Fall chum run abundance was good and surpassed the spawning escapement goal for the mainstem Yukon River. There were no concerns for obtaining an adequate sample size from proposed collections.

The impact of the sampling event on fall chum was minimized by timing the collections after peak spawning. Several tissue sampling events were conducted on fall chum, resulting in the collection of 448 samples.

Contracts and Personnel

In 2013, two multi-year (dependent upon receiving funding) contracts were setup. The first contract is for the collection of Chinook tissue from the McQuesten River (a tributary of Stewart) and the second contract is for Ross River (a tributary of Pelly). Although neither contract proceeded in 2013 due to contract timing and low Chinook abundance both contracts are valid until 2016. DFO plans to establish additional multiyear contracts in 2014 for other locations, contingent on funding from the Yukon River Panel.

As in past years, samplers consisted of both DFO staff and contractors. DFO's tissue sampling goals were benefitted by other DFO projects but were limited by staff availability. With limited DFO staff available for sampling activities, much of the collection work was completed by contractors. The experience of the contractors contributed to the successful collection of these important samples.

Budget Utilization

Given the low Chinook run, the sampling activity and budget was redirected to the fall chum run. Difficulties were encountered finding trained personnel that were available and able to sample in the colder temperatures. Several contracts were established and the majority of the fund was spent on tissue collection. A portion of the remaining funds will be spent on sampling equipment and shipping of the samples.

Additions to the Genetic Baseline

In 2013, 632 tissue samples were added to the Yukon River salmon genetic baseline as shown in Table 1. This surpassed the objective of collecting 200 tissue samples. The objective of 200 was established when the focus was on Chinook salmon. Chum salmon spawning locations are more concentrated while the sampling required of Chinook would have been more wide spread and difficult given low numbers.

Acknowledgements

Funding for this project was provided by the Yukon River Panel's Restoration and Enhancement Fund and Fisheries and Oceans Canada. This project would not have been possible without the contractors B. Mercer & Associates, Can-Nic-A-Nick Environmental Sciences, J. Wilson & Associates, and White Mountain Environmental Consulting or the work of DFO staff (Trix Tanner and Sean Collins). Alaska Department of Fish & Game (ADF&G) collected tissue samples from the Alaskan section of the Yukon River and shared its samples with DFO and the United States Fish & Wildlife Service (USFWS).

Appendix A. Joint Technical Committee Genetics Sub-Committee's Priorities

2013 R&E Priorities for adult Chinook genetic baseline tissue collections

Country	Main tributary	Branch tributary
US	Kandik River	
	Koyukuk River	Jim River
		Kateel River
		South Fork Koyukuk River
		Clear Ck/Hogatza River
	Melozitna River	
	Nulato River	
	Porcupine River	Sheenjek River
		Coleen River
	Tanana River	Chatanika River
		Goodpaster River
Canada	Porcupine River	Miner River
		Fishing Branch
	Pelly River	Mainstem Population
		Big Kalzas River
		Earn River
		Hoole River
		Mica
		Ross River
	Stewart	McQuesten River
		Janet River
	Teslin River	Mainstem Population
		Nisutlin River
		Morley River
		Jennings River
	White River	Nisling River
		Tincup Creek
	Yukon	Nordenskiold River
		North Big Salmon River

2013 R&E Priorities for adult chum genetic baseline tissue collections

Country	Main tributary	Branch tributary	Comments
US	Big Salt River		
	Porcupine River	Black River (Porcupine)	
	Tanana River	Chena River	Specifically to distinguish between summer and fall runs
		Salcha River	Specifically to distinguish between summer and fall runs
Canada	Pelly River		
	Stewart River		Highest priority is McQuesten River
	White River	Kluane Lake	
	Yukon	Klondike River	
		Minto	
		Tatchun Creek	

Appendix B. Klondike River Age, Sex and Length Data

Klondike River Egg Take

Collectors: Sean Collins and Trix Tanner

Species: Chinook
Date: Aug 1st, 2013

Sex	Fork Length (cm)	DNA
F	95	Y
F	100.5	Y
F		Y
M		Y

Appendix C. Nordenskiold Age, Sex and Length Data

Nordenskiold 2013 Samples

Date: August 23, 2013
Samplers: Trix Tanner and Sean Collins

Chinook #	Sex	Fork Length (mm to nearest 5)	Scale Card #	Scale #s	Condition	Collection method	Genetic Sample
1	M	965	43732	1-41	ripe, part spent	seine	Yes
2	M	1030	43732	2-42	ripe, part spent	seine	Yes
3	M	865	43732	3-43	SPENT	seine	Yes
4	M	1010	43732	4-44	SPENT	seine	Yes
5	F	955	43732	5-45	est 75% spent	seine	Yes
6	M	910	43732	6-46	ripe, part spent	seine	Yes
7	F	920	43732	7-47	fresh carcass	carcass	Yes
8	F	930	43732	8-48	fresh carcass	carcass	Yes
9	M	1090	43732	9-49	moribund	dip net	Yes

Appendix D. Swift River Age, Sex and Length Data

Swift River (tributary to Teslin Lake) Chinook sampling 2013
28-Aug-13
Trix Tanner and Sean Collins.

Fish #	Sex	FL (mm)	Scale Card	Scales	Comment	genetic samples taken
1	M	940	61314	1-41	ripe, worn, appeared largely spent	yes
2	F	895	61314	2-42	ripe, severe scoliosis- possible difficulty spawning?	yes, one axillary process a small nub (due to scoliosis deformity? Or to previous sampling?)
3	F	890	61314	3-43	spent (100%)	yes
4	M	800	61314	4-44	ripe, energetic	yes
5	M	930	61314	5-45	ripe, energetic	yes

Total number of fish observed: 15 (including the 5 captured and sampled).

Appendix E. Kluane Lake Fall Chum Report

COLLECTION OF DNA SAMPLES FROM CHUM SALMON SPAWNING IN KLUANE LAKE.

Prepared for: Fisheries & Oceans Canada
Whitehorse, Yukon

Prepared by: Jane Wilson

J. Wilson & Associates
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December, 2013

Introduction

Tissue samples for genetic analysis have been collected from a spawning population of Chum salmon located at the southeast end of Kluane Lake during field studies conducted in 2002 and 2011 (Wilson 2006 & 2011). A total of 91 tissue samples has been collected from this stock to date and sent to the Pacific Biological Station in Canada and the Alaska Department of Fish & Game (ADF&G) Gene Conservation Laboratory for analysis. Genetic information is used by fisheries managers to identify specific salmon stocks in mixed stock samples in the Yukon River for the purpose of estimating population sizes.

J. Wilson & Associates was contracted by Fisheries & Oceans Canada (DFO) to resume the collection of tissue samples in 2013 to augment the genetic baseline for this stock. Age, sex and size (ASL) data was also obtained to supplement data collected in the Upper Yukon River used to characterise the 2013 Chum run. Funding for this project was provided by the Yukon River Panel, Restoration and Enhancement (R&E) Fund under project CRE-98 administered by DFO. This report describes the sampling methods used and field results.

Study Site

The spawning site is located in Kluane Lake between the outlets of Christmas Creek and Silver Creek, near the historic site of Silver City (Figures 1 & 2). A 'Bed & Breakfast' owned and operated by Doug and Cecile Sias is located next to the Chum spawning area. Access to the site can be gained from the Alaska Highway about 58 km north of Haines Junction. Take the turn off east at the Silver City and Bed & Breakfast road sign on a gravel road approximately 5 km. The lake shore can be accessed from a pullout immediately west of the entrance to the Bed & Breakfast. Boat access can be obtained from a public boat launch located approximately 2.5 km north of the Sheep Mountain Visitor Centre.

Upwelling groundwater at this site is a critical hydrologic feature supporting a Chum salmon spawning environment (Figure 3). The proximity to the vigorous fluvial environments of Silver and Outpost creeks, strongly suggests that this is, at least in part, the source of upwelling groundwater along this portion of the lake (Wilson 2006).

Methods

Run timing of Chum salmon to the Kluane area was estimated from DFO in-season run timing data. Site visits were made on October 23 and October 27.

A small mesh (11.4cm) multi-filament gill net was used to capture live fish for sampling. The netting procedure involved one person walking one end of the net out from shore to the outer limit of the spawning area (about 20 m) while another person held the other end on shore. The net was walked perpendicular to the shore and looped back into shore after capturing a few fish. Fish were immediately sampled and then released.

Tissue samples for DNA analysis were obtained from live Chum salmon and carcasses that had recently washed ashore and still had red gills. Samples were obtained from the axillary appendage of fish in mid-spawn condition and from the operculum in post-spawn fish because of deteriorating axillary appendages. Samples from the axillary appendage were obtained by removing a small portion from the left and right appendage using guillotine clippers. Operculum samples were obtained by removing two small pieces using a paper punch. Tissue samples from each fish were stored in paired vials containing 95% ethyl alcohol[1].

Two length measurements (mid-eye fork (MEF) and post orbital hypural (POH)) were obtained from each sampled fish and the sex and spawning condition recorded. Five scales per fish were taken for age determination. All data, scale cards and DNA samples were delivered to DFO, Whitehorse for analysis.

A survey of the spawning site was to be conducted by boat to obtain an estimate of the size of the Chum population if lake conditions were calm during the site visits.

Results

A survey by boat was not conducted due to rough lake conditions at the time of sampling. Although a number of fish were observed from the shore during both visits to the site, it was not possible to obtain an accurate count of all spawners in the area due to glare at the low angle of view, wave action and the tendency for fish to move out into deeper water where it was impossible to see them.

A total of 116 Chum salmon was sampled for genetic material and ASL data over the two site visits (Appendix 1). Of these, 53 were female and 63 were male. The mean mid-eye fork length of females and males sampled was 567.3 mm and 585.9 mm, respectively. Of the fish sampled on October 23, 70% were post-spawn and 30% were mid-spawn. The majority of fish sampled on October 28 (93%) were post-spawn including one carcass sample. Age analysis was not completed at the time of writing this report.

Discussion

The main objective of this project to collect DNA samples was achieved with a sizeable number of fish captured using a small meshed gillnet. The total of 207 samples collected to date exceeds the sample size required (200) for analysis of the genetic characteristics of this particular run of Chum salmon.

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[1] One of each pair of samples is sent to both the Pacific Biological Station in Canada and the Alaska Department of Fish & Game (ADF&G) Gene Conservation Laboratory for analysis.

Acknowledgements

Field assistance for this project was provided by Brian Mercer (B. Mercer & Associates).

References

Wilson, J., 2006. Preliminary Investigation of Chum Salmon Spawning in Kluane Lake. Prepared for the Yukon River Panel, CRE project 57-02.

Wilson, J., 2011. Collection of DNA Samples from Chum Salmon Spawning in Kluane Lake. Prepared for Fisheries & Oceans Canada, Whitehorse, Yukon.

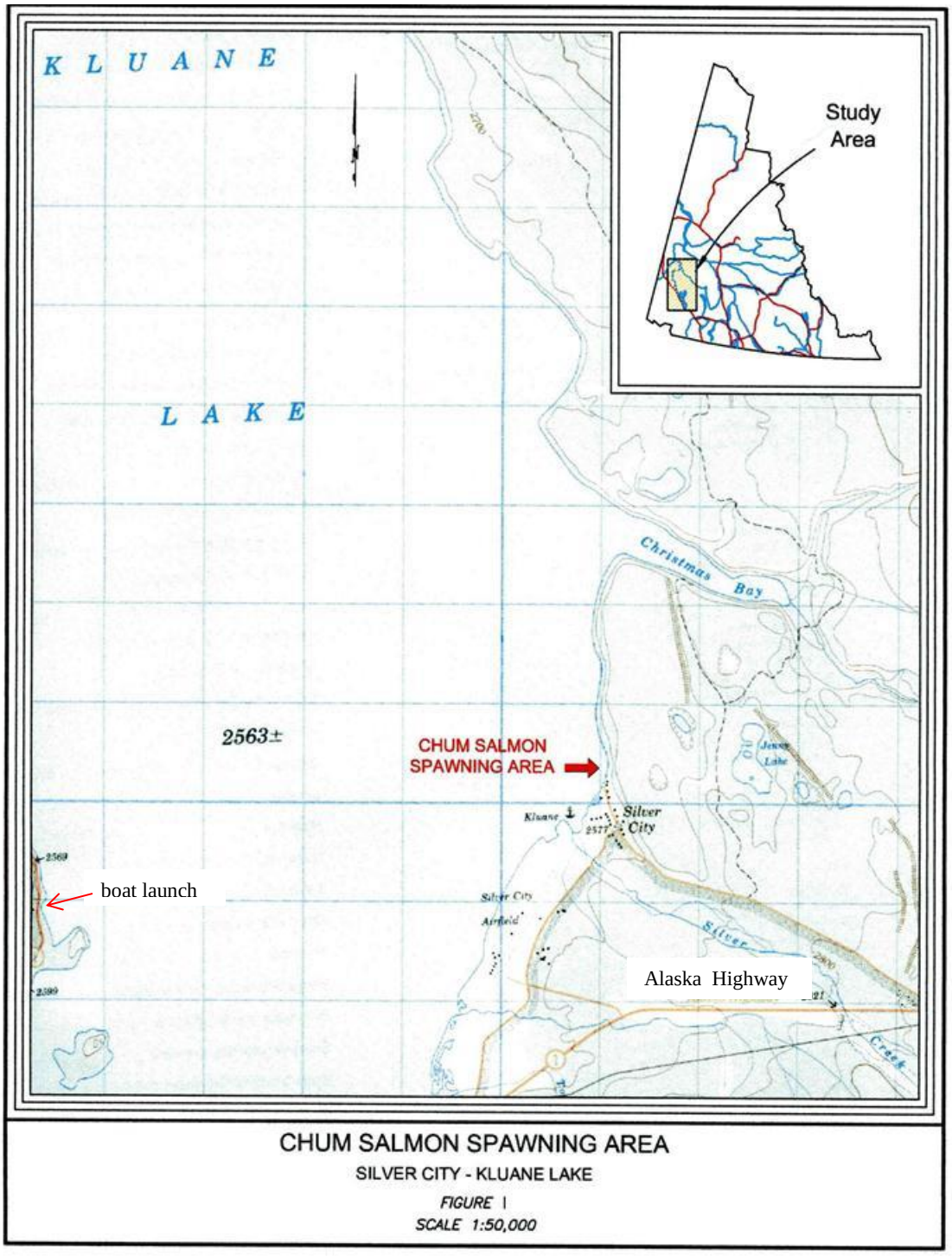

Figure 1. Chum Salmon Spawning Area, Kluane Lake.

Chum spawning area

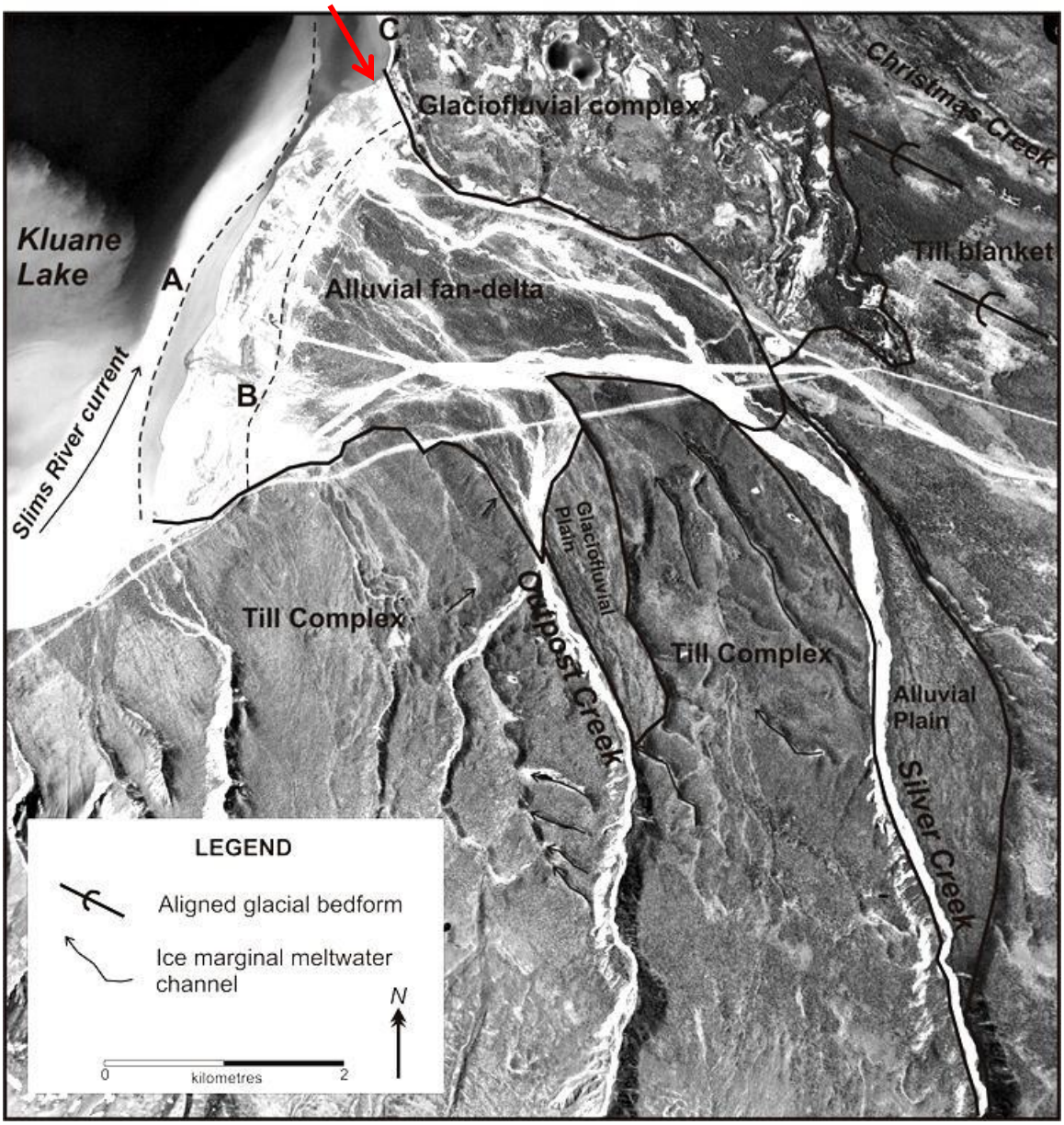

Figure 2. Annotated air photograph (NAPL A27478-85) showing geomorphic features at the southeast end of Kluane Lake. Outpost and Silver creeks originate in the Kluane Ranges immediately to the south.

Figure 3. Upwelling groundwater along lakeshore at chum salmon spawning site, Kluane Lake, October 23, 2013.

Appendix 1. Kluane Lake Chum salmon sampling data, 2013

DATE	FISH #	SEX	MEF (mm)	POHL (mm)	CONDITION*
23-Oct	1	M	550	475	P
23-Oct	2	F	595	530	P
23-Oct	3	F	590	520	P
23-Oct	4	M	570	510	M
23-Oct	5	F	585	525	P
23-Oct	6	M	580	520	P
23-Oct	7	M	555	490	P
23-Oct	8	F	610	550	P
23-Oct	9	F	545	475	M
23-Oct	10	M	595	540	M
23-Oct	11	F	550	485	P
23-Oct	12	M	570	510	P
23-Oct	13	F	620	550	M
23-Oct	14	M	600	530	P
23-Oct	15	M	590	520	P
23-Oct	16	M	590	520	P
23-Oct	17	M	620	545	M
23-Oct	18	F	545	480	P
23-Oct	19	F	550	485	P
23-Oct	20	M	595	525	M
23-Oct	21	F	570	505	M
23-Oct	22	M	600	535	P
23-Oct	23	M	610	545	P
23-Oct	24	M	600	530	P
23-Oct	25	M	565	495	M
23-Oct	26	M	570	500	P
23-Oct	27	M	610	545	P
23-Oct	28	M	630	555	M
23-Oct	29	F	550	495	P
23-Oct	30	M	605	530	P
23-Oct	31	M	605	540	P
23-Oct	32	M	620	545	P
23-Oct	33	F	580	515	M
23-Oct	34	F	550	500	P
23-Oct	35	M	610	540	P
23-Oct	36	F	585	525	P
23-Oct	37	M	600	535	M
23-Oct	38	F	550	495	P
23-Oct	39	M	570	515	M
23-Oct	40	F	585	515	P
28-Oct	41	M	605	540	C
28-Oct	42	F	590	530	P

DATE	FISH #	SEX	MEF (mm)	POHL (mm)	CONDITION*
28-Oct	43	F	545	490	P
28-Oct	44	F	565	495	P
28-Oct	45	F	570	515	P
28-Oct	46	F	595	530	P
28-Oct	47	F	580	515	P
28-Oct	48	M	610	545	P
28-Oct	49	M	570	500	P
28-Oct	50	F	575	515	P
28-Oct	51	M	570	530	P
28-Oct	52	M	580	510	P
28-Oct	53	M	605	535	P
28-Oct	54	F	590	525	P
28-Oct	55	F	545	485	P
28-Oct	56	F	570	510	P
28-Oct	57	M	590	515	P
28-Oct	58	F	620	540	M
28-Oct	59	F	520	470	P
28-Oct	60	M	560	495	P
28-Oct	61	F	530	470	P
28-Oct	62	F	540	490	P
28-Oct	63	M	610	530	P
28-Oct	64	F	600	520	M
28-Oct	65	M	570	505	P
28-Oct	66	F	575	510	P
28-Oct	67	F	535	475	P
28-Oct	68	F	560	505	P
28-Oct	69	F	600	525	P
28-Oct	70	M	590	510	P
28-Oct	71	F	570	505	P
28-Oct	72	M	560	505	P
28-Oct	73	F	560	500	P
28-Oct	74	F	540	485	P
28-Oct	75	F	575	520	P
28-Oct	76	F	580	525	P
28-Oct	77	F	575	520	P
28-Oct	78	F	520	460	P
28-Oct	79	M	580	515	P
28-Oct	80	F	560	495	P
28-Oct	81	M	580	525	P
28-Oct	82	M	570	505	P
28-Oct	83	M	580	510	P
28-Oct	84	M	580	515	P
28-Oct	85	M	555	495	M
28-Oct	86	M	595	540	P
28-Oct	87	F	575	525	P

DATE	FISH #	SEX	MEF (mm)	POHL (mm)	CONDITION*
28-Oct	88	M	540	485	P
28-Oct	89	M	545	485	M
28-Oct	90	M	540	470	P
28-Oct	91	M	675	605	P
28-Oct	92	M	570	505	P
28-Oct	93	M	565	500	P
28-Oct	94	F	555	495	P
28-Oct	95	M	565	500	P
28-Oct	96	M	620	555	P
28-Oct	97	M	570	505	P
28-Oct	98	M	580	515	M
28-Oct	99	F	540	485	P
28-Oct	100	M	570	505	P
28-Oct	101	M	600	535	P
28-Oct	102	M	585	515	P
28-Oct	103	F	570	505	P
28-Oct	104	M	605	545	P
28-Oct	105	F	560	495	P
28-Oct	106	F	620	560	P
28-Oct	107	M	540	475	P
28-Oct	108	M	600	520	P
28-Oct	109	M	635	575	P
28-Oct	110	F	545	490	P
28-Oct	111	F	545	490	P
28-Oct	112	F	555	495	P
28-Oct	113	M	540	490	P
28-Oct	114	M	600	535	P
28-Oct	115	M	595	520	P
28-Oct	116	F	555	500	P

* **P:** post-spawned; **M**: mid-spawn; **C**: carcass

Appendix F. Mainstem Teslin River Fall Chum Report

Teslin River Chum Salmon Genetic Materials Collection Program
October, 2013

Prepared for: Elizabeth MacDonald
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Yukon Stock Assessment Branch

Prepared by:
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November 2013

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REPORT

INTRODUCTION

The primary objective of this project was to collect genetic materials from chum salmon on the Teslin River. The secondary objective was to locate and record the locations of chum salmon spawning areas on the Teslin River.

Prior to this investigation spawning was known to occur near Boswell River and Millar Creek. Spawning activity was found near both of these locations however in both cases the spawning activity occurred in association with ground water flows entering the Teslin River upstream of the previously described areas.

RESULTS

The Boswell River chum spawning site occurs approximately 4 km upstream of the Boswell River on a bend of the river immediately below Baker Lake. Baker Lake has no obvious outlet and is a large lake approximately 9 km long with an average width of 1 km that parallels the Teslin River approximately 120 meters above it. The Miller Creek site was found in a side area of the main channel of the Teslin River approximately 2 km upstream of the outlet of Miller Creek. Genetic material from 125 chum salmon was collected from Boswell site and genetic samples from13 chum salmon were collected from the Miller Creek site. Samples from the Boswell site were collected between October 18 an 22, 2013, samples from the Miller Creek site were collected on October 24, 2013.

For all chum salmon captured; both of the axillary appendages of the pelvic fin were collected and stored in two separate sample bottles (creating a duplicate sample) for genetic analysis, fork length and post orbital caudal length were measured and recorded and a set of 5 scale samples from each of 118 of the samples were taken for later age determination. All field sample data has been presented in Excel format (attached). Field samples (axillary appendages and scale cards) were delivered to the Whitehorse office of DFO immediately upon return from the field in October.

It was estimated that the Boswell site had over 1,000 chum salmon active at the time of investigation and likely had more earlier in the run as numbers of fish on the redds were observed to decline over the 4 day period that they were evaluated. The spawning site consists of a small spring fed channel that flows to the river and an area of calm water in

a bay of the river that the spring fed channel feeds into (photos). The total area consists of 180 meters of small channel and an area of 300 meters by 75 meters along the river.

The Miller Creek is situated approximately 2 km upstream of Miller Creek. This spawning location occurs behind a large gravel bar with a quite water slough behind on the main river. The extent of this site was impossible to determine at the time of sampling due to ice over much of the spawning area. Spawning was observed in a small ice free channel that held approximately 25 chum salmon. Other chum salmon were observed moving along the ice edge.

Of significant note, a single Coho salmon was captured in a gillnet set in an eddy at Boswell Landing, approximately 150 meters downstream of the confluence of the Boswell on the Teslin River. This is the first ever record of a Coho salmon being captured or observed in the Teslin River system.

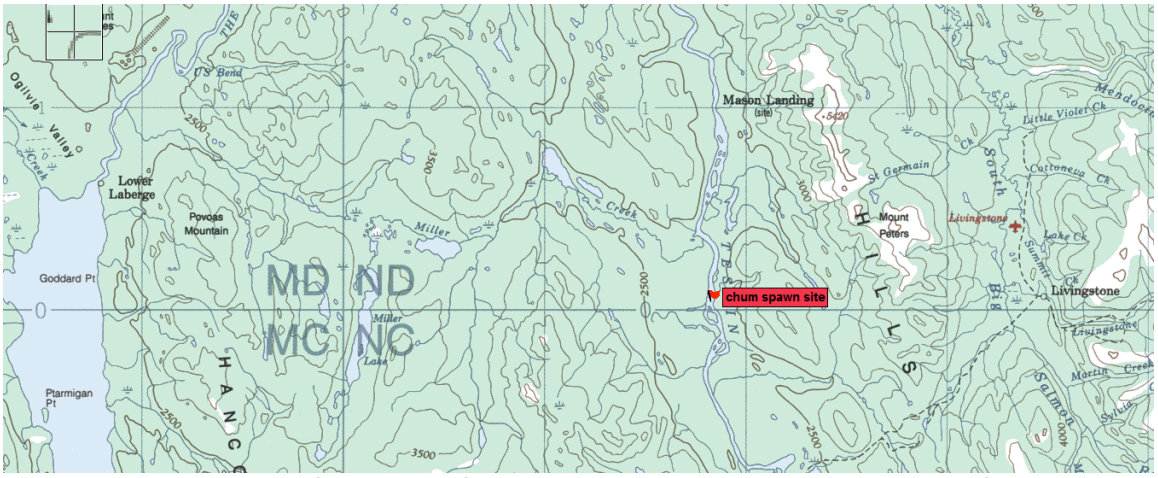

Figure 1: The location of the Miller Creek chum salmon spawning site identified on October 26, 2013 at map scale of 1:250,000.

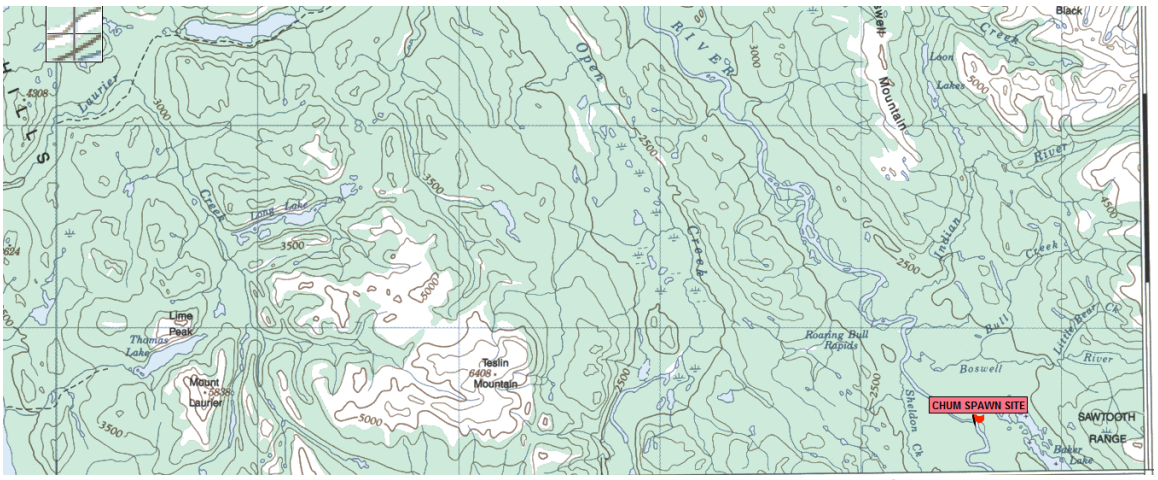

Figure 2: The Boswell River chum salmon site location recorded on October 21, 3013 at map scale 1:250,000.

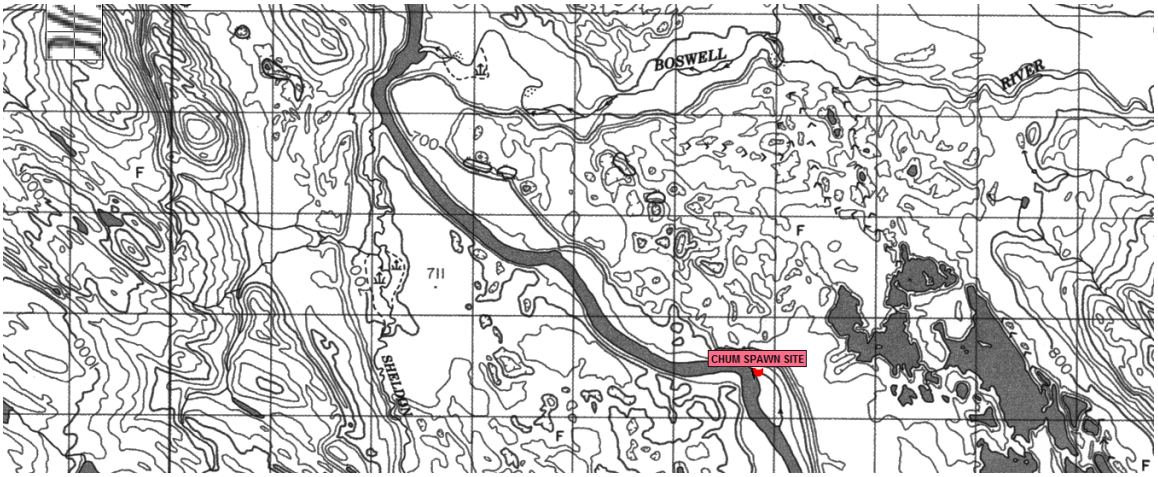

Figure 3: The Boswell River chum salmon spawning location at map scale 1:50,000. The northern half Baker Lake is visible to the right of the spawn site on the map.

Photo 1: Field crew members with chum salmon at the Boswell River site. The entire reach of the Teslin River visible in this photo was used as a spawning area. The small channel on the left margin of the photo is the inlet of the ground water channel.

Photo 2: The small ground water channel near its outlet with the Teslin River. This shallow channel had numerous redds in its shallow water that were as far as 180 meters from the Teslin River.

Photo 3: The open water area of the Miller Creek site on October 26, 3013. The main observed spawning area was along the edge of the abrupt bank.

Photo 4: The Miller Creek site viewed from 300 meters downstream, the open water area of photo 3 is located in the near middle of the photo.

Photo 5: The Coho salmon captured near the outlet of the Boswell River on October 24, 2013.

Appendix G. Mainstem Yukon River Fall Chum Report

UPPER YUKON RIVER (MINTO – TATCHUN) FALL CHUM SALMON GENETIC SAMPLING OCTOBER 2013

Prepared for:

FISHERIES AND OCEANS CANADA

Prepared by:

CAN-NIC-A-NICK ENVIRONMENTAL SCIENCES

October 2013

INTRODUCTION

The mainstem section of the Yukon River between Tatchun Creek and Minto Landing is within the Traditional Territory of the Little Salmon/Carmacks and Selkirk First Nations. The many sloughs and islands along the Yukon River represent important habitat for moose, salmon, and other wildlife. The segment of the Yukon River between Tatchun Creek and Minto Landing is especially known to contain important spawning habitat for chum salmon. The primary objective of this project was to collect 100 fall chum genetic samples from two separate spawning locations along the Yukon River, the first near the confluence of Tatchun Creek and the other near Minto Landing.

STUDY AREA

The study area for this project is a 50 km section of the Yukon River mainstem between Tatchun Creek and Minto in the Yukon Territory (Figure 1). The river in this segment contains a relatively unique and diverse assemblage of fish species, two of which are anadromous. These include Chinook and fall chum salmon that utilize the river as a migration corridor, and for spawning and rearing of their young. At least 12 other freshwater species have also been documented to inhabit the river. Among these are 5 different types of whitefish that include such uncommon fish as the broad whitefish and inconnu, both having a limited distribution in North America that is restricted to a few drainages of the Pacific Northwest. Arctic grayling is perhaps the most ubiquitous fish in the study area and can be found in a wide variety of mainstem habitats.

METHODS

The project commenced on October 11 and continued to October 15, 2013. A 5 m aluminum boat was used to locate spawning areas and transport sampling gear. Sampled fish were collected initially by finding suitable carcasses (red gills and clear eyes) in the water or along the banks. Additional live fish for sampling were obtained through the use of a small section of gillnet. The sample sites were geo-referenced using a hand held Garmin GPS.

The priority was for the collection of 100 fall chum genetic samples from two separate spawning sites. Both axillary appendages were removed from each sampled fish and deposited in separately labeled sample bottles containing ethyl alcohol. Additionally, five scale samples were procured from the preferred area from each sampled fish for subsequent age determination. Sex was determined from examination of external characteristics, and/or gonads of spawned out carcasses, where necessary. Three length measurements (nearest 0.5 cm) were taken from each fish and included fork length (FL), mid-eye to fork length (MEF) and post-orbital hypural length (POH). Each sampled fish was adipose clipped to avoid sample duplication. After marking, all live sampled fish were released at site of capture. Carcasses were sampled generally where they were found. Genetic samples were provided to DFO biologist in the Whitehorse office at the end of the field trip. Scale aging will be completed by DFO depending on relevance and budget.

RESULTS AND DISCUSSION

Water levels in the upper Yukon River were at a moderate to high stage during the project, which allowed easy access to many of the back channels by boat. Groups of spawning fish were easily seen at spawning locations and were plentiful. It is believed that the run into the Canadian portion of the upper Yukon River exceeded 160,000, suggesting an above average escapement (DFO 2013). A total of 100 fall chum salmon were genetically sampled at two spawning locations along the mainstem of the Yukon River. Sampling locations are presented in Figure 1. Based on observations of sampled fish, the survey period was after the spawning peak. Groups of spawning fish were typically observed holding over redds. All of the sampled carcasses and the majority of the live sampled fish were spent. Sampled fish ranged in fork length from 54.5 to 74.0 cm. The sex ratio was slightly male biased and determined to be 1.02 males to each female.

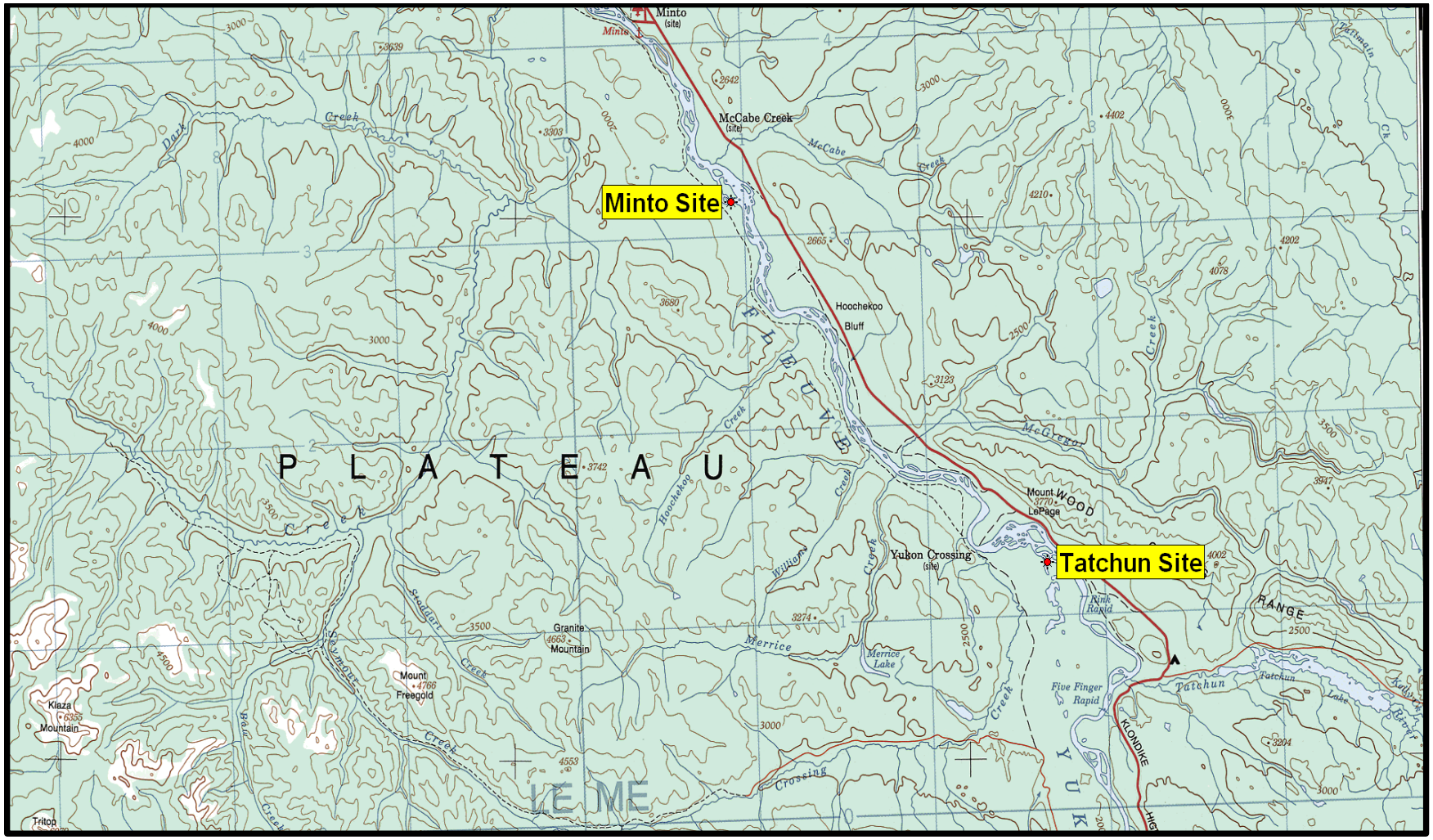

Figure 1 Chum salmon genetic sampling locations along the upper Yukon River, October 2013. (Minto Site 62.506974° N 136.762523° W; Tatchun Site 62.340342° N 136.414078° W - Position Format: Decimal Degrees NAD 27)

Table 1 Summary of ASL data collected from genetic sampled chum salmon from the upper Yukon River, October 2013.

Fish #	Date	Book #	Scale #	FL (cm)	MEF (cm)	POH (cm)	Sex	Condition	Method of Capture	Spawning Site
1	12-Oct-13	00901	10 - 50	66.0	59.0	52.5	M	Spent Carcass	Dead Pitch	Tatchun
2	12-Oct-13	00901	9 – 49	63.0	58.0	52.5	F	Spent Carcass	Dead Pitch	Tatchun
3	12-Oct-13	00901	8 – 48	63.5	56.0	50.0	M	Spent Carcass	Dead Pitch	Tatchun
4	12-Oct-13	00901	7 – 47	62.0	56.5	51.0	F	Spent Carcass	Dead Pitch	Tatchun
5	12-Oct-13	00901	6 – 46	65.0	58.0	52.0	M	Spent Carcass	Dead Pitch	Tatchun
6	12-Oct-13	00901	5 – 45	59.0	55.0	49.5	F	Spent Carcass	Dead Pitch	Tatchun
7	12-Oct-13	00901	4 – 44	60.0	56.0	50.0	F	Spent Carcass	Dead Pitch	Tatchun
8	12-Oct-13	00901	3 – 43	65.0	60.0	54.0	F	Spent Carcass	Dead Pitch	Tatchun
9	12-Oct-13	00901	2 – 42	60.0	54.0	48.0	M	Spent Carcass	Dead Pitch	Tatchun
10	12-Oct-13	00901	1 - 41	54.5	50.5	46.0	F	Spent Carcass	Dead Pitch	Tatchun
11	12-Oct-13	00902	10 - 50	66.0	59.0	52.0	M	Spent Carcass	Dead Pitch	Tatchun
12	12-Oct-13	00902	9 – 49	60.0	55.5	49.5	F	Spent Carcass	Dead Pitch	Tatchun
13	12-Oct-13	00902	8 – 48	64.0	57.0	50.5	M	Spent Carcass	Dead Pitch	Tatchun
14	12-Oct-13	00902	7 – 47	65.0	57.0	51.5	M	Spent Carcass	Dead Pitch	Tatchun
15	12-Oct-13	00902	6 – 46	58.5	53.0	48.5	F	Spent Carcass	Dead Pitch	Tatchun
16	12-Oct-13	00902	5 – 45	59.0	54.5	48.5	F	Spent Carcass	Dead Pitch	Tatchun
17	12-Oct-13	00902	4 – 44	61.0	55.0	50.0	F	Spent Carcass	Dead Pitch	Tatchun
18	12-Oct-13	00902	3 – 43	67.0	60.0	54.5	M	Spent Carcass	Dead Pitch	Tatchun
19	12-Oct-13	00902	2 – 42	69.0	60.0	53.5	M	Spent Carcass	Dead Pitch	Tatchun
20	12-Oct-13	00902	1 - 41	56.0	52.5	47.5	F	Spent Carcass	Dead Pitch	Tatchun
21	12-Oct-13	00903	10 - 50	63.5	55.0	48.5	M	100% Spent	Gillnet	Tatchun
22	12-Oct-13	00903	9 – 49	63.0	57.0	49.5	F	100% Spent	Gillnet	Tatchun
23	12-Oct-13	00903	8 – 48	62.0	57.0	50.0	F	100% Spent	Gillnet	Tatchun
24	12-Oct-13	00903	7 – 47	67.0	60.0	52.5	M	100% Spent	Gillnet	Tatchun
25	12-Oct-13	00903	6 – 46	59.5	55.5	48.5	F	100% Spent	Gillnet	Tatchun

Fish #	Date	Book #	Scale #	FL (cm)	MEF (cm)	POH (cm)	Sex	Condition	Method of Capture	Spawning Site
26	12-Oct-13	00903	5 – 45	64.0	59.0	52.5	F	100% Spent	Gillnet	Tatchun
27	12-Oct-13	00903	4 – 44	66.0	59.5	53.0	M	100% Spent	Gillnet	Tatchun
28	12-Oct-13	00903	3 – 43	66.5	61.5	54.0	F	100% Spent	Gillnet	Tatchun
29	12-Oct-13	00903	2 – 42	65.0	59.0	52.5	F	100% Spent	Gillnet	Tatchun
30	12-Oct-13	00903	1 - 41	68.5	60.0	53.0	M	100% Spent	Gillnet	Tatchun
31	12-Oct-13	00904	10 - 50	65.0	57.5	51.0	M	100% Spent	Gillnet	Tatchun
32	12-Oct-13	00904	9 – 49	65.0	57.5	51.5	M	100% Spent	Gillnet	Tatchun
33	12-Oct-13	00904	8 – 48	64.5	58.0	52.0	M	100% Spent	Gillnet	Tatchun
34	12-Oct-13	00904	7 – 47	67.5	60.5	53.0	M	100% Spent	Gillnet	Tatchun
35	12-Oct-13	00904	6 – 46	61.0	57.0	50.0	F	50% Spent	Gillnet	Tatchun
36	12-Oct-13	00904	5 – 45	67.0	60.0	53.5	M	100% Spent	Gillnet	Tatchun
37	12-Oct-13	00904	4 – 44	61.0	55.5	49.0	F	100% Spent	Gillnet	Tatchun
38	12-Oct-13	00904	3 – 43	62.0	56.5	50.5	F	100% Spent	Gillnet	Tatchun
39	12-Oct-13	00904	2 – 42	66.0	58.5	51.5	M	100% Spent	Gillnet	Tatchun
40	12-Oct-13	00904	1 - 41	62.5	58.0	52.0	F	100% Spent	Gillnet	Tatchun
41	12-Oct-13	00905	10 - 50	62.5	58.0	52.5	F	100% Spent	Gillnet	Tatchun
42	12-Oct-13	00905	9 – 49	67.0	59.5	53.0	M	100% Spent	Gillnet	Tatchun
43	12-Oct-13	00905	8 – 48	64.0	58.5	52.5	F	100% Spent	Gillnet	Tatchun
44	12-Oct-13	00905	7 – 47	60.5	55.0	49.0	F	100% Spent	Gillnet	Tatchun
45	12-Oct-13	00905	6 – 46	62.0	57.0	49.5	F	100% Spent	Gillnet	Tatchun
46	12-Oct-13	00905	5 – 45	65.5	59.0	52.0	M	100% Spent	Gillnet	Tatchun
47	12-Oct-13	00905	4 – 44	63.0	58.5	53.0	F	100% Spent	Gillnet	Tatchun
48	12-Oct-13	00905	3 – 43	65.0	58.0	51.5	M	100% Spent	Gillnet	Tatchun
49	12-Oct-13	00905	2 – 42	62.5	58.0	51.0	F	50% Spent	Gillnet	Tatchun
50	12-Oct-13	00905	1 - 41	71.0	62.0	55.0	M	100% Spent	Gillnet	Tatchun
51	12-Oct-13	00906	10 - 50	61.0	55.0	48.0	M	100% Spent	Gillnet	Tatchun
52	12-Oct-13	00906	9 – 49	60.5	55.5	50.0	F	100% Spent	Gillnet	Tatchun

Fish #	Date	Book #	Scale #	FL (cm)	MEF (cm)	POH (cm)	Sex	Condition	Method of Capture	Spawning Site
53	12-Oct-13	00906	8 – 48	64.0	56.5	50.0	M	100% Spent	Gillnet	Tatchun
54	12-Oct-13	00906	7 – 47	65.0	57.5	51.0	M	100% Spent	Gillnet	Tatchun
55	12-Oct-13	00906	6 – 46	67.0	59.0	52.0	M	100% Spent	Gillnet	Tatchun
56	12-Oct-13	00906	5 – 45	62.0	57.0	51.0	F	100% Spent	Gillnet	Tatchun
57	12-Oct-13	00906	4 – 44	66.0	59.0	51.5	M	100% Spent	Gillnet	Tatchun
58	12-Oct-13	00906	3 – 43	63.0	58.0	52.5	F	50% Spent	Gillnet	Tatchun
59	12-Oct-13	00906	2 – 42	57.5	53.0	48.0	F	100% Spent	Gillnet	Tatchun
60	12-Oct-13	00906	1 - 41	60.0	55.5	48.5	F	100% Spent	Gillnet	Tatchun
61	12-Oct-13	00907	10 - 50	68.5	61.0	54.0	M	100% Spent	Gillnet	Tatchun
62	12-Oct-13	00907	9 – 49	62.0	57.0	50.5	F	100% Spent	Gillnet	Tatchun
63	12-Oct-13	00907	8 – 48	67.0	60.0	52.0	M	100% Spent	Gillnet	Tatchun
64	12-Oct-13	00907	7 – 47	65.0	58.5	51.5	M	100% Spent	Gillnet	Tatchun
65	12-Oct-13	00907	6 – 46	66.0	59.0	51.5	M	100% Spent	Gillnet	Tatchun
66	12-Oct-13	00907	5 – 45	66.0	60.0	53.0	M	100% Spent	Gillnet	Tatchun
67	12-Oct-13	00907	4 – 44	67.5	62.0	55.0	F	100% Spent	Gillnet	Tatchun
68	12-Oct-13	00907	3 – 43	67.0	59.0	52.0	M	50% Spent	Gillnet	Tatchun
69	12-Oct-13	00907	2 – 42	60.0	55.5	49.5	F	50% Spent	Gillnet	Tatchun
70	12-Oct-13	00907	1 - 41	68.5	62.0	55.5	F	100% Spent	Gillnet	Tatchun
71	12-Oct-13	00908	10 - 50	66.0	59.0	51.5	M	100% Spent	Gillnet	Tatchun
72	12-Oct-13	00908	9 – 49	63.0	57.0	52.0	F	100% Spent	Gillnet	Tatchun
73	12-Oct-13	00908	8 – 48	71.0	62.0	55.0	M	100% Spent	Gillnet	Tatchun
74	12-Oct-13	00908	7 – 47	63.0	58.5	51.0	F	100% Spent	Gillnet	Tatchun
75	12-Oct-13	00908	6 – 46	65.0	58.5	52.0	M	100% Spent	Gillnet	Tatchun
76	12-Oct-13	00908	5 – 45	62.0	57.0	51.0	F	100% Spent	Gillnet	Tatchun
77	12-Oct-13	00908	4 – 44	62.0	56.0	48.5	M	50% Spent	Gillnet	Tatchun
78	13-Oct-13	00908	3 – 43	67.0	59.5	51.5	M	Spent Carcass	Dead Pitch	Tatchun
79	13-Oct-13	00908	2 – 42	69.0	61.5	53.0	M	Spent Carcass	Dead Pitch	Tatchun
80	13-Oct-13	00908	1 - 41	63.0	57.5	51.5	F	Spent Carcass	Dead Pitch	Tatchun

Fish #	Date	Book #	Scale #	FL (cm)	MEF (cm)	POH (cm)	Sex	Condition	Method of Capture	Spawning Site
81	13-Oct-13	00909	10 - 50	70.0	61.5	55.5	M	Spent Carcass	Dead Pitch	Tatchun
82	13-Oct-13	00909	9 – 49	68.5	60.5	54.0	M	Spent Carcass	Dead Pitch	Tatchun
83	13-Oct-13	00909	8 – 48	61.0	56.0	50.0	F	Spent Carcass	Dead Pitch	Tatchun
84	13-Oct-13	00909	7 – 47	66.0	60.5	54.5	F	Spent Carcass	Dead Pitch	Tatchun
85	13-Oct-13	00909	6 – 46	63.0	58.0	52.0	F	Spent Carcass	Dead Pitch	Tatchun
86	13-Oct-13	00909	5 – 45	61.0	56.0	49.5	F	Spent Carcass	Dead Pitch	Tatchun
87	13-Oct-13	00909	4 – 44	62.0	56.5	50.5	F	Spent Carcass	Dead Pitch	Tatchun
88	13-Oct-13	00909	3 – 43	66.5	58.0	51.5	M	Spent Carcass	Dead Pitch	Tatchun
89	13-Oct-13	00909	2 – 42	60.0	55.5	50.5	F	Spent Carcass	Dead Pitch	Tatchun
90	13-Oct-13	00909	1 - 41	58.0	53.0	47.5	F	Spent Carcass	Dead Pitch	Tatchun
91	13-Oct-13	00910	10 - 50	64.5	57.5	51.0	M	Spent Carcass	Dead Pitch	Tatchun
92	13-Oct-13	00910	9 – 49	59.0	54.0	49.0	F	Spent Carcass	Dead Pitch	Tatchun
93	13-Oct-13	00910	8 – 48	60.0	55.5	50.5	F	Spent Carcass	Dead Pitch	Tatchun
94	13-Oct-13	00910	7 – 47	60.5	56.0	51.0	F	Spent Carcass	Dead Pitch	Tatchun
95	13-Oct-13	00910	6 – 46	63.0	59.0	53.5	F	Spent Carcass	Dead Pitch	Tatchun
96	13-Oct-13	00910	5 – 45	65.0	58.0	51.0	M	Spent Carcass	Dead Pitch	Tatchun
97	13-Oct-13	00910	4 – 44	62.0	57.0	50.5	F	Spent Carcass	Dead Pitch	Tatchun
98	13-Oct-13	00910	3 – 43	60.0	55.0	47.5	F	Spent Carcass	Dead Pitch	Tatchun
99	13-Oct-13	00910	2 – 42	65.0	56.5	49.5	M	Spent Carcass	Dead Pitch	Tatchun
100	13-Oct-13	00910	1 - 41	60.5	55.5	49.5	F	Spent Carcass	Dead Pitch	Tatchun
101	14-Oct-13	00911	10 - 50	57.5	53.0	47.5	F	Spent Carcass	Dead Pitch	Minto
102	14-Oct-13	00911	9 – 49	63.0	57.0	50.5	M	Spent Carcass	Dead Pitch	Minto
103	14-Oct-13	00911	8 – 48	68.0	60.5	53.5	M	Spent Carcass	Dead Pitch	Minto
104	14-Oct-13	00911	7 – 47	68.0	60.5	54.0	M	Spent Carcass	Dead Pitch	Minto
105	14-Oct-13	00911	6 – 46	69.0	61.5	55.0	M	Spent Carcass	Dead Pitch	Minto
106	14-Oct-13	00911	5 – 45	67.0	59.0	51.0	M	Spent Carcass	Dead Pitch	Minto
107	14-Oct-13	00911	4 – 44	64.0	59.0	53.0	F	Spent Carcass	Dead Pitch	Minto
108	14-Oct-13	00911	3 – 43	61.0	54.5	4830	M	Spent Carcass	Dead Pitch	Minto

Fish #	Date	Book #	Scale #	FL (cm)	MEF (cm)	POH (cm)	Sex	Condition	Method of Capture	Spawning Site
109	14-Oct-13	00911	2 – 42	68.0	61.0	54.0	M	Spent Carcass	Dead Pitch	Minto
110	14-Oct-13	00911	1 - 41	62.0	57.0	51.5	F	Spent Carcass	Dead Pitch	Minto
111	14-Oct-13	00912	10 - 50	65.0	57.5	52.0	M	Spent Carcass	Dead Pitch	Minto
112	14-Oct-13	00912	9 – 49	59.0	53.0	47.0	M	Spent Carcass	Dead Pitch	Minto
113	14-Oct-13	00912	8 – 48	62.0	57.0	51.5	F	Spent Carcass	Dead Pitch	Minto
114	14-Oct-13	00912	7 – 47	59.5	54.5	48.5	F	Spent Carcass	Dead Pitch	Minto
115	14-Oct-13	00912	6 – 46	72.0	64.0	56.5	M	Spent Carcass	Dead Pitch	Minto
116	14-Oct-13	00912	5 – 45	57.5	53.5	47.5	F	Spent Carcass	Dead Pitch	Minto
117	14-Oct-13	00912	4 – 44	66.5	59.0	52.0	M	Spent Carcass	Dead Pitch	Minto
118	14-Oct-13	00912	3 – 43	72.0	64.5	57.5	M	Spent Carcass	Dead Pitch	Minto
119	14-Oct-13	00912	2 – 42	59.0	55.0	48.5	F	Spent Carcass	Dead Pitch	Minto
120	14-Oct-13	00912	1 - 41	64.0	58.5	53.5	F	Spent Carcass	Dead Pitch	Minto
121	14-Oct-13	00913	10 - 50	58.0	53.0	46.5	F	Spent Carcass	Dead Pitch	Minto
122	14-Oct-13	00913	9 – 49	65.0	58.0	51.5	M	Spent Carcass	Dead Pitch	Minto
123	14-Oct-13	00913	8 – 48	57.5	53.0	47.5	F	Spent Carcass	Dead Pitch	Minto
124	14-Oct-13	00913	7 – 47	64.5	59.0	52.5	F	Spent Carcass	Dead Pitch	Minto
125	14-Oct-13	00913	6 – 46	62.0	55.5	49.0	F	Spent Carcass	Dead Pitch	Minto
126	14-Oct-13	00913	5 – 45	72.0	64.0	57.0	M	Spent Carcass	Dead Pitch	Minto
127	14-Oct-13	00913	4 – 44	66.0	61.0	53.5	F	Spent Carcass	Dead Pitch	Minto
128	14-Oct-13	00913	3 – 43	72.0	64.0	56.5	M	Spent Carcass	Dead Pitch	Minto
129	14-Oct-13	00913	2 – 42	59.5	54.5	49.0	F	Spent Carcass	Dead Pitch	Minto
130	14-Oct-13	00913	1 - 41	67.5	60.5	53.5	M	Spent Carcass	Dead Pitch	Minto
131	14-Oct-13	00914	10 - 50	62.5	57.5	51.0	F	Spent Carcass	Dead Pitch	Minto
132	14-Oct-13	00914	9 – 49	62.5	57.0	51.0	F	Spent Carcass	Dead Pitch	Minto
133	14-Oct-13	00914	8 – 48	70.0	62.5	56.0	M	Spent Carcass	Dead Pitch	Minto
134	14-Oct-13	00914	7 – 47	65.0	58.0	51.5	M	Spent Carcass	Dead Pitch	Minto
135	14-Oct-13	00914	6 – 46	61.0	56.0	51.0	F	Spent Carcass	Dead Pitch	Minto
136	14-Oct-13	00914	5 – 45	63.5	57.0	52.0	F	Spent Carcass	Dead Pitch	Minto

Fish #	Date	Book #	Scale #	FL (cm)	MEF (cm)	POH (cm)	Sex	Condition	Method of Capture	Spawning Site
137	14-Oct-13	00914	4 – 44	72.0	62.5	54.0	M	Spent Carcass	Dead Pitch	Minto
138	14-Oct-13	00914	3 – 43	66.5	61.0	54.0	F	Spent Carcass	Dead Pitch	Minto
139	14-Oct-13	00914	2 – 42	66.0	61.0	55.0	F	Spent Carcass	Dead Pitch	Minto
140	14-Oct-13	00914	1 - 41	74.0	65.5	58.0	M	Spent Carcass	Dead Pitch	Minto
141	14-Oct-13	00915	10 - 50	58.5	53.5	48.0	F	Spent Carcass	Dead Pitch	Minto
142	14-Oct-13	00915	9 – 49	64.5	57.0	50.5	M	Spent Carcass	Dead Pitch	Minto
143	14-Oct-13	00915	8 – 48	62.5	55.5	48.5	M	Spent Carcass	Dead Pitch	Minto
144	14-Oct-13	00915	7 – 47	58.0	54.0	48.0	F	Spent Carcass	Dead Pitch	Minto
145	14-Oct-13	00915	6 – 46	56.0	53.0	46.0	F	Spent Carcass	Dead Pitch	Minto
146	14-Oct-13	00915	5 – 45	60.0	53.5	46.5	M	Spent Carcass	Dead Pitch	Minto
147	14-Oct-13	00915	4 – 44	66.0	58.0	52.0	M	Spent Carcass	Dead Pitch	Minto
148	14-Oct-13	00915	3 – 43	63.0	56.0	50.0	M	Spent Carcass	Dead Pitch	Minto
149	14-Oct-13	00915	2 – 42	61.5	55.0	48.5	M	Spent Carcass	Dead Pitch	Minto
150	14-Oct-13	00915	1 - 41	68.5	60.0	53.5	M	Spent Carcass	Dead Pitch	Minto
151	14-Oct-13	00916	10 - 50	66.0	58.5	52.5	M	Spent Carcass	Dead Pitch	Minto
152	14-Oct-13	00916	9 – 49	69.0	60.0	54.0	M	Spent Carcass	Dead Pitch	Minto
153	14-Oct-13	00916	8 – 48	66.0	58.5	51.5	M	Spent Carcass	Dead Pitch	Minto
154	14-Oct-13	00916	7 – 47	59.0	55.0	48.0	F	Spent Carcass	Dead Pitch	Minto
155	14-Oct-13	00916	6 – 46	62.5	58.0	51.0	F	Spent Carcass	Dead Pitch	Minto
156	14-Oct-13	00916	5 – 45	63.5	58.0	51.5	F	Spent Carcass	Dead Pitch	Minto
157	14-Oct-13	00916	4 – 44	64.0	57.0	49.5	M	Spent Carcass	Dead Pitch	Minto
158	14-Oct-13	00916	3 – 43	68.0	62.0	54.5	M	Spent Carcass	Dead Pitch	Minto
159	14-Oct-13	00916	2 – 42	65.0	59.5	53.5	F	Spent Carcass	Dead Pitch	Minto
160	14-Oct-13	00916	1 - 41	61.0	56.5	50.5	F	Spent Carcass	Dead Pitch	Minto
161	14-Oct-13	00917	10 - 50	69.0	61.0	54.5	M	100% Spent	Gillnet	Minto
162	14-Oct-13	00917	9 – 49	66.0	58.5	52.0	M	100% Spent	Gillnet	Minto
163	14-Oct-13	00917	8 – 48	64.0	59.0	52.0	F	100% Spent	Gillnet	Minto
164	14-Oct-13	00917	7 – 47	71.0	63.0	55.5	M	100% Spent	Gillnet	Minto

Fish #	Date	Book #	Scale #	FL (cm)	MEF (cm)	POH (cm)	Sex	Condition	Method of Capture	Spawning Site
165	14-Oct-13	00917	6 – 46	64.0	59.0	53.0	F	100% Spent	Gillnet	Minto
166	14-Oct-13	00917	5 – 45	71.5	63.0	55.5	M	100% Spent	Gillnet	Minto
167	14-Oct-13	00917	4 – 44	61.0	56.0	49.5	F	100% Spent	Gillnet	Minto
168	14-Oct-13	00917	3 – 43	66.0	58.5	52.0	M	100% Spent	Gillnet	Minto
169	14-Oct-13	00917	2 – 42	64.5	58.0	51.5	M	100% Spent	Gillnet	Minto
170	14-Oct-13	00917	1 - 41	63.0	58.0	51.0	F	100% Spent	Gillnet	Minto
171	14-Oct-13	00918	10 - 50	74.0	65.0	57.0	M	100% Spent	Gillnet	Minto
172	14-Oct-13	00918	9 – 49	60.0	54.5	49.0	F	100% Spent	Gillnet	Minto
173	14-Oct-13	00918	8 – 48	64.0	56.0	49.5	M	100% Spent	Gillnet	Minto
174	14-Oct-13	00918	7 – 47	64.0	56.5	49.5	M	100% Spent	Gillnet	Minto
175	14-Oct-13	00918	6 – 46	66.0	61.0	54.5	F	100% Spent	Gillnet	Minto
176	14-Oct-13	00918	5 – 45	65.0	57.5	51.0	M	100% Spent	Gillnet	Minto
177	14-Oct-13	00918	4 – 44	63.0	58.0	52.5	F	100% Spent	Gillnet	Minto
178	14-Oct-13	00918	3 – 43	70.0	62.5	55.5	M	100% Spent	Gillnet	Minto
179	14-Oct-13	00918	2 – 42	62.0	56.0	49.5	M	100% Spent	Gillnet	Minto
180	14-Oct-13	00918	1 - 41	61.0	56.0	49.5	F	100% Spent	Gillnet	Minto
181	14-Oct-13	00919	10 - 50	66.0	58.5	51.5	M	100% Spent	Gillnet	Minto
182	14-Oct-13	00919	9 – 49	59.0	55.0	48.5	F	50% Spent	Gillnet	Minto
183	14-Oct-13	00919	8 – 48	74.0	66.0	59.0	M	100% Spent	Gillnet	Minto
184	14-Oct-13	00919	7 – 47	61.5	56.5	50.0	F	100% Spent	Gillnet	Minto
185	14-Oct-13	00919	6 – 46	63.0	57.5	51.0	F	100% Spent	Gillnet	Minto
186	14-Oct-13	00919	5 – 45	65.5	58.5	51.5	M	100% Spent	Gillnet	Minto
187	14-Oct-13	00919	4 – 44	60.0	55.0	49.0	F	50% Spent	Gillnet	Minto
188	14-Oct-13	00919	3 – 43	66.0	61.0	52.5	F	50% Spent	Gillnet	Minto
189	14-Oct-13	00919	2 – 42	56.5	52.5	46.0	F	100% Spent	Gillnet	Minto
190	14-Oct-13	00919	1 - 41	65.5	58.0	51.5	M	100% Spent	Gillnet	Minto
191	14-Oct-13	00920	10 - 50	62.0	57.0	51.0	F	100% Spent	Gillnet	Minto
192	14-Oct-13	00920	9 – 49	68.0	61.0	53.5	M	100% Spent	Gillnet	Minto

Fish #	Date	Book #	Scale #	FL (cm)	MEF (cm)	POH (cm)	Sex	Condition	Method of Capture	Spawning Site
193	14-Oct-13	00920	8 – 48	67.0	58.5	52.0	M	50% Spent	Gillnet	Minto
194	14-Oct-13	00920	7 – 47	63.0	56.0	49.0	M	100% Spent	Gillnet	Minto
195	14-Oct-13	00920	6 – 46	68.0	61.5	53.5	M	100% Spent	Gillnet	Minto
196	14-Oct-13	00920	5 – 45	66.0	58.5	52.0	M	100% Spent	Gillnet	Minto
197	14-Oct-13	00920	4 – 44	64.0	58.0	51.5	M	100% Spent	Gillnet	Minto
198	14-Oct-13	00920	3 – 43	60.0	56.5	50.0	F	100% Spent	Gillnet	Minto
199	14-Oct-13	00920	2 – 42	64.5	56.5	50.5	M	100% Spent	Gillnet	Minto
200	14-Oct-13	00920	1 - 41	64.5	59.0	52.5	F	100% Spent	Gillnet	Minto

REFERENCES

DFO 2013. Memorandum: Yukon River Salmon Update, October, 2013. Department of Fisheries and Oceans Canada, 100-419 Range Road, Whitehorse, Yukon Y1A 3V1.