Aerial Survey Counts from Select Stikine River Chinook Spawning Sites, 2016

(A project supported by the Northern Fund through the Pacific Salmon Commission)

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Final Report

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Executive Summary

Aerial surveys were conducted to enumerate spawning Stikine River Chinook salmon, *Oncorhynchus tshawytscha*, at select Stikine River Chinook spawning sites on August 4th, 2016. The objectives were to provide a relative measure of onsite validation of lower reach Chinook salmon spawners against a mark-recapture program, as well the provision of aerial survey precision of spawners located above the Little Tahltan weir.

A combined total of 354 Chinook salmon was observed from five survey index sites. The majority of fish were located in the Little Tahltan and Tahltan Rivers. The lower reaches of Christina Creek and the Verrett River saw only two and forty-six fish respectively. The glacial runoff in the Tahltan River and Christina Creek during the August 4th survey had a negative effect on the observation of Chinook. Approximately 12% of the total run of large Chinook above the Little Tahltan weir was observed.

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1 Introduction

Stikine River Chinook salmon are harvested in both Canadian and U.S. waters. In the US, troll, recreational, commercial and subsistence gillnets fleets intercept Stikine River bound Chinook salmon. In Canada, commercial gillnet, food soc1al and ceremonial (FSC), and recreational fisheries target this population. Stikine River Chinook salmon are subject to the principles and annexes of international Pacific Salmon Treaty (PST). Fisheries management regimes are, therefore, driven by catch share provision as prescribed by the PST (PST 2009). The Transboundary Technical Committee (TTC), under the auspices of the PST, generates spawning goal escapements and annual total allowable catch metrics.

Chinook salmon in the Stikine River comprise one of over 50 indicator stocks included in annual assessments by the Chinook Technical Committee (CTC) of the Pacific Salmon Commission (PSC) to determine stock status, effects of management regimes, and other requirements of the Pacific Salmon Treaty (PST) (Der Hovanisian and Etherton 2006). The Stikine River is one of the largest producers of Chinook salmon in Northern B.C. and Southeast Alaska (Der Hovanisian and Etherton 2006). Spawning occurs in the lower mainstem and tributaries such as Tahltan, Little Tahltan, Chutine, Katete, Craig, Barrington and Tuya rivers; and Beatty, Christina, Verrett, Shakes, Sixmile, Andrew, and Tashoots creeks (DFO 1991; Pahlke and Etherton 1999; Bernard et al. 2000). The total Stikine River target escapement range is 14,000 to 28,000 large Chinook salmon with a point target of 17,368 large fish (PSC 2004). Reflective of the total Stikine River escapement goal, the target escapement range for Little Tahltan River is 2,700 to 5,300 large fish with a point target of 3,300 large fish (Bernard et al 2000).

The TTC uses a Chinook salmon model, referred to as the Stikine Chinook Salmon Management Model (SCMM), for in-season fisheries management. The SCMM is based on a linear regression between weekly cumulative CPUE of large Chinook salmon observed at a tagging site in the lower Stikine River and total run size based on mark-recapture studies conducted since 1996. For escapement enumeration, aerial helicopter surveys of the Little Tahltan River were conducted annually from 1975 – 2004, and a fish-enumeration weir has been operated at the mouth of the Little Tahltan River since 1985 (Benard et al. 2000). Since 1996, annual mark-recapture studies have been used to estimate spawning escapements (Pahlke and Etherton 1998, 1999, 2000; Pahlke et al. 2000; Der Hovanisian et al. 2002, 2003, 2004; Der Hovanisian and Etherton 2005; Der Hovanisian and Etherton 2006). In 1997 and 2005, radio-telemetry studies were conducted in conjunction with mark-recapture experiments to estimate the distribution and run timing of Chinook salmon spawners (Pahlke and Etherton 1999). Genetic stock identification (GSI) has provided insight germane to stock specific run timing and relative abundance in 2008, 2010, and 2012-13 to complement radio telemetry studies cited above (PSC 2015).

Over the past several years, core agency (DFO and ADF&G) funding has been reduced and as a result aerial surveys of the Little Tahltan River were terminated from 2005-13, and in 2014 the Little Tahltan

weir project was reduced in scope. Moreover, the weir program on the Little Tahltan River has recently been questioned as to its long term feasibility given its high cost and the potential of lower cost aerial survey counts serving as a surrogate to collect spawning escapement estimates. Analysis has shown that the aerial survey counts are significantly correlated with the Little Tahltan weir counts. Aerial survey counts were collected from the Little Tahltan River and other upper Stikine reach spawning sites including the Tahltan River and Beatty Creek from 1979 to 2004, Appendix A.1. Except for a Stikine River chinook spawning site located on the US reach of the Stikine River, there is a paucity of aerial survey counts from sites located within the lower reach of the Canadian section of the Stikine River. Two sites in particular support a sizeable spawning escapement of Chinook salmon; namely, the Verrett River and Christina Creek (Smith et al. 2007). These two sites coincide with one of the two Stikine River Chinook conservation units identified through Canada's Wild Salmon Policy (DFO 1995). It is important, therefore, to better monitor these sites thus providing, over the long term, a measure of the relative spawning numbers (indicator stocks) returning to these sites on an inter-annual basis. Furthermore, aerial surveys of these lower reach sites serves to validate system wide escapement estimates generated from the annual mark-recapture programme, provide surveyors with the opportunity to assess the areas for landscape changes; the surveys also provide the opportunity to investigate other non-target spawning sites while in en-route to select sites (increased costs to do short, additional surveys are marginal).

The following paper reports on the findings of a Stikine River Chinook salmon aerial survey project conducted on August 4th, 2016. The data is compared and contrasted with past surveys conducted at select sites from 1979 to 2015. The efficacy of the project and recommendations are also presented.

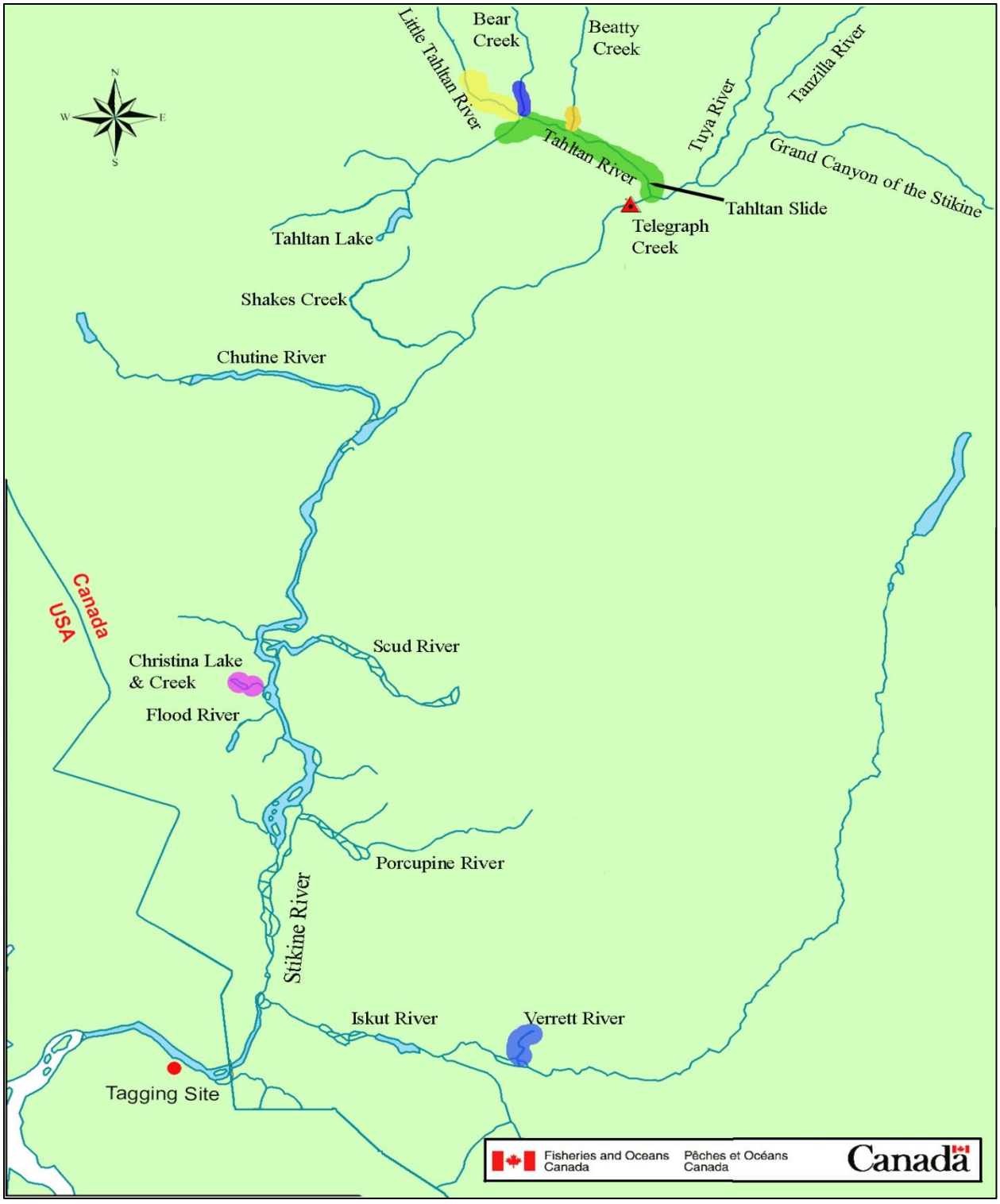


Figure 1 The lower to mid reach of the Stikine River drainage in British Columbia and Southeast Alaska, showing Chinook salmon aerial survey sites observed in 2016.

2 Methods

Lakelse Air's Bell 206 Jet Ranger helicopter was charted through DFO's contractual policy for a approximately six hours on August 4, 2015. The helicopter departed Dease Lake, B.C. at 0930 hrs. (Dease Lake is approximately 80 km north of the survey site.) Two surveyors sat in tandem on the starboard side of the helicopter thus approximating viewing conditions. Survey speed varied from a stationary hovering position to approximately 20 km/hr. Altitude of surveys varied from 30 to 100 metres.

Survey conditions were subjectively assessed based on water clarity, water flow regime, overhanging foliage, glare, and, to a lesser degree, air turbulence. Surveyors counted individual live fish and noted their activity (spawning pairs, schooled). Carcasses were also enumerated. Ancillary information relating to bear, wolf, and eagle sightings were tabulated.

At the termination of the survey, the counts taken from the two surveyors were tallied and the average of the two counts was adopted as the number of utility. The total count included both large Chinook salmon (>735 mm fork length) and smaller jack Chinook salmon. An inferred contribution of the two size groups was calculated based on the ratio of jack to large Chinook salmon enumerated at the Little Tahltan weir in 2016 (jack – 26%, large – 74%).

In preparation for the survey Lakelse Air Ltd. was notified a more than a fortnight in advance of the flight time and the appropriate booking was made. Jet (A) helicopter fuel was staged at a strategic site within the flight path of the survey well in advance of the survey date. Table 1 list's the locations and defines the boundaries of the survey zone for each of the spawning sites.

The August 4th flight surveyed Beatty Creek, Little Tahltan River, Tahltan River, Christina Creek, and Verrett River.

A second survey was not flown due to lack of availability of experienced surveyors during the remainder of the Chinook spawning period.

3 Results and Discussion

The survey conditions were mixed in that the August 4th survey weather was done under conditions that were favourable with aerial surveying (no fog or rain, sunny, light turbulence) coupled with low, and relatively clear flow regimes for Beatty Creek, Little Tahltan River, and the Verrett River; however, the Tahltan River and Christina Creek Index sites were impaired due to glacial runoff and high water respectively, Table 1.

Table 1 Summary of Chinook salmon counts taken from an aerial survey at select Stikine River Chinook spawning sites, August 4th, 2016.

Area	Start / Finish	Count: Live	Count: Carcass	2016 Date	Observers	Description of Survey Area	Comments
Tahltan River	1828	129	0	4-Aug	Frocklage	Tahltan River from Decheeka Falls	Viewing conditions were moderate; some
	1858				Sembsmoen	downstream to mouth	glacial runoff impairing observation.
						start:58^{0}06.822'//131^{0}19.720	Observed 30 eagles.
						end:58^{0}00.655'//130^{0}58.692	
Little Tahltan River	1651	144	8	4-Aug	Frocklage	Little Tahltan River from its mouth	Viewing conditions were good. Clear water
	1723				Sembsmoen	upstream approximately 13km.	throughout survey with small sections of glare.
						start:58^{0}07.282'//131^{0}19.124	downstream to mouth. Observed 12 eagles.
						end:58^{0}10.700'//131^{0}28.375	
Beatty Creek	1620	33	1	4-Aug	Frocklage	Beatty Creek from its mouth	Viewing conditions were excellent. Water was
	1637				Sembsmoen	upstream approximately 5 km.	low and clear. Observed a sow grizzly with two
						start:58^{0}06.130'//131^{0}11.271	cubs and 16 eagles.
						end:58^{0}07.106'//131^{0}10.655	
Christina Creek	1140	2	0	4-Aug	Frocklage	Christina Creek from its mouth	Viewing conditions were poor to fair due to
	1153				Sembsmoen	upstream approximately 6 km.	high water and glacial runoff.
						including the lower 2 km of the inlet	Observed 2 grizzly and 7 eagles.
						stream emptying into Christina Lk.	
						start:57^{0}14.282'//131^{0}50.364	
						end:57^{0}14.709'//131^{0}55.102	
Verrett River	1430	46	4	4-Aug	Frocklage	Verrett River from its mouth	Viewing conditions were good to excellent.
	1440				Sembsmoen	upstream to Verrett R. falls, including	Observed 1 grizzly and 3 eagles.
						a secondary channel flowing east	
						start:56^{0}41.488'//131^{0}01.009	
						end:56^{0}42.375'//130^{0}59.470	
TOTALS		354					
estimates large*		263					
estimated jack		91					

*based on the percentage of large Chinook to jack Chinook salmon (74.3%) observed at the Little Tahltan weir in 2016.

A total of 354 Chinook salmon (large and jacks) was observed in the prescribed index areas listed in Table 1. Both large Chinook salmon (fish measuring >735mm fork length) and "jack" Chinook salmon (fish measuring less than 736 mm fork length) were observed; however, the two size types were not distinguished in the field data. As a surrogate, the percentage of large salmon against the total run counted at the Little Tahltan River weir was applied to the total aerial survey count to provide an estimate of large and jack Chinook salmon observed. The highest concentration of Chinook salmon was observed in the Little Tahltan River, n=144, Table 1. There were only 2 Chinook salmon observed at Christina Creek and 46 Chinook salmon observed at the Verrett River index area; the former site had very poor viewing condition due to glacial runoff and higher water, while the latter site had excellent viewing conditions. Approximately 12% (107 large Chinook) of the total Little Tahltan weir count of 921 large Chinook salmon was observed during the aerial survey which is well below the 1985-2015 average of 45%, Appendix A.1. This contrast of accuracy rates may be due to hidden pockets of Chinook salmon

that were not visible at the time of the survey, as viewing conditions were excellent. The total count of 95 large Tahltan River Chinook salmon was approximately 5% of past surveys conducted at this reach of the river. Notwithstanding the slightly impaired viewing conditions at this site, the relatively poor count is possibly linked to the May 2014 Tahltan River rockslide that effectively blocked immigration of up to 70 percent of Tahltan River origin Chinook salmon. The Tahltan River rockslide may be size selective for salmon passage under different water flow regimes.

4 Budget and Project Operations

As presented in Appendix 3, the budget of $22,000 was only partially expended to the amount of $12,412.07 as only one survey was flown; as such $9,587.93 remains unspent. A total of $2,200 of this is a hold-back and thus $7,387.93 of the funds provided to date will be refunded. Expenditures were for helicopter fuel, its transport from Terrace B.C. to the lower Stikine River, and the helicopter charter, as follows:

Description	Budget (PSC)	Expenditure	Balance
Fuel Transport	3,000.00	1,848.40	1,151.60
Aerial Survey	16,000.00	8,457.50	7,542.50
Fuel	3,000.00	2,106.17	893.83
Grand Total	**22,000.00**	**12,412.07**	**9,587.93**

5 Conclusion

The project was partially fulfilled in that the five index sites were surveyed during one aerial flight. The ratio of (jack/ large) applied to the aerial survey counts from the Little Tahltan weir sample (jack/ large) ratio observed in 2016 should be used with a measure of scepticism given the possible salmon size selectivity for passage under different water flow regimes.

The aerial survey counts of the main stem Tahltan River were valuable in providing information on the spawning distribution of the species, i.e. found that spawners were located at many and varied sites from near the mouth of the river upstream to Decheeka Falls. The survey also provided insight into the migration success of Chinook salmon around the May 2014 rockslide. The survey results are also of value in association with the concurrent Stikine Chinook telemetry study.

6 Recommendations

Given that the importance of realizing the survey objectives which are to provide Chinook counts from index sites in both the upper (Little Tahltan, Tahltan, and Beatty) and lower reaches (Christina and Verrett) of the Stikine River which loosely corresponds to DFO's Wild Salmon Policy prescribed conservation units (stocks), in concert with augmenting the current Little Tahltan weir (jack/ large ratio) to aerial survey count ratio's, and providing some measure of validation of the system wide mark-recapture based escapement estimates, it is highly recommended that these surveys continue.

Moreover, the surveys of the Tahltan River gain special importance in light of the 2014 rockslide. Survey counts above the slide will provide insight as to salmon access conditions at the landslide site. It is further recommended that surveys be conducted as early as possible during the day and before peak glacial melt is manifest, thus capitalizing on opportune viewing conditions in glacier fed systems. (To note: this recommendation is not germane to the Little Tahltan index site given that this system has minor glacial runoff inputs.) Finally, it is imperative that planning and scheduling for the surveys start in early June to ensure helicopter availability and provide time for helicopter fuel placement and surveyor scheduling.

7 Acknowledgements

Cheri Frocklage (Tahltan Fisheries Co-ordinator) and Johnny Sembsmoen of DFO conducted the aerial surveys supported by this funding. Lakelse Air provided the air charter services. Bandstra Transportation and Myles Sampson provided fuel transport. Colleen Claggett, Carole Laframboise, and Kylie Townend (DFO) assisted with the financial administration and accounting for this project

8 Literature Cited

Bernard, D.R., S.A. McPherson, K.A. Pahlke, and P. Etherton. 2000. Optimal production of Chinook salmon from the Stikine River. Alaska Department of Fish and Game, Fishery Manuscript Series, No. 00-1, Anchorage.

Der Hovanisian, John A, Keith A. Pahlke, and Peter Etherton. 2002. Abundance of the chinook salmon escapement on the Stikine River,2001. Alaska Department of Fish and Game, Fishery Data Series No. 02- , Anchorage

Der Hovanisian, John A., Keith A. Pahlke, and Peter Etherton. 2003. Abundance of the chinook salmon escapement on the Stikine River, 2002. Alaska Department of Fish and Game, Fishery Data Series No. 03- , Anchorage

Der Hovanisian, John A., Keith A. Pahlke, and Peter Etherton. 2004. Abundance of the chinook salmon escapement on the Stikine River, 2003. Alaska Department of Fish and Game, Fishery Data Series No. 04- , Anchorage

Der Hovanisian, John A., and Peter Etherton. 2005. Abundance of the Chinook salmon escapement on the Stikine River, 2004. Alaska Department of Fish and Game, Fishery Data Series No. 05- , Anchorage

Der Hovanisian, J.A, and P. Etherton. 2006. Abundance of the Chinook salmon escapement on the Stikine River, 2005. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Data Series No. 06-01. Anchorage.

DFO (Department of Fisheries and Oceans, Canada). 2001. *FISS Search Results: Stikine River*., from Fisheries Information Summary System: [Cited December 2014]. Available from: http://www.cmnbc.ca/atlas_gallery/BC-fish-and-fish-habitat-atlas

Pahlke, K.A. and P. Etherton. 1998. Abundance of the Chinook salmon escapement on the Stikine River, 1996. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Data Series No. 97-37, Anchorage.

Pahlke, K.A. and P. Etherton. 1999. Abundance and distribution of the Chinook salmon escapement on the Stikine River, 1997. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Data Series No. 99-06, Anchorage.

Pahlke, K.A. and P. Etherton. 2000. Abundance of the Chinook salmon escapement on the Stikine River, 1998. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Data Series No. 00-24, Anchorage.

Pahlke, K.A., P. Etherton, and J.A. Der Hovanisian. 2000. Abundance of the Chinook salmon escapement on the Stikine River, 1999. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Data Series No. 00-25, Anchorage.

PSC (Pacific Salmon Commission). 2004. *Salmon management and enhancement plans for the Stikine, Taku and Alsek rivers, 2004.* December 2004. TCTR (04)-3. Vancouver, British Columbia, Canada.

PSC (Pacific Salmon Commission). 2015. *Salmon management and enhancement plans for the Stikine, Taku and Alsek rivers, 2015.* April 2015. TCTR (04)-3. Vancouver, British Columbia, Canada

PST (Pacific Salmon Treaty). 2004. Treaty between the governments of Canada and the government of the United States of America concerning Pacific salmon. http://www.psc.org/pubs/Treaty/Treaty%20July%202014.pdf

PST (Pacific Salmon Treaty). 2009. Treaty between the governments of Canada and the government of the United States of America concerning Pacific salmon. http://www.psc.org/pubs/Treaty/Treaty%20July%202014.pdf

Smith, J.J., D. Robichaud, M. Mathews, P. Etherton, B. Waugh, and K. Jensen. 2007. Mark-recapture and radiotelemetry studies of Stikine River adult salmon, 2000-2005. Pacific Salmon Comm. Tech.Rep. No X: X p.

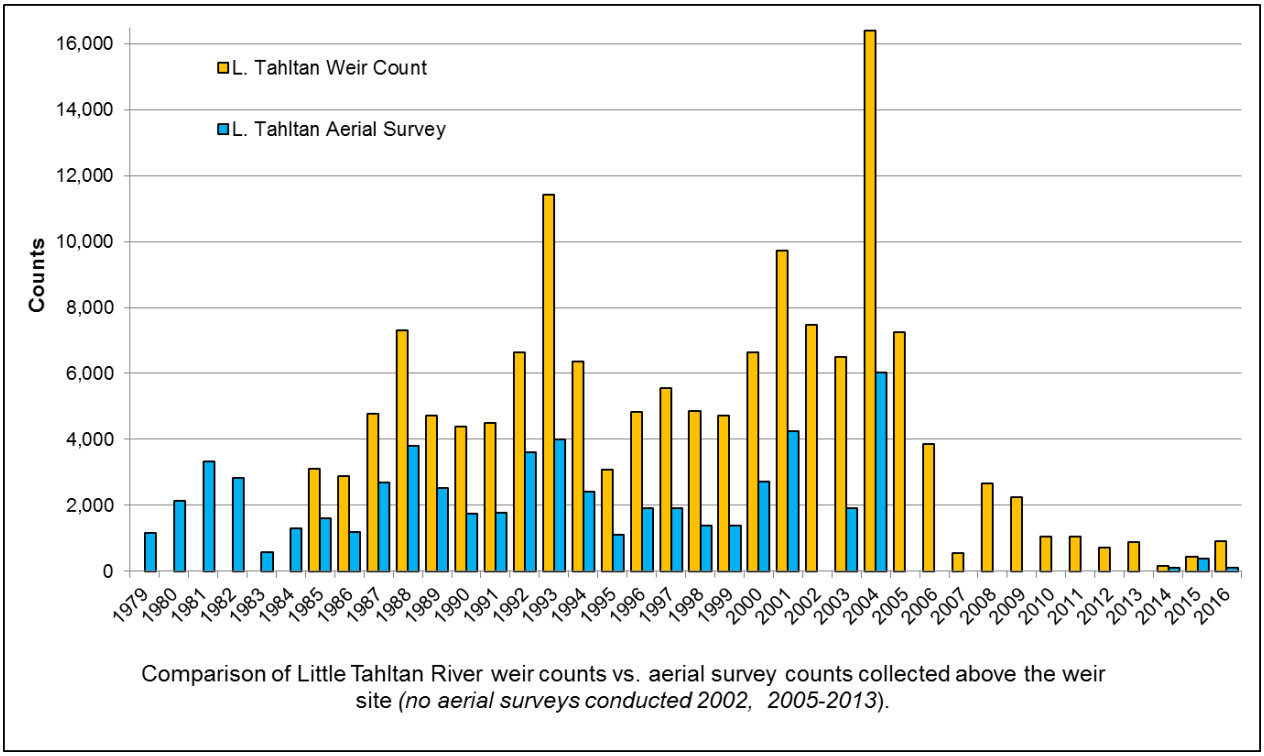
9 Appendices

Appendix 1 *Run size and escapement of Stikine River Chinook salmon based on weir counts and aerial survey estimates, 1979-2016.*

Year	Little Tahltan Weir	Little Tahltan Aerial	Tahltan Aerial	Beatty Aerial	Aerial count: L. Tahltan % of total weir
1979		1,166	2,118		
1980		2,137	960	122	
1981		3,334	1,852	558	
1982		2,830	1,690	567	
1983		594	453	83	
1984		1,294		126	
1985	3,114	1,598	1,490	147	51.32%
1986	2,891	1,201	1,400	183	41.54%
1987	4,783	2,706	1,390	312	56.58%
1988	7,292	3,796	4,384	593	52.06%
1989	4,715	2,527		362	53.59%
1990	4,392	1,755	2,134	271	39.96%
1991	4,506	1,768	2,445	193	39.24%
1992	6,627	3,607	1,891	362	54.43%
1993	11,425	4,010	2,249	757	35.10%
1994	6,360	2,422		184	38.08%
1995	3,072	1,117	696	152	36.36%
1996	4,821	1,920	772	218	39.83%
1997	5,547	1,907	260	218	34.38%
1998	4,873	1,385	587	125	28.42%
1999	4,733	1,379			29.14%
2000	6,631	2,720			41.02%
2001	9,730	4,258			43.76%
2002	7,476				
2003	6,492	1,903			29.31%
2004	16,381	6,014			36.71%
2005	7,253				
2006	3,860				
2007	562				
2008	2,663				
2009	2,245				
2010	1,057				
2011	1,058				
2012	720				
2013	878				
2014	169	121	514	15	71.63%
2015	450	374	110	63	83.11%
2016	921	107	95	25	11.62%
2016 % avg. of 1985-2015 Averages	19.45%	4.63%			
1985-2015	4,735	2,309	n/a	n/a	44.55%
1979-2004	n/a	2,374	n/a	n/a	41.10%
1979-1998	n/a	2,154	1,575	291	42.92%
1985-2004	6,293	2,526	1,642	291	41.10%

2014: Little Tahltan Weir (L/J - ratio = 80.9%)
2015: Little Tahltan Weir (L/J - ratio = 47.9%)
2016: Little Tahltan Weir (L/J - ratio = 74.3%)

Appendix 2 *Aerial survey counts versus Little Tahltan River weir counts of Chinook salmon, 1985-2016.*



Comparison of Little Tahltan River weir counts vs. aerial survey counts collected above the weir site *(no aerial surveys conducted 2002, 2005-2013)*.

Appendix 3 *Financial Summary*

Project Budget Form

Name of Project: **Stikine River Chinook Aerial Surveys, 2016.** **Page 1 of 2**

ELIGIBLE COSTS

Labour

Wages & Salaries

Position	# of crew	# of work days	hrs per day	rate per hour	Total (In-kind & Cash & PSC Amount)	In-Kind & Cash	PSC	Spent (PSC)	Variance (+/-)
Senior Technician (DFO EG-5)	1	12	7.5	35	3,150.00	3,150.00	0.00	0.00	0.00
Senior Technician (DFO EG-5)	1	12	7.5	35	3,150.00	3,150.00	0.00	0.00	0.00
Fisheries Technician (DFO EG-3)	1	5	7.5	32	1,200.00	1,200.00	0.00	0.00	0.00
Financial Officer	1	1	7.5	30	225.00	225.00	0.00	0.00	0.00
									0.00
									0.00
									0.00
Person Days (# of crew x work days)		30		sub total	7,725.00	7,725.00	0.00	0.00	0.00

Labour - Employer Costs (percent of wages subtotal amount)

	rate	20%		sub total	1,545.00	1,545.00	0.00	0.00	0.00

Subcontractors & Consultants	# of crew	# of work days	hrs per day	rate per hour	Total (In-kind & Cash & PSC Amount)	In-Kind & Cash	PSC	Spent (PSC)	Variance (+/-)
Helicopter Fuel Haul (includes boat charter)					3,000.00	0.00	3,000.00	1,848.40	1,151.60
Insurance if applicable	rate	0%							
				sub total	3,000.00	0.00	3,000.00	1,848.40	1,151.60

Volunteer Labour	# of crew	# of work days	hrs per day	rate per hour	Total (In-kind & Cash & PSC Amount)	In-Kind & Cash	PSC	Spent (PSC)	Variance (+/-)
Skilled									
Un-skilled									
Insurance if applicable	rate	0%							
				sub total					
			Total Labour Costs		12,270.00	9,270.00	3,000.00	1,848.40	1,151.60

Site / Project Costs

Travel (does not include to & from work)	Helicopter charter			16,000.00	0.00	16,000.00	8,457.50	7,542.50
Small Tools & Equipment								
Site Supplies & Materials	Helicopter fuel			3,000.00	0.00	3,000.00	2,106.17	893.83
Equipment Rental								
Work & Safety Gear								
Repairs & Maintenance								
Permits								
Technical Monitoring								
Other site costs								
			Total Site / Project Costs	19,000.00	0.00	19,000.00	10,563.67	8,436.33

Project Budget Form

ELIGIBLE COSTS

Training (e.g. Swift water, bear aware, electrofishing, etc.).				**Total (In-kind & Cash & PSC Amount)**	**In-Kind & Cash**	**PSC**	**Spent (PSC)**	**Variance (+/-)**
Name of course	# of crew	# of work days	Cost Per Person					
			Total Training Costs	0.00	0.00	0.00	0.00	0.00
Overhead / Indirect Costs								
Office space; including utilities, etc.				800.00	800.00	0.00	0.00	0.00
Office supplies				100.00	100.00	0.00	0.00	0.00
Telephone & long Distance				100.00	100.00	0.00	0.00	0.00
Photocopies & printing								
Insurance								
Indirect/ overhead costs								
			Total Overhead Costs	1,000.00	1,000.00	0.00	0.00	0.00
Capital Costs / Assets								
Assets are things of value that have an initial cost of $250 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.								
			Total Capital Costs	0.00	0.00	0.00	0.00	0.00
			Project Total Costs	32,270.00	10,270.00	22,000.00	12,412.07	9,587.93