Stikine River Chinook and Coho Salmon Coded Wire Tagging Augmentation, 2016.

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

March 2017

Johnny Sembsmoen and Ian Boyce
Fisheries and Oceans Canada
Suite 100, 419 Range Road
Whitehorse, Yukon Territory
Y1A 3V1

Executive Summary

In 2016 funding was received from the Northern Endowment Fund (NEF) under the umbrella of the Pacific Salmon Commission to augment an existing Stikine River Chinook and coho coded wire tagging program. This year's funding was the ninth time over the past ten years that that the N/F has provided financial support to shore up staffing, operation, and maintenance monies. The existing program originated in 2000 and has operated every year since its inception date. Prior to additional support funding provided by the 2006 Northern Fund grant, the original tagging goals of 20,000-25,000 chinook and 25,000 coho salmon smolts were seldom met. (*Note: In response to the relatively low recovery rates of tagged Stikine River Chinook and coho salmon from the 2000 to 2005 tagging projects, the Chinook tagging goal was increased to 40,000 smolts and later reduced to 32,000 and the coho goal was increased to 25,000 to 30,000 fish in January 2006. Smith et al, 2010, however, recommended that the coho tagging goal be reduced to 10,000 fish because of the fundamental change in the coho study objective which focused on marine interception by area and gear only, and not on overall coho smolt survival*). In 2016, the Chinook tagging goal was achieved whereas the coho tagging goal was not met. The success of achieving the Chinook goal in 2016 may be due to increased crew capture efficiency. The failure to reach the coho goal may be attributed to poor smolt production in the contributing cycle (spawning) years and / or missing smolt outmigration timing.

A total of 34,681 Chinook smolts were tagged, which exceeded the tagging goal of 32,000 fish, and was slightly below the 2009-15 average of 36,515 Chinook smolts. In concert with the release of capture and tagged Chinook smolts, a total of 4,064 coho smolts were tagged, which is well below the tagging goal of 10,000 fish, and is also well below the 2010-15 average catch of 9,086.

It appears evident that without the NEF support for this project that in all likelihood the tagging goals will not be met. It is recommended that the Stikine Chinook and coho augmentation project be continued in 2017 through to 2018.

Note: This report uses previous years' reports as a template. Peter Etherton (DFO, ret.) was a primary author on these reports and developed most of the text.

Table of Contents

1.0 INTRODUCTION 1

2.0 METHODS 3

3.0 RESULTS AND DISCUSSION 5

3.1 BUDGET AND PROJECT OPERATIONS.....11

4.0 CONCLUSION AND RECOMMENDATIONS.....11

5.0 LITERATURE CITED 12

List of Tables

Table 1Total coded wire tags applied to Stikine River Chinook and coho salmon smolts, 2000-16. 5
Table 2 Daily catch, effort and CPUE for Stikine River Chinook and coho salmon smolts, 2016..... 6

List of Figures

Figure 1 Map showing most of the Stikine River drainage and all of the Chinook and coho salmon coded wire tagging study area. 4
Figure 2 Daily catch of Chinook salmon smolts against daily Stikine River water temperatures (degrees Celsius), 2016. 7
Figure 3 Daily catch of coho salmon smolts against Stikine River water temperatures (degrees Celsius), 2016. 8
Figure 4 Weekly catch of Stikine River Chinook Salmon Smolts, 2016 vs. 2009-15 average. 9
Figure 5 Weekly catch of Stikine River coho salmon smolts, 2016 vs. 2000-15 average.. 9
Figure 6 Stikine River water temperatures (degrees Celsius), 2016 vs. 2000-15 average. 10
Figure 7 Stikine River water levels taken at the USGS water gauge, 2016 vs. 1976-15average. 10

List of Appendices

Appendix 1 Daily releases of coded wire tagged Stikine River Chinook salmon smolts, 2000-16. 13
Appendix 2 Daily releases of coded wire tagged Stikine River coho salmon smolts, 2000-16..... 14
Appendix 3 Financial Summary 15

1.0 Introduction

The Stikine River drainage covers approximately 52,000 km^2 (Bigelow et al. 1995), much of which is inaccessible to anadromous fish because of natural barriers. Principal tributaries include the Tahltan, Chutine, Scud, Porcupine, Tanzilla, Iskut, and Tuya rivers. The lower river and most tributaries are glacially occluded (e.g., Chutine, Scud, Porcupine, and Iskut rivers). Only 2% of the drainage is in Alaska (Beak Consultants Limited 1981). The upper drainage of the Stikine is accessible via the Telegraph Creek Road and the Stewart Cassiar Highway.

All seven North American species of the genus *Oncorhynchus* are present in the Stikine River (Scott and Crossman 1985). Sockeye salmon *(O. nerka*) is the most abundant, followed by Chinook salmon *(O. tshawytscha)*. Coho salmon *(O. kisutch)* ranks third in hierarchy of abundance. There are relatively minor numbers of pink salmon *(O. gorbuscha),* chum salmon *(O. keta),* and steelhead trout *(O. mykiss), a portion of which are resident species and are not anadromous.* Cutthroat trout *(O. clarki)* appear to be relatively abundant throughout the lower reaches of the river and some may be anadromous.

Stikine River salmon are harvested by U.S. commercial gillnet, troll, subsistence, and sport fisheries in Alaskan Districts 106 and 108. Stikine River salmon are also harvest in the US portion of the Stikine River by fishers licensed under a subsistence fishery. Additional catches of unknown quantity are taken in U.S. troll and seine fisheries in marine waters beyond Districts 106 and 108. In Canada, Stikine River salmon are harvested in two commercial gillnet fisheries located in the lower and upper Stikine River, and by a Canadian aboriginal fishery in the upper portion of the river (Figure 1). In addition, Canadian terminal area sockeye fisheries are operated in the lower Tuya River and/or at Tahltan Lake when escapements are estimated to include excess salmon to spawning requirements (ESSR). A minor Chinook salmon recreational fishery also exists in the Canadian sections of the Stikine River drainage. There is very little recreational fishing targeting coho salmon in the Canadian section of the Stikine River.

Because the Stikine River is a transboundary river (TBR) which originates in British Columbia, Canada, and flows to the sea near Wrangell, Alaska (Figure 1) the harvest of its salmon resources are governed by the principles and specifics (annexes) outlined in the Pacific Salmon Treaty (PST 1985). Generally, the catch sharing of Stikine River sockeye and coho was negotiated at the outset of the PST and successfully renegotiated at the expiration of the annexes. Catch sharing arrangements of Stikine River Chinook salmon, however, were deferred until such time that both Canada and the US determined that the population had rebounded from low numbers observed in the 1970's and 1980's. It was further agreed to under Annex IV, chapter 1, paragraph 2 of the PST that abundance based management regimes for Stikine Chinook, sockeye and coho salmon be developed and implement by 2004.

Based on the analyses from the information garnered from a suite of Stikine Chinook assessment activities including: aerial surveys (1975-1999), Little Tahltan weir counts (1985-1999), and an in-river mark-recapture projects (1995-1999), Bernard et al (2000) concluded that the Chinook run had rebounded from the its formerly depressed state and that escapements were above the optimum escapement of goal of 17,400 large fish since 1985 (excluding 1995). Based on the results of these stock assessment studies and after

discussions and negotiations between the Canadian and US sections of the Pacific Salmon Treaty's transboundary river panel, directed commercial fisheries were sanctioned by the Pacific Salmon Commission, under the authority of the Pacific Salmon Treaty (PST) in February 2005.

In order to properly prosecute this new directed Chinook fishery and adhere to the principle of abundance based management, the stock assessment studies conducted proceeding the new fishery were maintained, namely: the in-river mark recapture project, select aerials surveys, and the Little Tahltan River Chinook weir. The coded wire tagging (cwt) project was also maintained and was one of the recommendations listed by Bernard et al, (2000) who recommended that a coded wire tagging program be reinstated with the objective of providing both freshwater and marine survivorships estimates of Stikine Chinook salmon and to further provide a measure of catch accounting of this population.

Canada and the US acted on this recommendation to coded wire tag Chinook salmon in the spring of 2000. Canada's recommendation to capitalize on the Chinook cwt study infrastructure and include the tagging of coho salmon was adopted by ADF&G. The state of knowledge of Stikine coho salmon is not at the level of Stikine Chinook or sockeye where abundance based management regimes are in effect. It is widely believed by fisheries managers that the information and necessary Stikine River coho management tools will require a substantial amount of time and resources to collect and implement. The coho cwt study is a start at better developing the state of knowledge that will lead to affective abundance based management.

Since the inception of the Stikine cwt program through till 2006 the tagging goals of 20-25k Chinook smolts and 25k coho smolts have seldom been met, Table 1. Further, it had become apparent in January 2006 that our tagging fraction of Chinook salmon smolts was inadequate to properly assess smolt run size and outside fishery interception rates. A new tagging goal of 40k Chinook was adopted and later reduced in 2009 to 32,000 smolts. The new coho tagging goal of 25k-30k was adopted in 2006, but based on the recommendation from Smith, et al. (2010) the tagging goal was reduced to 10,000 coho smolts.

In order to meet the cwt tagging goals it was apparent that an increase in staff and support monies was required. To that end an application entitled "*Stikine River CWT Augmentation*" was submitted to and approved by the Northern Fund Committee in January 2006. An application to conduct the project for three consecutive years (2007-2009) was approved; however, the 2009 component was not funded due to the poor returns of the NEF's investments. The 2009 project was "rolled over" to 2010 through to 2014. The 2016 project was funded as on ongoing project. The following report summarizes the 2016 project and contrasts the results with past year's cwt project results.

2.0 Methods

Three field staff, including a camp cook, was hired in late March and started their employ in mid-April. From Wrangell Alaska and Telegraph Creek B.C., staff, equipment and supplies were boated using both government and charter vessels to the Fisheries and Oceans Canada field camp located on the banks of the Stikine River approximately 50 km upstream from its mouth. Fixed wing aircraft chartered out of Atlin B.C. and Telegraph Creek were also used to support the project. Camp supplies and equipment were purchased in mid-April through to the end of the project.

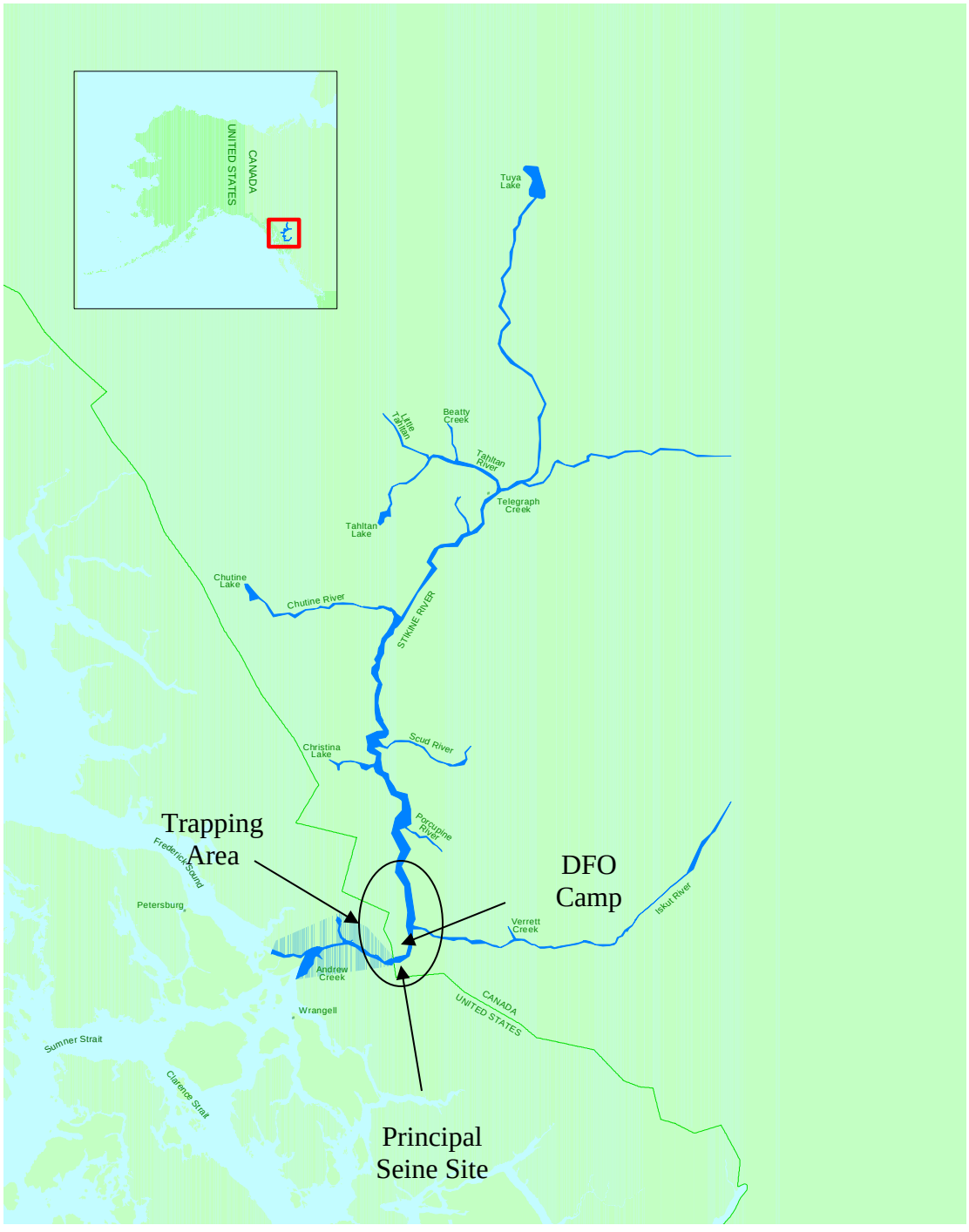
These three field staff fitted into the base crew of six souls for a total of eight field workers. On occasion up to ten field workers were on site. These extra bodies consisted of managerial staff from the Alaska Department of Fish and Game (ADF&G).

Chinook and coho salmon smolts were captured with beach seines and baited minnow traps in the mainstem Stikine River from the Canada/US boundary upstream approximately 20 km, and within the Iskut River (Figure 1). Seine net captured in concert with Gee minnow traps were utilized from April 22-25, May 4, and May 18-20. The majority of Chinook and coho smolts were caught from April 26 – May 12 utilizing just the seine net capture method. The staff participated as required in both the trapping and tagging components of the project. When the out migration commenced in early May, beach seining effort was increased, while Gee trapping abated substantially.

All healthy Chinook salmon smolt ≥ 50 mm fork length (FL) and coho salmon ≥ 70mm FL were tranquilized with a buffered MS 222 solution, injected with a CWT, and had their adipose fin removed. Each CWT is formed by cutting a 1.1 mm section of coded wire from a spool, which is stamped with a unique code and contains enough wire for approximately 10,000 tags. All marked (CWT') salmon smolts were released approximately 3 km downstream of the DFO camp. A sub sample of 100 tagged fish from the tagged fish holding in the pens was checked for tag retention after a 12 hours period of post tagging captivity. If tag retention was less than 98 per cent, the whole tagging group for the current day was checked for presence of a coded wire tag and those without were retagged. Daily mortalities were assessed and documented.

Flat bottom river boats (4.9-5.5 meter's) powered with jet drive outboards (30-60 hp) were used for Gee minnow trapping. Staff accessed the seine sites with the same equipment; however, seining was conducted without the aid of the boats. The crew 'walked" the seine net down specific river bars and pursed the seine onto the bank of the river. Fish were then hand dipped from within the bight of the seine, enumerated, and placed into a water-filled 22 litre bucket. A water filled, 100 litre tub, aerated tote was used for transport from the capture site to the tagging site located near the DFO camp (Figure 1). Depending on the quantity of fish available for tagging, fish were tagged either during the evening after the daily trapping concluded or the fish were tagged by an assigned tagging crew throughout the course of the day. Seldom were fish held overnight before tagging operations commenced; seldom were fish held for longer than 24 hrs.

Figure 1 Map showing most of the Stikine River drainage and all of the Chinook and coho salmon coded wire tagging study area.



3.0 Results and Discussion

Field operations commenced on 20 April; tagging commenced on the 22 April. The project concluded on 20 May. A total of 34,681 and 4,064 Chinook and coho were tagged respectively, Table 1. A slightly below average number of Chinook were captured and tagged in 2016 vs. the 2009-15 average. Very few of the chinook smolts were captured in Gee minnow traps; almost all were taken in beach seines predominantly at sites located in the mainstem Stikine River extending from the USA/Canada boundary upstream approximately 20 km, Figure 1. The majority of the coho smolts were taken in Gee minnow traps located throughout the study area.

The total Chinook tagged in 2016 was 8 % above the tagging goal of 32,000 fish. The sum of coho tagged in 2016 was 59 % below the tagging goal of 10,000 smolts.

Table 1Total coded wire tags applied to Stikine River Chinook and coho salmon smolts, 2000-16.

Table 1. Total coded wire tags applied to Stikine River Chinook and coho salmon smolts.

Year	Chinook		coho	
	# applied	goal	# applied	goal
2000	14,565	20,000	17,456	25,000
2001	5,194	20,000	22,267	25,000
2002	17,406	20,000	14,714	25,000
2003	19,928	22,000	8,757	25,000
2004	25,797	22,000	13,852	25,000
2005	22,167	25,000	13,098	25,000
2006	47,249	40,000	31,183	25,000
2007	23,755	40,000	18,850	25,000
2008	44,024	40,000	26,032	25,000
2009	42,056	32,000	6,588	25,000
2010	35,012	32,000	11,008	10,000
2011	32,164	32,000	10,153	10,000
2012	34,799	32,000	11,085	10,000
2013	49,361	32,000	8,665	10,000
2014	41,998	32,000	4,104	10,000
2015	20,215	32,000	9,502	10,000
2016	**34,681**	**32,000**	**4,064**	**10,000**
Chinook avg. 2009-15	36,515			
coho avg. 2010-15			9,086	

The peak Chinook catch of 2,545 fish occurred on May 5th, while the peak coho catch of 467 fish took place on April 23rd, Table 2, Figures 2 & 3.

Table 2 Daily catch, effort and CPUE for Stikine River Chinook and coho salmon smolts, 2016.

Date	Tagged Chinook	Seine Sets	Seine CPUE	Tagged Coho	Traps	Trap CPUE
22-Apr	192	15	12.8	105	38	2.8
23-Apr	497	23	21.6	467	38	12.3
24-Apr	1753	27	64.9	441	38	11.6
25-Apr	1497	45	33.3	239	18	13.3
26-Apr	1852	47	39.4	210	0	
27-Apr	2247	47	47.8	197	0	
28-Apr	1748	50	35.0	169	0	
29-Apr	1167	47	24.8	207	0	
30-Apr	1373	52	26.4	165	0	
01-May	942	51	18.5	103	0	
02-May	800	48	16.7	93	0	
03-May	1433	48	29.9	223	0	
04-May	2200	47	46.8	170	11	15.5
05-May	2545	67	38.0	153	0	
06-May	2382	39	61.1	121	0	
07-May	2323	46	50.5	217	0	
08-May	1819	35	52.0	99	0	
09-May	2097	55	38.1	187	0	
10-May	1647	47	35.0	90	0	
11-May	1080	44	24.5	107	0	
12-May	1826	32	57.1	55	0	
13-May	0		0.0	0	0	
14-May	44	15	2.9	17	0	
15-May	357	18	19.8	12	0	
16-May	497	29	17.1	43	0	
17-May	0	0	0.0	0	0	
18-May	324	17	19.1	18	20	0.9
19-May	17	0	0.0	69	63	1.1
20-May	22	0	0.0	87	63	1.4
21-May	0	0	0.0	0	0	
22-May	0	0	0.0	0	0	
Totals	**34681**			**4064**		

Note: Seine and Trap CPUE are approximate when methods deployed simultaneously. Tagged fish were released the day after capture.

The timing of Chinook smolts in 2016 based solely on catch performance (CPUE) appears to be 2 weeks earlier than the 2009-15 average, Figure 4. Figure 5 depicting the weekly CPUE of coho in 2016 is inconclusive in assessing run timing in that coho fishing effort typically wanes in early May in order to direct more effort at catching Chinook smolts but does appear to be near normal when compared to 2010-15 average.

Fishing conditions are typically affected at the outset of the field season by variations in snow levels and ice conditions. High water levels serve to diminish fishing efficiency and usually occur in late May and early June. Hence late or early springs may result in a varied catch level independent of smolt abundance. The relatively early high water which commenced on 18 April and ended on 10 May (2 weeks early) more than likely adversely affected catch performance of

minnow traps, and seine net fishing activities which is the main method for catching Chinook smolts; however the catch of Chinook smolts was better than expected given the early high water levels.

Figure 2 Daily catch of Chinook salmon smolts against daily Stikine River water temperatures (degrees Celsius), 2016.

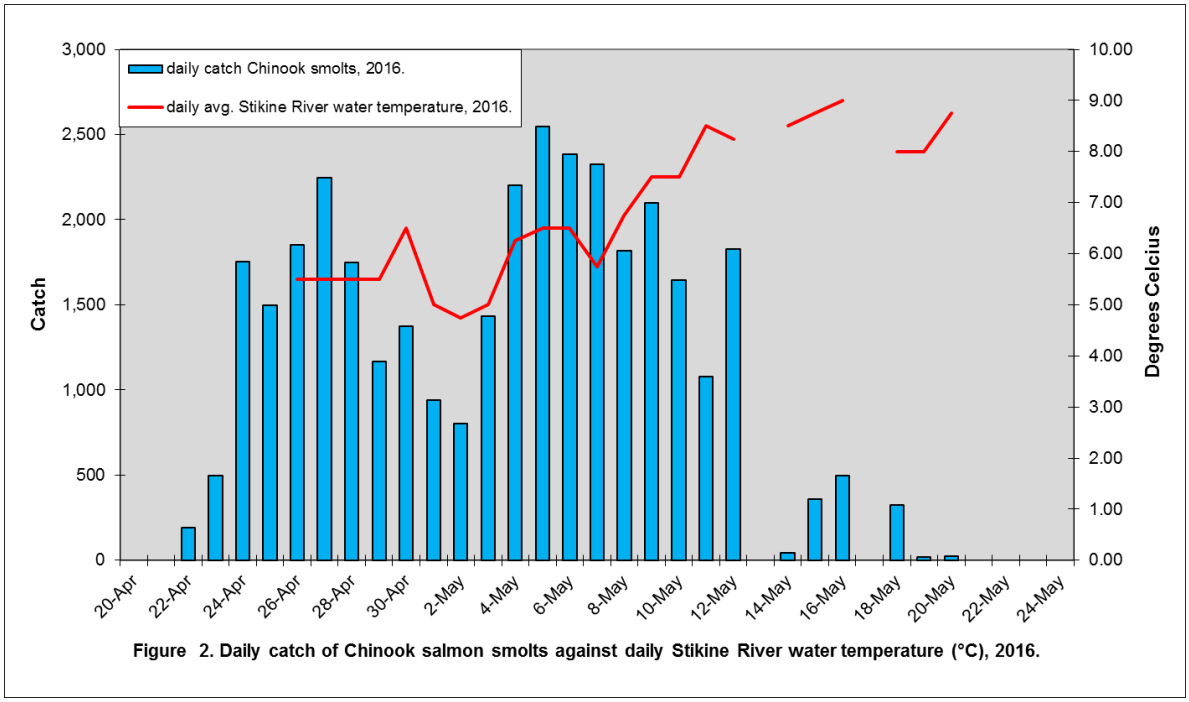


Figure 2. Daily catch of Chinook salmon smolts against daily Stikine River water temperature (°C), 2016.

Stikine River water temperatures in 2016 were 1.0 – 3.5 above the 10 year average for most of the project, Figure 6. The behavior response of juvenile Chinook and coho to water temperatures is uncertain; however, Sandercock (1991) indicated that year to year variations in timing are related to annual environment variation. Druker (1972) showed that Karluk River, Alaska coho smolts migrate between 5 and 13.3 degree Celsius. Figure 3 shows that 71 per cent of the 2016 Stikine River coho smolts migrated below this range of temperatures. Further, McHenry (1981) indicate that few coho smolts migrate in water temperatures below 3.9 degrees Celsius in Bear Creek, Alaska. Healy (1991) indicates that there has been no systematic study of the factors that trigger migration, yet Bell (1958) related peak smolt migration to spring floods and increasing temperatures. A causative factor for peak migration whether it be hypothesized to be water temperatures or water level was somewhat evident in the 2016 coded wire tagging project, Figures 3,4,6,7. Catches of Chinook smolts often improved when the water level (Figure 7) started to rise. It must be reiterated that smolt catches serve as a proxy for migration timing in Figures 2 & 3. The appropriateness for this proxy is very much suspect. At best the catches over time serve as general qualitative measure of run timing, especially in light of the physical challenges of catching migrating smolts during high water periods.

In 2006 through till 2008 it was found that chinook smolts had a propensity to migrate during darkness. A three person crew, on occasion a two person crew, fished a 70 metre seine net between the approximately hours of 2100 and 0200 hrs. The nocturnal nature of the migrating Chinook was clearly evident in 2006-08, as daytime seining yielded a relatively low catch rate of

smolts. This nocturnal behaviour was not evident with coho smolts. It's interesting to note that Meehann and Sniffin (1962) found no evidence of nocturnal migration in their study of Taku River salmonid smolts. (The Taku River is located approximately 200 km north of the Stikine River). In 2009 through till 2014 the night time seining was severely curtailed due to the logistic challenges (overtime and employee health/ morale) associated with it.

Figure 3 Daily catch of coho salmon smolts against Stikine River water temperatures (degrees Celsius), 2016.

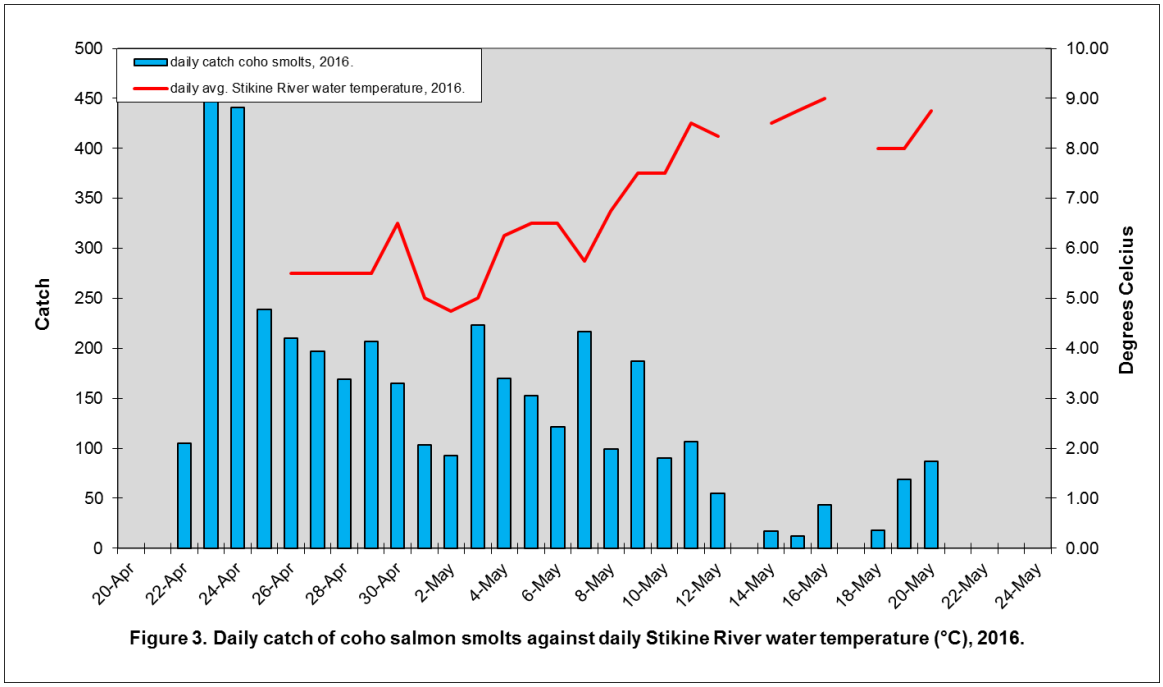


Figure 3. Daily catch of coho salmon smolts against daily Stikine River water temperature (°C), 2016.

Total daily catches taken by Gee minnow traps and by seine nets were recorded and transcribed into electronic files within a Microsoft excel file.

Figure 4 Weekly catch of Stikine River Chinook Salmon Smolts, 2016 vs. 2009-15 average.

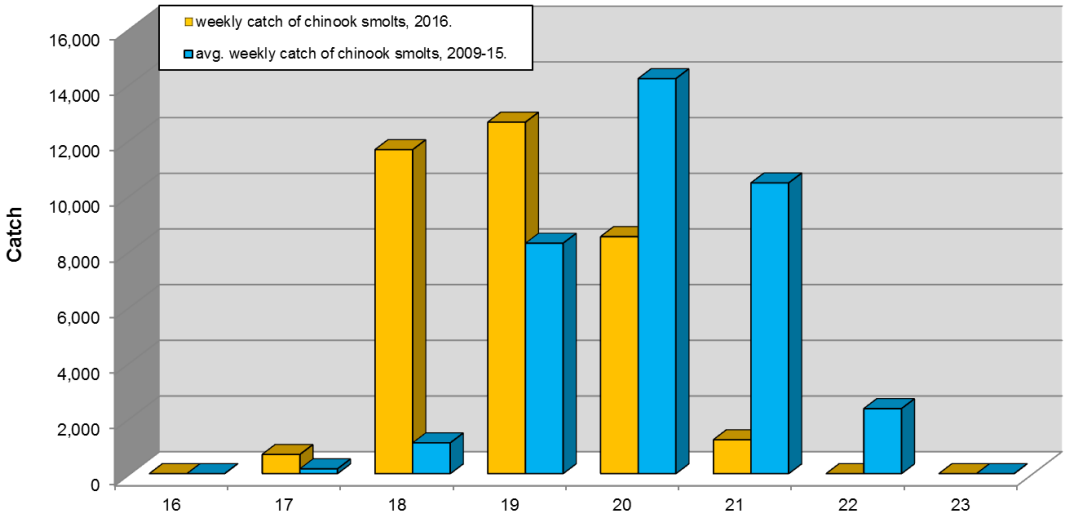


Fig 4. Weekly catch of Stikine River Chinook salmon smolts in 2016 vs. average catch from 2009-15. *This data may provide a coarse estimate of run timing, but does not account for fishing conditions or effort.*

Tag codes germane to the 2016 tagged Chinook and coho salmon were inputted into the Alaska Department of Fish and Game's coded wire tag website (www.taglab.org). Once this data set is verified, it will be forward to and inputted into Regional Mark Processing Centre website (www.rmpc.com).

Figure 5 Weekly catch of Stikine River coho salmon smolts, 2016 vs. 2000-15 average.

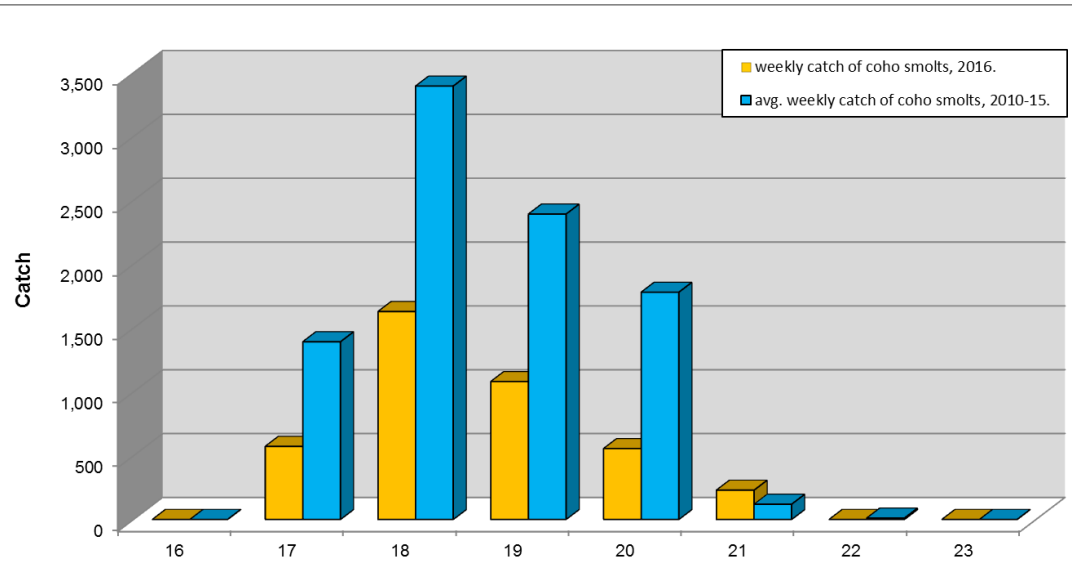


Fig 5. Weekly catch of Stikine River coho salmon smolts in 2016 vs. average catch from 2010-15. *This data provides a coarse estimate of run timing, but does not account for fishing conditions and effort.*

Returning marked fish from this year's project will be intercepted in 2018 through to 2022 by marine gillnet, troll and sport approach water fisheries, primarily in Alaska, and in inriver Stikine commercial, aboriginal and sport fisheries.

Figure 6 Stikine River water temperatures (degrees Celsius), 2016 vs. 2000-15 average.

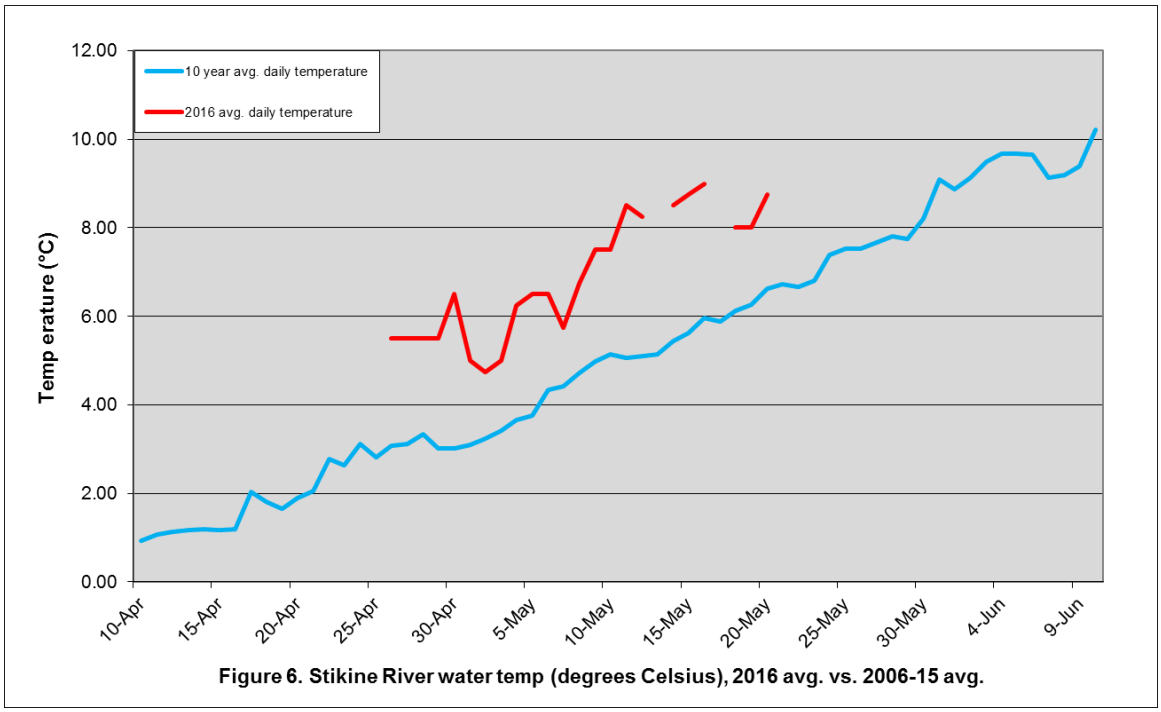


Figure 6. Stikine River water temp (degrees Celsius), 2016 avg. vs. 2006-15 avg.

Figure 7 Stikine River water levels taken at the USGS water gauge, 2016 vs. 1976-15average.

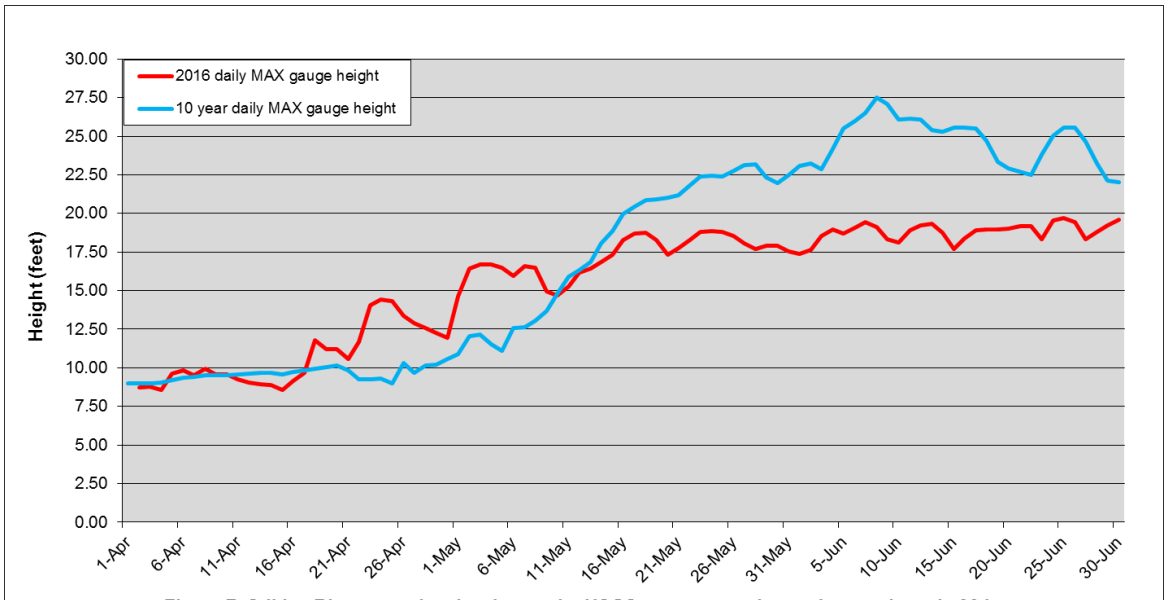


Figure 7. Stikine River water levels taken at the USGS water gauge located approximately 30 km downstream from the confluence of the Stikine and Iskut rivers, 2016 vs. 2006-15 avg.

3.1 Budget and Project Operations

As presented in Appendix 3, the expenditures of Northern Endowment Funds amounted to $90,040.00 which matched the budgeted amount of $90,040.00. The 10% holdback of $9,000.00 is anticipated once the final project report is accepted by the Pacific Salmon Commission. A summary of Fund expenditures in relation to budgeted amounts is as follows:

Description	Budget (PSC)	Expenditure	Balance
Salary	38,363.00	24,976.18	13,386.82
Salary EPB @ 20%	7,672.00	4,995.24	2,676.76
Tahltan First Nation	25,600.00	41,663.58	-16,063.58
Travel	7,800.00	7,800.00	0.00
Small Tools & Equipment	600.00	600.00	0.00
Site Supplies & Materials	3,800.00	3,800.00	0.00
Work & Safety Gear	600.00	600.00	0.00
Repairs & Maintenance	1,500.00	1,500.00	0.00
Other site costs	4,105.00	4,105.00	0.00
Grand Total	**90,040.00**	**90,040.00**	**0.00**

4.0 Conclusion and Recommendations

The project objectives were partially met. The Chinook salmon smolt tagging goal of 32,000 was exceeded with a catch of 34,681 and is most likely due to a combination of higher seasonal water temperatures and lower than average water levels in the months of May and June given the majority of Chinook smolts are caught by the beach seining method. The coho tagging goal of 10,000 smolts was not met with a catch of 4,064. The relative success of the overall project was due to the support provided by the Northern Endowment Fund.

It is recommended that the Stikine Chinook and coho augmentation project be continued in 2017 through 2018 in order to achieve the current tagging objectives for Stikine Chinook and coho salmon smolts.

5.0 Literature Cited

Beak Consultants Limited. 1981. Preliminary analysis of the potential impact of hydroelectric development of the Stikine River system on biological resources of the Stikine River estuary. Report for the British Columbia Hydro and Power Authority. Richmond, British Columbia, Canada.

Bell, R. 1958. Time, size, and estimated numbers of seaward migrants of Chinook salmon and steelhead trout in the Brownlee-Oxbow section of the middle Snake River. State of Idaho Department of Fish and Game, Boise, ID. 36 p.

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, Division of Sport Fish, Fishery Manuscript No. 00-1. Anchorage.

Bigelow, B. B., B. J. Bailey, M. M. Hiner, M. F. Schellekens and K. R. Linn. 1995. Water resources data Alaska water year 1994. U. S. Geological Survey Water Data Report AK-94-1, Anchorage

Drucker, B. 1972. Some life history characteristics of coho salmon of Karluk River system, Kodiak, Alaska. Fish. Bull. (U.S.) 70:79-94.

Healy, M.C. 1991b. Life history of chinook salmon (Oncorhynchus tshawytcha). Pages 311-393 in C. Groot and L. Margolis, *eds.*, *Pacific salmon life histories*. University of British Columbia Press, Vancouver.

McHenry, E.T. 1981. Coho salmon studies in the Resurrection Bay area. Annu.Prog. Rep. Alaska Dep. Fish Game Fed. Aid Fish Restoration 1980-81:427-449

Meehan. W.R., and D.B. Siniff. 1962. A study of the downstream migrations of anadromous fishes in the Taku River, Alaska. Trans. Am. Fish. Soc. 91:339-407.

PST (Pacific Salmon Treaty). 2004. Treaty between the government of Canada and the government of the United States of America concerning Pacific salmon. Prepared by the Pacific Salmon Commission, Vancouver, British Columbia.

Sandercock, F.K. 1991b. Life history of coho salmon (Oncorhynchus kisutch). Pages 397-445 in C. Groot and L. Margolis, *eds.*, *Pacific salmon life histories*. University of British Columbia Press, Vancouver.

Scott W.B. and E.J. Crossman. 1985. Freshwater fishes of Canada. Bulletin 184. Fisheries Research Board of Canada, Ottawa 1973.

Smith, J.J., P. Etherton, and P. Richardsons, 2010. Migratory pattern, timing, and harvest of coho salmon based on coded-wire tagging studies, 2000-2007. Pacific Salmon Commission, document EA3065.

Tripp, D and P. McCart. 1983. Effects of different coho stocking strategies on coho and cutthroat trout production in isolated headwater streams. Can. Tech. Fish. Aquat. Sci. 40:452-461.

Appendix 1 Daily releases of coded wire tagged Stikine River Chinook salmon smolts, 2000-16.

Appendix Table 1. Daily release of coded wire tagged (cwt) Stikine River Chinook salmon, 2000-16.
Note: 32,000 Chinook smolt catch goal since 2009.

Date	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2000-15 Avg.	2009-15 Avg.
9-Apr																			
10-Apr																			
11-Apr																			
12-Apr		59																59	
13-Apr		0				127												64	
14-Apr	13	74				0	119											52	
15-Apr	14	0				0	61											19	
16-Apr	53	55				278	59											111	
17-Apr	0	0				0	60											15	
18-Apr	0	82				266	154											126	
19-Apr	0	0				0	0		44									9	
20-Apr	244	124				176	277		0		63							147	63
21-Apr	121	85				0	144		69		89			9		14		66	37
22-Apr	0	83				0	227		211		111			41		83	192	95	78
23-Apr	305	85		94	1,059	122	438		130		82			43		67	497	243	64
24-Apr	145	0		72	0	0	413		215		25			55	38	106	1,753	97	56
25-Apr	83	0		0	0	0	503		0		115			34	68	106	1,497	83	81
26-Apr	352	113	170	0	1,114	162	0	182	460		96	0		16	76	159	1,852	207	69
27-Apr	553	111	0	0	0	0	1,174	76	159		42	27	67	6	65	100	2,247	159	51
28-Apr	562	0	183	0	545	1,356	401	118	360		73	24	29	25	28	44	1,748	250	37
29-Apr	404	0	0	0	0	0	479	62	0		48	46	29	94	86	65	1,167	88	61
30-Apr	391	91	237	0	314	2,469	402	123	419		131	10	21	381	74	74	1,373	342	115
1-May	0	118	0	0	0	0	343	197	233	75	0	45	26	244	95	54	942	89	77
2-May	972	0	83	0	0	1,320	287	262	0	0	0	50	0	483	83	124	800	229	106
3-May	668	0	0	0	708	0	736	123	579	168	1,207	36	671	631	87	211	1,433	364	430
4-May	558	149	0	0	404	0	0	290	245	0	1,285	36	1,083	1,584	468	311	2,200	401	681
5-May	362	0	0	0	1,448	981	1,024	117	447	444	997	160	692	962	1,255	195	2,545	568	672
6-May	776	0	32	348	0	0	827	222	784	0	1,327	687	1,867	1,773	1,593	320	2,382	660	1,081
7-May	731	174	20	0	0	813	904	297	2,387	1,446	1,420	434	946	2,475	2,012	463	2,323	908	1,314
8-May	671	0	0	265	0	0	2,620	394	3,557	3,059	1,535	311	491	3,151	2,786	693	1,819	1,221	1,718
9-May	591	202	119	0	0	2,074	2,684	422	2,512	3,064	871	228	352	3,343	4,455	865	2,097	1,361	1,883
10-May	312	0	0	547	0	1,023	2,693	107	2,104	3,568	907	1,048	929	4,631	4,342	1,655	1,647	1,492	2,440
11-May	512	229	159	0	5,758	0	2,967	771	2,620	4,614	857	1,603	1,256	4,336	5,268	1,902	1,080	2,053	2,834
12-May	545	0	675	542	0	1,929	2,216	628	2,882	3,181	886	1,427	1,627	3,216	3,767	1,954	1,826	1,592	2,294
13-May	266	0	0	0	0	1,695	2,394	327	2,640	2,805	831	1,196	1,489	3,092	3,340	2,777	0	1,428	2,219
14-May	0	311	0	879	2,075	0	1,421	260	3,552	2,867	794	1,297	718	3,266	2,400	1,801	44	1,353	1,878
15-May	424	0	773	825	0	1,516	1,751	722	3,139	2,862	1,109	1,827	1,487	1,618	2,689	2,004	357	1,422	1,942
16-May	248	502	0	958	0	0	1,658	193	1,067	1,932	1,797	2,817	1,567	3,060	2,505	1,056	497	1,210	2,105
17-May	0	0	410	951	6,937	683	2,831	508	1,204	1,533	713	2,648	979	1,933	945	954	0	1,452	1,386
18-May	530	0	0	639	0	0	3,267	758	1,375	189	2,389	3,523	1,388	660	0	834	324	972	1,283
19-May	0	307	0	491	1,284	1,049	1,915	1,207	928	1,683	1,907	5,022	1,605	1,191	851	407	17	1,240	1,809
20-May	304	0	274	961	0	0	3,061	2,122	3,085	1,911	3,348	3,192	1,187	1,500	639	210	22	1,362	1,712
21-May	0	696	0	412	1,107	903		1,123	2,756	1,480	3,386	1,758	1,038	1,251	313	399		1,108	1,375
22-May	353	707	0	520	0	0		1,260	1,239	1,038	2,116	1,270	1,225	1,053	8	91		725	972
23-May	0	0	290	0	0	816	3,176	1,384	0	1,493	0	988	1,993	930	0	117		699	789
24-May	545	0	0	1,106	2,044	0	624	2,944	2,043	1,553	2,164	355	3,129	891	731			1,209	1,471
25-May	0	807	2,184	538	0	0	653	1,941	577	1,091	761		3,711	942	695			993	1,440
26-May	0	0	831	0	0	855	1,177	1,675	0		1,035	99	1,015	441	236			526	565
27-May	806	0	916	1,123	1,000	1,117		2,442	0		495		935					883	715
28-May	0	0	1,468	0		0	606	498	2				741					368	741
29-May	386	0	707	1,392		0							321					468	321
30-May	0	0	626	602		347	449						185					316	185
31-May	0	30	1,435	458		0	54											330	
1-Jun	547		0	717		90												339	
2-Jun	0		1,683	1,439														1,041	
3-Jun	0		0	907														302	
4-Jun	132		0	954														362	
5-Jun	0		1,039	0														346	
6-Jun	0		699	838														512	
7-Jun	67		0	755														274	
8-Jun	0		945	595														513	
9-Jun	0		0															0	
10-Jun	18		972															495	
11-Jun	0		0															0	
12-Jun	1		476															239	
Total	14,565	5,194	17,406	19,928	25,797	22,167	47,249	23,755	44,024	42,056	35,012	32,164	34,799	49,361	41,998	20,215	34,681	35,653	39,150

Appendix 2 Daily releases of coded wire tagged Stikine River coho salmon smolts, 2000-16.

Appendix 2. Daily release of coded wire tagged (cwt) Stikine River coho salmon smolts, 2000-16.
Note: 10,000 coho smolt catch goal since 2010.

Date	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011[a]	2012	2013	2014	2015	2016	2000-15 Avg.	2010-15 Avg.
9-Apr		183																183	
10-Apr		0																0	
11-Apr		0																0	
12-Apr		789																789	
13-Apr		0				1,276												638	
14-Apr	389	786				0	441											404	
15-Apr	280	0				0	151											108	
16-Apr	428	992				1,193	315											732	
17-Apr	0	0				0	302											76	
18-Apr	0	860				1,114	450											606	
19-Apr	0	0			1,329	0	0		643									329	
20-Apr	729	1,298			1,010	1,522	1,033		0		679							896	679
21-Apr	842	1,179			0	0	603		565		1,294			288		23		533	535
22-Apr	0	1,076		455	1,879	0	764		1,057		1,137			641		316	105	733	698
23-Apr	1,516	939		0	908	1,536	1,311		1,130		772			674		197	467	898	548
24-Apr	792	0		576	948	0	1,209		1,056		488			754	145	287	441	569	419
25-Apr	428	0		0	905	0	1,327		0		1,060			330	118	304	239	407	453
26-Apr	578	1,594	1,857	0	740	1,392	0	1,060	1,962		1,602	514		184	134	620	210	874	611
27-Apr	627	1,207	0	0	794	0	2,740	428	1,029		867	504	956	72	158	521	197	660	513
28-Apr	568	0	1,204	0	860	1,004	1,162	1,303	1,504		1,098	504	982	150	154	473	169	731	560
29-Apr	141	0	0	0	0	0	1,478	291	1,002		768	735	643	228	296	340	207	395	502
30-Apr	681	1,068	1,921	0	1,125	503	1,262	736	1,368		1,243	509	533	458	301	284	165	799	555
1-May	0	940	0	0	898	0	1,019	1,168	995	723		735	566	482	378	324	103	549	497
2-May	559	0	937	0	282	523	1,093	711	0	0		808	0	375	112	522	93	395	363
3-May	779	0	0	0	0	0	1,353	121	2,175	881		586	666	329	10	522	223	495	423
4-May	392	1,436	444	0	177	0	0	798	1,270	0		970	396	277	157	528	170	456	466
5-May	359	0	0	0	0	1,563	1,723	540	497	1,073		776	307	286	266	482	153	525	423
6-May	412	0	0	639	164	0	1,367	754	1,230	0		480	285	320	210	438	121	420	347
7-May	331	1,054	492	0	40	716	1,548	681	710	716		739	361	253	216	511	217	558	416
8-May	340	0	668	894	106	0	991	605	1,566	1,163		503	204	588	165	436	99	549	379
9-May	318	1,086	688	0	120	913	779	725	348	262		281	158	293	144	455	187	438	266
10-May	254	0	0	889	306	393	779	107	628	0		442	164	0	265	633	90	324	301
11-May	582	1,311	827	0	0	0	693	1,025	816	0		576	368	342	247	533	107	488	413
12-May	416	0	1,672	722	302	454	870	930	870	0		491	598	250	205	302	55	539	369
13-May	409	0	0	0	257	147	895	820	800	413			549	120	139	200	0	339	252
14-May	0	887	0	117	138	0	49	496	632	399		63	235	76	109	87	17	219	114
15-May	416	0	738	259	87	172	634	795	155	0		42	492	43	48	71	12	263	139
16-May	205	911	0	384	326	0	784	212	466	266		78	438	62	27	30	43	279	127
17-May	0	0	803	324	0	179	344	713	328	0		131	386	97	13	21	0	223	130
18-May	393	0	0	305	42	0	487	711	57	56		41	398	64	0	10	18	171	103
19-May	0	613	0	341	0	239	657	896	96	439		8	396	90	10	0	69	252	101
20-May	408	0	897	276	17	0	440	454	184	0		5	346	54	14	14	87	207	87
21-May	0	449	0	202	29	161	0	295	89	0		8	262	51	0	0		103	64
22-May	457	371	0	182	24	0	0	356	11	197		6	269	46	5	16		129	68
23-May	0	0	709	0	0	136	121	341	0	197		1	127	141	0	2		118	54
24-May	354	0	0	275	0	0	9	367	230	427		0		129	18			139	49
25-May	0	526	282	35	7	168		209	48	475		7		94	33			157	45
26-May	0	0	140	0	20	0		109	0	475				24	7			70	16
27-May	310	0	108	137	0	263		88	0	475								153	
28-May	0	0	202	270	12	0		5	392	867								194	
29-May	249	650	21	312		0			0	867								300	
30-May	0	0	13	0		1			123	990								161	
31-May	0	62	0	286		0												70	
1-Jun	353		18	190		11												143	
2-Jun	0		8	328														112	
3-Jun	0		0	182														61	
4-Jun	323		0	111														145	
5-Jun	0		17	0														6	
6-Jun	0		31	39														23	
7-Jun	443		0	16														153	
8-Jun	0		10	11														7	
9-Jun	0		0															0	
10-Jun	285		7															146	
11-Jun	0																	0	
12-Jun	110																	110	
Total	17,456	22,267	14,714	8,757	13,852	15,579	31,183	18,850	26,032	11,361	11,008	10,153	11,085	8,665	4,104	9,502	4,064	21,548	12,082

Appendix 3 Financial Summary

Project Budget Form

Name of Project: Stikine River Coded Wire Tagging Augmentation, 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 (+/-)
DFO Stock Assessment Biologist Bi-3	1	8	7.5	47	2,820.00	2,820.00			0.00
DFO Stock Assessment Biologist Bi-2	1	8	7.5	36	2,160.00	2,160.00			0.00
DFO Fishery Technician EG 4	1	55	7.5	33	20,419.00		20,419.00	24,976.18	-4,557.18
DFO Fishery Technician EG 3	1	55	7.5	29	17,944.00		17,944.00	0.00	17,944.00
					0.00				0.00
					0.00				0.00
					0.00				0.00
Person Days (# of crew x work days)		126		**sub total**	43,343.00	4,980.00	38,363.00	24,976.18	13,386.82

Labour - Employer Costs (percent of wages subtotal amount)

	rate	20%		**sub total**	8,668.00	996.00	7,672.00	4,995.24	2,676.76

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 (+/-)
Tahltan First Nation (TFN)	2	64	8	25	25,600.00	0.00	25,600.00	41,663.58	-16,063.58
Insurance if applicable	rate	0%							
				sub total	25,600.00	0.00	25,600.00	41,663.58	-16,063.58

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		77,611.00	5,976.00	71,635.00	71,635.00	0.00

Site / Project Costs

Travel (do not include to & from work)	Air & boat charters, vehicle fuel, staff incidentals	11,000.00	3,200.00	7,800.00	7,800.00	0.00
Small Tools & Equipment		1,000.00	400.00	600.00	600.00	0.00
Site Supplies & Materials	Provisions, sample and smolt trapping essentials, etc.	3,800.00	0.00	3,800.00	3,800.00	0.00
Equipment Rental		0.00	0.00	0.00	0.00	0.00
Work & Safety Gear	Waders, Rain gear, PPE, etc.	600.00	0.00	600.00	600.00	0.00
Repairs & Maintenance	Outboards, generator, misc.	1,500.00	0.00	1,500.00	1,500.00	0.00
Permits		0.00	0.00	0.00	0.00	0.00
Technical Monitoring		0.00	0.00	0.00	0.00	0.00
Other site costs	Gasoline, propane, heating oil	4,105.00	0.00	4,105.00	4,105.00	0.00
	Total Site / Project Costs	22,005.00	3,600.00	18,405.00	18,405.00	0.00

Project Budget Form

ELIGIBLE COSTS **2016** **Page 2 of 2**

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					
Firearm safety	2	2	300	600.00	600.00	0.00	0.00	0.00
Swift water Rescue	1	3	500	500.00	500.00	0.00	0.00	0.00
			Total Training Costs	1,100.00	1,100.00	0.00	0.00	0.00
Overhead / Indirect Costs								
Office space; including utilities, etc.								
Insurance								
Office supplies	Printer Cartridges, Computer Parts, etc.,							
Telephone & long Distance	Satellite Phone & Internet			1,200.00	1,200.00	0.00	0.00	0.00
Photocopies & printing								
Other overhead costs	Admin Overhead @ 3%			3,021.00	3,021.00	0.00	0.00	0.00
			Total Overhead Costs	4,221.00	4,221.00	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	104,937.00	14,897.00	90,040.00	90,040.00	0.00

Budget Summary	**Total Budget Costs**	**Budget (PSC)**	**Actual Spent (PSC)**	**Variance (+/-)**
Total Labour Costs (Includes in kind cos	77,611.00	71,635.00	71,635.00	0.00
Total Site / Project Costs	22,005.00	18,405.00	18,405.00	0.00
Total Training Costs (In kind cost)	1,100.00	0.00	0.00	0.00
Total Overhead Costs (In kind cost)	4,221.00	0.00	0.00	0.00
Total Capital Costs	0.00	0.00	0.00	0.00
Project Total	104,937.00	90,040.00	90,040.00	0.00