

Northern Boundary Area Summer Chum Salmon Monitoring Project 2013: Final Report to the Pacific Salmon Commission Northern Fund

by

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ABSTRACT

The Alaska Department of Fish and Game (ADF&G) currently monitors summer chum salmon spawning abundance in 13 index streams in the Boundary Area of southern Southeast Alaska that are assessed primarily through aerial survey methods. ADF&G commercial fisheries managers had expressed concern regarding their ability to obtain reliable counts of chum salmon in some of the large mainland rivers where chum salmon may be masked by high densities of pink salmon, particularly in years of low chum salmon abundance. The primary objective of this project was to conduct helicopter surveys of summer chum salmon on currently monitored, large mainland river systems east of Ketchikan. Three complete helicopter surveys of the five targeted mainland rivers were conducted by three Ketchikan area management biologists in 2013. Additional foot and aerial surveys conducted concurrently on three smaller chum salmon index systems similarly allowed for direct comparisons with aerial survey estimates. In general, management biologists felt their views from helicopter surveys were improved over fixed-wing surveys. As part of the regular chum salmon monitoring program in Southeast Alaska, we recommend that a peak foot survey be conducted during the first week of August at as many of the smaller index streams as funding allows. In addition, a single helicopter survey conducted annually in late July or early August may offer a relatively inexpensive way for managers to help validate their fixed-wing aerial survey chum salmon counts at large mainland river systems.

INTRODUCTION

The Alaska Department of Fish and Game (ADF&G) currently monitors summer chum salmon spawning abundance in 13 index streams in the Boundary Area of southern Southeast Alaska that are assessed primarily through aerial survey methods (Eggers and Heintz 2008, Piston and Heintz 2011). Annual peak survey counts at these streams provide a meaningful indicator of trends in relative abundance, and form the basis of the current lower-bound sustainable escapement goal for southern Southeast Alaska summer chum salmon (Piston and Heintz 2011). High pink salmon abundance in many of these chum salmon index streams, however, can make it difficult to identify chum salmon during routine fixed-wing aerial surveys (Van Alen 2000). This is particularly true of the large mainland river systems where the size of the rivers also makes it difficult to ground-truth aerial survey counts. Although there is broad overlap in run timing of pink and summer-run chum salmon in these rivers, chum salmon tend to spawn earlier in the season than pink salmon (Van Alen 2000), which tend to hold in deeper areas in the lower portions of the river prior to spawning later in the summer.

ADF&G commercial fisheries managers have expressed concern regarding their ability to obtain reliable counts of chum salmon in some large mainland rivers where chum salmon may be masked by high densities of pink salmon, particularly in years of low chum salmon abundance. Improved stock assessment was needed to ensure that perceived low chum salmon abundance was not simply the result of limitations in the methods used to monitor chum salmon, and to provide biologists confidence in their ability to effectively separate chum salmon from more numerous pink salmon on the spawning grounds. The primary objective of this project was to conduct helicopter surveys of summer chum salmon on currently monitored, large mainland river systems east of Ketchikan. Helicopter surveys provided surveyors improved views of these streams, and an opportunity to validate observations of chum and pink salmon abundance, identify primary chum salmon spawning areas, and improve managers' ability to identify chum salmon during routine aerial surveys of other index streams in the area. Additional foot and aerial surveys conducted concurrently on two smaller chum salmon index systems and one proposed new index stream (Harris River) similarly allowed for direct comparison between methods. Results from these surveys will guide future chum salmon monitoring in the Boundary Area.

Although not a primary focus of this project, baseline pink and chum salmon genetic samples were collected opportunistically while conducting foot surveys.

PROJECT OBJECTIVES:

- Compare fixed-wing aerial survey counts to helicopter survey counts of chum salmon on five large mainland chum salmon index streams east of Ketchikan.
- Compare fixed-wing aerial survey counts to foot survey counts of chum salmon on two smaller chum salmon index streams east of Ketchikan and one proposed index stream on Prince of Wales Island.
- Document peak spawning periods in targeted chum salmon index streams.

STUDY SITE

Surveys were conducted at ADF&G summer chum salmon index streams in the Southern Southeast Subregion (SSE) of Southeast Alaska, which extends from Sumner Strait, in the north, to the Canadian border in the south—a distance of approximately 240 km (Figure 1). The SSE Subregion includes 13 streams, many of which are located on the mainland, east of Ketchikan, Alaska. Fixed-wing aircraft and helicopter surveys were conducted at the five largest mainland chum salmon index streams east of Ketchikan: the Tombstone (ADF&G stream no. 101-15-019), Keta (ADF&G stream no. 101-30-030), Marten (ADF&G stream no. 101-30-060), Wilson (ADF&G stream no. 101-55-020), and Blossom (ADF&G stream no. 101-55-040) rivers (Figure 1). Fixed-wing aircraft and foot surveys were conducted at two smaller chum salmon index streams: Hidden Inlet (ADF&G stream no. 101-11-101) and Carroll River (ADF&G stream no. 101-45-078). An additional paired foot and fixed-wing aircraft survey was conducted at the Harris River (102-60-082), which is a proposed new chum salmon index stream on Prince of Wales Island.

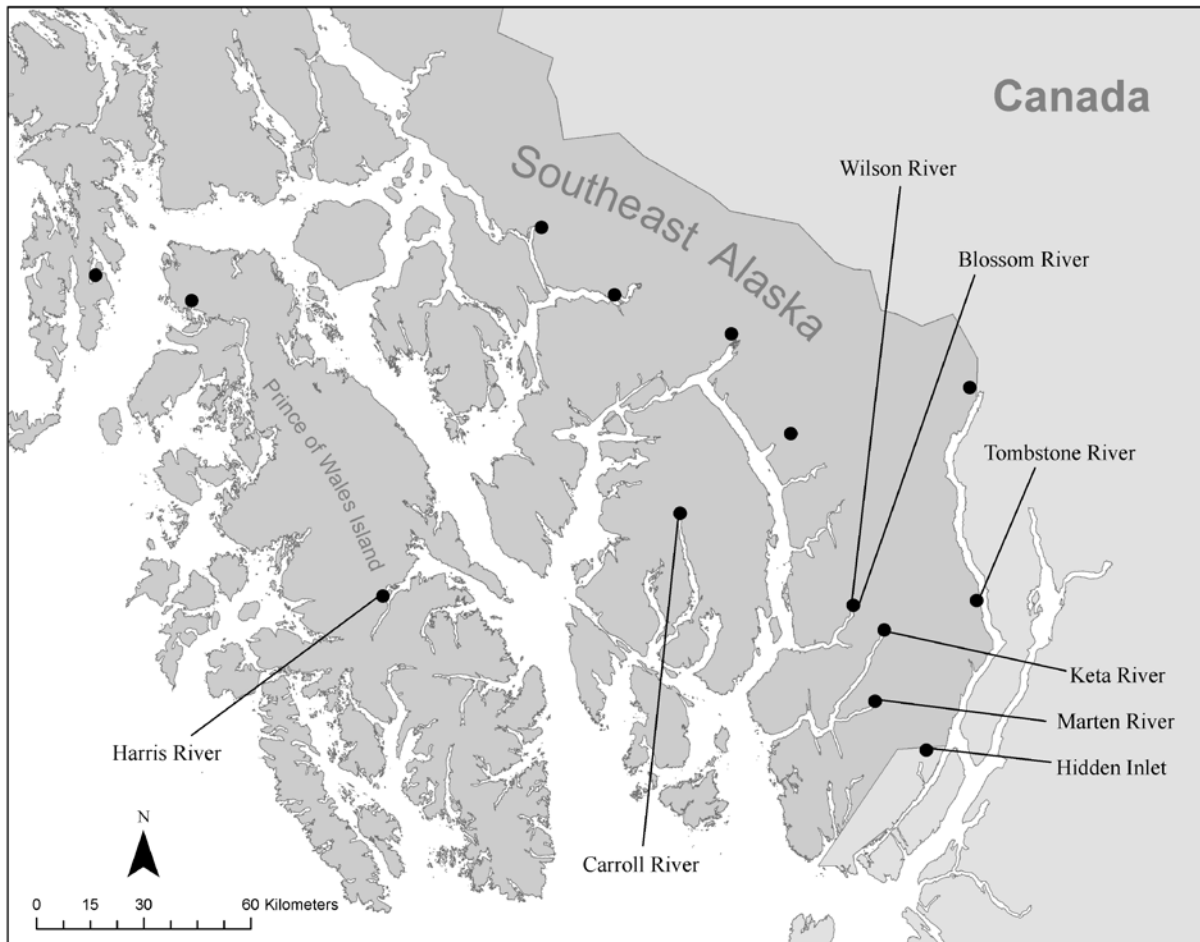


Figure 1.–Southern Southeast Subregion summer chum salmon index streams and index streams targeted for helicopter and foot surveys in 2013.

METHODS

In 2013, comparison of fixed-wing and helicopter surveys were conducted at the five largest mainland chum salmon index streams east of Ketchikan: the Tombstone (ADF&G stream no. 101-15-019), Keta (ADF&G stream no. 101-30-030), Marten (ADF&G stream no. 101-30-060), Wilson (ADF&G stream no. 101-55-020), and Blossom (ADF&G stream no. 101-55-040) rivers. Each of the three Ketchikan area management biologists flew at least one complete fixed-wing aerial survey of all five systems, followed by a complete helicopter survey of the same systems the next day (or as soon as possible). Aerial surveys were conducted in a Cessna 185 airplane flown at an altitude of 150 to 200 meters and a speed of approximately 110 km/hour. Helicopter surveys were conducted in a Hughes 500 helicopter following standard survey protocols (Pahlke 1996; Shaul and Tydinco 2006). At least one survey was conducted in late July or the first few days of August when chum salmon abundance was assumed to peak and prior to the first large influx of pink salmon onto spawning areas. Two additional surveys were conducted through mid-August to allow for observations under different densities and distribution of pink and chum salmon, and to ensure that the peak of chum salmon abundance was observed in the late July–early August surveys. Observers wore polarized glasses during surveys to reduce glare off the

water and optimize visibility. Survey counts were recorded on standardized escapement survey forms, along with survey conditions (visibility, water levels, weather, and tide stage) and other pertinent observations, and were entered into the Southeast Alaska Integrated Fisheries Database.

Three complete helicopter surveys of the five targeted mainland rivers were conducted by three Ketchikan area management biologists in 2013. The first helicopter survey was completed on 17 July 2013, following a 16 July fixed-wing aerial survey. The second helicopter survey took place on 29 July 2013, following a fixed-wing aircraft survey on 28 July 2013. The third helicopter survey was conducted on 6 August 2013, preceding a 7 August fixed-wing aircraft survey. Several other attempted helicopter surveys were cancelled due to weather and were not rescheduled because of limited staff time related to management of the record return of pink salmon that occurred in 2013. Additional fixed-wing aircraft surveys were conducted on each of these rivers as part of normal monitoring associated with commercial fisheries management.

Comparison of fixed-wing aircraft and foot surveys were conducted at two smaller chum salmon index streams east of Ketchikan: Hidden Inlet (ADF&G stream no. 101-11-101) and Carroll River (ADF&G stream no. 101-45-078). An additional paired foot and fixed-wing aerial survey was conducted at a proposed new index stream (Harris River) on Prince of Wales Island. Foot surveys were conducted by research staff and available management staff from late July to late-August as close as possible to regularly scheduled fixed-wing aircraft surveys to provide direct comparison and ground-truth aerial surveys. Hidden Inlet and Carroll River were surveyed two or three times over the course of the season, and the Harris River was surveyed once in late August.

RESULTS

HELICOPTER SURVEYS

During the first paired fixed-wing/helicopter survey, the observer counted more chum salmon during the helicopter survey at every targeted stream, and in some cases the estimates were as much as 6-fold higher during the helicopter survey (Table 1). In the second and third set of surveys, the observer's estimates were not consistently higher or lower during the helicopter surveys. During both of the final surveys observers had to estimate chum salmon mixed in with 100s of thousands of pink salmon and felt they had their best estimates during the helicopter surveys. All observers' counts generally matched up reasonably well with each other, which was likely in part due to the learning experience provided in 2012 when observer C had difficulty separating species during the last survey with extremely high pink salmon abundance. One observer was able to obtain high definition video footage of his entire helicopter survey, which allowed for a review of the survey with other managers and may provide future training opportunities for new observers. All managers agreed that helicopter surveys provided a valuable learning experience that would improve their ability to survey large mainland rivers.

Table 1.–Helicopter and aerial survey chum salmon counts at five southern Southeast Alaska summer chum salmon index streams, 2013.

Stream	Date	Survey Type	Stream Live	Stream Dead	Total	Observer
Marten River	7/16/2013	Aerial	2,000		2,000	A
Marten River	7/17/2013	Helicopter	12,500		12,500	A
Keta River	7/16/2013	Aerial	1,900		1,900	A
Keta River	7/17/2013	Helicopter	6,932		6,932	A
Blossom River	7/16/2013	Aerial	0		0	A
Blossom River	7/17/2013	Helicopter	975		975	A
Wilson River	7/16/2013	Aerial	2,000		2,000	A
Wilson River	7/17/2013	Helicopter	6,670		6,670	A
Tombstone River	7/16/2013	Aerial	3,000		3,000	A
Tombstone River	7/17/2013	Helicopter	3,355		3,355	A
Marten River	7/28/2013	Aerial	8,000		8,000	B
Marten River	7/29/2013	Helicopter	1,400	100	1,500	B
Keta River	7/28/2013	Aerial	7,000		7,000	B
Keta River	7/29/2013	Helicopter	11,000	350	11,350	B
Blossom River	7/28/2013	Aerial	10,000		10,000	B
Blossom River	7/29/2013	Helicopter	7,400		7,400	B
Wilson River	7/28/2013	Aerial	3,000		3,000	B
Wilson River	7/29/2013	Helicopter	1,200		1,200	B
Tombstone River	7/28/2013	Aerial	5,000			B
Tombstone River	7/29/2013	Helicopter	6,400	100	6,500	B
Keta River	8/6/2013	Helicopter	6,000	1,000	7,000	C
Keta River	8/7/2012	Aerial	2,000		2,000	C
Marten River	8/6/2013	Helicopter	6,000	2,000	8,000	C
Marten River	8/7/2012	Aerial	2,000	1,000	3,000	C
Blossom River	8/6/2013	Helicopter	5,000	1,000	6,000	C
Blossom River	8/7/2012	Aerial	2,000		2,000	C
Wilson River	8/6/2013	Helicopter	500		500	C
Wilson River	8/7/2012	Aerial	1000		1000	C
Tombstone River	8/6/2013	Helicopter	10,000	1,000	11,000	C
Tombstone River	8/7/2012	Aerial	20,000		20,000	C

FOOT SURVEYS

Carroll River

In 2013, five complete aerial surveys of the Carroll River were conducted by three Ketchikan area management biologists and three foot surveys were conducted by Ketchikan area research biologists. Foot surveys were conducted on 31 July, 6 August, and 15 August (Table 2). Aerial surveys were conducted 7 July, 15 July, 22 July, 30 July, and 7 August, which allowed for direct

comparison of the two methods (Table 2). Carroll River offers excellent counting conditions during a foot survey, particularly in the upper half of the river where chum salmon spawning density is highest. In 2013, extreme low water conditions led to unprecedented visibility during the first two foot surveys, particularly in the pools in the lower river where fish are typically difficult to see from the ground. During the first set of paired surveys on 6 and 7 August 2013, the aerial observer had a difficult time seeing chum salmon in the creek and only estimated 1,000 live chum salmon in the intertidal area and 140,000 pink salmon in the creek. The paired foot survey showed that there were very few chum salmon in the creek (approximately 500). The difficulty counting chum salmon from the air was as much a factor of low chum salmon abundance as it was a result of large numbers of pink salmon masking chum salmon in the creek. During the second set of surveys on 6 and 7 August, the aerial observer estimated 2,000 live chum salmon and foot surveyors estimated approximately 750. Although the aerial observers count was over twice as high as the foot surveyors, all of these counts correctly identified the fact that overall chum salmon abundance was very low. On the final foot survey, conducted on 15 August, the estimated number of live chum salmon had dropped to approximately 422 fish (all actively spawning or spawned out) and it was clear that the chum salmon run had nearly ended.

Hidden Inlet

In 2013, three aerial surveys of Hidden Inlet were conducted by two Ketchikan area management biologists and two foot surveys were conducted by Ketchikan area research biologists. Foot surveys were conducted on 25 July and 14 August (Table 2). Aerial surveys were conducted 25 July, 7 August, and 14 August, which allowed for direct comparison of the two methods. Hidden Inlet is a relatively small, clear stream that offers excellent counting conditions during a foot survey with few areas for chum salmon to avoid detection. Pink salmon returned to Hidden Inlet in record numbers in 2013, with over 90,000 present on the first survey and nearly 300,000 counted on the final aerial survey. During the first set of paired surveys the estimated number of live chum salmon in the creek was very low: the aerial observer could not readily identify chum salmon and only estimated pink salmon, and the foot survey confirmed that very few (<200) live chum salmon were present. An aerial survey was conducted on 7 August 2013 and the observer noted that there appeared to be very few chum salmon present and made a rough estimate of 2,000 live fish. During the second set of paired surveys, the aerial observer estimated more live chum salmon than the foot surveyors, 1,100 versus approximately 270, but correctly identified that chum salmon abundance was very low.

Harris River

In 2013, paired fixed-wing aircraft and foot surveys were conducted at the Harris River on August 21–22. On 21 August, the aerial observer estimated 7,000 live chum salmon and 390,000 live pink salmon in the river. The following day, foot surveyors estimated approximately 1,500 live chum salmon and 230,000 live pink salmon in the river. Separating chum salmon from the much more abundant pink salmon was extremely difficult from the air, but foot surveyors found that most of the chum salmon were actively spawning in riffles where easily visible and there was little sign of chum salmon holding in pools. The foot survey began approximately 0.5 km above the bridge Hydaburg Road bridge on the upper river and ended approximately 7 miles downriver at the Harris River Road bridge just above intertidal. The aerial survey continued down through intertidal and large numbers of pink salmon were still present below the foot survey area. However, very few chum salmon were observed in the lower river and the difference in chum salmon counts between the aerial and foot survey observers was not due to

large numbers of fish in the lower 0.5 km of river. Although the Harris River is a very long system, virtually the entire system is easily walked and the visibility is excellent under normal or low water levels.

Table 2.– Aerial and foot survey counts of chum salmon at three southern Southeast Alaska summer chum salmon index streams (Carroll River, Hidden Inlet, and Harris River), 2013.

Stream	Date	Survey Type	Intertidal	Stream Live	Stream Dead	Total	Observer
Carroll River	7/7/13	Aerial		50		50	A
Carroll River	7/15/13	Aerial		5,000		5,000	B
Carroll River	7/22/13	Aerial	2,000			2,000	A
Carroll River	7/30/13	Aerial	1,000			1,000	A
Carroll River	7/31/13	Foot		570		570	D
Carroll River	7/31/13	Foot		460		460	E
Carroll River	8/6/13	Foot		655		655	F
Carroll River	8/6/13	Foot		700	10	710	D
Carroll River	8/6/13	Foot		900	10	910	E
Carroll River	8/7/13	Aerial		2000		2,000	A
Carroll River	8/15/13	Foot		422	250	672	D
Hidden Inlet	7/25/13	Foot	24	174		198	D
Hidden Inlet	7/25/13	Foot	11	103		113	F
Hidden Inlet	7/25/13	Aerial ¹					C
Hidden Inlet	8/7/13	Aerial		2,000			C
Hidden Inlet	8/14/13	Foot	30	250	190	449	D
Hidden Inlet	8/14/13	Foot	32	227	190	470	F
Hidden Inlet	8/14/13	Aerial		1,100	200	1,300	B
Harris River	8/21/13	Aerial		7,000		7,000	A
Harris River	8/22/13	Foot		1,530	152	1,682	D
Harris River	8/22/13	Foot		1,470	152	1,622	F

¹No chum salmon were counted due to the very large numbers of pink salmon in the stream.

SPAWNING PERIODS

Unlike 2012, where chum salmon abundance peaked in most streams prior to the widespread spawning of pink salmon, almost all targeted streams in 2013 were inundated with tremendous numbers of pink salmon by late July. At most streams surveyed peak chum salmon abundance was generally highest in late July or early August, with the exception of Harris River on Prince of Wales Island which has generally later run timing than the mainland systems. In 2013, there was no window of opportunity for counting chum salmon before they were highly mixed with pink salmon. The Wilson River, for example, contained an estimate 120,000 pink salmon by 17 July 2013.

Genetic Sampling

In 2013, we collected pink salmon tissue samples from Hidden Inlet (232) and Carroll River (240), as well as a set of streams on Prince of Wales Island that were accessed on the trip to survey Harris River: Harris River (204), Klawock River (204), Maybeso Creek (120), Steelhead Creek (201), Sal Creek (201), Ratz Creek (200), Black Bear Creek (200), Gutchi Creek (205), and West Arm Moira Sound (219). In addition, 104 chum salmon tissue samples were collected at Harris River and 41 chum salmon samples were collected at Carroll River. All of these samples are for future use in genetic baselines for Southeast Alaska. Tissue samples are archived at the ADF&G Gene Conservation Laboratory, Anchorage.

DISCUSSION

The helicopter and foot surveys conducted in the first two years of this project have been invaluable for giving management and research biologist increased confidence in chum salmon index counts to SSE boundary area streams. In 2013, pink salmon returned to southern Southeast Alaska in record numbers (highest escapement index and 2nd highest harvest on record; Figure 2). Without the helicopter and additional foot surveys conducted for this project, management biologists would have been left uncertain about wild chum salmon escapements at many index streams. Most index streams were inundated with pink salmon early in the season and there was no opportunity to conduct peak chum salmon escapement surveys prior to the arrival of large numbers of pink salmon on the spawning grounds. The helicopter and foot surveys made it clear that wild chum salmon abundance was very low at some of the smaller index streams and poor to average at most of the larger mainland systems (further supported by catch data). Without these extra surveys it may have been assumed that large numbers of chum salmon were missed during aerial surveys due to masking by pink salmon. The first two years of this project provided radically different counting conditions and additional years would be beneficial to help current managers see the full range of variation in combined chum/pink salmon escapement sizes.

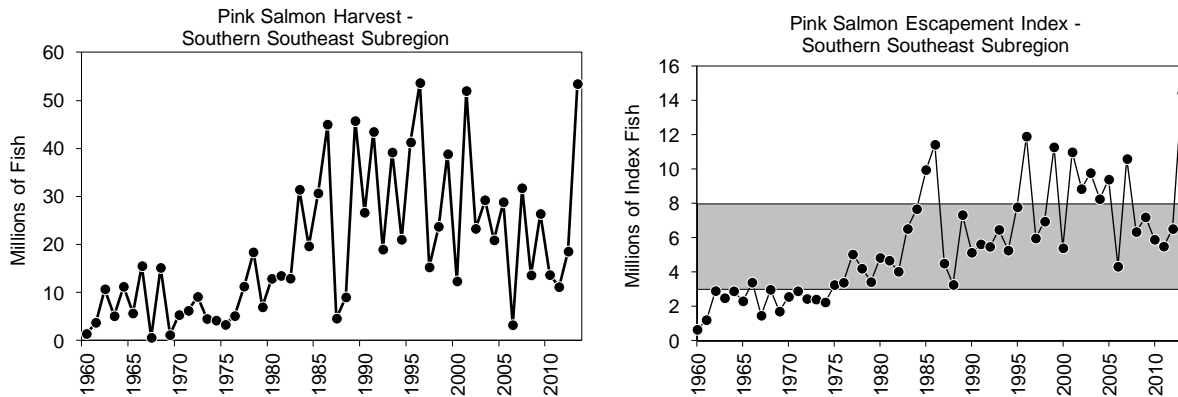


Figure 1.—Annual pink salmon harvest and escapement index for the Southern Southeast subregion, 1960–2013 (Districts 1–8). The shaded area indicates the escapement goal range of 3.0 million to 8.0 million index spawners.

Foot surveys of smaller streams were extremely valuable for ground-truthing aerial survey estimates and may offer the best opportunity for obtaining reliable and consistent chum salmon index counts, particularly for smaller streams with large, overlapping pink salmon runs. Chum salmon tend to move quickly to spawning riffles in smaller Southeast Alaska streams and can be easily picked out from more numerous pink salmon during foot surveys, even on years of very high pink salmon abundance. High definition video of surveys conducted from a helicopter showed promise as a tool for improving peak survey estimates on larger rivers. The videos obtained in 2012 and 2013 provided an additional opportunity to review counts and differentiate between species.

The Alaska Department of Fish and Game (ADF&G) currently maintains an escapement index of 13 summer-run chum salmon streams in the Boundary Area that are assessed primarily through aerial survey methods. Two additional index streams were identified during the first two years of this project, including one that was determined to be suitable for conducting long-term foot and aerial surveys (Harris River). These streams will be added to the Southern Southeast

Subregion summer chum salmon escapement index during the next Alaska Board of Fisheries meeting in winter 2014/2015. At the conclusion of this project (additional years pending), it is recommended that a peak foot survey be conducted during the first week of August at as many of the smaller index streams as funding allows. In addition, a single helicopter survey conducted annually in late July or early August may offer a relatively inexpensive way for managers to help validate fixed-wing aerial survey chum salmon counts at large mainland river systems.

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APPENDIX A

Appendix A 1.–Financial statement of expenditures, 2013.

Site / Project Costs	Description	Project Budget	Actual Expenditures
Travel	Small plane charters for conducting foot surveys at Hidden Inlet and Carroll River, 8 hours @\$675/hr.	\$8,400	\$7,958
	Helicopter charters for conducting surveys at Keta, Marten, Blossom, Wilson, and Tombstone rivers, 24 hours @\$1000/hr.	\$20,200	\$13,379
	Fixed-wing aerial survey of targeted mainland chum salmon rivers and Harris River.		\$7,390
	Ferry to Prince of Wales Island for Harris River survey.		\$427
	Per diem for Prince of Wales survey trip.		\$88
	Campsite for Harris River survey and genetic sample collections		\$66
	Two fuel barge charters to deliver helicopter fuel to remote storage site near targeted rivers.	\$4,000	\$7,394
Helicopter Fuel	Helicopter Fuel, 330 gallons at \$5.00/gallon	\$1,650	\$2,029
Small Tools & Equipment	Misc, supplies	\$470	\$781
Total Site / Project Costs		\$34,720	\$39,512¹

¹Includes approximately \$4,800 rolled over from prior year's budget.

Total expenditures for the 2013 Northern Boundary Area summer chum salmon monitoring project came very close to the overall budget. Costs for small plane charters to Hidden Inlet and Carroll River were as anticipated, but the helicopter surveys were much less expensive than anticipated due to several weather (fog) related cancellations. Overall costs for fixed-wing and helicopter surveys were close to the projected amount due to the addition of extra fixed-wing aircraft surveys. We also funded extra fixed-wing surveys of all the targeted river systems to cover extra flights that were necessary due to several weather related disruptions to survey plans for this project. We also conducted a fixed-wing aircraft survey of the Harris River (this river will be added as a new chum salmon index stream) and used some funding to conduct a matched foot survey there. The overall cost of the Harris River survey was less than the other systems because we were able to access the island by ferry and camp in a tent while on the island to save money.

Expenditures for most non-travel related items were generally similar to our planned budget. The fuel barge cost was determined through a bid process and came out lower than anticipated by \$556. Costs for helicopter fuel and miscellaneous sampling supplies came in very near our projected budget. We were able to rollover approximately \$4,800 in unspent funds from our prior year project and received permission after the 2013 field season to use the remaining funding to provide another fuel barge trip and additional helicopter fuel to the remote storage site. The fuel stored at this site is all used for chum, Chinook, and coho salmon surveys that relate directly to PSC obligations. Overall, we ended the season with approximately \$6 remaining in the direct spending portion of our budget, including the rollover funds from the 2012 season.