

# **Northern Boundary Area Summer Chum Salmon Monitoring Project 2012: 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 2012. Additional foot and aerial surveys conducted concurrently on two 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 much better than from fixed-wing surveys, although one observer still found it very difficult to identify chum salmon late in the season when pink salmon abundance peaked. 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 had 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 similarly allowed

for direct comparison to aerial survey estimates. 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 from Hidden Inlet and Carroll River 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.
- Document primary chum salmon spawning areas and 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).

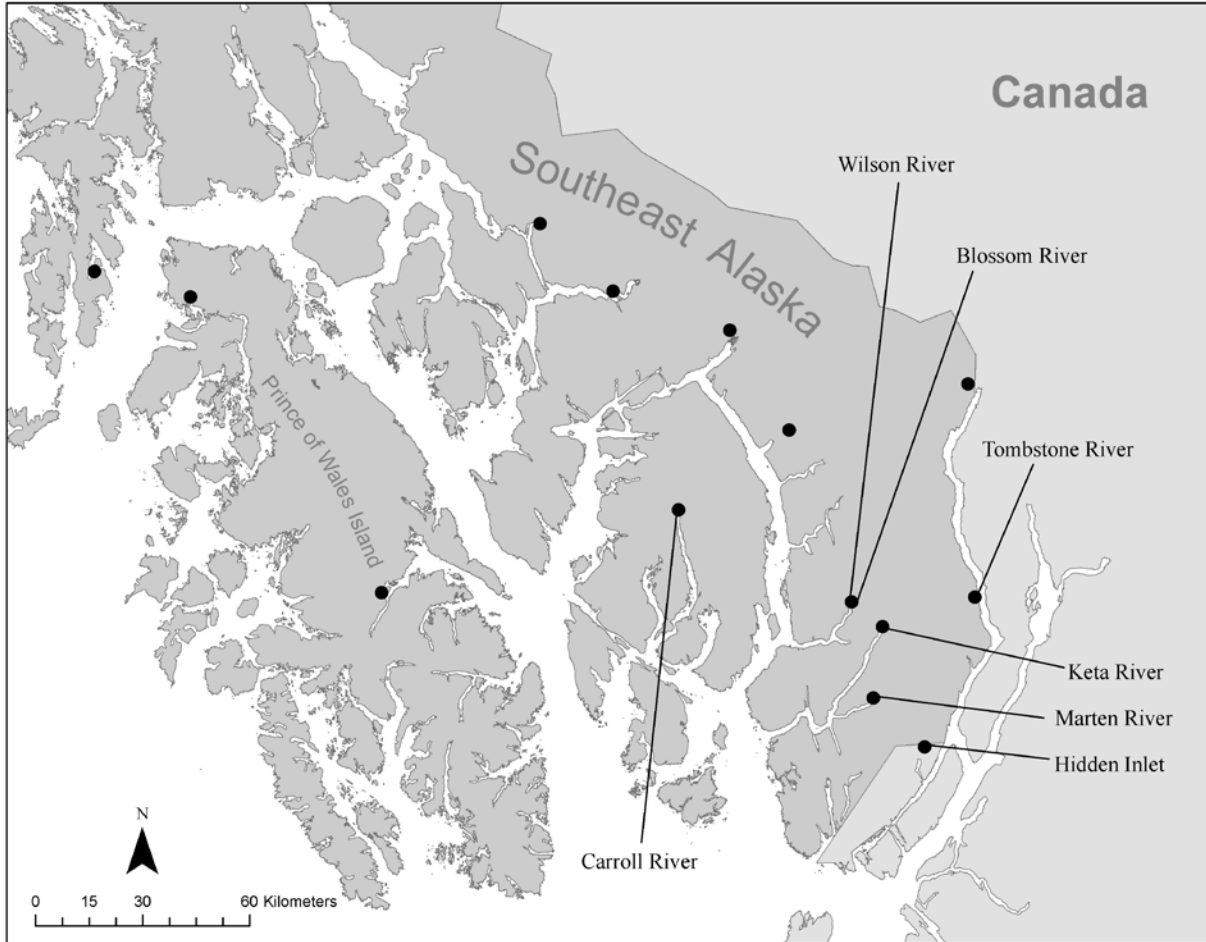


Figure 1.–Southern Southeast Subregion summer chum salmon index streams and index streams targeted for helicopter and foot surveys in 2012.

## METHODS

In 2012, 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. Up to three 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 2012. The first helicopter survey was completed on 26 July 2012, following a 25 July fixed-wing aerial survey. The second helicopter survey was cancelled twice due to weather and took place on 14 August 2012, seven days after the paired fixed-wing aircraft survey on 7 August 2012. The third helicopter survey was conducted on 17 August 2012, following a 16 August fixed-wing aircraft survey. 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 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). Foot surveys were conducted by research staff and available management staff from late July to mid-August as close as possible to regularly scheduled fixed-wing aircraft surveys to provide direct comparison and ground-truth aerial surveys. Each river was surveyed at least three times over the course of the season, which allowed for identification of the peak chum salmon spawning period in each river.

## **RESULTS**

### **HELICOPTER SURVEYS**

In general, management biologists felt they obtained much better views of chum salmon from helicopter surveys than fixed-wing surveys, although one observer still found it very difficult to identify chum salmon late in the season when pink salmon abundance peaked. During the first paired fixed-wing/helicopter survey, the observer counted approximately 55% more chum salmon (Table 1) and 60% more pink salmon during the helicopter survey. In the second set of surveys, weather conditions delayed the helicopter survey until a week after the initial fixed-wing survey and after chum salmon runs had passed the peak of abundance, which resulted in generally fewer chum salmon counted. The third observer counted approximately 48% more chum salmon and 33% more pink salmon during the helicopter survey, but determined that he over-counted chum salmon by a large margin in at least one river after reviewing video footage from the survey. This observer felt it was still difficult to differentiate between species, even from a helicopter, when pink salmon were at very high densities and distributed throughout the system. Some of the rivers contained an estimated 200,000 or more pink salmon at the time of the final two helicopter surveys in mid-August, compared to much lower numbers of pink salmon in late July. 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, 2012.

Stream	Date	Survey Type	Intertidal	Stream Live	Stream Dead	Total	Observer
Marten River	7/25/2012	Aerial		3,000		3,000	A
Marten River	7/26/2012	Helicopter		3,470		3,470	A
Keta River	7/25/2012	Aerial		12,000		12,000	A
Keta River	7/26/2012	Helicopter		16,400		16,400	A
Blossom River	7/25/2012	Aerial	4,000			4,000	A
Blossom River	7/26/2012	Helicopter		11,895		11,895	A
Wilson River	7/25/2012	Aerial		7,000		7,000	A
Wilson River	7/26/2012	Helicopter		3,800		3,800	A
Tombstone River	7/25/2012	Aerial		1,500		1,500	A
Tombstone River	7/26/2012	Helicopter		7,150		7,150	A
Marten River	8/14/2012	Helicopter		2,000	1,000	3,000	B
Keta River	8/14/2012	Helicopter		3,000	4,000	7,000	B
Blossom River	8/14/2012	Helicopter		5,000	3,000	8,000	B
Wilson River	8/14/2012	Helicopter		3,000	1,500	4,500	B
Tombstone River	8/14/2012	Helicopter		5,000	4,000	9,000	B
Keta River	8/16/2012	Aerial		15,000		15,000	C
Keta River	8/17/2012	Helicopter		12,000		12,000	C
Marten River	8/16/2012	Aerial		6,000		6,000	C
Marten River	8/17/2012	Helicopter		20,000		20,000	C
Blossom River	8/16/2012	Aerial		20,000		20,000	C
Blossom River	8/17/2012	Helicopter		30,000		30,000	C
Wilson River	8/16/2012	Aerial		8,000		8,000	C
Wilson River	8/17/2012	Helicopter		10,000		10,000	C
Tombstone River	8/16/2012	Aerial		40,000		40,000	C
Tombstone River	8/17/2012	Helicopter		<b>60,000<sup>1</sup></b>		<b>60,000</b>	C

<sup>1</sup>After reviewing video footage of this survey the observer, and other research and management staff, agreed that a large proportion of the chum salmon counted were actually pink salmon. This was likely the case for other rivers on the helicopter survey conducted on 17 August 2012.

## FOOT SURVEYS

### Carroll River

In 2012, eight 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 management biologists. An additional helicopter survey was conducted as part of one management biologist's mainland river survey. Foot surveys were conducted on 3 August, 10 August, and 20 August (Table 2). Aerial surveys were conducted 11 July, 16 July, 20 July, 23 July, 27 July, 4 August, 8 August, 14 August (helicopter) and 17 August (pink salmon count only), 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. Fish holding in pools in the lower river can be difficult to see from the ground, however. The estimated number of live chum salmon in the creek was slightly higher during aerial surveys—foot survey estimates during the first two paired surveys were approximately 65% of the aerial estimates. During the first set of paired surveys on 3–4 August, the aerial observer estimated 7,000 live chum salmon and foot surveyors estimated approximately 4,900. During the second set of surveys on 8 and 10 August, the aerial observer estimated 8,000 live chum salmon and foot surveyors estimated approximately 5,000. On 14 August, an estimate of 4,000 live chum salmon was obtained on a helicopter survey. On the final foot survey, conducted on 20 August, the estimated number of live chum salmon had dropped to approximately 2,500 fish (all actively spawning or spawned out) and it was clear that the chum salmon run had nearly ended.

### **Hidden Inlet**

In 2012, three aerial surveys of Hidden Inlet were conducted by three Ketchikan area management biologists and three foot surveys were conducted by Ketchikan area research biologists. Foot surveys were conducted on 27 July, 7 August, and 18 August (Table 2). Aerial surveys were conducted 25 July, 7 August, and 16 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. During the first set of paired surveys the estimated number of live chum salmon in the creek was very similar between the two methods: 1,200 on the aerial survey and 1,040 on the foot survey. The aerial observer noted an additional 6,000 chum salmon near the mouth of the creek, but subsequent surveys did not indicate an influx of chum salmon of this magnitude. During the second set of surveys, the aerial observer estimated over twice as many chum salmon as the foot surveyors: 4,000 versus approximately 1,800. On the final set of surveys, the aerial observer estimated 6,000 live chum salmon, but it was clear from the ground that the chum salmon run had nearly ended and there were only approximately 400 live chum salmon in the creek.

Table 2.– Aerial and foot survey counts of chum salmon at two southern Southeast Alaska summer chum salmon index streams (Carroll River and Hidden Inlet), 2012.

Stream	Date	Survey Type	Intertidal	Stream Live	Stream Dead	Total	Observer
Carroll River	7/11/2012	Aerial		0		0	C
Carroll River	7/16/2012	Aerial		500		500	A
Carroll River	7/20/2012	Aerial		150		150	A
Carroll River	7/23/2012	Aerial		7,000		7,000	A
Carroll River	7/27/2012	Aerial		6,000		6,000	A
Carroll River	8/3/2012	Foot		5,760		5,760	D
Carroll River	8/3/2012	Foot		4,050		4,050	F
Carroll River	8/4/2012	Aerial		7,000		7,000	A
Carroll River	8/8/2012	Aerial		8,000		8,000	A
Carroll River	8/10/2012	Foot		5,330	250	5,580	D
Carroll River	8/10/2012	Foot		4,720	250	4,970	B
Carroll River	8/14/2012	Helicopter		4,000	1,500	5,500	B
Carroll River	8/20/2012	Foot		2,540	2,450	4,990	D
Hidden Inlet	7/25/2012	Aerial		1,200		1,200	A
Hidden Inlet	7/27/2012	Foot		1,040		1,040	D
Hidden Inlet	8/7/2012	Foot	30	2,090	10	2,130	E
Hidden Inlet	8/7/2012	Foot		1,480		1,480	E
Hidden Inlet	8/7/2012	Foot	250	1,670	10	1,930	D
Hidden Inlet	8/7/2012	Aerial		4,000		4,000	B
Hidden Inlet	8/16/2012	Aerial		<b>6,000<sup>1</sup></b>		<b>6,000</b>	C
Hidden Inlet	8/18/2012	Foot	20	340	30	390	D
Hidden Inlet	8/18/2012	Foot	20	350	30	400	F

<sup>1</sup>The vast majority of these fish were pink salmon, based on observations from the ground on 18 August 2012.

## SPAWNING AREAS AND TIMING

Chum salmon were widely distributed in most of the surveyed systems, and surveyors reported that it was not practical to map primary spawning grounds while conducting a survey. During helicopter surveys, one observer noted that most of the chum salmon he saw on the Wilson River were in side-channel habitats, and two observers noted that most of the chum salmon observed spawning in the Blossom River in mid-August were in the upper half of the survey area. One observer noted that most of the chum salmon spawning in the Keta River were at the upper end of the system. In both of the smaller, foot-surveyed streams, spawning chum salmon were widely distributed from the upper intertidal sections to the upper reaches of the survey areas.

## Spawning Periods

In general, peak chum salmon abundance in most of the surveyed streams occurred in late July and early August. At the Carroll River and Hidden Inlet, where foot surveys were conducted, it was clear that aerial survey counts conducted during the first week of August captured the peak of the chum salmon run prior to the main influx of pink salmon. At Hidden Inlet, almost all the fish actively spawning during a 7 August survey were chum salmon and most pink salmon in the system were holding in pools in the lower river. There were few live chum salmon present in the stream by the 18 August survey and pink salmon were actively spawning throughout the system. At the Carroll River, chum salmon abundance was at its peak from 3 to 10 August. Pink salmon were mostly schooled up in deeper holes during the 3 August survey, but had begun to spread out

through the creek by the 10th. By 20 August, all remaining chum salmon were actively spawning or spawned out.

The peak of chum salmon abundance at the five large mainland rivers also appeared to occur during late July or early August, although there was some disagreement among observers later in the season when pink salmon abundance was high. The last observer to fly a helicopter survey obtained video footage of some systems, including the entire length of the Tombstone River. After reviewing the footage it was agreed that he had overestimated the number of chum salmon, particularly in the upper river.

## **Genetic Sampling**

A total of 111 chum salmon tissue samples were collected at Hidden Inlet in 2012, which increased the total sample size for this stream to more than 200 samples. In addition, 109 pink salmon tissue samples were collected at Hidden Inlet and 205 pink salmon samples were collected in 2012 at Carroll River for future use in development of a genetic baseline for Southeast Alaska. Tissue samples are archived at the ADF&G Gene Conservation Laboratory, Anchorage.

## **DISCUSSION**

Separating pink and chum salmon can be extremely difficult, even from a helicopter, when pink salmon densities are high and they are distributed throughout the entire system. High definition video of surveys conducted from a helicopter showed promise to provide an additional opportunity to review counts and differentiate between species under those circumstances. 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 streams with large, overlapping pink salmon runs.

In 2012, peak chum salmon abundance appeared to occur in late July or early August at most systems. The final two helicopter surveys, which were conducted within three days of each other by different management biologists, resulted in some confusion as to whether or not the peak of the chum salmon escapement had passed by early August. On a 14 August 2012 survey, observer B felt that the peak had passed and that chum numbers were in decline. This observer estimated nearly as many dead chum salmon as live (Table 1). Observer C conducted a helicopter survey of the five targeted streams on 17 August 2012 and counted approximately seven times the number of chum salmon that observer B had estimated only three days before. Observer C, however, obtained high definition video footage of their entire Tombstone River survey and after review of the footage agreed that he had greatly overestimated the number of chum salmon in the river. It was likely that observer C overestimated the number of chum salmon in the other four systems as well. Additional evidence for this was obtained in the paired fixed-wing and foot survey counts at Hidden Inlet. Observer C had what would have been a peak aerial survey estimate of chum salmon for this creek on 16 August 2012 (6,000 fish), but it was clear from the ground on 18 August 2012 that the peak was well past and there were very few live chum salmon remaining in the creek (Table 2).

Additional years of helicopter surveys would clarify run timing for some streams and determine if the temporal segregation of pink and chum salmon is consistent over time. Continued

helicopter surveys would also provide valuable opportunities for managers to observe chum salmon at varying pink salmon densities. 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.

<b>Site / Project Costs</b>	<b>Description</b>	<b>Project Budget</b>	<b>Actual Expenditures</b>
Travel	Small plane charters for conducting foot surveys at Hidden Inlet and Carroll River, 8 hours @\$675/hr.	\$5,400	\$9,192
	Helicopter charters for conducting surveys at Keta, Marten, Blossom, Wilson, and Tombstone rivers, 24 hours @\$1000/hr.	\$24,000	\$12,360
	Fixed-wing aerial survey of targeted mainland chum salmon rivers.		\$1,836
	Fuel barge charter to deliver helicopter fuel to remote storage site near targeted rivers.	\$3,000	\$3,900
Satellite Phone	Satellite phone for emergency communication while in remote field situations.		\$46
Helicopter Fuel	Helicopter Fuel, 330 gallons at \$5.00/gallon	\$1,650	\$1,700
Small Tools & Equipment	Misc, supplies	\$670	\$887
<b>Total Site / Project Costs</b>		\$34,720	\$29,921

Expenditures for the 2012 Northern Boundary Area summer chum salmon monitoring project came in below budget overall. Costs for small plane charters to Hidden Inlet and Carroll River were higher than anticipated and the helicopter surveys were much less expensive than anticipated. Overall costs for planned fixed-wing and helicopter surveys were \$7,848 less than projected. We also funded an extra fixed wing survey of all the targeted river systems to cover an extra flight that was necessary due to several weather related disruptions to survey plans for this project. The total cost of this extra flight was \$1,836, which left our total expenditures for flights \$6,012 less than anticipated. The cost of fixed-wing flights to Hidden Inlet can be difficult to predict because poor weather requires the flight to follow a longer path around the coast and up Portland Canal, whereas the flight is more direct through mountain passes and considerably less expensive during clear weather conditions. The anticipated cost of the helicopter flights was based on best estimates made through consultation with management biologists who conduct the surveys. Actual flight times were less than anticipated for completing the full mainland river survey. Using what we learned from this season, we planned on conducting more helicopter surveys for the continuation of this project in 2013.

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 higher than anticipated by \$900. A small cost of \$46 was incurred to cover the cost of a satellite phone that was carried for safety in the field while conducting foot surveys. Costs for helicopter fuel and miscellaneous sampling supplies came in very near our projected budget. Overall, we ended the season with approximately \$4,800 remaining in the direct spending portion of our budget.