

# **ROGUE RIVER SPRING CHINOOK SALMON CONSERVATION PLAN**

## **Evaluation of spring Chinook salmon spawning in Big Butte Creek, 2008**

**Rogue Watershed District  
Oregon Department of Fish and Wildlife  
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### Introduction

A conservation plan for Rogue River spring chinook salmon, developed in cooperation with a public advisory committee, was approved by the Oregon Fish and Wildlife Commission in 2007. The conservation plan lists several management strategies to bring numbers of naturally produced spring chinook back up to a desired status level that is sustainable and will support economically important fisheries. Management strategy 9.2 calls for enhancement of spring chinook (CHS) in Big Butte Creek through an increase in the amount of available spawning habitat.

A small falls on lower Big Butte Creek (Crowfoot Falls, rivermile 0.6) is considered a partial barrier, limiting the upstream passage of adults, and thus limiting natural production in upstream areas. Two allied action items (Action 2.1 and 2.2) relate to this issue. Upstream passage at Crowfoot Falls might be enhanced if additional ambient flow of cool, spring-fed water can be realized during the upstream migration of adult CHS in Big Butte Creek. Determination of the amount of flow needed to enhance upstream migration would be valuable because flows during the critical migration period are significantly affected by water withdrawal from the creek.

As part of conservation plan implementation, ODFW conducted enhanced surveys in 2008 on Big Butte Creek to verify current conditions and explore enhancement opportunities. To facilitate the work, ODFW Restoration and Enhancement Program (R&E) grant funding was utilized to hire two seasonal employees to complete the enhanced surveys.

The goal of the enhanced survey effort in Big Butte Creek funded by R&E was to determine the relationship between flow and the spawning distribution of CHS. Individual objectives included surveying for spawning distribution, determining redd densities above and below Crowfoot Falls, and evaluating upstream passage at Crowfoot Falls

### Methods

In 2007, ODFW completed some preliminary surveys of potential spawning areas in Big Butte Creek. The following sampling plan relies extensively on the results of those preliminary surveys.

#### Objective 1—Index Spawning Distribution

Adult CHS and redds have been observed in the mainstem and South Fork Big Butte Creek. A barrier falls on the south fork at the town of Butte Falls (approximately 13.3 miles upstream) is the upper extent of CHS distribution (Fig. 1). CHS have not been found in North Fork Big Butte. Spawning surveys conducted by ODFW have historically been conducted in the first 0.6 miles of Big Butte Creek below Crowfoot Falls. In 2008, spawning surveys were conducted on three additional reaches of Big Butte Creek: Crowfoot Falls (RM 0.6) to an unnamed tributary

(RM 1.8); unnamed tributary (RM 1.8) to Netherlands Bridge (RM 2.7); and Gray Creek (RM 7.6) to Dog Creek (RM 8.1) (Fig. 1).

Surveys were conducted weekly between September 21 and November 7, 2008. Surveyors counted the number of redds, carcasses, and actively spawning adults. New this year, the redds were marked with orange painted rocks to prevent repeated counts.

CHS carcasses were classified according to sex and age, and all fish less than 60 cm (24 inches) were called jacks. Each carcass was examined for fin clips, and snouts and scales were collected from adipose fin-clipped CHS. The carcasses were cut in half to prevent recounting.

Landowners along the selected reaches were contacted by telephone or mail prior to the start of the surveys. One landowner on Reach 3 denied access, and we were unable to contact three others. These properties were adjacent to each other and accounted for 0.2 miles of stream; all four properties were on the west bank of the creek. In response, this location was surveyed from the east bank. All of the potential spawning areas were visible from this location so it is unlikely that any redds were missed. Carcasses that were deposited on the west bank could not be retrieved and some may have been missed if they were hidden under vegetation or behind boulders. Actively spawning CHS may have been scared off redds as the samplers walked upstream and may have been missed.

The lowest part of Reach 1 was surveyed in a drift boat during the mainstem Rogue surveys. No actively spawning CHS or redds were counted during the float survey. The rest of this reach was surveyed on foot according to the same protocol as the other reaches.

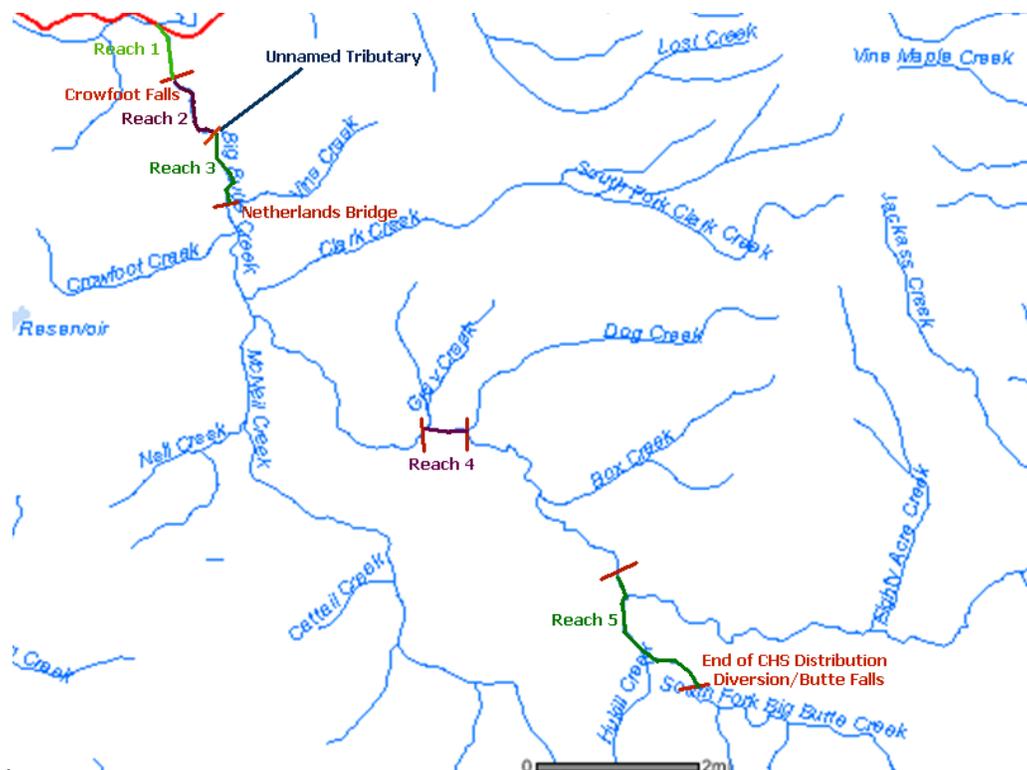


Figure 1 Survey Reaches

Approximately 10.1 miles of stream habitat available to CHS were not surveyed for carcasses and redds (4.9 miles between Netherlands Bridge and Gray Creek and 5.2 miles between Dog Creek and Butte Falls). Included in this distance is a 1.9 mile reach of Big Butte between the Netherlands Bridge and McNeil Creek that is dominated by steep gradient boulder rapids and bedrock (based on landowner reports and previous surveys). Excluding this reach, then approximately 8.2 miles of potential spawning habitat was not surveyed in 2008.

#### Objective 2—Determine Redd Densities

During the final two weeks of surveys, spawning gravel area was measured in the survey reaches to evaluate gravel availability and relative use above and below Crowfoot Falls. Only areas with suitably sized, well sorted gravels were counted. Areas with large cobble, boulders, or bedrock were not included in the counts. The R&E-funded seasonal employees completed the first survey. Because of the early departure of one worker, an assistant district biologist assisted with the final survey.

In the first round of gravel counts, measurements were made in areas where CHS actually spawned. Samplers judged, based on observations from previous surveys, the size of the area that was actually used by spawners. Samplers measured the average length and width of these areas. All of the redds associated with a patch of gravel were counted whether or not the redds were counted previously. GPS coordinates were taken in gravel patches during the first set of surveys, except for Reach 2. Gravel patches in Reach 2 were small, mostly 4 square meters or smaller, and widely scattered throughout the reach; no GPS coordinates were recorded.

All suitable gravel areas were counted the following week, regardless of spawning activity. The second set of gravel counts included the areas that were previously counted and represents an estimate for all of the gravel available in the survey reach. During the second set of surveys, GPS points were taken only in Reach 1 in an area that was well downstream of the main gravel and spawning area. In the other segments, the original coordinates covered all of the major gravel areas.

#### Objective 3—Estimate Upstream Passage at Crowfoot Falls

A survey based on observations of passage at Crowfoot Falls was designed to occur during a planned increase in stream flow in October. Each year the Eagle Point Irrigation District temporarily stops diverting water from Big Butte Creek to perform maintenance in its canals. ODFW worked cooperatively with irrigation district staff to monitor CHS passage immediately before and immediately after the increase in streamflow. Additional monitoring at the falls was conducted to refine techniques, as well as during a storm event.

Upstream CHS passage at Crowfoot Falls was monitored between October 1 and October 11. On October 10, the Eagle Point Irrigation District stopped diverting water. Flows rose from 73 cfs on October 10 to 152 cfs on October 11. Step three of the ladder was monitored from sunrise to sunset on both of these days. A video camera was set up at the ladder and used as a back-up while the observer walked to the other side of the falls to check passage there. The video was downloaded to a computer and viewed the following week. Successful and unsuccessful passage attempts were counted. Prior to October 10, observers watched the fish ladder and falls periodically throughout the day and recorded successful and unsuccessful passage attempts.

## Results

### Objective 1 Index Spawning Distribution

The spawning surveys started on September 23, 2008. The three reaches above the falls were surveyed weekly through November 7. The reach below the falls was surveyed weekly through November 12. Table 1 summarizes the numbers of CHS spawners, carcasses and redds counted on each survey reach, and the densities per mile based on observations made during surveys.

Table 1 Spawning survey results

	Miles				Spawners	Carcasses	Redds
Survey	Surveyed	Spawners	Carcasses	Redds	Per mile	Per mile	Per mile
Mouth to Crowfoot Falls	0.6	121	105	87	201.7	175.0	145.0
Crowfoot Falls to unnamed trib	1.2	5	8	4	4.2	6.7	3.3
unnamed trib to Netherlands	0.9	50	26	36	55.6	28.9	40.0
Gray Cr to Dog Cr	0.5	0	1	3	0	2.0	6.0
Below Falls	0.6	121	105	87	201.7	175.0	145.0
Above Falls	2.6	55	35	43	21.2	13.5	16.5

Downstream of Crowfoot Falls, the highest count of actively spawning CHS was made during the first survey on September 23 (Figure 2). The peak carcass count occurred on October 1st and the peak redd count was made on October 6th (Figures 3, 4).

Upstream of the falls, the peak count for spawning CHS and carcasses occurred on October 9<sup>th</sup>. The peak date above the falls is later than the peak below the falls, and follows a storm on October 4th that increased flows in Big Butte Creek from 64 cfs to 80 cfs. This change in flow also corresponded to an increase in successful attempts made in navigating the Crowfoot Falls fish ladder. The peak redd count was made on October 2 (Figures 3, 4). The reach between the unnamed tributary at river mile 1.8 and Netherlands Road Bridge had the highest spawning activity among surveyed reaches above the falls, with most of the observations occurring in the lower half-mile of this survey.

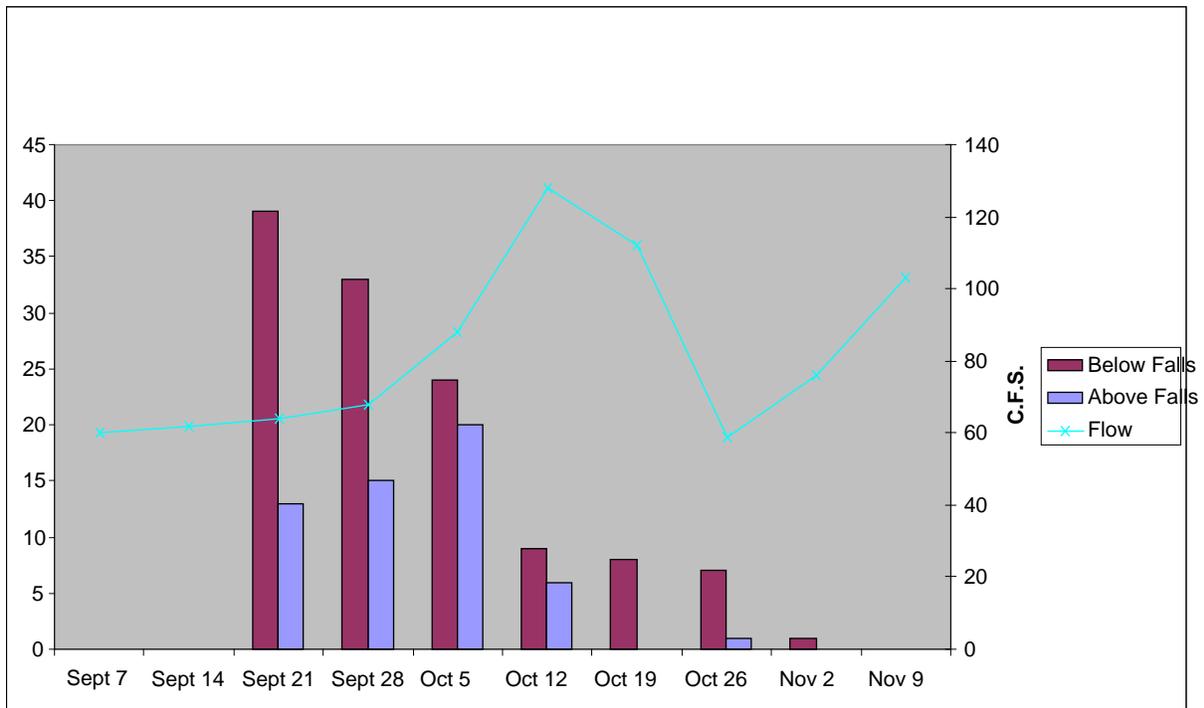


Figure 2. Weekly counts of live spring chinook salmon.

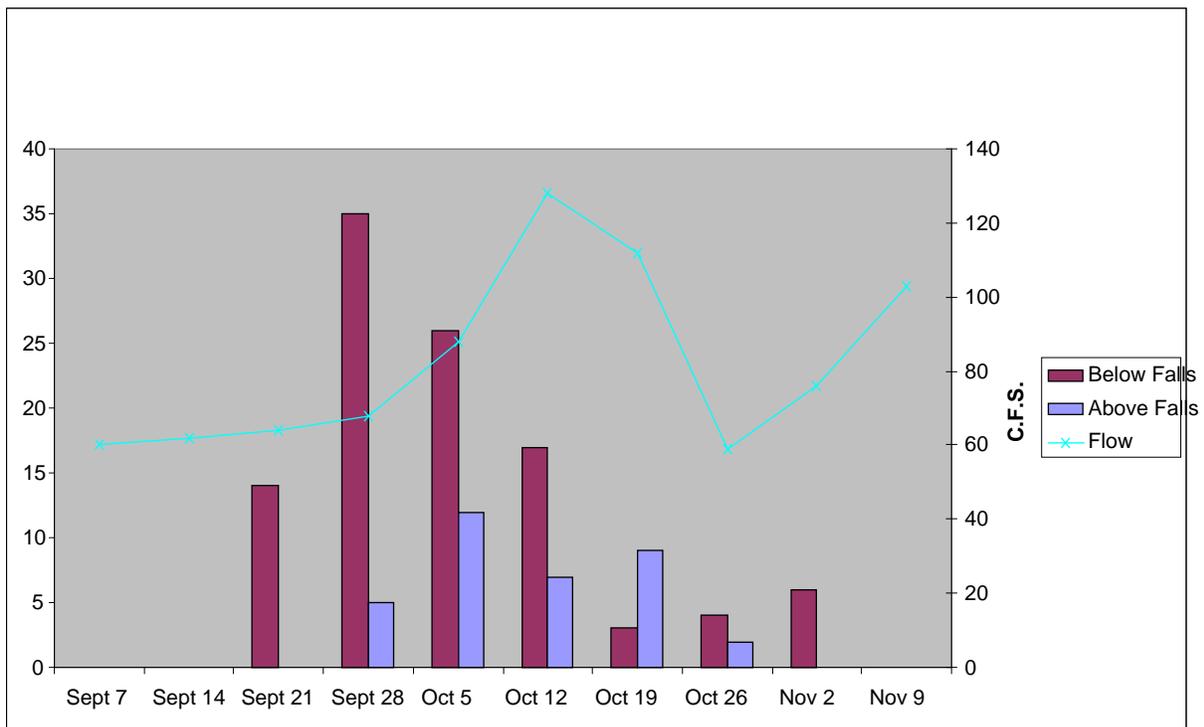


Figure 3. Weekly recoveries of spring chinook salmon carcasses.

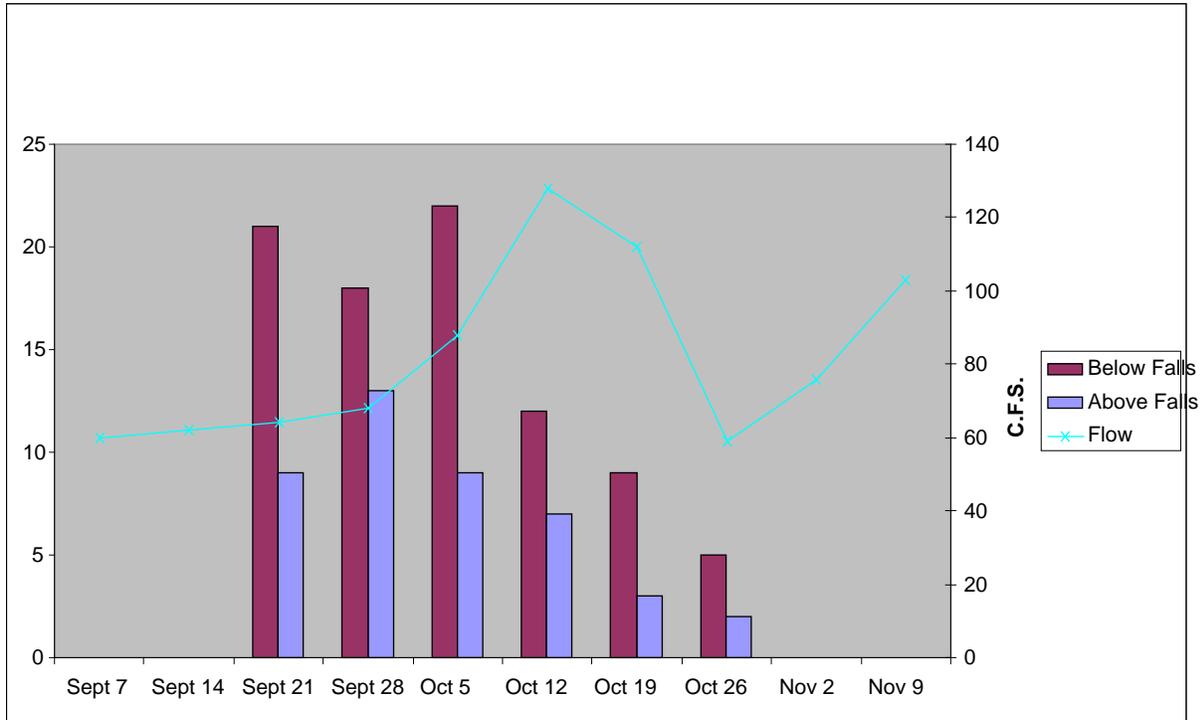


Figure 4. Weekly counts of spring chinook salmon redds.

#### Objective 2 Determine Redd Densities

To determine redd densities, gravel resources were estimated on all survey reaches. There was an estimated 756 square meters of gravel suitable for spawning downstream of Crowfoot Falls; with redds covering 95% of this area. In surveyed reaches upstream of the falls, the amount of available gravel was estimated to be 267 square meters with redds covering 16% of this area (Table 2).

Table 2. Estimated density of spawning gravel in areas of Big Butte Creek.

Survey	Miles Surveyed	Available Gravel (m2)*	Used Gravel*	Gravel % Used	Gravel m2/mile
Mouth to Crowfoot Falls	0.6	756	720	95.2	1260.0
Crowfoot Falls to unnamed trib	1.2	38	1.5	3.9	31.7
unnamed trib to Netherlands	0.9	212	36	17.0	235.6
Gray Cr to Dog Cr	0.5	17	6	35.3	34.0
Below Falls	0.6	756	720	95.2	1260.0
Above Falls	2.6	267	43.5	16.3	102.7

\*Surveyor teams differed between the two counts.

### Objective 3 Estimate Upstream Passage at Crowfoot Falls

During the observation survey, CHS attempted to pass Crowfoot Falls and/or step three of the fish ladder 47 times, and were successful on 10 attempts. Attempts per hour varied (some days no attempts were observed), but overall attempts decreased throughout the survey period from 4.0 attempts per hour on October 1<sup>st</sup> to 0.4 attempts per hour on October 11<sup>th</sup>.

Observations at the falls--the un-laddered section of Crowfoot Falls was observed for 8.3 hours between October 2-11. Four adult CHS attempted to jump the falls during the survey, and none of them were successful. No jump attempts were made on October 10 or 11 during the irrigation diversion shut down, when flows increased from 73 cfs on October 10 to 152 cfs on October 11 (Figure 5).

Observations at the ladder--step 3 of the fish ladder was monitored for 39.1 hours from October 1-11. Thirty-three unsuccessful passage attempts were made compared to ten successful attempts. Some of the unsuccessful passage attempts were probably made by the same fish. Samplers observed only one CHS per day successfully navigate the ladder on October 10 and 11.

The rate of successful passage attempts (successful attempts per hour) was highest on October 4 following a rainstorm which brought the flows up from 64 cfs to 80 cfs. Success in passing the ladder, measured as the ratio of successful versus unsuccessful attempts per hour, increased on the two days that streamflow increased during the survey, although samples sizes were small. The rate of unsuccessful passage attempts (unsuccessful attempts per hour) was highest on October 1 when flows were at 60 cfs (Figure 6).

During the passage observations at Crowfoot Falls conducted before the planned flow increase (October 1-7), all attempts at passage by CHS were observed in the afternoon hours, despite almost equal amount of observation hours before and after 1:00pm. Peak counts were observed after 4:00pm. During the survey immediately before and after the streamflow increase (October 10-11), most of the attempts were observed during the morning hours of the survey.

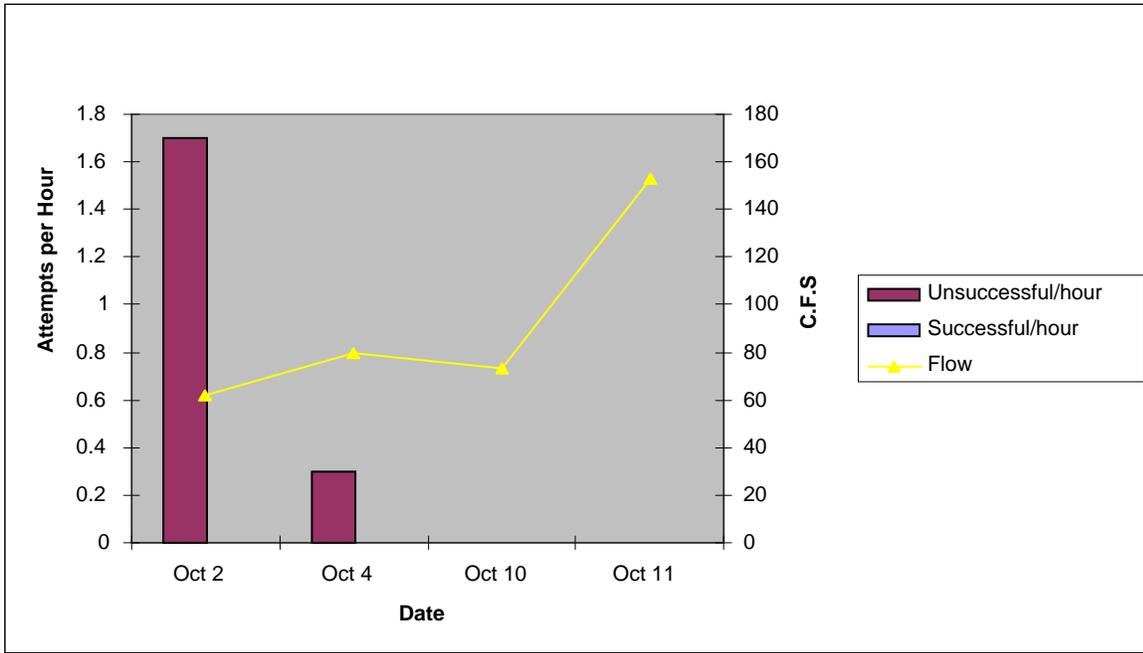


Figure 5. Passage attempts by spring chinook salmon at un-laddered side of Crowfoot Falls.

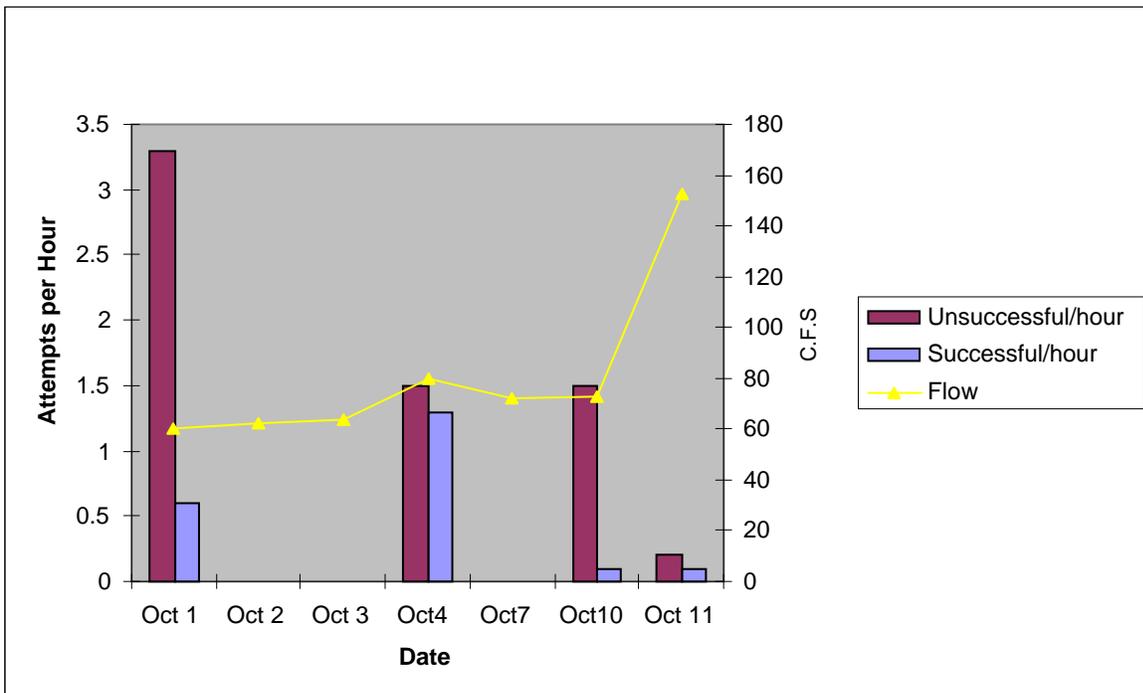


Figure 6. Passage attempts by spring chinook salmon in the fish ladder at Crowfoot Falls.

Average fall stream flows in Big Butte Creek are shown in Figure 7. Flows during September and October of 2008 were similar to the long term average.

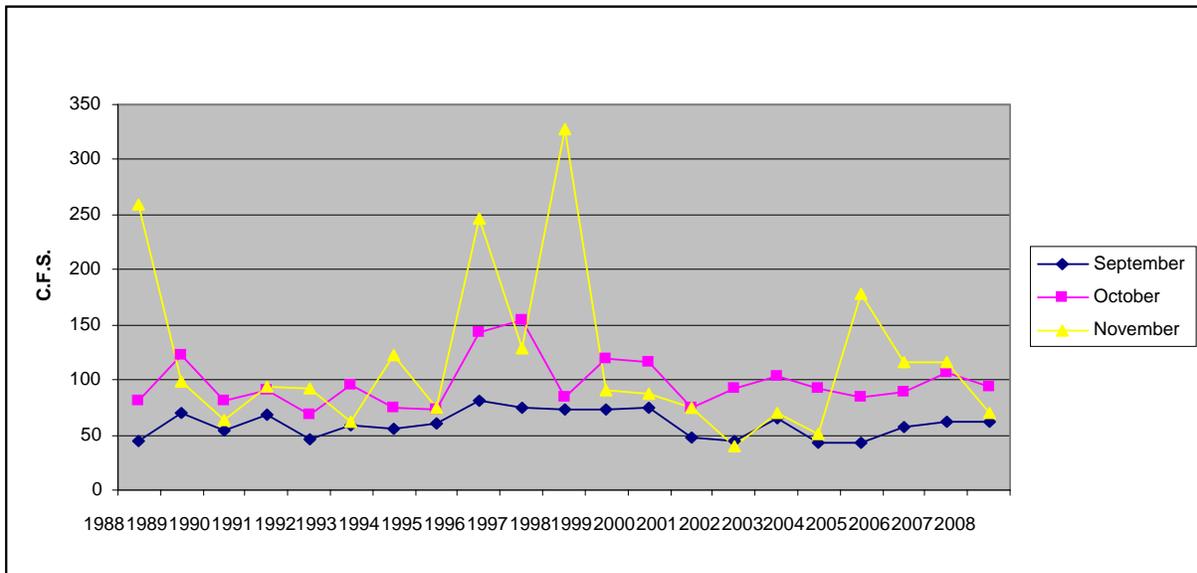


Figure 7. Average monthly stream flows 1988-2008

### Conclusions

Project results indicated that Crowfoot Falls was at least a partial barrier to the upstream migration of CHS in Big Butte Creek in 2008, despite the presence of a fish ladder. Less than 25% of the observed attempts by CHS to pass the falls and/or step three of the ladder were successful in 2008. Only 16% of the available gravel in survey reaches above the falls was used in 2008, compared to the use of over 95% of the available gravel below the falls.

The survey also confirmed that the amount of available gravel differs above and below Crowfoot Falls. The 0.6 miles of Big Butte Creek below the falls is a low gradient reach where gravel deposits, with an estimated 756 m<sup>2</sup> of gravel available (1,260 m<sup>2</sup> per mile). In the 2.6 miles of Big Butte surveyed above the falls, the creek is typically a low to moderate gradient stream constrained by hillslopes. An estimated 267 m<sup>2</sup> of gravel was measured in the survey reaches above the falls (103 m<sup>2</sup> per mile). Assuming that there is 10.8 miles of CHS spawning habitat upstream of Crowfoot Falls, and that the density of gravel throughout this area is 103m<sup>2</sup> per mile, we project that only about 1,100 m<sup>2</sup> of gravel is available to CHS that successfully pass Crowfoot Falls. In contrast, there is about 750 m<sup>2</sup> of spawning gravel in the 0.6 mile reach immediately downstream of Crowfoot Falls.

It is interesting to note that redd density measured as the number of redds observed divided by the available gravel was higher above the falls (0.16 redds/m<sup>2</sup> available gravel) than below the falls (0.11 redds/m<sup>2</sup> available gravel). At the same time, we measured a larger area of gravel that was not used by spawning CHS above the falls. The apparent dichotomy may be a result of several factors, including: the much smaller amount of gravel above the falls; differences in redd size above and below the falls; or superimposition affecting the reliability of the redd counts.

Improvement of passage at Crowfoot Falls should improve CHS production in Big Butte in three ways: by the reducing the energy spent by individual fish passing the falls (improving fish condition); by increasing the use of available spawning gravel; and by reducing the risk of superimposition below the falls. Increases in production will be modest due to the low amount

of gravel above the falls. Sampling in 2008 indicated that improvements to CHS passage at Crowfoot Falls likely need to be in place by no later than late September to benefit the largest portion of the CHS run.

Success in passing the ladder, measured as the ratio of successful versus unsuccessful attempts per hour, increased on the two days that streamflow increased during the survey, although samples sizes were small. Conversely, the rate of unsuccessful passage attempts (unsuccessful attempts per hour) was highest on October 1 when flows were at 60 cfs (Figure 6). An increase in flow, especially if done between early September and early October would apparently increase the rate of successful passage. During the October 4<sup>th</sup> storm, a higher percentage of the total streamflow appeared to enter the ladder as Big Butte Creek approached 80 cfs that day.

Observations at the fish ladder point to other potential improvements to enhance the upstream passage of CHS at Crowfoot Falls. Jump heights at steps one-three were 27, 18 and 21 inches respectively. In addition, a long shallow chute is located upstream of step three, with a water depth of only five inches at the most shallow point. Even at low flows, churning and boiling of the water may present a problem for fish. Water flows over the entire length of each step, creating turbulence over the entire pool.

The quality of habitat in Big Butte Creek for CHS is affected by a variety of natural factors in the watershed. Topography, valley width, channel size and other factors limit the amount of spawning gravel available within the range of CHS. Cost effective habitat improvement may still be possible, however. Several private landowners and a timber company have expressed interested in participating in habitat improvement work on Big Butte Creek.

Anecdotal evidence hints that gravel conditions may have changed over time. A survey conducted in 1954 found 49 CHS, six carcasses and 31 redds from ¼ mile below Dog Creek to approximately 100 yards upstream. The 2008 survey found only three redds in a survey of 0.5 miles from Gray Creek upstream to Dog Creek. Samplers found little gravel in this reach during the 2008 surveys.

Spawning was well underway at the start of the 2008 survey, which indicates that the historical strategy of an early spawning life history is still evident among CHS that spawn in Big Butte Creek. Similar surveys, if conducted in future years, should start in early September in order to encompass the entire period of spawning.

#### Recommendations

**Repeat this evaluation in 2009 and/or 2010.** Another year of evaluation would increase the reliability of the conclusions presented in this report; especially if the surveys begin in early September. In addition, ODFW should explore the potential for obtaining a ten day or two week increase in flow during the middle of September.

**Review fish ladder improvements with engineering staff.** ODFW will review the results of the survey with fish passage program staff in 2009. Among potential improvements, district staff will ask for a review of three proposals submitted by assistant Rene Pellisier: constructing a small wall on creek side of ladder above step three to reduce water and false attraction; installing an additional step above step three; adding to the tops of steps one-three to concentrate flow at the low point of each step.

**Survey all potential spawning habitat.** The volume of potential spawning habitat needs to be surveyed over the entire length of CHS spawning habitat in Big Butte Creek. An estimated 8.2 miles of potential spawning habitat was not surveyed in 2008. The amount of suitable CHS spawning habitat should be surveyed during the spawning season, and evaluated to identify habitat improvement opportunities.

#### Acknowledgments

ODFW would like to thank all the landowners who granted permission for the survey and who expressed care and concern for Big Butte Creek. Thanks to Jim Hutchins from the Oregon Stewardship program for his assistance in contacting landowners and conducting surveys. Thanks also to volunteers for assisting with the observation survey at Crowfoot Falls (Jeremy Stahler; Pete Mazzini, John Bootlock, Barbara Wagner and Richard Wagner with the Upper Rogue Watershed Council), to ODFW's Fish Restoration and Enhancement Program for providing grant funding for enhanced CHS surveys in 2008, and to the Eagle Point Irrigation District for flow notification and cooperation.

## Appendix

### GPS Coordinates—Survey Reaches

<b>GPS Coordinates UTM WGS 84 Datum</b>				
<b>Survey Reaches</b>	<b>Start</b>		<b>End</b>	
Reach 1 (float) Mouth to Crowfoot Falls	0525208 E	4722874 N	0525208 E	4722680 N
Reach 1 (walk) Mouth to Crowfoot Falls	0525208 E	4722680 N	0525295 E	4721917 N
Reach 2 Crowfoot Falls to Unnamed Tributary	0525295 E	4721917 N	0525979 E	4720828 N
Reach 3 Unnamed Tributary to Netherlands Bridge	0525979 E	4720828 N	0526492 E	4719470 N
Reach 4 Gray Creek to Dog Creek	0530615 E	4715126 N	0531334 E	4715065 N
Reach 5 Forks to Diversion (Butte Falls)	0534497 N	4712066 N	0535822 E	4710552 N

## Weekly Survey Data by Reach

### Mouth to Crowfoot Falls

Date	Unmarked Carcasses				Marked Carcasses				Carcasses	Redds	Live Fish
	Male	Female	PSF	Jacks	Male	Female	PSF	Jacks			
9/23/2008	3	2	0	2	3	3	1	0	14	21	39
10/1/2008	10	10	0	2	12	0	0	1	35	18	33
10/6/2008	9	5	0	6	3	3	0	0	26	22	24
10/14/2008	2	4	0	5	2	3	0	1	17	12	9
10/22/2008	1	1	0	1	0	0	0	0	3	9	8
10/29/2008	1	0	0	3	0	0	0	0	4	5	7
11/5/2008	4	1	0	0	1	0	0	0	6	0	1
11/12/2008	0	0	0	0	0	0	0	0	0	0	0
<b>TOTAL</b>	<b>30</b>	<b>23</b>	<b>0</b>	<b>19</b>	<b>21</b>	<b>9</b>	<b>1</b>	<b>2</b>	105	87	121

### Crowfoot Falls to Unnamed Tributary

Date	Unmarked Carcasses				Marked Carcasses				Carcasses	Redds	Live Fish
	Male	Female	PSF	Jacks	Male	Female	PSF	Jacks			
9/25/2008	0	0	0	0	0	0	0	0	0	0	0
10/2/2008	1	0	0	0	1	0	0	0	2	1	1
10/9/2008	0	0	0	0	0	0	0	0	0	1	4
10/17/2008	2	0	0	2	0	0	0	0	4	1	0
10/24/2008	2	0	0	0	0	0	0	0	2	1	0
10/31/2008	0	0	0	0	0	0	0	0	0	0	0
11/7/2008	0	0	0	0	0	0	0	0	0	0	0
<b>TOTAL</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	8	4	5

## Weekly Survey Data by Reach

### Unnamed Tributary to Netherlands Bridge

Date	Unmarked Carcasses				Marked Carcasses				Carcasses	Redds	Live Fish
	Male	Female	PSF	Jacks	Male	Female	PSF	Jacks			
9/25/2008	0	0	0	0	0	0	0	0	0	8	13
10/2/2008	2	0	0	1	0	0	0	0	3	12	14
10/9/2008	7	3	1	1	0	0	0	0	12	7	16
10/17/2008	3	0	0	0	0	0	0	0	3	5	6
10/24/2008	1	6	0	0	0	0	0	0	7	2	0
10/31/2008	1	0	0	0	0	0	0	0	1	2	1
11/7/2008	0	0	0	0	0	0	0	0	0	0	0
<b>TOTAL</b>	<b>14</b>	<b>9</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	26	36	50

### Gray Creek to Dog Creek

Date	Unmarked Carcasses				Marked Carcasses				Carcasses	Redds	Live Fish
	Male	Female	PSF	Jacks	Male	Female	PSF	Jacks			
9/25/2008	0	0	0	0	0	0	0	0	0	1	0
10/2/2008	0	0	0	0	0	0	0	0	0	0	0
10/9/2008	0	0	0	0	0	0	0	0	0	1	0
10/17/2008	0	0	0	0	0	0	0	0	0	1	0
10/24/2008	0	0	0	0	0	0	0	0	0	0	0
10/31/2008	0	1	0	0	0	0	0	0	1	0	0
11/7/2008	0	0	0	0	0	0	0	0	0	0	0
<b>TOTAL</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	1	3	0