2009 SPAWNING GROUND SURVEYS

of Kelsey, West Tributary, Richards, and Coal Creeks

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Acronyms and Abbreviations

AUC	Area Under the Curve
cm	Centimeter
CWT	Coded-wire tag
DEA	David Evans and Associates, Inc.
ESA	Endangered Species Act of 1973
ESU	Evolutionarily Significant Units
FL	Fork length
GPS	Global Positioning System
INPFC	International North Pacific Fisheries Commission
POH	Postorbital to hypural plate
WDFW	Washington Department of Fish and Wildlife

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1.0 ABSTRACT

The City of Bellevue monitored spawning activity in the Kelsey Creek watershed in 2009, marking the ninth consecutive year that this information has been collected. Weekly spawning ground surveys were conducted for 18 consecutive weeks in Kelsey Creek and the West Tributary from 3 September through 30 December 2009. Surveys of Richards Creek were conducted every other week during September and October, and Coal Creek was surveyed every other week beginning on the 28th of October and ending on the 23rd of December.

Observations of Chinook salmon were limited to a total of 12 live spawners and 20 carcasses in Kelsey, West Tributary, and Richards creeks. Based on the inspection of carcasses for the presence or absence of an adipose fin, the predominance of Chinook salmon in the Kelsey Creek basin are hatchery strays since they were clipped (marked). No Chinook were observed in Coal Creek during 2009 (or 2008). The 2009 Chinook salmon escapement in Kelsey Creek based on redd counts is 13, which was lower than 2008 (n=20). The 2009 Chinook salmon escapement was very low compared to peak returns in 2006 and 2007 (n=180–193), but higher than the escapement estimates from 2001 through 2005 (n=0-10). Observations of coho salmon were limited to three (live) in Kelsey Creek and six (5 live and 1 carcass) in Coal Creek. Based on a count of six redds in the upper reaches of Kelsey Creek, the coho salmon escapement estimate for 2009 is 15. Observations of sockeye salmon were limited to four in Richards Creek, and no redds were noted during 2009.

The presence of both natural and man-made barriers within the Kelsey Creek basin appears to be negatively influencing spawning success. This conclusion is based on the high abundance of beaver dams and weirs, pre-spawn carcasses observed in or below beaver dams, and an overall high level of pre-spawn mortality.

2.0 INTRODUCTION

In the Pacific Northwest, Pacific salmon (*Oncorhynchus* spp.) is an important economic, biological, and cultural resource that embodies the values of the region. Habitat degradation and fragmentation, coupled with harvest and hatchery practices, have led to an acute decline in the abundance of Pacific salmon, culminating in several listings under the Endangered Species Act (ESA). In 1999, the Puget Sound Chinook salmon (*O. tshawytscha*) Evolutionarily Significant Unit (ESU) was listed as threatened under the ESA (Federal Register 1999). In turn, federal, state, local, and tribal governments and citizens have engaged in salmon recovery planning to develop watershed-specific recovery strategies for Chinook salmon within the Puget Sound ESU. The goals of these efforts are to implement scientifically-based recovery plans that will result in the recovery (de-listing) of Chinook salmon stocks within the Puget Sound ESU, which includes 22 independent and 16 extant populations (Ruckelshaus et al. 2006).

The Cedar/Sammamish watershed is the most highly urbanized watershed within the Puget Sound ESU. Three large, naturally spawning groups of fall Chinook salmon exist in the watershed—Cedar River, Bear Creek, and Issaquah Creek. In addition, there are several sub basins within the watershed that consistently have spawning Chinook salmon, including Kelsey, North, Swamp, May, Lewis, Little Bear, McAleer, and Thornton creeks (Kerwin 2001). Two Chinook hatcheries are operated within the watershed—one at Portage Bay operated by the University of Washington, and the other on Issaquah Creek operated by the Washington Department of Fish and Wildlife (WDFW). Over the past decade, greater attention has been

placed on accurately assessing the abundance of spawning salmon across the Cedar/Sammamish watershed, including the Kelsey Creek and Coal Creek basins.

Historically, Kelsey Creek supported runs of Chinook, coho (*O. kisutch*), and sockeye (*O. nerka*) salmon, as well as both cutthroat (*O. clarki*) and steelhead/rainbow (*O. mykiss*) trout. As the watershed became more developed in the 20th century, Kelsey Creek became less hospitable to supporting fish populations (Scott et al. 1986). The combination of altered flow regimes and resulting changes in sediment transport processes are thought to be primarily responsible for the decline in native fishes within the Kelsey Creek Basin (Richey 1982).

3.0 METHODS

3.1 Survey Protocol

In 2009, spawning ground surveyors from King County, David Evans and Associates, Inc. (DEA), the City of Bellevue, and WDFW surveyed large sections of Kelsey Creek, West Tributary, Richards Creek, and Coal Creek. Weekly salmon spawner surveys were conducted on Kelsey Creek (#080259) from 3 September through 30 December 2009 (16 surveys), and West Tributary (#080264) from 8 September through 8 December 2009 (13 surveys). Bi-monthly surveys were conducted on Richards Creek (#080261) from 10 September through 20 October and Coal Creek (#080268) from 28 October through 8 December 2009 (4 surveys each).

The purpose of this work was to document the timing, abundance, and biological characteristics of naturally spawning salmon in Bellevue streams. Since only a portion of each stream is surveyed, escapement estimates are not possible. Instead, the data included in this report represents an index of escapement, although it is thought that greater than 75 percent of the spawning habitat is included within the index area (Watershed Company 2009).

Polarized sunglasses were worn by surveyors to increase visibility, and all live and dead fish were recorded. When possible, streams were walked starting downstream to increase sampling effectiveness as described by Ames (1984). Attempts were made during surveys to avoid disturbance of fish on redds. Surveys were not conducted if water conditions were dangerously high or fast, if turbidity impaired visual detection of fish, or above reaches with obvious downstream blockages, especially on Richards Creek. Conditions permitting, the entire stream was sampled on each survey date.

All observed salmon carcasses were retrieved and identified during each spawning ground survey. All carcasses were examined for the presence of external marks (tags or adipose fin-clip), then scanned for presence of a coded-wire tag (CWT) in the snout. If a fish was found to have an adipose fin-clip or a CWT, we considered it to be marked and of hatchery origin. Both postorbital to hypural plate (POH) and fork length (FL) were measured on carcasses to the nearest centimeter, sex was recorded, and females were examined for egg retention (termed spawning success). The body cavity was opened on females and checked for 0, 25, 50, 75, or 100 percent egg retention. Egg retention of 0-5 percent was assigned a 0, 6-25 percent to the 25 category, 26-50 percent to the 50 category, 51-75 percent to the 75 category, and 76-100 percent to the 100 category. The tail of each carcass was removed to ensure it would not be recounted during subsequent survey efforts.

Six scales were removed from each Chinook carcass to determine age. Scales were removed from the area several rows above the lateral line between the posterior end of the dorsal fin and the anterior insertion of the anal fin (INPFC 1963). Scales were mounted on gummed scale cards

and read by WDFW staff at the Scale and Otolith Lab in Olympia, Washington. Age notation used the Gilbert-Rich system, with the total age noted normally, and the freshwater age represented as a subscript (Koo 1962). For the purposes of this report, we will use the total age without the freshwater subscript since greater than 95 percent of the Chinook in the Cedar/Sammamish watershed only spend one year rearing in freshwater. Although an attempt was made to collect all the data on all carcasses, many of the carcasses were either highly decomposed or had been preyed upon such that not all data could be collected from every carcasses recovered during the various survey events. Redds were noted whenever encountered, and their location was recorded on a Global Positioning System (GPS) receiver. Due to the occurrence of sympatric salmon species, redds were positively identified by attending species, size of redd (if no attending species), and timing.

There are several methods of generating escapement estimates including using cumulative redd counts, determining the area under the curve (AUC) based on live counts, and using peak spawner counts to generate a relative abundance estimate. The AUC escapement method is dependent on an accurate estimate of fish stream residence time, which is generally lacking for the surveyed streams. Therefore, this report uses primarily the redd based method to generate an escapement estimates by taking the total number of redds documented in each stream, and then multiplying that number by the average number of fish per redd. In this case, the spawning ground escapement, ***E*r**, is estimated by:

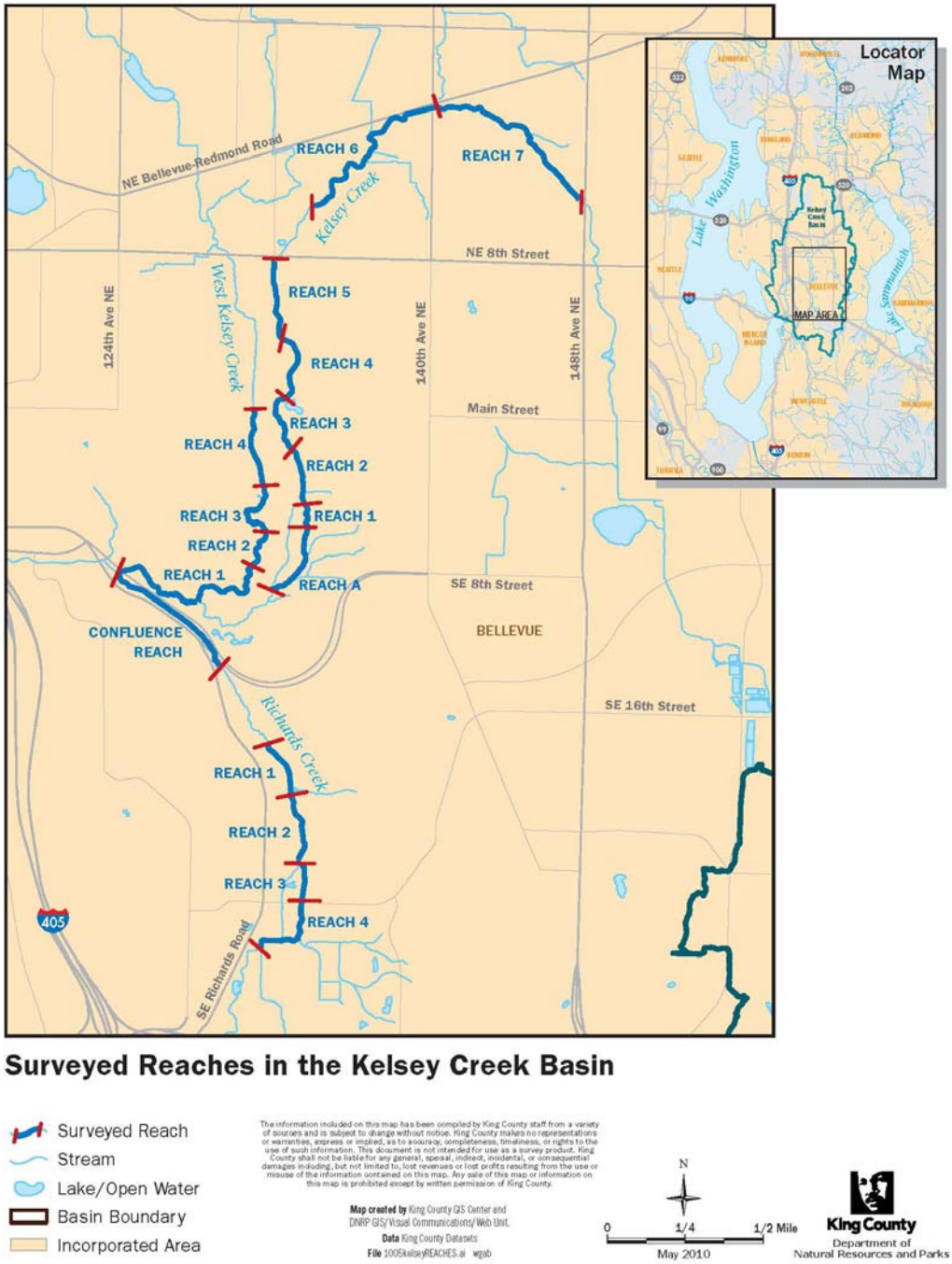
$$E\mathrm{r} = R * \Phi$$

where R is the total number of redds and Φ represents the average number of fish per redd. In the Cedar/Sammamish watershed, we assume that Φ is 2.5 with one female and 1.5 males per redd. The reason the ratio is 1.5 males per redd is to account for the fact that males often fertilize more than one redd (Briggs 1953; Healey and Prince 1998; Berejikian et al. 2000).

3.2 Study Area and Reach Descriptions

There are eight survey index reaches in Kelsey Creek mainstem, four in the West Tributary, and four in Richards Creek (**Figure 1**). Index reaches have been established over the past decade, and the index reaches in 2009 were the same as those used in 2008 (Watershed Company 2009).

Figure 1. Map of 2009 Survey Reaches in the Kelsey Creek Basin.



Kelsey Creek

In Kelsey Creek, Reach A begins within the Kelsey Creek Park and ends at a bend within Kelsey Creek, where Reach 1 starts (approximately River Mile 3.2). Reach 1 continues upstream to the footbridge near the boundary of the park where Reach 2 begins. Reach 2 continues from the footbridge to the property boundary of the Glendale Golf Course, where Reach 3 starts. Reach 3 extends upstream to the first weir adjacent to the pumphouse to Reach 4. Reach 4 ends at a footbridge with an armored bank, and Reach 5 extends upstream to the northern boundary of the Glendale Golf Course at a culvert underneath NE 8th Street. Property access was not granted for

a section from the culvert at NE 8th Street to an area downstream of 134th Avenue NE. Reach 6 begins immediately downstream of the 134th Avenue NE bridge and continues to Valley Creek. Reach 7 extends upstream from the confluence of Valley Creek to 148th Avenue NE. **Figure 2** includes typical habitat photos for Kelsey Creek. Additional photos are contained in **Section 5.2 Fish Passage**.

Figure 2. Kelsey Creek Typical Habitat Photos from 2009.

West Tributary

In the West Tributary, Reach 1 begins at the confluence with Kelsey Creek and extends upstream to the first footbridge in Kelsey Creek Park. Reach 2 starts at the end of Reach 1 and continues to the second footbridge. Reach 3 continues upstream to the boundary of the Glendale Golf Course. Reach 4 begins at the downstream boundary of the golf course and ends at its northern boundary. **Figure 3** includes typical habitat photos and beaver activity in West Tributary.

Figure 3. West Tributary Typical Habitat Photos from 2009.

Richards Creek

Index reaches of Richards Creek begin at its confluence with Kelsey Creek and extend upstream. The confluence reach is from the confluence to the intersection of Richards Road and Lake Hills Connector. The area upstream in Bannerwood Park has extensive beaver dams, and was not surveyed. Reach 1 began at the culvert in Bannerwood Park and continues upstream to the next culvert crossing. Reach 2 extends upstream to the confluence with East Creek, and Reach 3 continues upstream to the culvert underneath Kamber Road. Reach 4 includes the segment of stream between Kamber Road and the confluence of Richards Creek and Sunset Creek. **Figure 4** includes typical habitat photos of Richards Creek and beaver-related issues (note beaver leveler in bottom right photo).

Figure 4. Richards Creek Typical Habitat Photos from 2009.

Coal Creek Basin

The index reach in Coal Creek starts at the upstream side of I-405 and continues upstream to the culvert at Coal Creek Parkway, approximately 1.5 miles upstream (**Figure 5**). **Figure 6** includes typical habitat photos and the remains of one post-spawned coho salmon carcass. Additional photos are contained in **Section 5.2 Fish Passage**.

Figure 5. Map of 2009 Survey Reaches in the Coal Creek Basin.

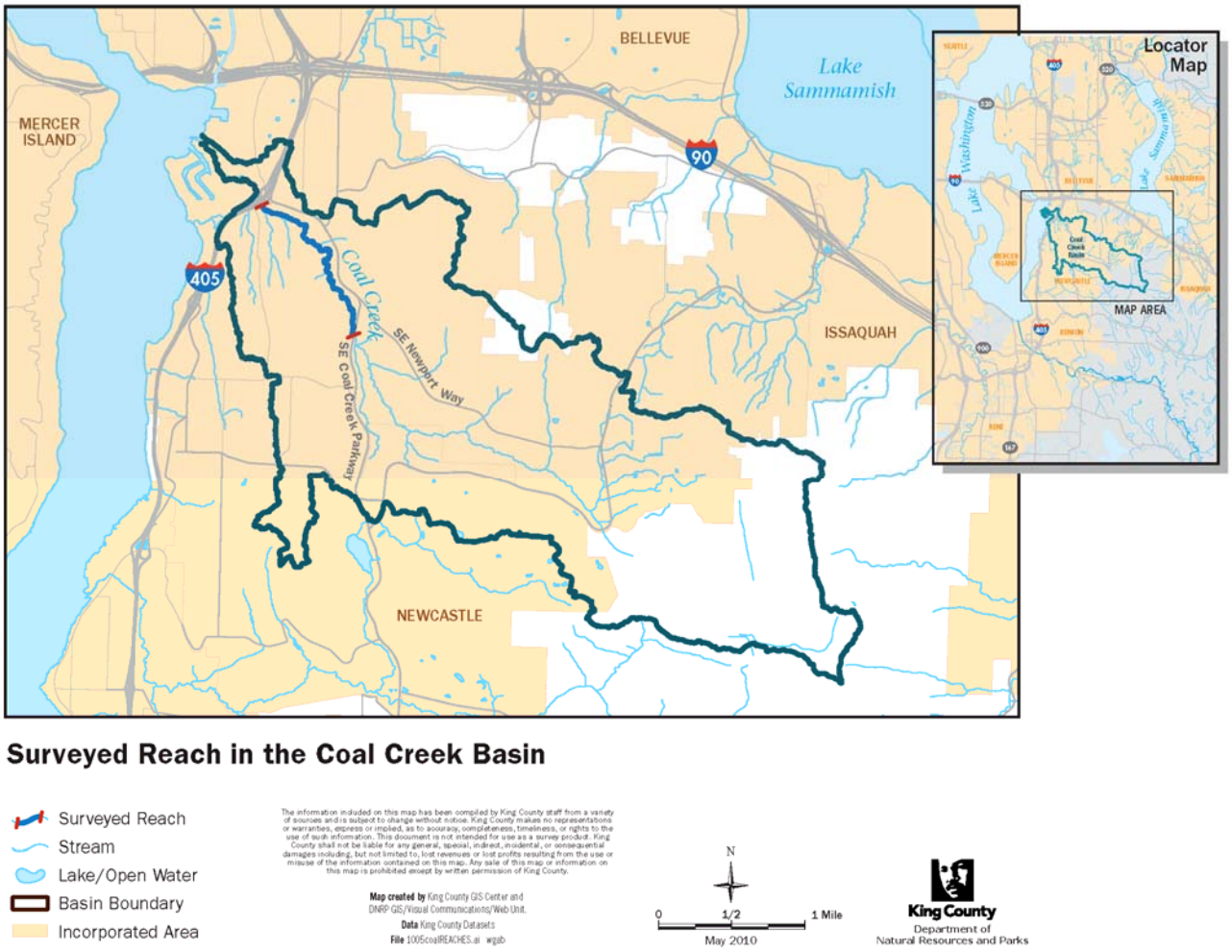
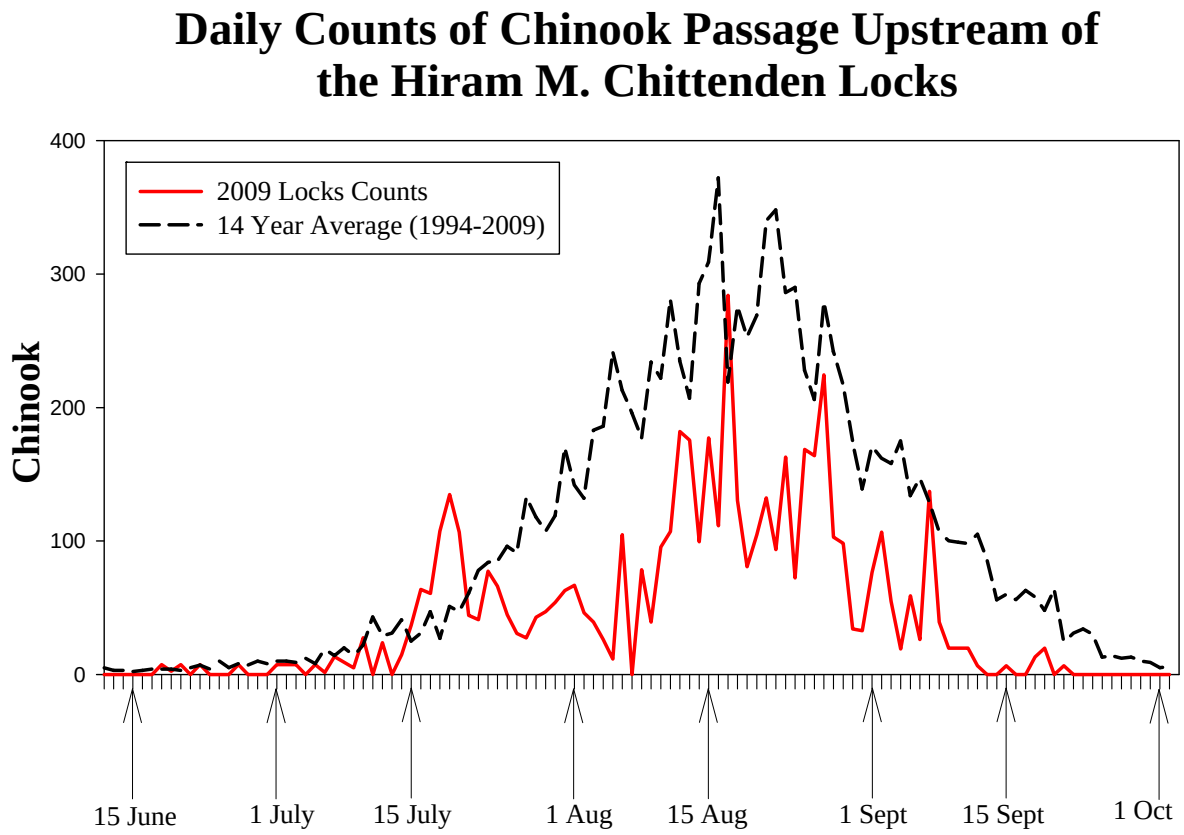


Figure 6. Coal Creek Typical Habitat Photos from 2009.

4.0 RESULTS

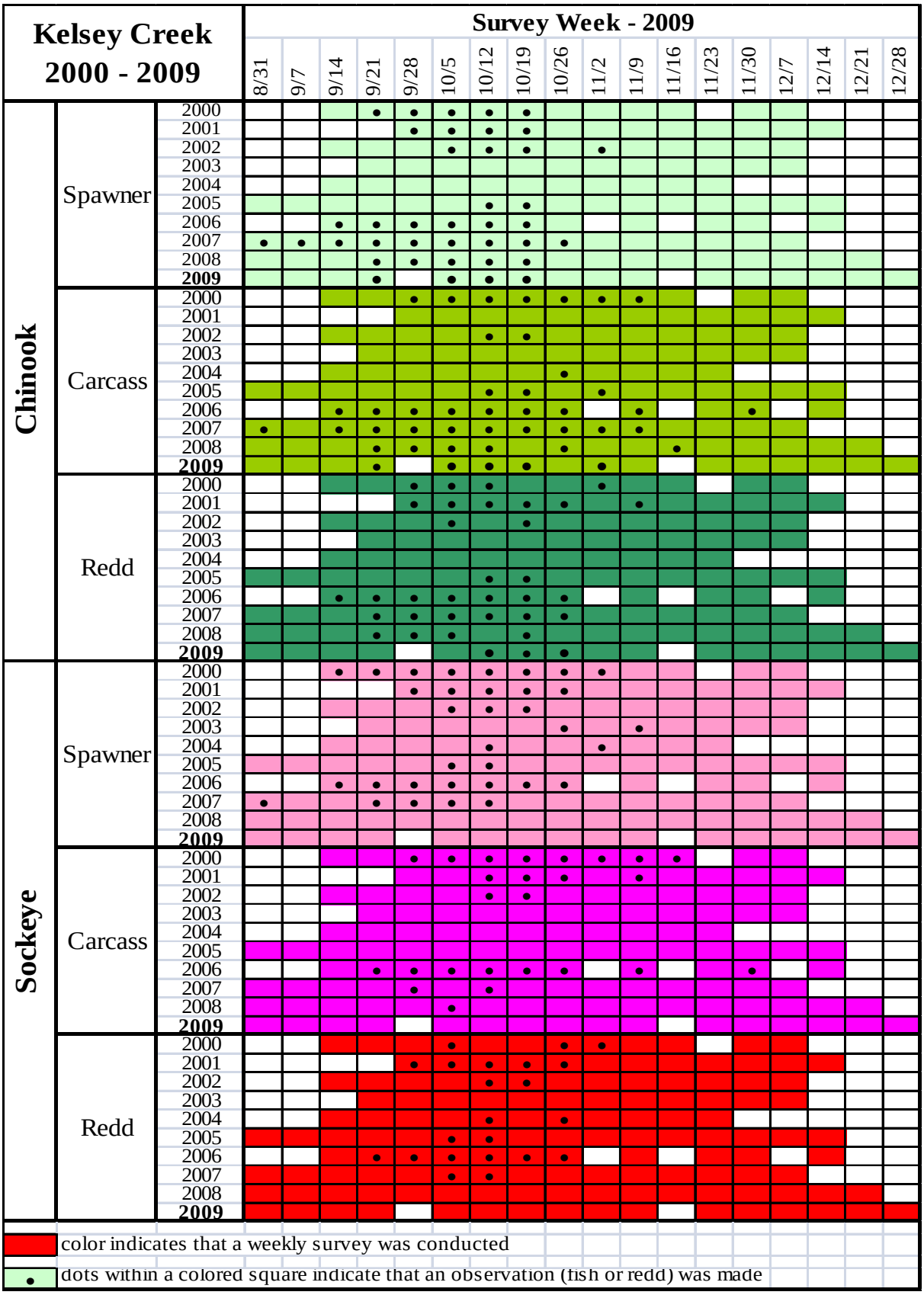
Spawning ground surveys in Bellevue streams were conducted over an 18-week period in 2009 (**Table 1**). Surveys began on 1 September and continued until 30 December 2009. Chinook salmon counts at the Chittenden Locks suggested that the return in 2009 would be less than the average over the past 14 years (**Figure 7**), and that was the case for Bellevue creeks. Although the return of salmon to Bellevue creeks was very low in 2009, Chinook, sockeye, and coho salmon were observed, along with cutthroat trout.

Figure 7. Counts of Chinook Salmon Migrating Upstream of the Hiram M. Chittenden Locks.



Data provided by Mike Mahovolich, Muckleshoot Indian Tribe, Fisheries Department.

Table 1. 2009 Spawning Ground Surveys



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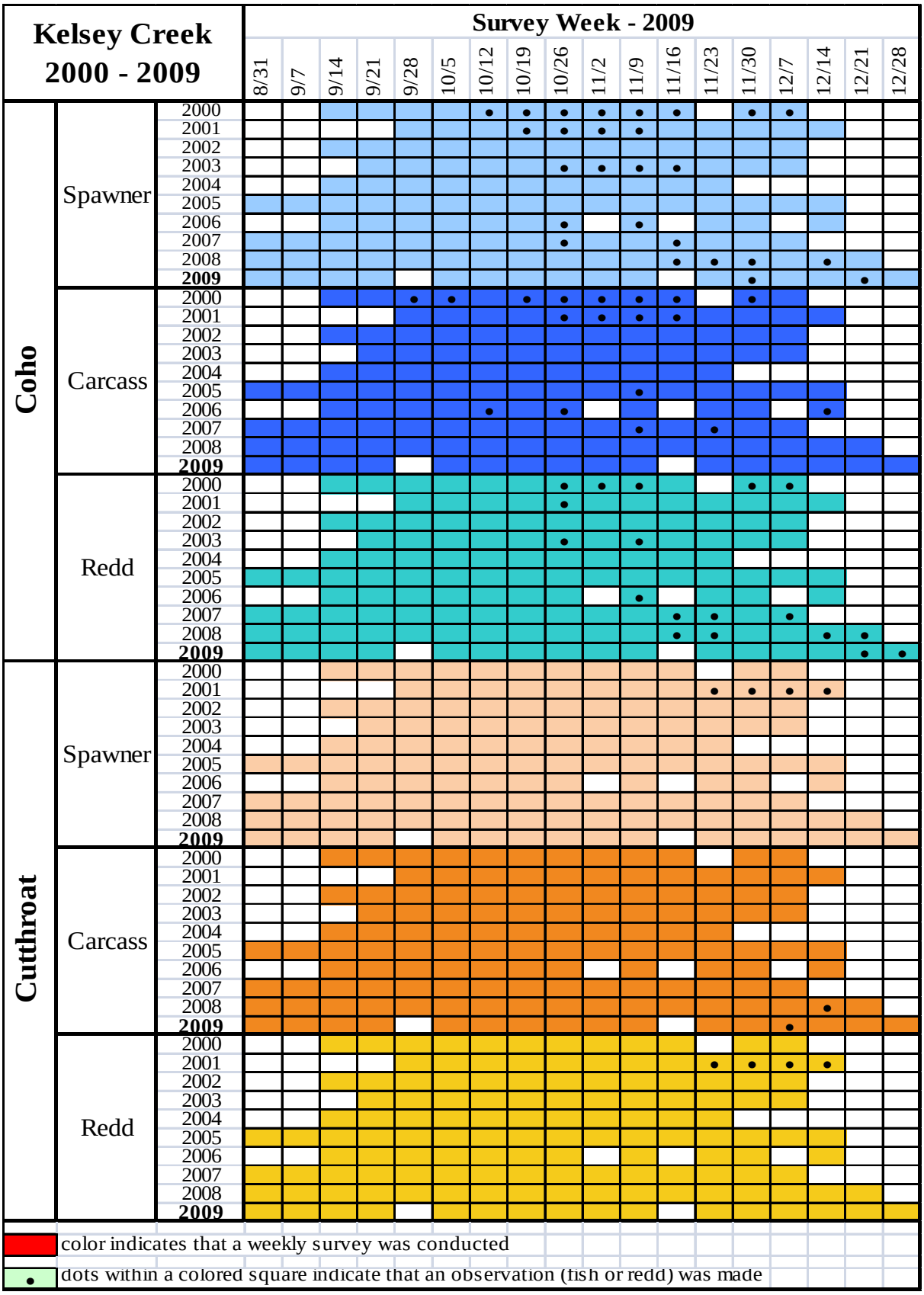


Table 1. 2009 Spawning Ground Surveys (continued)

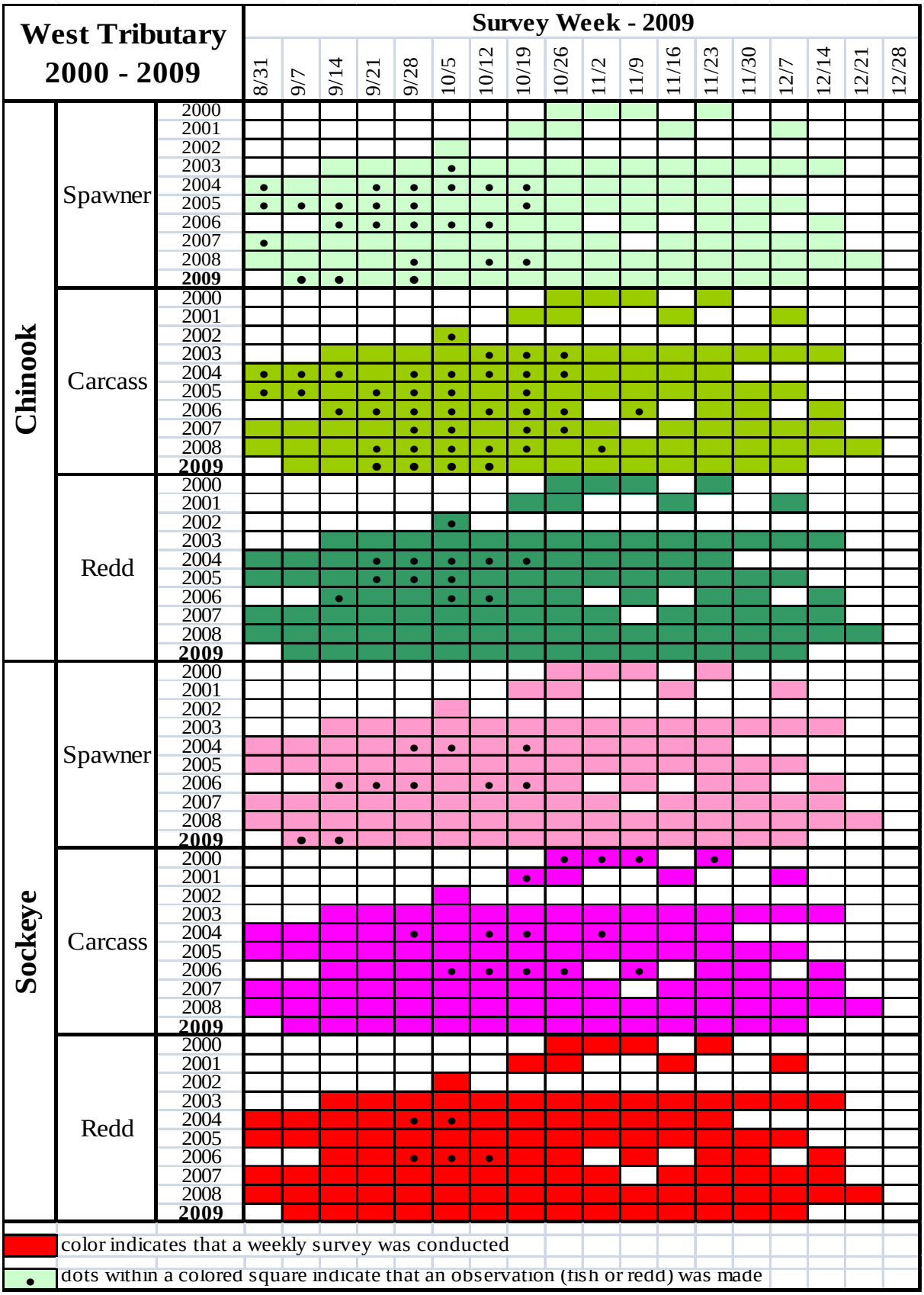


Table 1. 2009 Spawning Ground Surveys (continued)

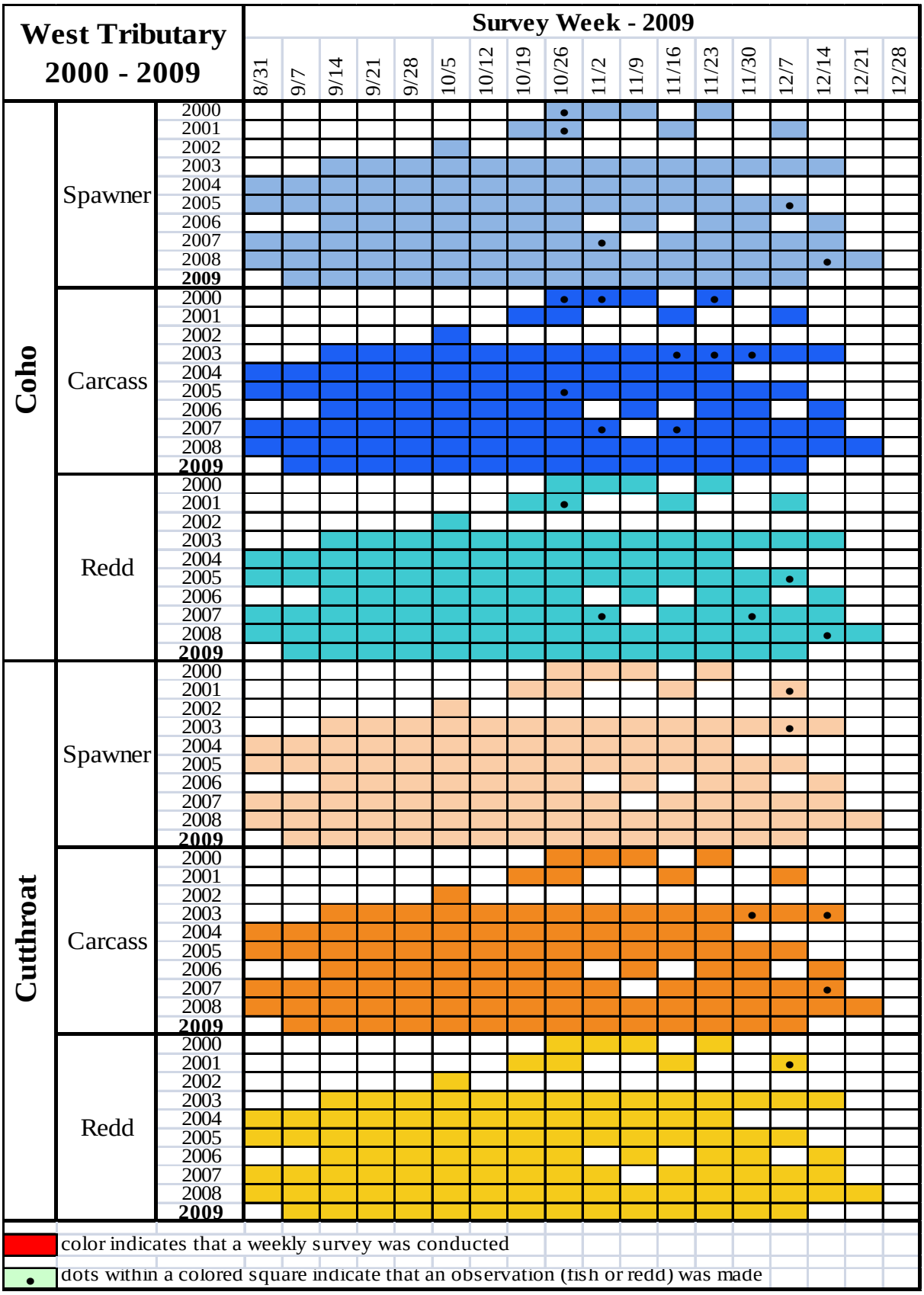


Table 1. 2009 Spawning Ground Surveys (continued)

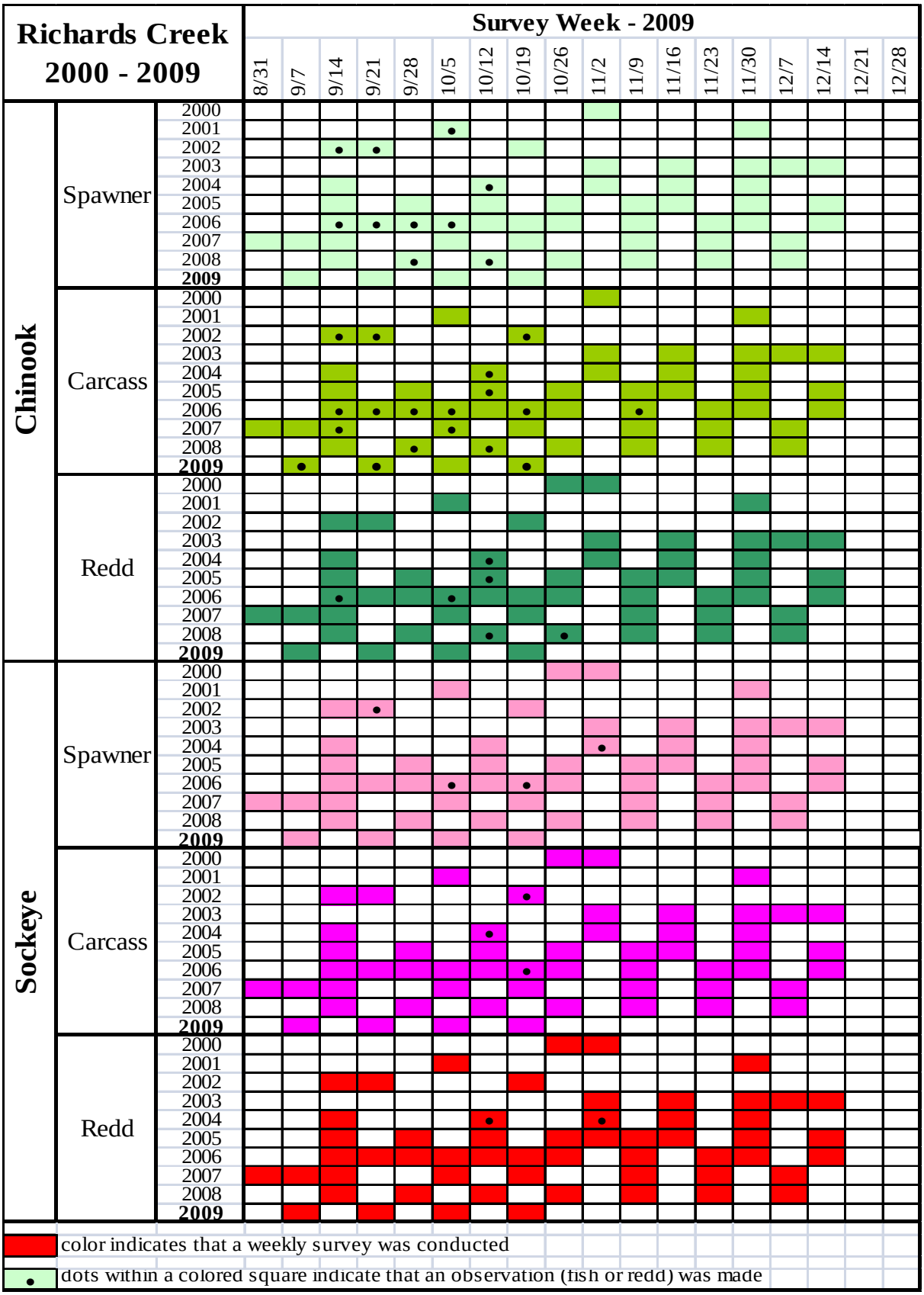


Table 1. 2009 Spawning Ground Surveys (continued)

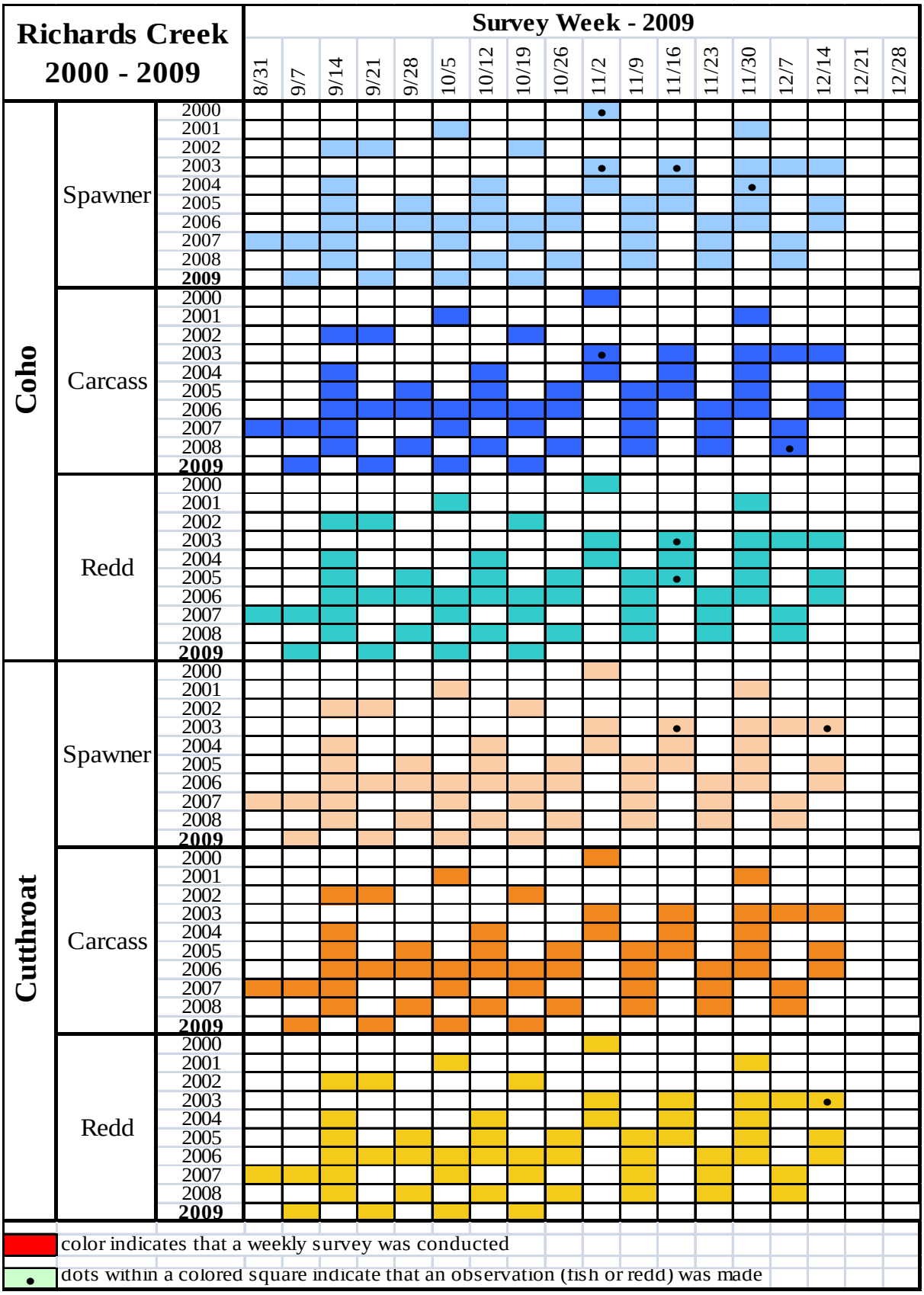


Table 1. 2009 Spawning Ground Surveys (continued)

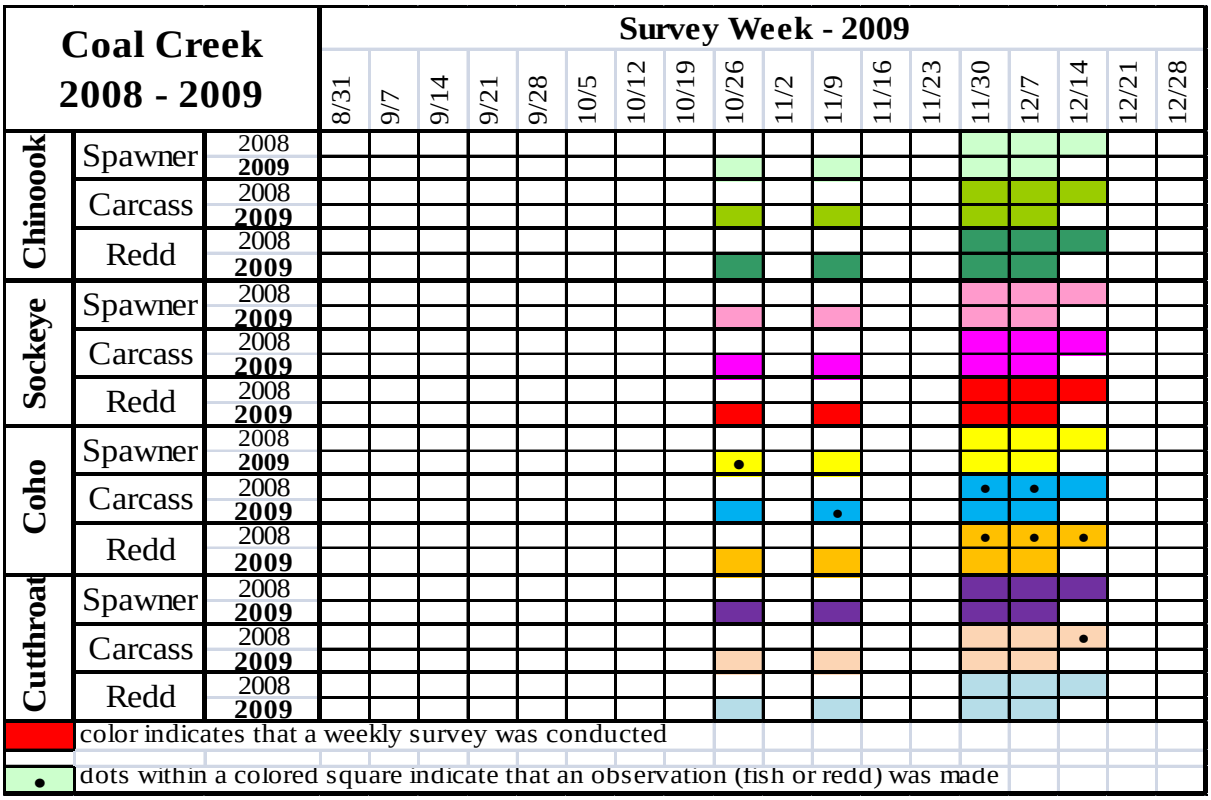


Table 2 summarizes redd based escapement estimates and peak counts for Kelsey Creek from 2000 through 2009.

Table 2. Kelsey Creek Redd Based/Peak Count Escapement Summary from 2000 - 2009

Year	Chinook Escapement	Coho Escapement	Sockeye Escapement	Yearly Total Salmon Escapement
2000	25/4	40/7	113/42	178/53
2001	10/4	5/4	38/15	53/23
2002	10/5	0/0	38/9	48/14
2003	0/0	15/5	0/1	15/5
2004	0/0	0/0	5/3	5/3
2005	10/3	0/0	5/2	15/5
2006	180/43	3/1	488/124	671/168
2007	193/73	25/1	20/15	238/89
2008	20/7	25/3	0/0	45/10
2009	13/3	15/2	0/0	28/5
Total	501/142	128/23	707/211	1336/375

4.1 Chinook Salmon

A total of 20 Chinook salmon carcasses were counted in Kelsey (n=8), West Tributary (n=7), and Richards (n=5) creeks during 2009 (**Table 3**). Chinook salmon spawners were first observed on 8 September 2009 in the West Tributary of Kelsey Creek, and the last live Chinook was observed on 20 October in Kelsey Creek (**Appendix A**). A total of 11 Chinook spawners (i.e., live) were observed in the Kelsey Creek system, some of which could have been documented as carcasses later in the season. Three Chinook spawners were counted in the West Tributary, and eight were observed in Kelsey Creek, but none were observed in Richards Creek or Coal Creek. Based on the inspection of 14 intact carcasses, pre-spawn mortality ranged from a low of zero percent in Kelsey Creek to a high of 75 percent in Richards Creek (overall is 29%).

Table 3. 2009 Chinook Salmon Survey Summary

Stream	Total Surveys	Total Live Count	Total Carcass Count	Total Redd Count	Pre-spawn mortality	Redd Based Escapement Estimate
Kelsey	16	8	8	5	0/5 (0%)	13
West Trib.	13	3	7	0	1/5 (20%)	0
Richards Creek	4	0	5	0	3/4 (75%)	0
Coal Creek	4	0	0	0	0	0
Total	37	11	20	5	4/14 (29%)	13

Figure 8. Chinook Salmon Carcasses from Kelsey Creek Basin.

Five Chinook redds were constructed within survey reaches, all of which were located in mainstem Kelsey Creek (**Figure 9**). Chinook salmon redds were restricted to Reach A (n=4) and Reach 2 (n=1), although both live spawners and carcasses were documented up to Reach 7 (**Table 4**). Based on this data, the 2009 escapement estimate for Chinook in Kelsey Creek is 13.

Table 4. Kelsey Creek 2009 Chinook Salmon Summary

Reach	Spawner	Carcass	Redd
A	6	3	4
1	0	1	0
2	0	0	1
3	0	0	0
4	0	0	0
5	0	0	0
6	2	2	0
7	0	2	0
Total	8	8	5

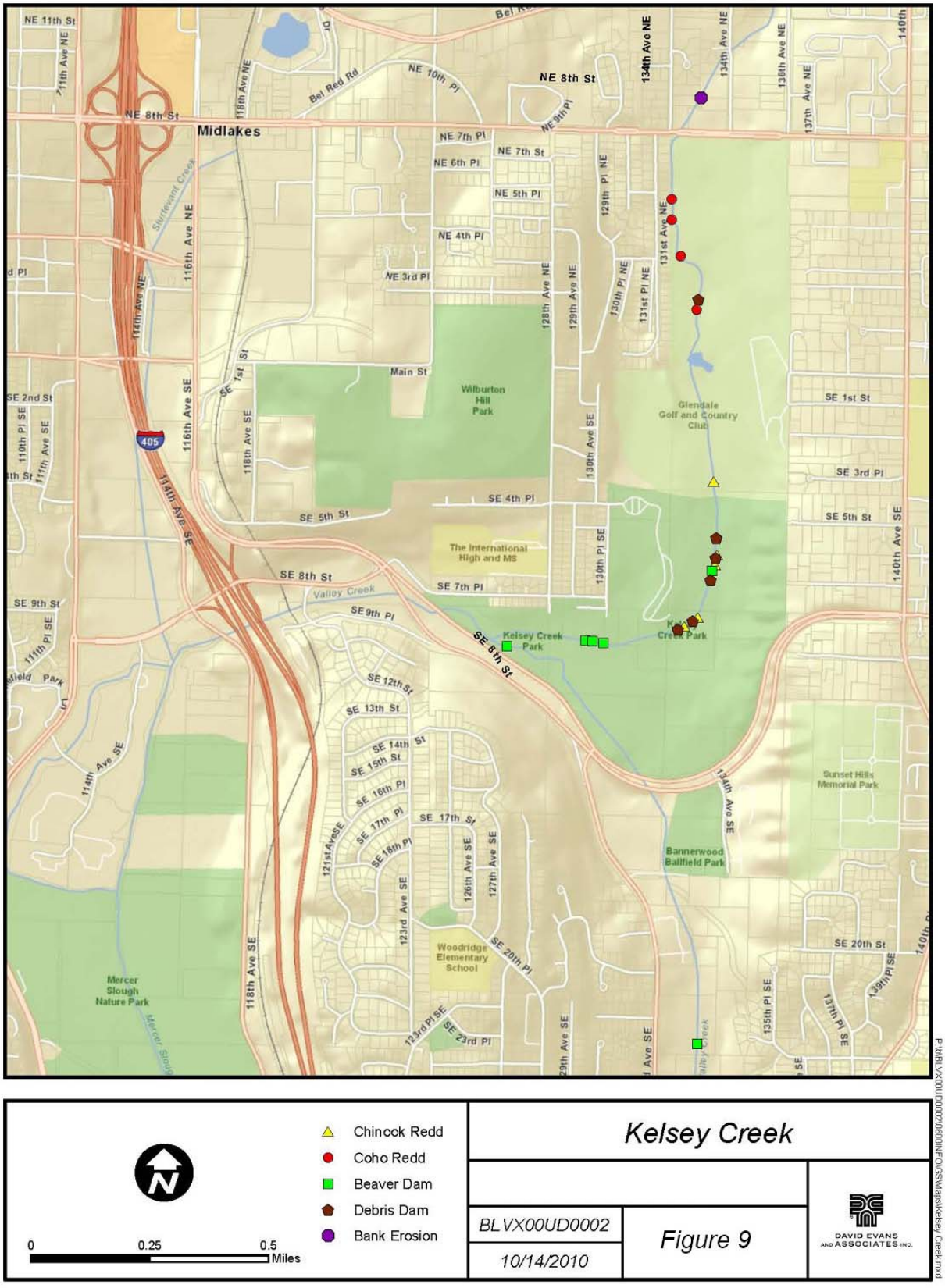
Eight Chinook carcasses were recovered from Kelsey Creek, three of which were of hatchery (marked) origin. The remainder were either to decomposed or had been scavenged upon to the point origin could not be accurately ascertained. Some of the carcasses were highly decomposed and/or preyed upon, therefore, sex or origin could not be ascertained. Three of the carcasses were male, two were female, and three were of unknown gender. No CWT/pit tags were recovered from any of the carcasses in Kelsey Creek. The largest specimen recovered in Kelsey Creek was a male with total length of 98 cm (38.6 inches). **Appendix A** contains the summarized data for all survey events undertaken in 2009.

Seven Chinook carcasses were recovered in the West Tributary. This included three that were male, two that were female, and two unknown due to decomposition or scavenging. Four were of hatchery origin based on the adipose fin being clipped; however, one carcass had a complete adipose fin and is therefore assumed have been naturally propagated. No CWT/pit tags were recovered from any of the carcasses in the West Tributary. The largest specimen recovered in West Tributary was a female with total length of 92 cm (36.2 inches). This large female was located just prior or downstream of the start of Reach 5 and had not spawned since egg retention was 100 percent (pre-spawn mortality). However, the other female carcass recovered from West Tributary was spent and is therefore assumed to have successfully spawned. As was the case in all streams, numerous carcasses were either partially scavenged or badly decomposed making data collection problematic or impossible. Some Chinook became trapped in or at beaver dams or debris piles, while others had numerous puncture wounds. Based on the available data, the escapement estimate for Chinook in the West Tributary during 2009 was zero.

Five Chinook carcasses were recovered in Richards Creek. One was a female, three were males, and one was unknown (i.e., too decomposed or preyed upon to identify). Four were of hatchery origin and one had a complete adipose. Beaver dams in the confluence reach blocked migration and resulted in stranding and mortality, and predation from river otter, coyote, and/or raccoon, based on likely predators within surveyed streams. Three of the Chinook had 100 percent egg/milt retention and therefore died before spawning, while the status of the other two could not be ascertained due to decomposition or scavenging. Based on the number of redds observed, the escapement estimate for Chinook in Richards Creek during 2009 was zero.

No Chinook spawners, carcasses, or redds were observed in Coal Creek. However, the Coal Creek surveys started at the end of the Chinook spawning season.

Figure 9. Chinook and Coho Salmon Redd Locations in Kelsey Creek in 2009.



Scales were collected from 10 Chinook carcasses within the overall Kelsey Creek basin including four from Kelsey Creek, five from West Tributary, and one from Richards Creek (**Appendix B**). Based on the analysis of scales collected from these 10 Chinook salmon in the Kelsey Creek basin, six were age 3 (5 male + 1 female), three were age 4 (2 male + 1 female), and one female was age 5. Nine out of ten of the Chinook sampled to determine age were of hatchery origin.

4.2 Sockeye Salmon

Sockeye salmon were first observed on 8 September 2009, and the last live sockeye was seen on 16 September, all in West Tributary of Kelsey Creek (**Table 5**). The total count of live sockeye was four fish, which were all observed in Reach 3. No live sockeye, carcasses, or redds were observed in the mainstem of Kelsey Creek, Richards Creek, or Coal Creek in 2009. Since no redds were observed, the redd-based escapement estimate for sockeye in all streams surveyed is zero.

Table 5. Sockeye Salmon Survey Summary

Stream	Total Surveys	Total Live Count	Total Carcass Count	Total Redd Count	Pre-spawn mortality	Redd Based Escapement Estimate
Kelsey	16	0	0	0	0	0
West Trib.	13	4	0	0	0	0
Richards Creek	4	0	0	0	0	0
Coal Creek	4	0	0	0	0	0
Total	37	4	0	0	0	0

4.3 Coho Salmon

Coho salmon were first observed in Coal Creek on 28 October 2009, and the last coho was observed in Kelsey Creek on 23 December 2009 (**Table 6**). A total of 6 coho redds were observed in Kelsey Creek during the 2009 salmon surveys. All redds were located in upper Kelsey Creek including two in Reach 4, two in Reach 5, one in Reach 6, and one in Reach 7. The escapement estimate for coho was estimated at 15 in Kelsey Creek (redd based) and five for Coal Creek (live spawners observed). The only coho carcass that was recovered was sampled on 12 November 2009 in Coal Creek. That fish was a male of hatchery origin (i.e., marked with an adipose fin clip). A total of 5 spawners were observed in Coal Creek, four on October 28 and one on November 12, 2009.

Table 6. Coho Salmon Survey Summary

Stream	Total Surveys	Total Live Count	Total Carcass Count	Total Redd Count	Pre-spawn mortality	Redd Based Escapement Estimate
Kelsey	16	3	0	6	0	15
West Trib.	13	0	0	0	0	0
Richards Creek	4	0	0	0	0	0
Coal Creek	4	5	1	0	0/1 (0%)	0
Total	37	8	1	0	0	15

4.4 Cutthroat Trout

Cutthroat trout are the most abundant year-round salmonid species in the surveyed streams. They have diverse life history strategies including resident, fluvial (matures in a river), adfuvial (matures in a lake), and anadromous (matures in the ocean [sea-run]). According to Wydoski and Whitney (1979) inland races of resident cutthroat spawn in April and May, while sea-run cutthroat spawn primarily from late December to February. Therefore, the probability of observing spawning cutthroat trout during the survey period is low. However, two carcasses were documented in Kelsey Creek on 3 December 2009 (**Table 7**). Both were recovered from Reach A and had puncture wounds. One was a female with zero eggs but the caudal fin was not worn, indicating it may not have spawned. The female had a total length of 49 cm (19.3 inches), which is large and therefore probably not a resident fish. The second fish was a male and did not have any milt left, but the degree of decomposition was high. It had a total length of 43 cm (16.9 inches). Both of these fish were likely adfluvial or sea-run. No other cutthroat trout (carcasses, spawners, or redds) were observed during the 2009 salmon spawner surveys.

Table 7. Cutthroat Trout Survey Summary

Stream	Total Surveys	Total Live Count	Total Carcass Count	Total Redd Count	Pre-spawn mortality	Redd Based Escapement Estimate
Kelsey	16	0	2	0	0/2 (0%)	0
West Trib.	13	0	0	0	0	0
Richards Creek	4	0	0	0	0	0
Coal Creek	4	0	0	0	0	0
Total	37	0	2	0	0	0

Figure 10. Cutthroat Trout Carcasses from Kelsey Creek.

5.0 DISCUSSION

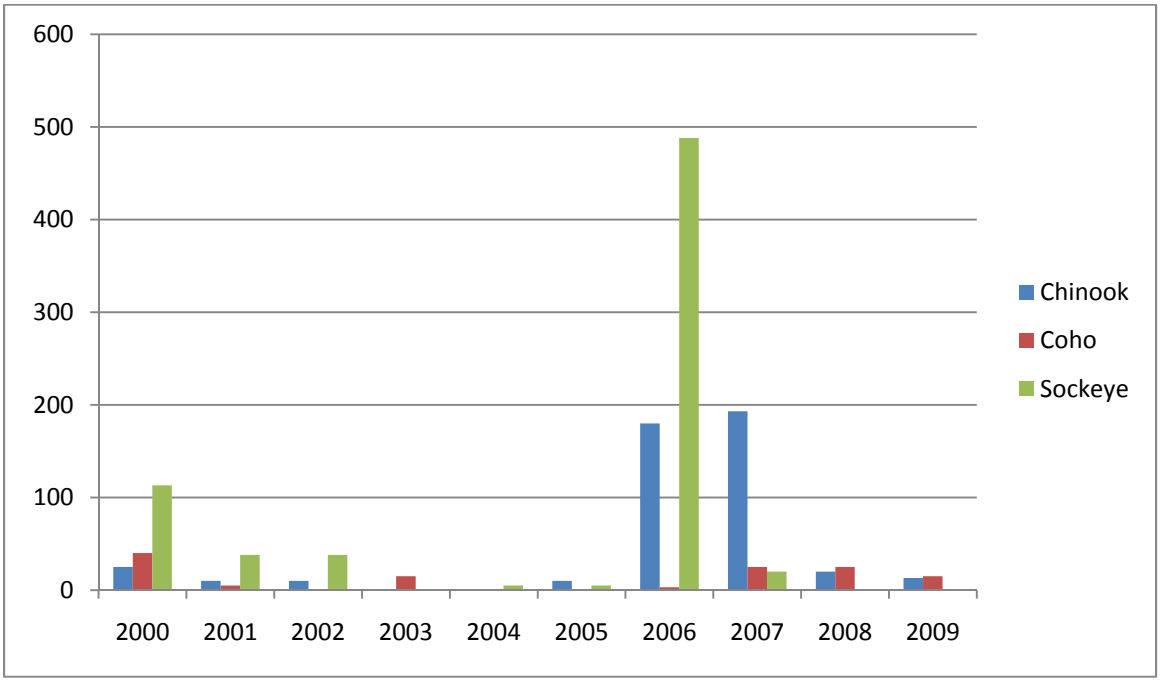
5.1 Spawning Escapement and Redd Distribution

In 2009, salmon spawning escapement (redd-based) for Kelsey Creek was estimated at 13 Chinook, 0 sockeye, and 15 coho. These escapement estimates are based on regularly surveyed index reaches in Kelsey Creek and have not been expanded to the entire Kelsey Creek watershed. Spawning escapement for the West Tributary is estimated at 0 Chinook, 0 sockeye, and 0 coho. Richards Creek escapement is estimated at 0 Chinook, 0 sockeye, and 0 coho.

Survey conditions were good in 2009, and Chinook redd counts are thought to be relatively accurate. Although high-water events did occur throughout the spawning season, we were able to survey during low water and this gives us confidence that survey efficiency was high and observation errors were minimal. Most spawning occurred in the lower Kelsey Creek mainstem in 2009, with four out of the five Chinook redds constructed in Reach A. Spawning activity was not observed in the West Tributary in 2009. However, redd construction in the survey reaches of the West Tributary has not historically occurred (see previous spawner survey reports 2000-2008) and the majority of redd construction in the system likely occurs above the survey reaches. Continued fish passage difficulties from low flows and intermittent barriers in Richards Creek prevented fish from spawning in the upper reaches and resulted in 100 percent predation on Chinook salmon (i.e., carcasses showed signs of predation and were pre-spawn). Two mature cutthroat trout carcasses were observed during a salmon spawner survey on Kelsey Creek in 2009. Theses carcasses appeared to have spawned and were located in Reach A.

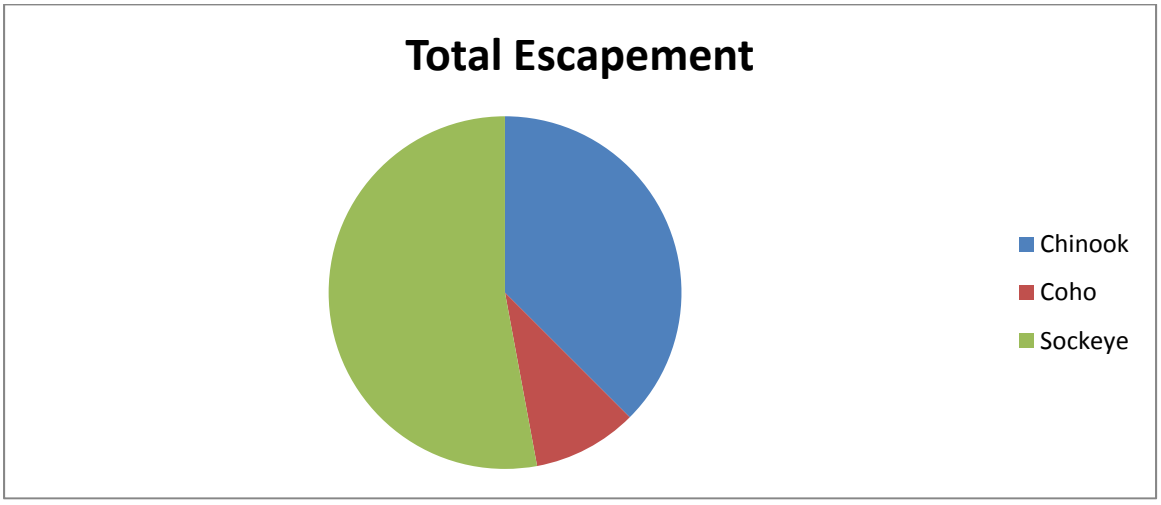
Overall salmon escapement in Kelsey Creek during 2009 was low (n=13) compared with results from previous survey efforts (**Figure 11**). Chinook salmon escapement in the Kelsey Creek basin is typically below 20, while the arithmetic mean is approximately 50. The mean of 50 is skewed due to high escapement estimates in 2006 and 2007 that ranged from 180 to 193. Coho salmon escapement is variable, and ranged from zero in 2002, 2004, and 2005 to a peak of 40 during 2000. The redd based coho escapement for 2009 of 15 is slightly above the arithmetic mean of approximately 13. Sockeye salmon escapement is also variable, ranging from zero in 2003 to a peak of 488 in 2006. Based on the data from 2000 through 2009, the arithmetic mean escapement for sockeye salmon in Kelsey Creek is approximately 71. The low return of sockeye salmon to the Kelsey Creek basin mirrored their return to the Lake Washington Watershed. 2009 had the lowest sockeye returns on record since 1964, with only an estimated 33,702 sockeye entering the watershed through the Chittenden Locks (Mike Mahovolich, Muckelshoot Tribe, personal communication).

Figure 11. Kelsey Creek Salmon Redd Based Escapement.



Overall salmon abundance based on summing redd based escapement for each species from 2000 through 2009 indicates Kelsey Creek produces mostly sockeye salmon (n=707), followed by Chinook salmon (n=501), and then coho salmon (n=128). This overall trend is graphically depicted in **Figure 12**.

Figure 12. Total Escapement in Kelsey Creek from 2000 through 2009.



Chinook salmon redd distribution by reach within the mainstem Kelsey Creek from 2000 through 2009 has been variable, however, some trends are becoming evident (**Figure 13**). The distribution of Chinook salmon redds in mainstem Kelsey Creek during 2009 was restricted to the lower most reaches. This is in contrast to the overall redd distribution trend based on data

from 2000 through 2009, which indicates the predominance of spawning has historically occurred primarily in Reaches 4, 5, 6, and 7, and to a lesser degree in Reach A. The use of Reach A for spawning spiked in 2006 when a total of 14 Chinook redds were counted. Chinook salmon spawning in Reaches 1, 2, and 3 has been limited during all survey years (**Figure 14**).

Figure 13. Yearly Chinook Salmon Redd Distribution by Reach from 2000 through 2009.

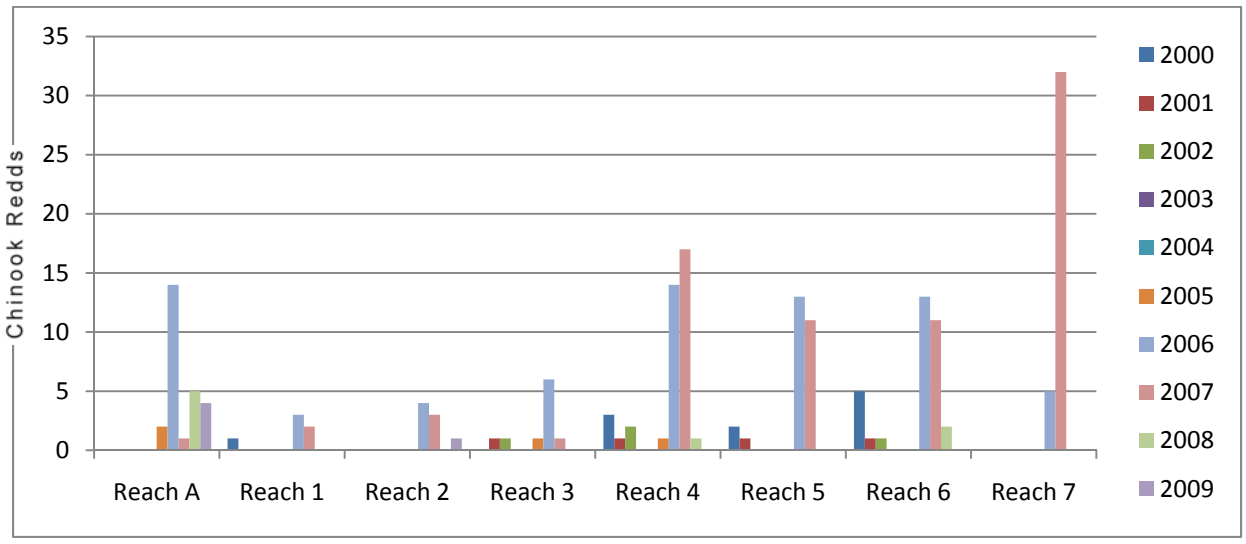
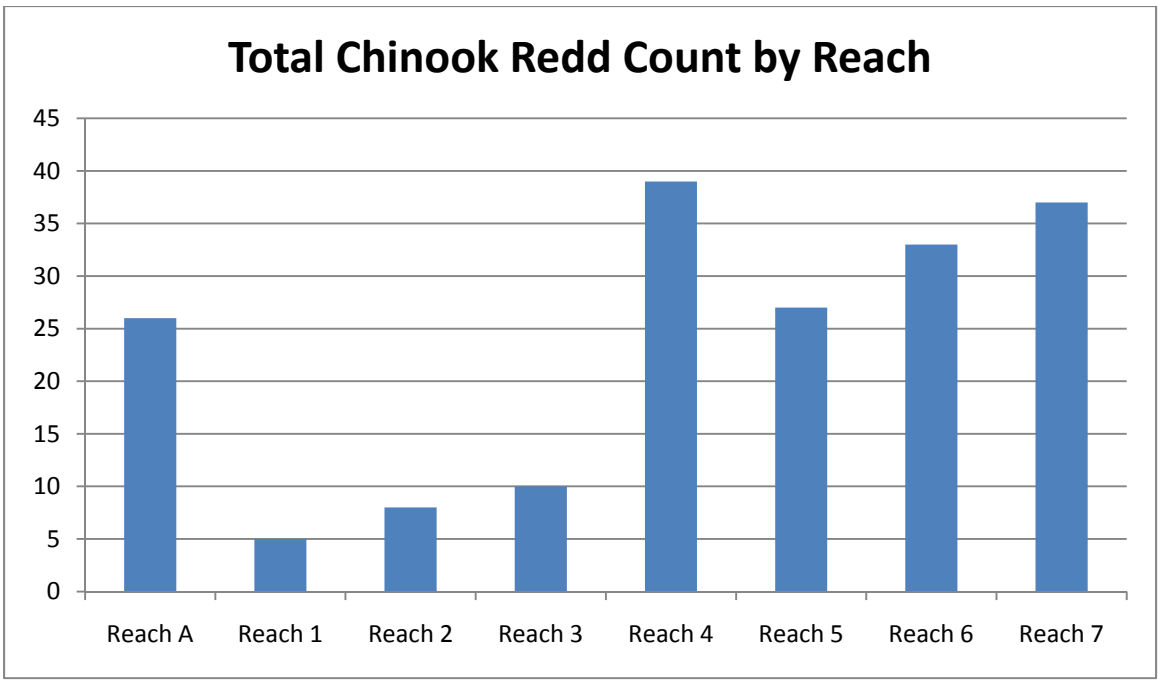


Figure 14. Total Chinook Salmon Redd Count by Reach from 2000 through 2009.



5.2 Fish Passage

In lower Kelsey Creek at the West Tributary confluence, the pond leveling device was still effective, allowing fish to negotiate beaver dam areas formerly impassable at lower flows. However, the construction of a series of three new beaver dams in Reach 1 of the West Tributary caused the West Tributary to be routed to the north through a dense forest of willows. The water flow in the original channel was reduced by 75 percent, causing a significant fish passage issue. However, this series of dams was constructed after the Chinook run was complete.

Fish passage was a concern in the main stem of Kelsey Creek due to both natural and anthropogenic factors (**Figure 15**). At least three beaver dams and low flows during the first part of the spawning season hindered passage into Kelsey Creek. At least 22 weirs exist in Kelsey Creek, which further complicates fish passage for some species/age classes depending on weir height and stream flow. Some of these weirs have been identified to be improved during 2010 and 2011.

Fish passage was also a concern in Richards Creek during the beginning of the Chinook spawning season (September and October) due to the low flows and impassable beaver dams. Several Chinook salmon carcasses were found on or near beaver dams in the Confluence Reach. It appeared the Chinook were preyed upon. However, a series of beaver dams below Reach 1 in Bannerwood Park would likely prevent fish passage to the upper reaches in any case.

Figure 15. Constructed and Natural Potential Barriers to Fish Passage in Surveyed Streams in 2009.

Coal Creek

Lower Kelsey below West Tributary

Kelsey Glendale Golf Course

Kelsey Glendale Golf Course

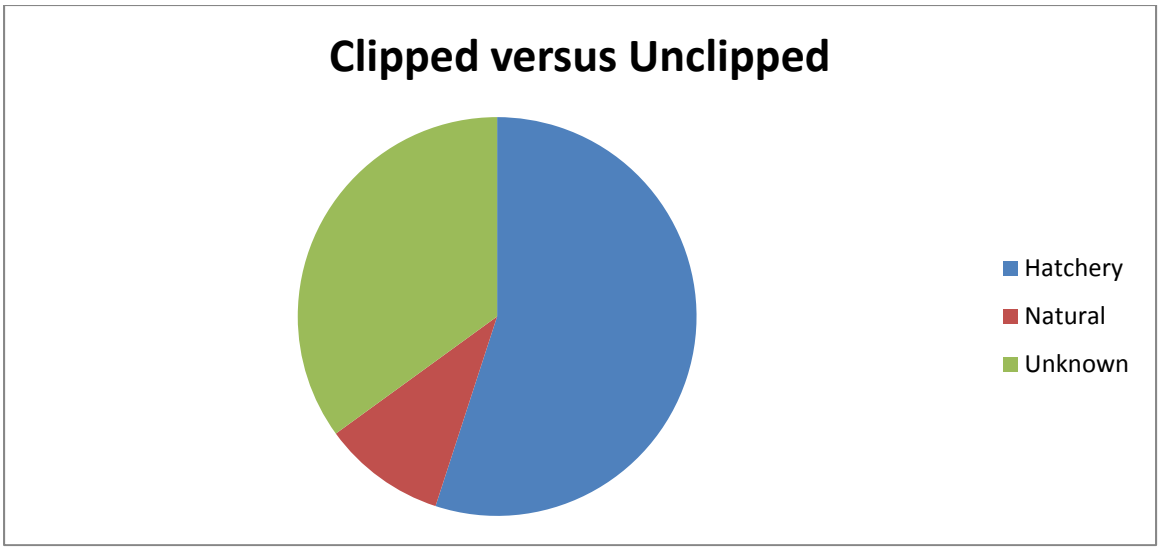
Kelsey Glendale Golf Course

Kelsey Creek at Kelsey Farm Park, Reach 1

5.3 Wild/Hatchery Origin and Gender

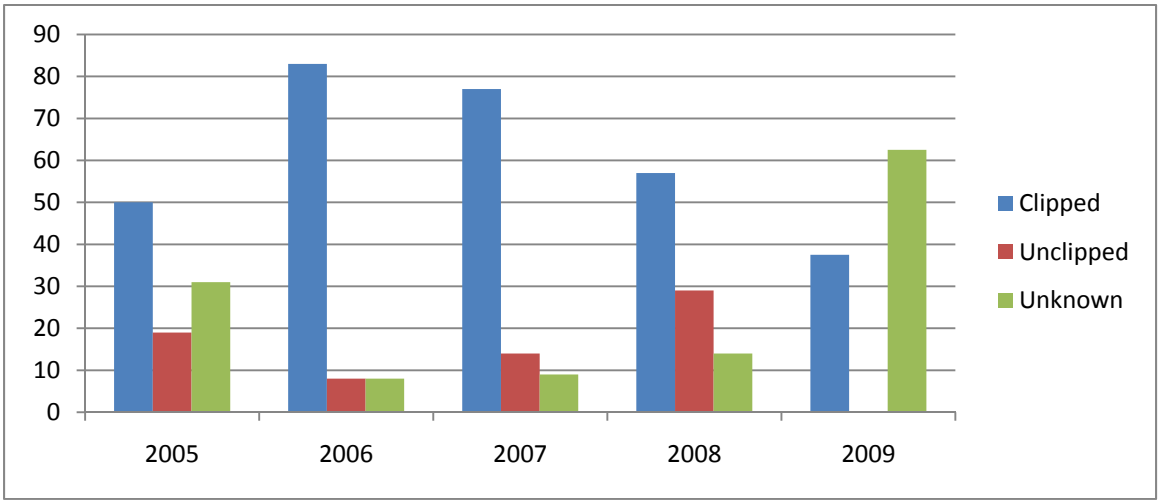
Similar to 2008, a large percentage of the Chinook salmon observed in 2009 were of hatchery origin. A total of 20 Chinook salmon carcasses were observed during 2009. Eleven were clipped, two were not clipped, and seven were unknown (**Figure 16**). Based on 13 carcasses being in good enough condition to determine origin, 85 percent were of hatchery origin and 15 percent presumed wild origin. The high percentage of hatchery fish in the 2009 run indicates that natural Chinook production in the Kelsey Creek system is still limited by some factor or combination of factors and that hatchery strays are the primary contributor to Chinook abundance in this system.

Figure 16. Percent Clipped, Unclipped, and Unknown Origin Chinook Salmon in 2009.



Based on data from eight carcasses recovered from the mainstem of Kelsey Creek, 37.5 percent were clipped, zero percent were unclipped, and 62.5 percent were undetermined (due to high degree of decomposition or predation). A comparison based on percentage clipped versus unclipped for the mainstem Kelsey Creek from 2005 through 2009 is outlined in **Figure 17.**

Figure 17. Chinook Salmon Origin (Percentage) in Mainstem Kelsey Creek.



The analysis of scales collected from 10 Chinook in the Kelsey Creek basin during the 2009 surveys revealed that six were age 3, three were age 4, and one was age 5 (**Appendix B**). Within this subset of the data, 3 were female and 7 were male, while 9 were clipped and 1 unclipped. The oldest would have been from 2004, the 4 year-olds from 2005, and the age 3 Chinook from 2006. Since escapement estimates were high in 2006 and 2007, more unclipped progeny from those years should start being encountered during future survey events assuming they successfully spawned, reared, and outmigrated from the Kelsey Creek basin.

The ratio of male to female Chinook salmon during 2009 was similar to previous years in that females were slightly more prevalent than males. This trend is apparent when reviewing data for the West Tributary from 2003 through 2009 (**Table 8**).

Table 8. Relative Abundance of Male and Female Salmonids in West Tributary

Species	Year	Total Observed	Male	Female
Chinook	2003	6	33%	67%
	2004	81	30%	70%
	2005	40	43%	58%
	2006	59	49%	51%
	2007	7	33%	67%
	2008	16	50%	50%
	2009	5	40%	60%
Sockeye	2003	0	NA	NA
	2004	10	30%	70%
	2005	0	NA	NA
	2006	37	35%	65%
	2007	0	NA	NA
	2008	0	NA	NA
	2009	0	NA	NA
Coho	2003	2	50%	50%
	2004	0	NA	NA
	2005	2	0%	100%
	2006	1	0%	100%
	2007	3	33%	67%
	2008	0	NA	NA
	2009	0	NA	NA

5.4 Pre-spawn Mortality

Each year, in Kelsey Creek (as in other urban streams), a number of female (and male) salmon experience pre-spawn mortality or die before they have a chance to deposit their eggs. Female salmon that die before they spawn typically have 100 percent egg retention, unless subject to predation or decomposition. Inspection of female carcasses is typically done to determine pre-spawn mortality, but male pre-spawn mortality is not tracked because it is difficult to determine by carcass inspection.

In 2009, a total of five female Chinook carcasses (excluding decomposed or preyed upon carcasses) were recorded in the Kelsey Creek system index area (including the West Tributary and Richards Creek). Of these, two contained 100 percent of their eggs and were therefore considered pre-spawn casualties, which equates to an overall rate for Chinook of 40 percent. However, pre-spawn mortality was variable, ranging from 0 percent in Kelsey Creek, 50 percent in West Tributary, and 100 percent in Richards Creek. Many of the carcasses were partially

consumed by predators or highly decomposed such that spawning status, origin, or sex could not be accurately ascertained. Therefore, the overall level of pre-spawn mortality could have been higher. Coho and sockeye pre-spawn mortality rates were zero because no female carcasses were observed. The one female cutthroat carcass observed on Kelsey Creek was presumed to have spawned because it did not contain eggs. The overall rate of pre-spawn mortality for all species in 2009 was 33 percent.

For purposes of comparison, Chinook pre-spawn mortality in the Cedar River ranged from 1.5 percent in 2003, 3 percent in 2004, and 0.8 percent in 2005 (Berge et al. 2006). Pre-spawn mortality in Bear Creek ranged from 8 percent in 2003, 4 percent in 2004, and 6.5 percent in 2005. Pre-spawn mortality in Issaquah Creek ranged from 23 percent in 2003 to 22.7 percent in 2005.

5.5 Physical Stream Conditions

Physical stream habitat conditions in the surveyed portions of the Kelsey Creek mainstem have changed little since 2005 (Watershed Company 2009). The most significant change in habitat occurred in Reach 1 of the West Tributary. Beaver dam construction has significantly altered the lower half mile of Reach 1. A series of beaver dams diverted 75 percent of the water flow out of the main channel in late 2009. Most of the water now flows in a shallow spread-out fashion for a half mile to connect with Kelsey Creek upstream of the former confluence of the two streams.

5.6 Conclusions and Recommendations

The 2009 data indicate production of anadromous salmonids in the Kelsey Creek and Coal Creek basins was low for all species, Chinook abundance is dependent upon hatchery strays, and overall species use is highly variable from year to year. The data also indicate pre-spawn mortality in the Kelsey Creek basin is relatively high, some of which can be attributed to barriers to fish passage.

Based on the available data the following recommendations are proposed:

1. Continue annual salmon spawner surveys. This would allow for the complete analysis of adult returns from 2007 when the existing peak Chinook return was reported. The ratio of hatchery to natural Chinook should increase as the returning progeny from 2006 and 2007 start returning in larger numbers. This will reveal the current potential for Kelsey Creek to produce Chinook salmon and its contribution to the overall Lake Washington escapement goal.
2. If possible, determine origin of Chinook salmon within the Kelsey Creek basin through genetic analysis. Genetic samples should be taken from both clipped and unclipped carcasses to document origin of Chinook salmon in the basin.
3. Continue stream habitat enhancement efforts to address known factors of decline including: a) fish passage [e.g., remove weirs in Glendale]; b) channel processes affecting redd survival [e.g., reduce sedimentation and improve gravel quality]; c) water quality [e.g., reduce dissolved metals and stream temperature]; d) degraded riparian habitat [e.g., remove invasive species and improve buffer quality]; e) large woody debris [e.g., install instream wood and plant conifers along stream channel]; and f) altered flow due to impervious surface [e.g., new stormwater facilities and maximize retrofit].

4. Coho salmon abundance in both Kelsey and Coal creeks is extremely low and should be significantly higher. Factors that are influencing this low abundance need to be investigated.
5. One known factor that is impacting salmonids in Kelsey Creek is fish passage barriers, both manmade (weirs) and natural (beaver dams). Continue monitoring the Kelsey mainstem and tributaries for beaver dams and other potential fish blockages during both low and high flows. Monitor during late summer months to allow time for planning and installation of any new beaver devices or dam removal. Continue to coordinate with WDFW to maintain Hydraulic Permit Approvals for such work. Perform weekly maintenance on existing beaver dam leveling devices to make sure debris does not clog them. Remove beaver devices from the stream that are no longer functioning so beavers do not use them as platforms on which to build new dams.
6. Although the Kelsey Creek spawner surveys effectively monitor the annual spawning effort of adult salmonids, estimates of egg to juvenile survivorship and overall juvenile salmonid production from the system are currently unknown. To measure salmon productivity in Kelsey Creek, determine feasibility of measuring smolt production by counting salmonid juveniles migrating to Lake Washington.
7. Conduct a stream fish-passage assessment that documents the location and specifics of each potential barrier within the surveyed streams. Location could be documented via GPS and then incorporated into GIS databases. The documentation of specifics of each potential barrier would include type of barrier, jump height, pool depth, condition, opportunities for improving passage, and photos.
8. Implement weekly QA/QC procedures of field data forms.

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Appendix A: Data Sheets

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2009 Salmon Survey Data

Stream	Observation Date	Measruements Made	Species	Reach Number	Spawner (S), Carcass ©	Sex (M/F/U)	Adipose fin clip	Total Length (cm)	Fork Length (FL)	POH (cm)	Body Depth (cm)	Cut off lower Jaw (y/N)	Coloration (Ocean, Partial, Spawn)	% egg retention	Pre-spawn mortality	Estimated time since death	Scale samples collected (y/N)	Genetic Samples collected (y/n)	Comments
Coal	28-Oct	N	Coho		S	U	U												Before trail foot bridge, paired with another coho, no redds in sight
Coal	28-Oct	N	Coho		S	U	U												Before trail foot bridge, paired with another coho, no redds in sight
Coal	28-Oct	N	Coho		S	U	U												After trail foot bridge, paired with another coho, no redds in sight
Coal	28-Oct	N	Coho		S	U	U												After trail foot bridge, paired with another coho, no redds in sight
Coal	12-Nov	N	Coho		C	M	Y												Near bridge at end of survey
Coal	30-Nov																		Zero spawners or carcasses
Coal	8-Dec																		Zero spawners or carcasses
Kelsey	3-Sep																		Zero spawners or carcasses
Kelsey	11-Sep																		Zero spawners or carcasses
Kelsey	18-Sep																		Zero spawners or carcasses
Kelsey	25-Sep	Y	Chinook	7	C	M	U	81.5	80	63	18	Y	P	0	N	2	Y	N	At Ilahee Creek Apartments
Kelsey	25-Sep	N	Chinook	6	S	U	Y												At 140th street bridge
Kelsey	25-Sep	N	Chinook	6	S	U	U												At 140th street bridge
Kelsey	6-Oct	N	Chinook	6	C	U	U					Y	S	0	U	7	N	N	too decomposed, unable to sample
Kelsey	6-Oct	N	Chinook	6	C	U	U					Y	S	0	U	7	N	N	too decomposed, unable to sample
Kelsey	6-Oct	N	Chinook	A	S	U	U												below beaver dam
Kelsey	6-Oct	N	Chinook	A	S	U	U												below beaver dam
Kelsey	6-Oct	N	Chinook	A	S	U	U												below beaver dam
Kelsey	13-Oct	N	Chinook	A	C	U	U					Y	S	0	U	7	Y	N	Badly decomposed carcass. Not much too sample but took scales
Kelsey	13-Oct	N	Chinook	1	C	U	U					Y	S	0	U	7	N	N	Carcass badly decomposed
Kelsey	13-Oct	N	Chinook	A	S	U	U												On redd
Kelsey	13-Oct	N	Chinook	A	S	U	U												On redd
Kelsey	20-Oct	Y	Chinook	A	C	M	Y	95	95		25	N	S		U		U	N	stream changed direction at beaver dam
Kelsey	20-Oct	Y	Chinook	7	C	F	Y	95	95		30	N	S		U		U	N	Low water levels
Kelsey	20-Oct	N	Chinook	A	S	U	U												On redd below beaver dam
Kelsey	28-Oct																		Zero spawners or carcasses
Kelsey	3-Nov	Y	Chinook	A	C	M	Y		98	78	27	N	S	0	U	2	Y	N	Found just above beaver dam with predation
Kelsey	12-Nov																		Zero spawners or carcasses
Kelsey	24-Nov																		Zero spawners or carcasses, only surveyed reaches 2-5
Kelsey	3-Dec	Y	Cutthroat	A	C	F	N	49	48	40.5	10.5	Y	S	0	N	1	N	N	Fish had puncture wound all through, caudal fin not worn
Kelsey	3-Dec	Y	Cutthroat	A	C	M	N	43	42	34.5	10	Y	S	0	N	7	N	N	Puncture wound on one side, no milt left, decomp high
Kelsey	3-Dec	N	Coho	4	S	U	U												Just upstream of pumphouse weir
Kelsey	10-Dec																		Zero spawners or carcasses
Kelsey	18-Dec																		Zero spawners or carcasses
Kelsey	23-Dec	N	Coho	4	S	U	U												Downstream of redd by 50 feet
Kelsey	23-Dec	N	Coho	7	S	U	U												On redd
Kelsey	30-Dec																		Zero spawners or carcasses
Richards	10-Sep	Y	Chinook	Confl	C	M	N	88.5	87	72	21	Y	P	100	Y	2	Y	N	Scavenged body, found below beaver dam, likely did not spawn due to predation

Richards	10-Sep	Y	Chinook	Confl	C	M	Y	96	92	73	24	Y	P	100	Y	2	Y	N	Scavenged body, found above beaver dam, likley did not spawn due to predation
Richards	10-Sep	Y	Chinook	Confl	C	F	Y	86.5	84	67.5	22	Y	P	100	Y	1	Y	N	No scavenging, died in attempt to migrate around beaver dams
Richards	21-Sep	N	Chinook	Confl	C	U	Y								U	7	Y	N	Carcass 3/4 eaten
Richards	6-Oct																		Zero spawners or carcasses
Richards	20-Oct	N	Chinook	Confl	C	M	Y					Y	S	0	U	10	N	N	
West trib	8-Sep	N	Chinook	3	S	U	U												In pool upstream of auto bridge
West trib	8-Sep	N	Sockeye	3	S	U	U												In pool upstream of auto bridge
West trib	8-Sep	N	Sockeye	3	S	U	U												In pool upstream of auto bridge
West trib	16-Sep	N	Chinook	3	S	U	U												In pool upstream of auto bridge
West trib	16-Sep	N	Sockeye	3	S	U	U												In pool upstream of auto bridge
West trib	16-Sep	N	Sockeye	3	S	U	U												In pool upstream of auto bridge
West trib	22-Sep	Y	Chinook	4	C	F	Y		92	76	22	Y	S	100	Y	2	Y	N	Just before end of reach 4
West trib	29-Sep	Y	Chinook	1	C	F	Y		80	63	19	Y	S	0	U	2	Y	N	
West trib	29-Sep	N	Chinook	1	S	U	Y												
West trib	6-Oct	Y	Chinook	1	C	M	N	69	67	54	11	Y	S	0	N	7	Y	N	
West trib	6-Oct	N	Chinook	1	C	M	Y					Y	S	0	U	7	Y	N	Half eaten, no measurements
West trib	6-Oct	Y	Chinook	2	C	M	Y	79	78	66	16	Y	S	0	N	7	Y	N	Partially eaten
West trib	13-Oct	N	Chinook	4	C	U	U								U	10	N	N	Too decomposed, unable to sample
West trib	13-Oct	N	Chinook	4	C	U	U								U	10	N	N	Too decomposed, unable to sample
West trib	20-Oct																		Zero spawners or carcasses
West trib	28-Oct																		Zero spawners or carcasses
West trib	5-Nov																		Zero spawners or carcasses
West trib	12-Nov																		Zero spawners or carcasses
West trib	23-Nov																		Zero spawners or carcasses
West trib	30-Nov																		Zero spawners or carcasses
West trib	8-Dec																		Zero spawners or carcasses

2009 Salmon Spawner Survey Data

Stream	Observation Date	Measruements Made	Species	Reach Number	Spawner (S), Carcass ©	Sex (M/F/U)	Adipose fin clip	Total Length (cm)	Fork Length (FL)	POH (cm)	Body Depth (cm)	Cut off lower Jaw (y/N)	Coloration (Ocean, Partial, Spawn)	% egg retention	Pre-spawn mortality	Estimated time since death	Scale samples collected (y/N)	Genetic Samples collected (y/n)	Comments
Coal	28-Oct	N	Coho		S	U	U												Before trail foot bridge, paired with another coho, no redds in sight
Coal	28-Oct	N	Coho		S	U	U												Before trail foot bridge, paired with another coho, no redds in sight
Coal	28-Oct	N	Coho		S	U	U												After trail foot bridge, paired with another coho, no redds in sight
Coal	28-Oct	N	Coho		S	U	U												After trail foot bridge, paired with another coho, no redds in sight
Coal	12-Nov	n	Coho		S	M	U												
Kelsey	25-Sep	N	Chinook	6	S	U	Y												At 140th street bridge
Kelsey	25-Sep	N	Chinook	6	S	U	U												At 140th street bridge
Kelsey	6-Oct	N	Chinook	A	S	U	U												below beaver dam
Kelsey	6-Oct	N	Chinook	A	S	U	U												below beaver dam
Kelsey	6-Oct	N	Chinook	A	S	U	U												below beaver dam
Kelsey	13-Oct	N	Chinook	A	S	U	U												On redd
Kelsey	13-Oct	N	Chinook	A	S	U	U												On redd
Kelsey	20-Oct	N	Chinook	A	S	U	U												On redd below beaver dam
Kelsey	3-Dec	N	Coho	4	S	U	U												Just upstream of pumphouse weir
Kelsey	23-Dec	N	Coho	4	S	U	U												Downstream of redd by 50 feet
Kelsey	23-Dec	N	Coho	7	S	U	U												On redd
West trib	8-Sep	N	Chinook	3	S	U	U												In pool upstream of auto bridge
West trib	8-Sep	N	Sockeye	3	S	U	U												In pool upstream of auto bridge
West trib	8-Sep	N	Sockeye	3	S	U	U												In pool upstream of auto bridge
West trib	16-Sep	N	Chinook	3	S	U	U												In pool upstream of auto bridge
West trib	16-Sep	N	Sockeye	3	S	U	U												In pool upstream of auto bridge
West trib	16-Sep	N	Sockeye	3	S	U	U												In pool upstream of auto bridge
West trib	29-Sep	N	Chinook	1	S	U	Y												

2009 Salmon Carcass Survey Data

Stream	Observation Date	Measruements Made	Species	Reach Number	Spawner (S), Carcass ©	Sex (M/F/U)	Adipose fin clip	Total Length (cm)	Fork Length (FL)	POH (cm)	Body Depth (cm)	Cut off lower Jaw (y/N)	Coloration (Ocean, Partial, Spawn)	% egg retention	Pre-spawn mortality	Estimated time since death	Scale samples collected (y/N)	Genetic Samples collected (y/n)	Comments
Coal	12-Nov	N	Coho		C	M	Y												Near bridge at end of survey
Kelsey	25-Sep	Y	Chinook	7	C	M	U	81.5	80	63	18	Y	P	0	N	2	Y	N	At Ilahee Creek Apartments
Kelsey	6-Oct	N	Chinook	6	C	U	U					Y	S	0	U	7	N	N	too decomposed, unable to sample
Kelsey	6-Oct	N	Chinook	6	C	F	U					Y	S	0	U	7	N	N	too decomposed, unable to sample
Kelsey	13-Oct	N	Chinook	A	C	U	U					Y	S	0	U	7	Y	N	Badly decomposed carcass. Not much too sample but took scales
Kelsey	13-Oct	N	Chinook	1	C	U	U					Y	S	0	U	7	N	N	Carcass badly decomposed
Kelsey	20-Oct	Y	Chinook	A	C	M	Y	95	95		25	N	S		U		U	N	stream changed direction at beaver dam
Kelsey	20-Oct	Y	Chinook	7	C	F	Y	95	95		30	N	S		U		U	N	Low water levels
Kelsey	3-Nov	Y	Chinook	A	C	M	Y		98	78	27	N	S	0	U	2	Y	N	Found just above beaver dam with predation
Kelsey	3-Dec	Y	Cutthroat	A	C	F	N	49	48	40.5	10.5	Y	S	0	N	1	N	N	Fish had puncture wound all through, caudal fin not worn
Kelsey	3-Dec	Y	Cutthroat	A	C	M	N	43	42	34.5	10	Y	S	0	N	7	N	N	Puncture wound on one side, no milt left, decomp high
Richards	10-Sep	Y	Chinook	Confl	C	M	N	88.5	87	72	21	Y	P	100	Y	2	Y	N	Scavenged body, found below beaver dam, likely did not spawn due to predation
Richards	10-Sep	Y	Chinook	Confl	C	M	Y	96	92	73	24	Y	P	100	Y	2	Y	N	Scavenged body, found above beaver dam, likley did not spawn due to predation
Richards	10-Sep	Y	Chinook	Confl	C	F	Y	86.5	84	67.5	22	Y	P	100	Y	1	Y	N	No scavenging, died in attempt to migrate around beaver dams
Richards	21-Sep	N	Chinook	Confl	C	U	Y								U	7	Y	N	Carcass 3/4 eaten
Richards	20-Oct	N	Chinook	Confl	C	M	Y					Y	S	0	U	10	N	N	
West trib	22-Sep	Y	Chinook	4	C	F	Y		92	76	22	Y	S	100	Y	2	Y	N	Just before end of reach 4
West trib	29-Sep	Y	Chinook	1	C	F	Y		80	63	19	Y	S	0	U	2	Y	N	
West trib	6-Oct	Y	Chinook	1	C	M	N	69	67	54	11	Y	S	0	N	7	Y	N	
West trib	6-Oct	N	Chinook	1	C	M	Y					Y	S	0	U	7	Y	N	Half eaten, no measurements
West trib	6-Oct	Y	Chinook	2	C	M	Y	79	78	66	16	Y	S	0	N	7	Y	N	Partially eaten
West trib	13-Oct	N	Chinook	4	C	U	U								U	10	N	N	Too decomposed, unable to sample
West trib	13-Oct	N	Chinook	4	C	U	U								U	10	N	N	Too decomposed, unable to sample

2009 Salmon Redd Survey Data

Redd Number	Stream	Observation Date	Species	Reach Number	Fish on Redd (Y/N)	M/F/Both/U	Redd location
1	Kelsey	13-Oct	Chinook	A	Y	U	Near beaver dam
2	Kelsey	13-Oct	Chinook	A	Y	U	Near beaver dam
3	Kelsey	20-Oct	Chinook	A	Y	U	Below beaver dam
4	Kelsey	28-Oct	Chinook	A	N	U	Upstream of beaver dam
5	Kelsey	28-Oct	Chinook	2	N	U	Downstream of first foot bridge in golf course
6	Kelsey	23-Dec	Coho	4	Y	U	
7	Kelsey	23-Dec	Coho	4	N	U	
8	Kelsey	23-Dec	Coho	5	N	U	
9	Kelsey	23-Dec	Coho	5	N	U	
10	Kelsey	23-Dec	Coho	7	Y	U	On redd behind church
11	Kelsey	30-Dec	Coho	6	N	U	Upstream of 134th bridge by 500 feet

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Appendix B: Chinook Carcass Data

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Appendix B: Chinook Carcass Scale Data

Stream	Stream #	Basin	Year	Date	Month	Reach	Sex	TL	FL	POH	% Unspawned	Ad-Clipped	Age	Gilbert-Rich Age	Comments
Kelsey Creek	0259	Kelsey Creek Basin	2009	3-Nov-09	November	Reach A	M		98	78	na	Y	4	4_1	
Kelsey Creek	0259	Kelsey Creek Basin	2009	6-Oct-09	October	Reach 6	F		unknown	unknown	eaten	Y	4	4_1	POE/FL unable to collect due to predation
West Tributary Kelsey Creek		Kelsey Creek Basin	2009	22-Sep-09	September	Reach 4	F		92	76	100	Y	5	5_1	Depth=22, 100% pre-spawn mort 1+ days
West Tributary Kelsey Creek		Kelsey Creek Basin	2009	29-Sep-09	September	Reach 1	F		80	63	0	Y	3	3_1	Depth=19
West Tributary Kelsey Creek		Kelsey Creek Basin	2009	6-Oct-09	October	Reach 1	M	69	67	54		N	3	3_1	Depth=11; Total length=69
West Tributary Kelsey Creek		Kelsey Creek Basin	2009	6-Oct-09	October	Reach 2	M		unknown	unknown		Y	3	3_1	Depth=20; Half eaten, predation
West Tributary Kelsey Creek		Kelsey Creek Basin	2009	6-Oct-09	October	Reach 2	M	79	78	66		Y	3	3_1	Depth=16/13; Total length=79; Partly eaten
Kelsey Creek	0259	Kelsey Creek Basin	2009	25-Sep-09	September	Reach 7	M		80	63		Y	4	4_1	Depth=18; Total length=81.5
Kelsey Creek	0259	Kelsey Creek Basin	2009	13-Oct-09	October	Reach A	M		unknown	unknown		Y	3	3_1	Decomposed badly, not much of carcass
Richard's Creek		Kelsey Creek Basin	2009	21-Sep-09	September	Reach 1	M		unknown	unknown		Y	3	3_1	Badly decomposed, predated on

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