Bellevue Summer Electrofishing 2011

Final Report

December 2011

Prepared for

City of Bellevue
Utilities Department
450 110th Avenue NE
P.O. Box 90012
Bellevue, WA 98009

Prepared by

Peter Heltzel
Senior Fisheries Biologist
Cardno/TEC Inc.
2825 Eastlake Ave E.
Seattle, WA 98102
206-267-1400
psheltzel@tecinc.com

Table of Contents

List of Tables

List of Figures

Executive Summary

Three urban streams in the City of Bellevue were sampled for fish presence/absence during the summer of 2011. These included two previously sampled sites on Kelsey Creek, two sites not previously sampled on Coal Creek and one site on Yarrow Creek where sampling had never taken place.

Results from Coal Creek (RM 0.79) showed relatively higher fish diversity compared to all other sites; however, this site had a low coho to cutthroat ratio, indicating urban impacts are occurring. Results from Coal Creek (RM 4.07) showed decreased fish diversity, similar to other urban streams, but showed a coho to cutthroat ratio of 1.4, suggesting that habitat restoration at this site is providing good habitat and urban impacts are lessened.

Fish passage is hydrologically blocked downstream of the sampling site on Yarrow Creek (RM 1.13), preventing anadromous species access to the upper reaches. As would be expected, results showed very low diversity as only cutthroat were caught during sampling.

Both Kelsey Creek sites (RM 3.81 and 3.83) showed low native species diversity and low coho to cutthroat ratios (0.1 and 0.4, respectively), indicating that urban impacts are influencing fish populations in this section of the creek. These sites did show changes from previous years sampling (i.e. absence of coho in 2007 and lower diversity in 2011) which could be attributed to differences in netting efficiency, timing of sampling, and flow regimes at the time of sampling.

Further studies are recommended to help further evaluate the effectiveness of existing and future capital projects for improving fish habitat and the success of salmonid supplementation efforts. Below is a detailed list of recommendations for the City of Bellevue to facilitate these actions.

- Collect fish condition data at electrofishing sites to determine relative health of priority fish species and compare this data to other Western Washington urban streams where this particular data has been collected.
- Add electrofishing and diet studies to current Benthic Index of Biological Integrity (BIBI) sites. Collect gut content data from priority salmonid species at current BIBI sites to determine if aquatic or terrestrial prey items dominate. This data will help determine prey species availability and use by salmonids. Data collected can help determine if riparian and/or substrate improvements are necessary. Also, compare size of coho and cutthroat fish populations to other Puget Sound lowland reference streams to see if fish are smaller from lack of prey.
- Maintain consistent electrofishing program that visits the exact same sites during the same time of year to help improve determination of status and trends of priority fish species.
- Add additional electrofishing dates earlier in the year at these same sites once every five years to help determine seasonality of fish species use (e.g., March).
- Investigate water quality, temperature, and flow conditions in areas with changes in species diversity/density.

Native and non-native fish species presence, status, and trends in urban streams can be a useful tool in determining the health of urban streams. Implementing the recommendations mentioned above would help the City of Bellevue ascertain if changes in fish populations and density are due to natural environmental changes, beneficial habitat modifications, or changes in land use in their local urban streams.

1.0 Introduction

Electrofishing was conducted at three urban streams in the City of Bellevue during late July and early August 2011. These streams included, Kelsey, Coal, and Yarrow Creek (Figure 1). Sampling locations on Coal Creek were electrofished for the first time and the City of Bellevue (The City) had not sampled any sites on Yarrow Creek prior to the summer of 2011. Historical data does exist for other sampling sites on Kelsey Creek and Coal Creek.

The purpose of electrofishing at these locations was to establish new sites and develop a baseline for fish species presence/absence and diversity. These sites were chosen to help evaluate and determine the effectiveness of habitat restoration or changes due to urban impacts. These sites can be revisited in coming years to determine if changes in habitat, public or private operations, or land use regulations are having positive or detrimental effects on fish population structures.

This report describes the methods used for sampling, results from electrofishing in the summer of 2011, and recommendations for future actions. The data presented in this report represents a reference point to which the City can determine any possible changes in the status and trends of fish populations in response to large environmental change.

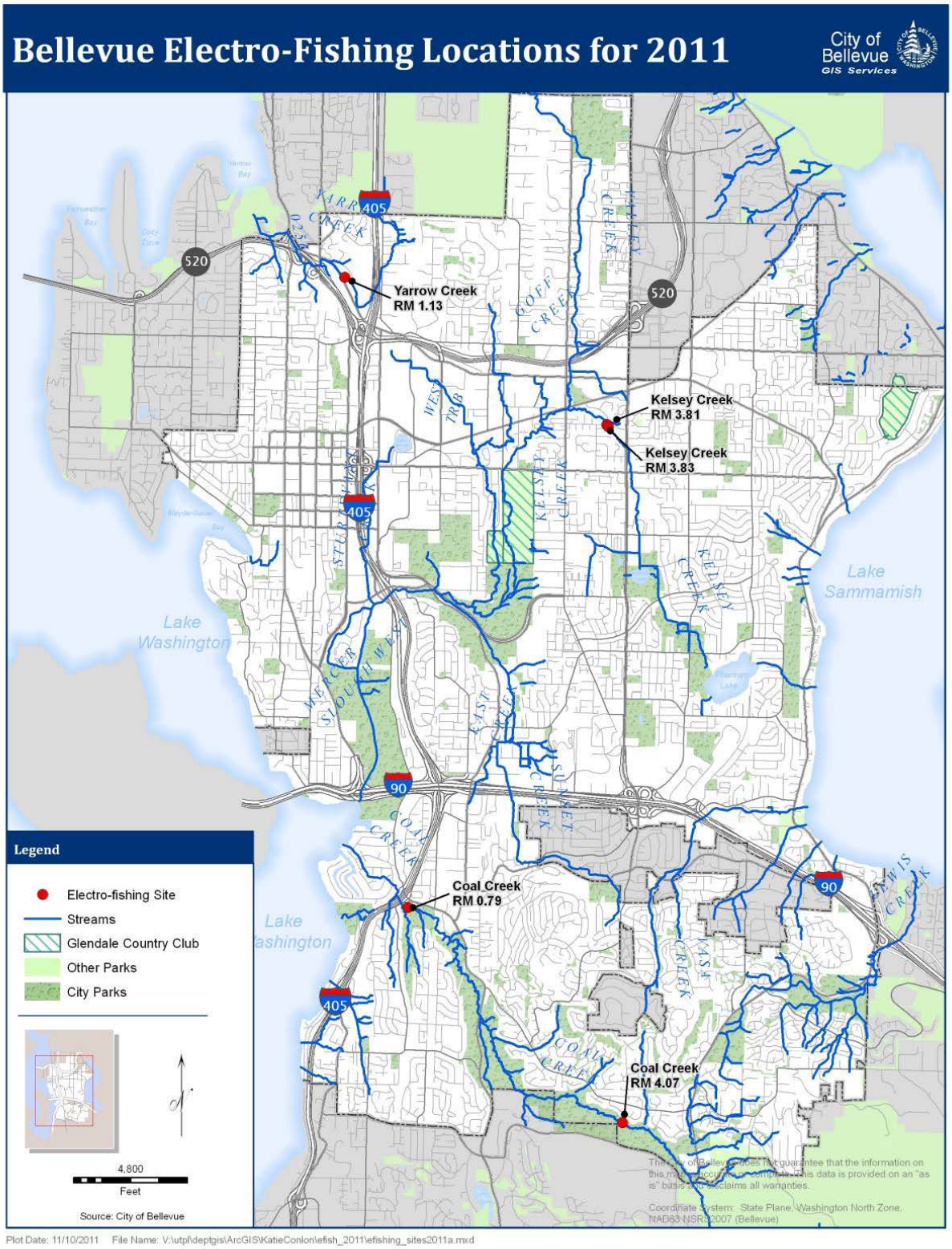


Figure 1. Site map showing electrofishing sites sampled in late July and early August 2011.

2.0 Methods

Electrofishing was performed on July 27, July 28 and August 1, 2011 (Table 1). Two sites were sampled on Coal Creek (RM 0.79 and 4.07), one site on Yarrow Creek (RM 1.13), and two sites on Kelsey Creek (RM 3.81 and 3.83).

Table 1. Survey dates and site summary for 2011 electrofishing.

Date	Stream Name	River Mile (RM)	Reach Length (ft.)	Site Description
July 27, 2011	Coal Creek	0.79	211	Above I-405 Regional Detention Facility. Low grade with mainly riffles with fewer pools. Conductivity relatively high at 604 µs/cm. Some cloudiness to water. Weir at bottom end of reach and some woody debris present throughout. Stream banks dominated by salmonberry, blackberry, and horsetail.
July 27, 2011	Coal Creek	4.07	96.5	Located at the habitat restoration site at the Cinder Mine Site. High grade with lower conductivity at 182 µs/cm. Numerous large woody debris, large boulders, and pools. Relatively short riffles. Stream banks dominated by fern, maple, and cedar.
July 28, 2011	Yarrow Creek	1.13	224	Located on City of Bellevue property across from WSDOT maintenance facility on Northup Way, Bellevue. Fish passage is hydrologically blocked below sampling site. Lower grade with typical conductivity at 218 µs/cm. Woody debris present with stream banks dominated by salmonberry, fern, and ivy.
August 1, 2011	Kelsey Creek	3.81	86	Adjacent to Peltzer property (14434 NE 14th Pl) up to the Griffith property (14602 NE 13th Pl) juvenile coho incubation facility on site. Lower grade with typical conductivity at 251 µs/cm. Some woody debris present with log jam at bottom end of reach. Mostly riffle features. Stream banks dominated by salmonberry and vine maple.
August 1, 2011	Kelsey Creek	3.83	101	Adjacent to Griffith property (14602 NE 13th Pl). Lower grade with typical conductivity 251 µs/cm. Woody debris present with hanging vine maple. Equal ratio of pools to riffles. Stream banks dominated by vine maple, salmonberry, and alder.

Methods of sampling in 2011 were similar to past efforts by the City. Electrofishing was conducted using a Smith-Root Electrofisher Model 12b. Settings on the electrofishing equipment for Coal Creek (RM 0.79) were most effective at 400 volts (v), 50 Hertz (Hz), and 8 milliseconds (ms). Settings were set at 200 v, 50 Hz, and 8 ms for all other sites. The higher voltage needed at the lower Coal Creek site was likely a product of the higher conductivity at that site (604 µs/cm) (Table 1).

Block nets were placed at the bottom and top of each reach and a single pass was made with the electrofisher. One person utilized the electrofishing backpack and two people with long handled dip nets followed closely alongside to capture fish[1]. Team members followed the electrofishing team with buckets of fresh stream water. Fish were tracked by habitat type (riffle or pool) and captured fish were placed in corresponding buckets. Captured fish were temporarily anesthetized on site using a dilute solution of MS-222 (Tricaine methanesulfonate) in water for identification and fork length measurements. Fish were then allowed to recover in fresh river water supplied with an aerator until fully recovered. Once recovered, they were released back into the stream. Fish were captured as authorized under Washington State Scientific Collection Permit #11-092.

Temperature (C°), dissolved oxygen (mg/L), conductivity (µs/cm), and pH were recorded using an YSI water quality sonde deployed at each stream reach. Air temperature, reach length, and time fished were also recorded. Field sheets for 2011 sampling can be found in Appendix A.

[1] Two netters were used throughout each reach. Netters were consistently swapped out and the team was comprised of a combination of experienced netters, in-experienced netters, and volunteers.

3.0 Results

3.1 Water Quality Measurements

Water quality parameters at all of the electrofishing stations showed relatively typical values for urban streams. Temperature and dissolved oxygen values for all sites ranged from 13.41 C° to 13.96 C° and 10.9 mg/L to 12.15 mg/L, respectively (Table 2). These values were characteristic for sampling during Summer months. Conductivity and pH values at the Kelsey Creek, Yarrow Creek and Coal Creek (RM 4.07) ranged from 182 µs/cm to 251 µs/cm and 7.42 to 7.88, respectively. However, the Coal Creek (RM 0.79) site showed conductivity and pH values of 604 µs/cm and 8.32, respectively. These two parameters were relatively high when compared to all of the other sites.

Table 2. Water quality parameters for electrofishing sites during late July and early August 2011.

Site	Temperature (C°)	DO (mg/L)	pH	Conductivity (µs/cm)
Coal Creek (RM 0.79)	13.67	12.14	8.32	604
Coal Creek (RM 4.07)	13.83	11.78	7.42	182
Yarrow Creek (RM 1.13)	13.41	12.15	7.88	218
Kelsey Creek (RM 3.81)	13.96	10.9	7.88	251
Kelsey Creek (RM 3.83)	13.96	10.9	7.88	251

3.2 Species Distribution and Density

Only three fish species were captured during the 2011 electrofishing surveys (Figure 2). These included cutthroat, juvenile coho, and sculpin. However, it should be noted that all members of the genus *Cottus* were categorized simply as sculpin. There were also other species seen during electrofishing that were not captured, which included unidentified salmonids and lamprey. These species were included in Figure 2 as "other".

Figure 2 shows that cutthroat and juvenile coho were the only two species caught at both Kelsey Creek sites. Cutthroat, juvenile coho, and sculpin were captured at the Coal Creek RM 0.79 site. It should be noted that this site was the only site where sculpin species were captured. An unidentified salmonid and one lamprey species were also seen but not captured at this site. Cutthroat and juvenile coho were captured at the Coal Creek RM 4.07 site, and two unidentified salmonids were also seen but not captured. Only cutthroat were captured at the Yarrow Creek site.

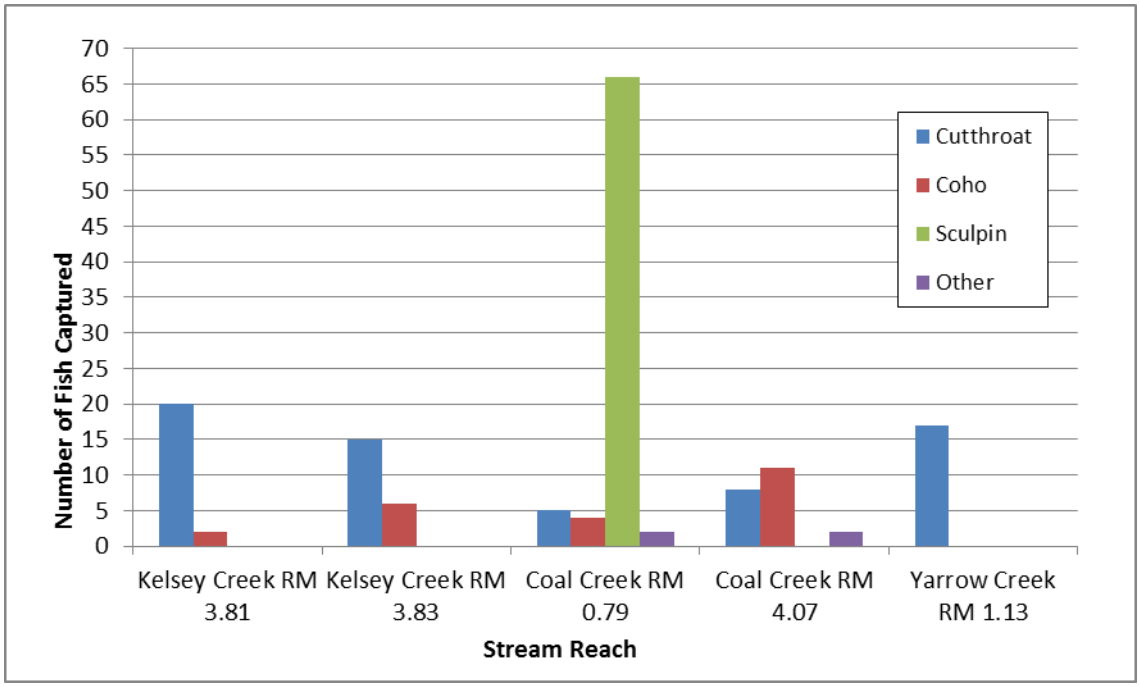


Figure 2. Species distribution by stream reach for 2011 sampling.

Relative percentage of each fish species captured by site can be seen in Figure 3. Coal Creek (RM 0.79) showed sculpin dominating the catch at 86% with cutthroat and coho at 6% and 5%, respectively. Other species seen but not captured constituted the other 2%. Coal Creek (RM 4.07) showed cutthroat and coho at 38% and 52% of the catch, respectively. Unidentified salmonids not captured constituted the other 10%. Cutthroat dominated 100% of the catch at Yarrow Creek with no other species captured. Kelsey Creek (RM 3.81) showed cutthroat as the highest percentage captured at 91% and coho at 9%. Kelsey Creek (RM 3.83) showed similar results with cutthroat constituting 71% of the catch and coho at 29%.

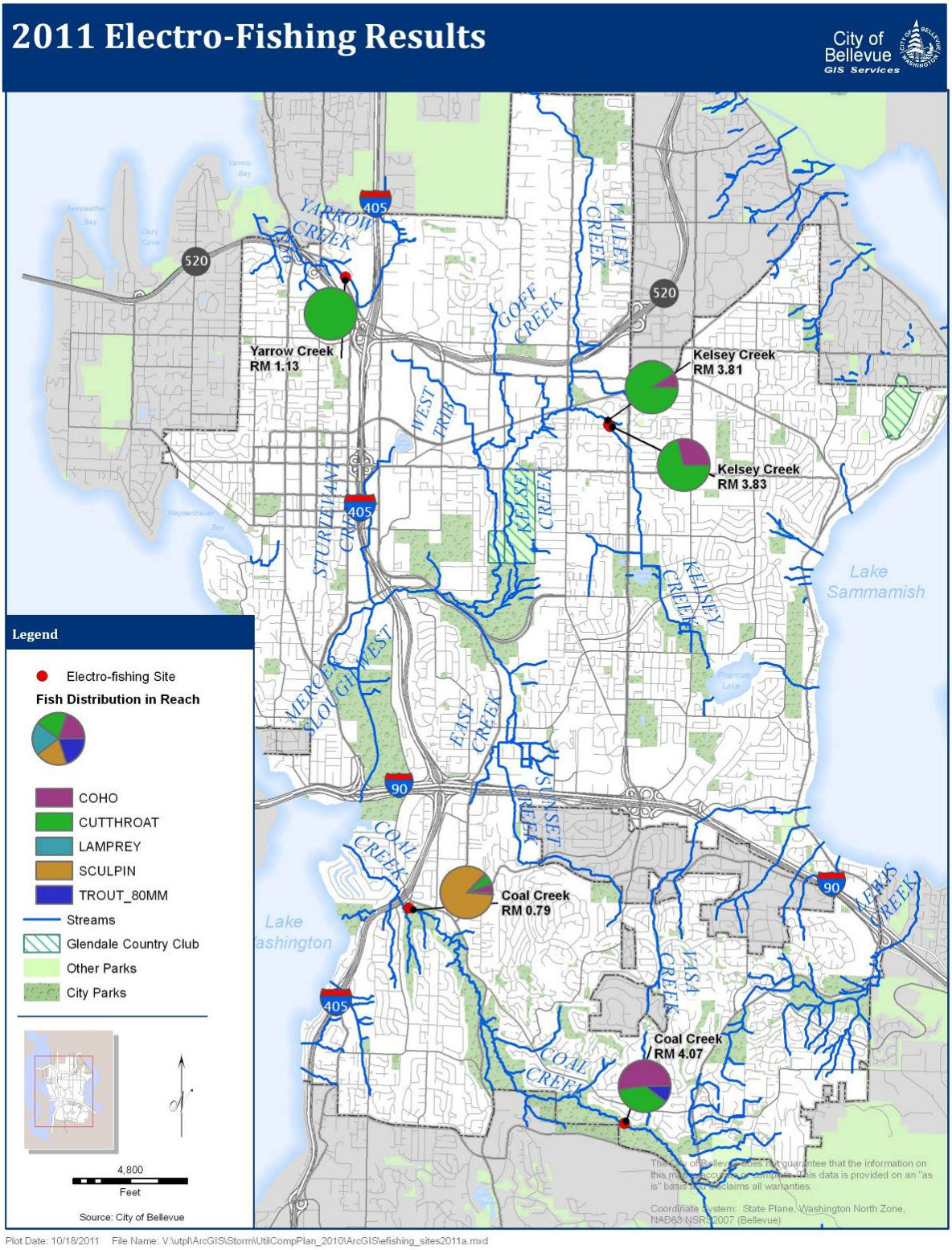


Figure 3. Site map showing species distribution (percentage) by site.

Figure 4 shows the number and species of fish captured by habitat type (pool or riffle). It should be noted for all sampling sites, except for Kelsey Creek RM 3.83, that the habitat type was dominated by riffles (Table 3). Therefore, as would be expected, Kelsey Creek RM 3.81, Coal Creek RM 4.07, and Yarrow Creek showed higher numbers of fish captured from riffle habitats. Similarly, Coal Creek RM 0.79 showed higher numbers of sculpin captured in riffle habitats. However, this site showed slightly higher numbers of cutthroat captured in pool habitats and equal number of coho captured from each habitat type. Although pools habitats were more abundant that riffle habitats at Kelsey Creek RM 3.83, numbers of fish caught were higher in riffle habitats than pool habitats.

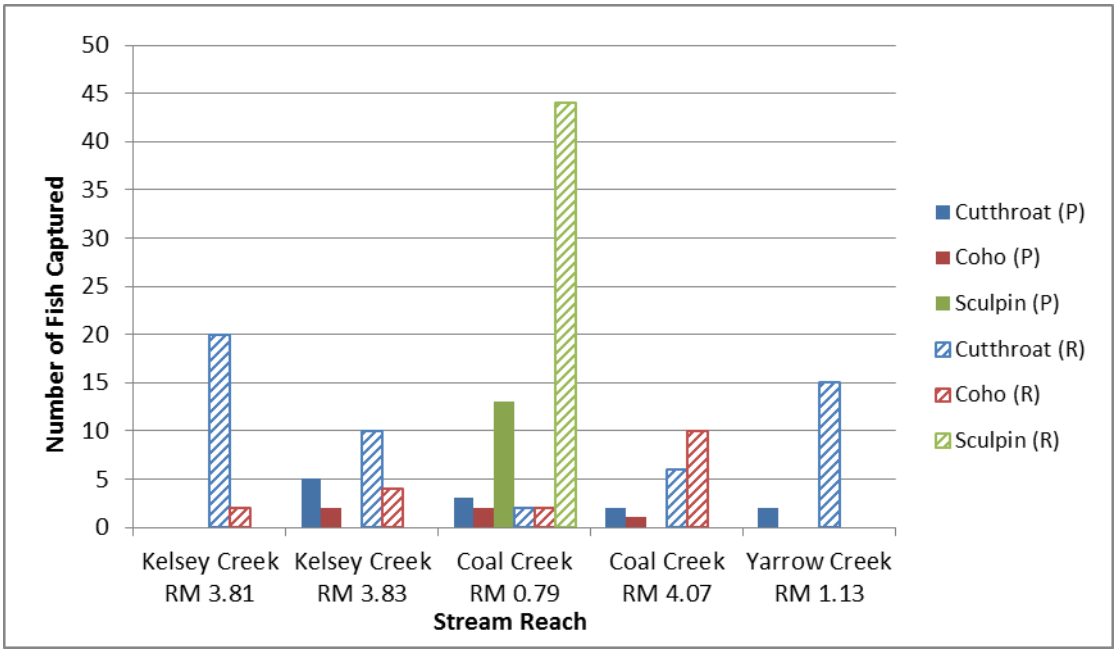


Figure 4. Number and species of fish captured by pool or riffle habitat type (P=pool, R=riffle).

Table 3. Total pool and riffle lengths in feet for sampled reaches.

Site	Total Pool Lengths (ft.)	Total Riffle Lengths (ft.)
Coal Creek (RM 0.79)	67	144
Coal Creek (RM 4.07)	20	77
Yarrow Creek (RM 1.13)	42	182
Kelsey Creek (RM 3.81)	0	86
Kelsey Creek (RM 3.83)	59	51

Table 4 shows the estimated density of fish species caught for each site. Fish density analysis was determined by normalizing the total fish count per one foot for each reach[2]. Kelsey Creek (RM 3.81) showed the highest density of cutthroat at 0.23 fish/ft., while Coal Creek (RM 0.79) showed the lowest density at 0.02 fish/ft. It should be noted that the density of cutthroat at Coal Creek (RM 4.07) was four

[2] Comparison of relative abundance data between sites should be considered only on a gross level as differences in collection technique and netting efficiency can vary.

times higher than the other Coal Creek site (RM 0.79) lower in the system. Coal Creek (RM 4.07) showed the highest density of coho at 0.11 fish/ft. and was five times higher than the Coal Creek site at RM 0.79. Density of coho at Kelsey Creek at RM 3.83 (0.06 fish/ft.) was three times higher than Kelsey Creek RM 3.81 (0.02 fish/ft.). No coho were captured at Yarrow Creek. Density of sculpin at Coal Creek RM 0.79 was 0.31 fish/ft., while no sculpin were captured at any other sites.

The ratio of coho to cutthroat varied among all sites (Table 4). Coal Creek (RM 4.07) showed the highest ratio of 1.4 and Kelsey Creek (RM 3.81) showed the lowest ratio of 0.1. Yarrow Creek showed a ratio of zero, as cutthroat was the only salmonid species caught. However, this was due to a downstream fish barrier blocking access to anadromous fish.

Table 4. Estimated density (fish/ft.) of fish species caught and ratio of coho to cutthroat for all sites.

Site	Total Reach Length (ft.)	Cutthroat (fish/ft.)	Coho (fish/ft.)	Sculpin (fish/ft.)	Coho to Cutthroat Ratio
Coal Creek (RM 0.79)	211	0.02	0.02	0.31	0.5
Coal Creek (RM 4.07)	97	0.08	0.11	0	1.4
Yarrow Creek (RM 1.13)	224	0.08	0	0	0
Kelsey Creek (RM 3.81)	86	0.23	0.02	0	0.1
Kelsey Creek (RM 3.83)	101	0.15	0.06	0	0.4

3.3 Cutthroat Length Distribution

In general, both Kelsey Creek sites showed the highest number of cutthroat captured, although these sites showed the lowest mean lengths (69.9 mm and 82.5 mm) (Table 5). Yarrow Creek showed relatively high number of cutthroat captured in comparison to the other sites and showed the widest range of lengths (50 mm to 225 mm). Coal Creek sites showed the lowest number of cutthroat caught, although these sites had larger fish in general, with Coal Creek RM 0.79 showing a mean length of 131.2 mm.

Table 5. Number caught, mean length (mm), length range (mm) and standard deviation (stdev) of lengths for cutthroat across all sites sampled.

Site	Number of Cutthroat Caught	Mean Length (mm)	Range (mm)	Stdev
Coal Creek (RM 0.79)	6	131.2	75-196	47.8
Coal Creek (RM 4.07)	8	104.3	61-186	41.8
Yarrow Creek (RM 1.13)	17	107.1	50-225	69.1
Kelsey Creek (RM 3.81)	20	69.9	44-138	21.8
Kelsey Creek (RM 3.83)	15	82.5	43-179	42.4

Figure 5 shows cutthroat length frequency distribution for both Coal Creek sites (RM 0.79 and RM 4.07). Although the sample size is very small for both sites, the frequency distributions suggest that possibly three year-classes of cutthroat trout were present. It should be noted that relatively higher numbers of smaller fish (70-110 mm) were seen at Coal Creek RM 4.07 than RM 0.79.

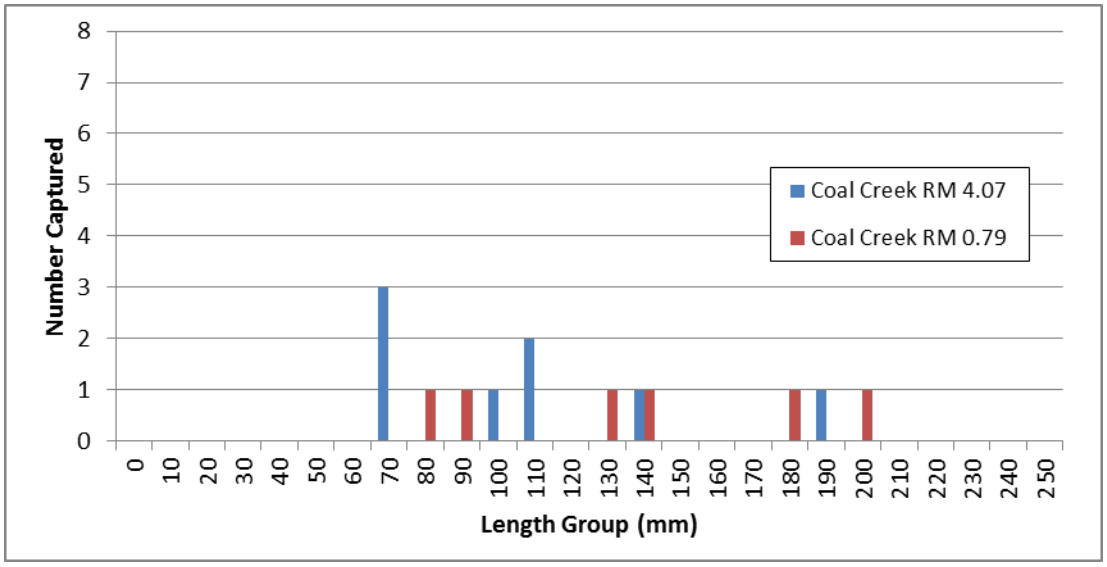


Figure 5. Length frequency distribution for cutthroat at Coal Creek sites (RM 0.79 and 4.07).

Figure 6 shows cutthroat length frequency distribution for Yarrow Creek (RM 1.13). Again, samples size is relatively low. However, the frequency distribution suggests that possibly three year-classes of cutthroat trout were present. Relatively higher numbers of smaller fish (50 to 80 mm) was seen at Yarrow Creek, although good representation of larger fish (200+ mm) was seen as well.

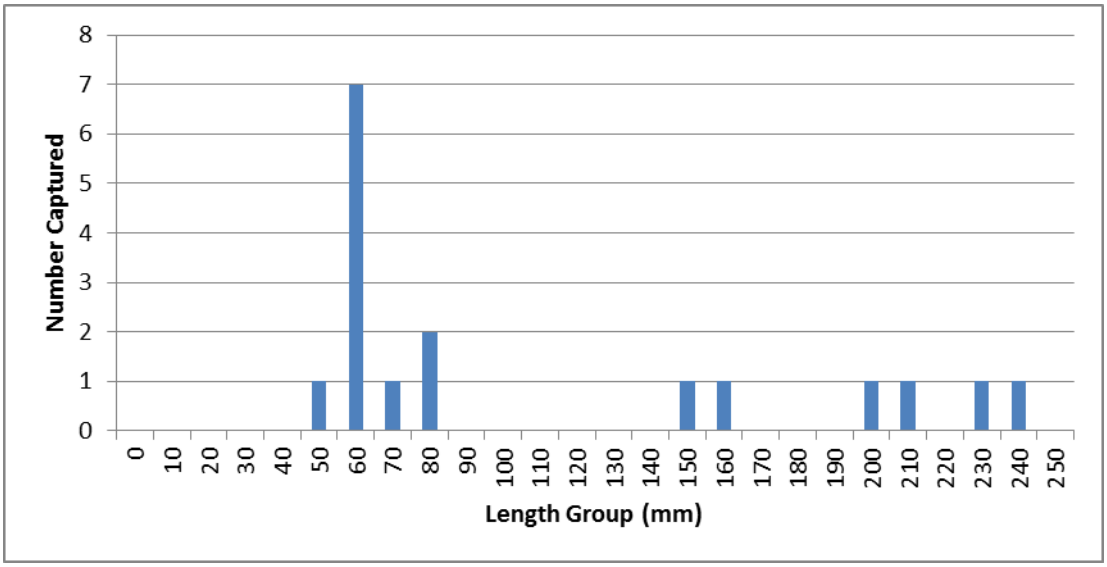


Figure 6. Length frequency distribution for cutthroat at Yarrow Creek (RM 1.13).

Figure 7 shows cutthroat length frequency distribution for Kelsey Creek sites (RM 3.81 and RM 3.83). Although, the samples size is once again relatively low for both Kelsey Creek sites, the frequency distribution suggests possibly two year-classes of cutthroat trout were present at Kelsey Creek RM 3.81 and three year-classes were present at Kelsey Creek RM 3.83. However, it should be noted that these two sampling locations were adjacent to each other and it is likely that all of these fish captured were from the same population.

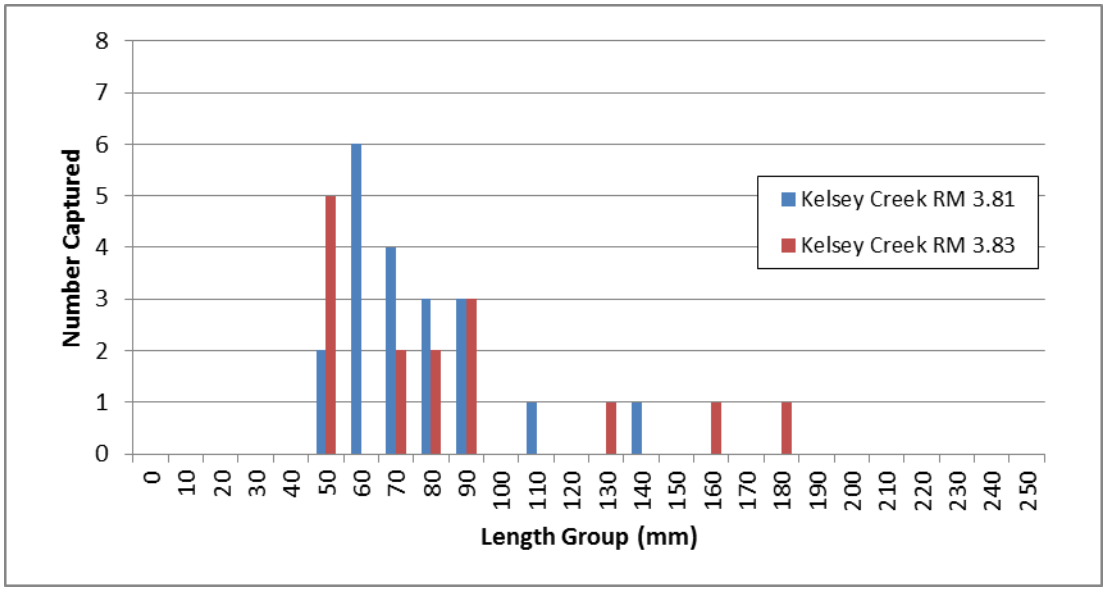


Figure 7. Length frequency distribution of cutthroat at Kelsey Creek (RM 3.81 and RM 3.83).

3.4 Coho Length Distribution

Low numbers of juvenile coho were caught across all sites (Table 6). However, the highest number of coho were caught at the Coal Creek RM 4.07 site. Ranges of lengths for coho (0+ age) were all relatively similar across all sites, with Kelsey Creek RM 3.83 showing the largest coho caught at 95 mm (1+ age).

Table 6. Number caught, mean length (mm), length range (mm) and stdev of lengths for first year coho (0+) across all sites sampled.

Site	Number of 0+ Coho Caught	Mean Length (mm)	Range (mm)	Stdev
Coal Creek (RM 0.79)	3	75.3	65-81	8.9
Coal Creek (RM 4.07)	11	61.5	45-71	7.7
Yarrow Creek (RM 1.13)	0	0	0	0
Kelsey Creek (RM 3.81)	2	57.5	55-60	3.5
Kelsey Creek (RM 3.83)	5[3]	64	53-84	13.5

[3] One 95 mm coho was caught at this site and not included in the table due to being in a different age class.

Figure 8 shows coho length frequency distribution for Coal Creek RM 0.79 and RM 4.07. Although the sample size is very low, the frequency distribution suggests a one year-class (0+ age) for both sites.

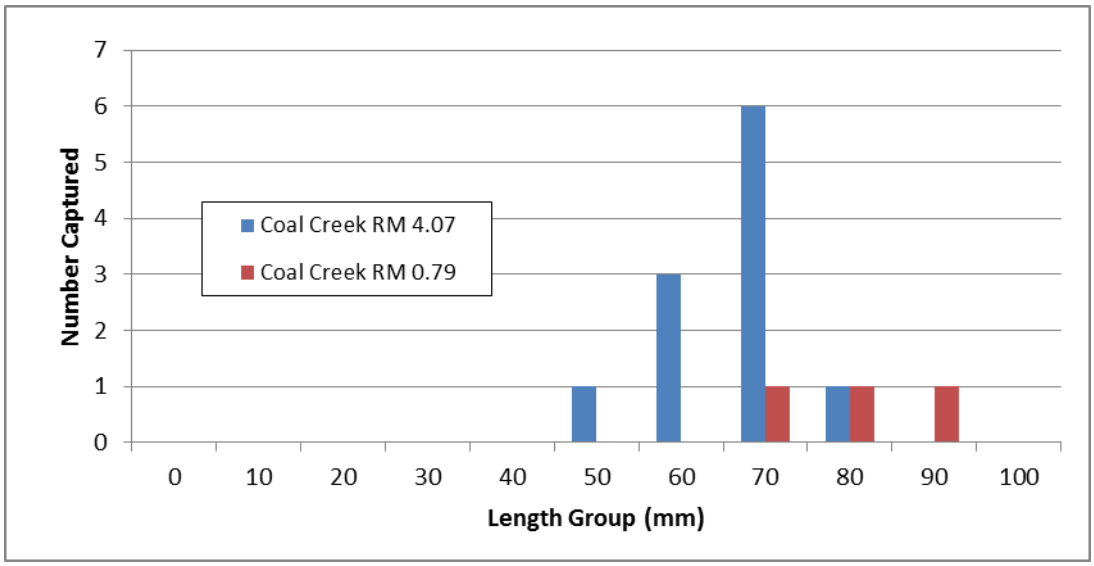


Figure 8. Length frequency distribution of coho at Coal Creek (RM 0.79 and RM 4.07).

Figure 9 shows coho length frequency distribution for Kelsey Creek RM 3.81 and RM 3.83. Sample sizes at both sites were extremely low, with only one 0+ coho caught at Kelsey RM 3.81. However, the frequency distribution for RM 3.83 suggests two year-classes present at Kelsey Creek RM 3.83. One fish captured measured 95 mm in length, suggesting that there are 1+ coho present at this site.

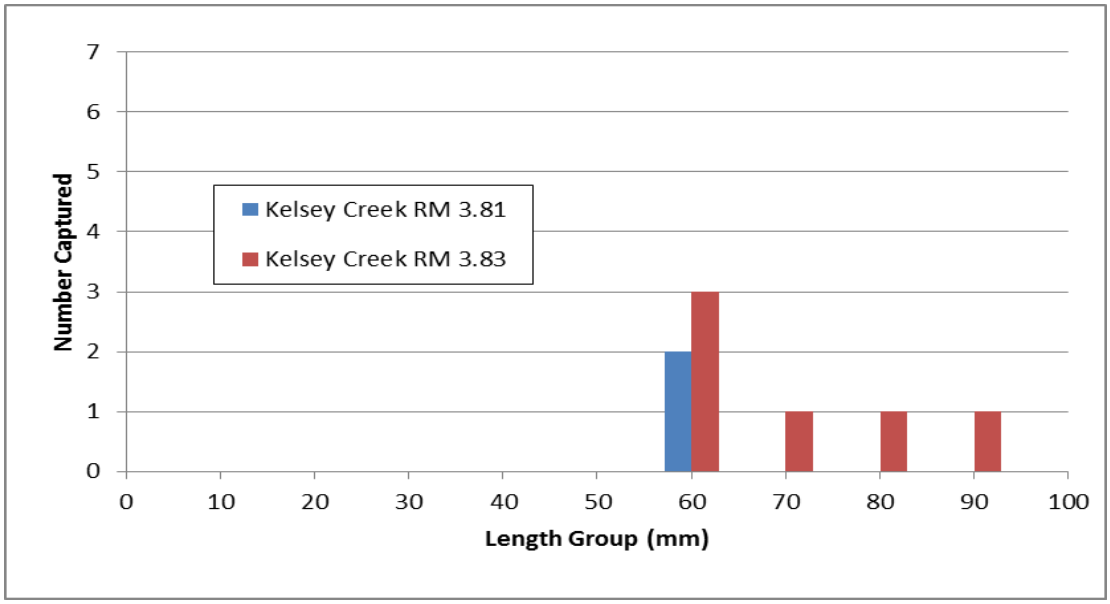


Figure 9. Length frequency distribution of coho at Kelsey Creek (RM 3.81 and RM 3.83).

3.5 Native and Non-Native Species

Three native fish species, cutthroat, coho and sculpin, were captured at Coal Creek RM 0.79 in 2011 (Table 7). One lamprey was seen but not captured at this site. Native cutthroat and coho were captured at Coal Creek RM 4.07, Kelsey Creek RM 3.81 and RM 3.83. Only native cutthroat were captured at Yarrow Creek RM 1.13. No other native species were captured during 2011 sampling at these sites. Most Puget Sound lowland streams should contain other native species including, but not limited to sculpin, dace, lamprey, and largescale suckers. All of the sites showed relatively diminished diversity of native species indicating possible urban impacts.

Differences in native species composition between 2011 sampling and past sampling on Kelsey Creek and Coal Creek is likely due to habitat differences in sampling sites (specifically Coal Creek), netting efficiency, and possible identification variances.

Non-native fish species were absent during 2011 sampling events at all sites (Table 8). Non-native species were also absent during 2007 sampling at the same Kelsey Creek sites. However, non-native species were captured at other Kelsey Creek sites in previous years and could be attributed to differences in habitat availability, flow regimes, or environmental variations between sites.

[This page intentionally left blank.]

Table 7. Native species documented in Bellevue streams during 1983, 1996, 1997, 2002, 2007, 2010, and 2011 summer fish surveys.

Common Name	Scientific Name	Year	Kelsey Creek									West Tributary			Valley Creek		Coal Creek				Yarrow Creek	Richards Creek			
		River Mile	0.2	1.06	1.4	1.8	2.1	2.59	3.81	3.83	3.97	0.4	1.01	2.2	0.2	0.82	0.79	2.0	2.4	4.07	1.13	0.5	0.65	0.77	0.9
Coho Salmon	*Oncorhynchus kisutch*	1983	x			x	x																		
		1996	x		x		x				x		x		x	x		x							
		1997	x								x					x									x
		2002					x											x	x						
		2007		x		x									x	x									
		2010										x			x										
		2011							x	x							x			x					
Cutthroat Trout	*Oncorhynchus clarki*	1983	x			x	x											x	x						
		1996	x		x		x	x			x		x		x	x		x	x						x
		1997	x								x					x									x
		2002		x	x		x					x			x			x	x			x			
		2007		x		x	x		x	x					x	x									
		2010			x	x	x					x			x								x		
		2011							x	x							x			x	x				
Rainbow Trout	*Oncorhynchus mykiss*	1983	x			x	x																		
		1996																							
		1997	x																						x
		2002					x																		
		2007				x																			
		2010																							
		2011																							
Sculpin	*Cottus spp.*	1983																x	x						
		1996	x															x							
		1997	x													x									x
		2002																x	x						
		2007																							
		2010																							
		2011															x								
Three-spine stickleback	*Gasterosteus aculeatus*	1983	x			x	x																		
		1996																							
		1997																							x
		2002		x								x										x			
		2007		x																					
		2010										x											x	x	
		2011																							
Western Brook Lamprey	*Lampetra richardsoni*	1983																							
		1996						x											x						x
		1997														x									x
		2002		x								x			x			x				x			
		2007		x			x		x	x					x										
		2010				x						x			x										
		2011															x								

Common Name	Scientific Name	Year	Kelsey Creek									West Tributary			Valley Creek		Coal Creek				Yarrow Creek	Richards Creek			
		River Mile	0.2	1.06	1.4	1.8	2.1	2.59	3.81	3.83	3.97	0.4	1.01	2.2	0.2	0.82	0.79	2.0	2.4	4.07	1.13	0.5	0.65	0.77	0.9
Largescale Sucker	*Catostomus macrocheilus*	1983																							
		1996			x		x						x												
		1997																							
		2002																							
		2007		x																					
		2010										x													
		2011																							
Dace (longnose or speckled)	*Rhinichthys spp.*	1983																							
		1996	x		x								x												
		1997	x																						
		2002			x		x					x													
		2007		x		x	x																		
		2010				x						x													
		2011																							
Trout Fry (<80 mm)		1983																							
		1996	x										x		x	x									
		1997	x								x					x									x
		2002		x	x		x					x			x			x	x			x			
		2007		x		x	x		x	x					x	x									
		2010			x	x	x					x			x								x		
		2011							x	x							x			x	x				

= did not sample
= sampled, no fish seen
x = sampled, fish seen

Table 8. Non-native species documented in Bellevue streams during 1983, 1996, 1997, 2002, 2007, 2010, and 2011 summer fish surveys.

Common Name	Scientific Name	Year	Kelsey Creek									West Tributary			Valley Creek		Coal Creek				Yarrow Creek	Richards Creek			
		River Mile	0.2	1.06	1.4	1.8	2.1	2.59	3.81	3.83	3.97	0.4	1.01	2.2	0.2	0.82	0.79	2.0	2.4	4.07	1.13	0.5	0.65	0.77	0.9
Bluegill	*Lepomis macrochirus*	1983																							
		1996	x				x				x				x										
		1997																							
		2002					x																		
		2007																							
		2010				x	x					x													
		2011																							
Largemouth Bass	*Micropterus salmoides*	1983																							
		1996																							
		1997									x														
		2002																							
		2007																							
		2010			x																				
		2011																							
Pumpkinseed	*Lepomis gibbosus*	1983																							
		1996																							
		1997																							
		2002					x																		
		2007																							
		2010																							
		2011																							
Crappie (black or white)	*Pomoxis spp.*	1983																							
		1996																							
		1997																							
		2002																							
		2007																							
		2010			x	x																			
		2011																							
Carp	*Cyprinus carpio*	1983																							
		1996																							
		1997																							
		2002																							
		2007																							
		2010			x																				
		2011																							

= did not sample
= sampled, no fish seen
x = sampled, fish seen

[This page intentionally left blank.]

4.0 Discussion and Recommendations for Future Actions

Non-native fish were absent at both Coal Creek sampling sites and three native fish species were found at Coal Creek RM 0.79, which included cutthroat, coho, and sculpin species (Tables 7 and 8). One lamprey was also seen but not captured at this site. This site showed higher native species diversity than all other sites, indicating that this specific site on Coal Creek may have less urban impacts than other sites. However, a low coho to cutthroat ratio (0.5) indicates that this site on Coal Creek does have urban impacts as seen in Lucchetti and Fuerstenberg (1993) where coho to cutthroat ratios of >2 indicates excellent habitat, 1 to 2 indicates good habitat, and < 1 indicates urban impacts. In healthy streams, juvenile coho account for 2 to 10 times the number of juvenile cutthroat. As urbanization continues, juvenile and adult resident cutthroat become more dominant and eventually surpass coho both in total numbers and biomass, which seems to be the case for this site (Anderson 2011).

Native cutthroat and coho were the only species caught at the Coal Creek RM 4.07 site. This sampling site was located in a habitat restoration area with plenty of large woody debris, pools and riffles (Appendix B). Results showed that priority species, cutthroat and coho, were utilizing this area and the coho to cutthroat ratio was 1.4 indicating that restoration efforts are providing good habitat. However, further studies are needed to confirm continued use in and around the restoration site.

As mentioned earlier, the two Coal Creek sites sampled in 2011 had not been previously sampled. Therefore, directly comparing results from this study to previous year's studies is not recommended due to the difference in site locations and habitat types. However, comparing 2011 results to past data on Coal Creek on a gross watershed scale, shows that juvenile coho and sculpin presence on Coal Creek has been episodic (Table 7), and cutthroat presence has been consistent.

In the first year of sampling, native cutthroat was the only species caught at the Yarrow Creek RM 1.13 site in 2011. Fish passage is hydrologically blocked downstream of this site preventing anadromous species access to the upper reaches of Yarrow Creek. The absence of juvenile coho, for example, would therefore be expected for any future sampling at this site until the blockage was removed. However, cutthroat showed a very strong presence with three year-classes, indicating that Yarrow Creek is likely a relatively healthy urban stream capable of sustaining not only cutthroat trout populations, but other anadromous species as well.

Non-native fish were absent at both Kelsey Creek sampling sites (RM 3.81 and 3.83) and native cutthroat and coho were found at both sites (Tables 7 and 8). Low native species diversity and low coho to cutthroat ratios at both sites (0.1 and 0.4, respectively), indicate that urban impacts are influencing fish populations in this section of the creek. Comparing 2011 results to past data on Kelsey Creek on a gross watershed scale, shows that juvenile coho presence has been relatively consistent, and cutthroat presence has been very consistent (Table 7). However, there is a coho supplementation project in Kelsey Creek that may be responsible for maintaining the juvenile coho presence.

It is recommended that further studies be conducted on each of the preceding reaches to help further evaluate the effectiveness of existing and future capital projects for improving fish habitat and the

success of salmonid supplementation efforts. Continued studies to track the diversity, size, and abundance of native and non-native fish species for use as an indicator of overall stream health is also advised. Below is a detailed list of recommendations for the City of Bellevue to facilitate these actions.

- Collect fish condition data at electrofishing sites to determine relative health of priority fish species and compare this data to other Western Washington urban streams where this particular data has been collected.
- Add electrofishing and diet studies to current Benthic Index of Biological Integrity (BIBI) sites. Collect gut content data from priority salmonid species at current BIBI sites to determine if aquatic or terrestrial prey items dominate. This data will help determine prey species availability and use by salmonids. Data collected can help determine if riparian and/or substrate improvements are necessary. Also, compare size of coho and cutthroat fish populations to other Puget Sound lowland reference streams to see if fish are smaller from lack of prey.
- Maintain consistent electrofishing program that visits the exact same sites during the same time of year to help improve determination of status and trends of priority fish species.
- Add additional electrofishing dates earlier in the year at these same sites every five years to help determine seasonality of fish species use (e.g., March).
- Investigate water quality, temperature, and flow conditions in areas with changes in species diversity/density.

Native and non-native fish species presence, status, and trends in urban streams can be a useful tool in determining the health of urban streams. Changes in these attributes can also be used to determine if alterations in land use, habitat restoration activities, or supplementation efforts are influencing fish populations. However, fish use or lack thereof, in urban streams can be due to many variables including, temporal and spatial changes, habitat type and condition, water quality, and climate. Changes to any one of these variables, without collecting data from each of them, make it difficult to determine what might be causing changes in fish densities and species composition. However, collecting consistent data on habitat change, fish use and diets (both temporally and spatially), would help ascertain if changes in fish populations and density are due to natural environmental changes, beneficial habitat modifications, or changes in land use. Implementing the recommendations mentioned above would help the City of Bellevue further answer these questions in their local urban streams.

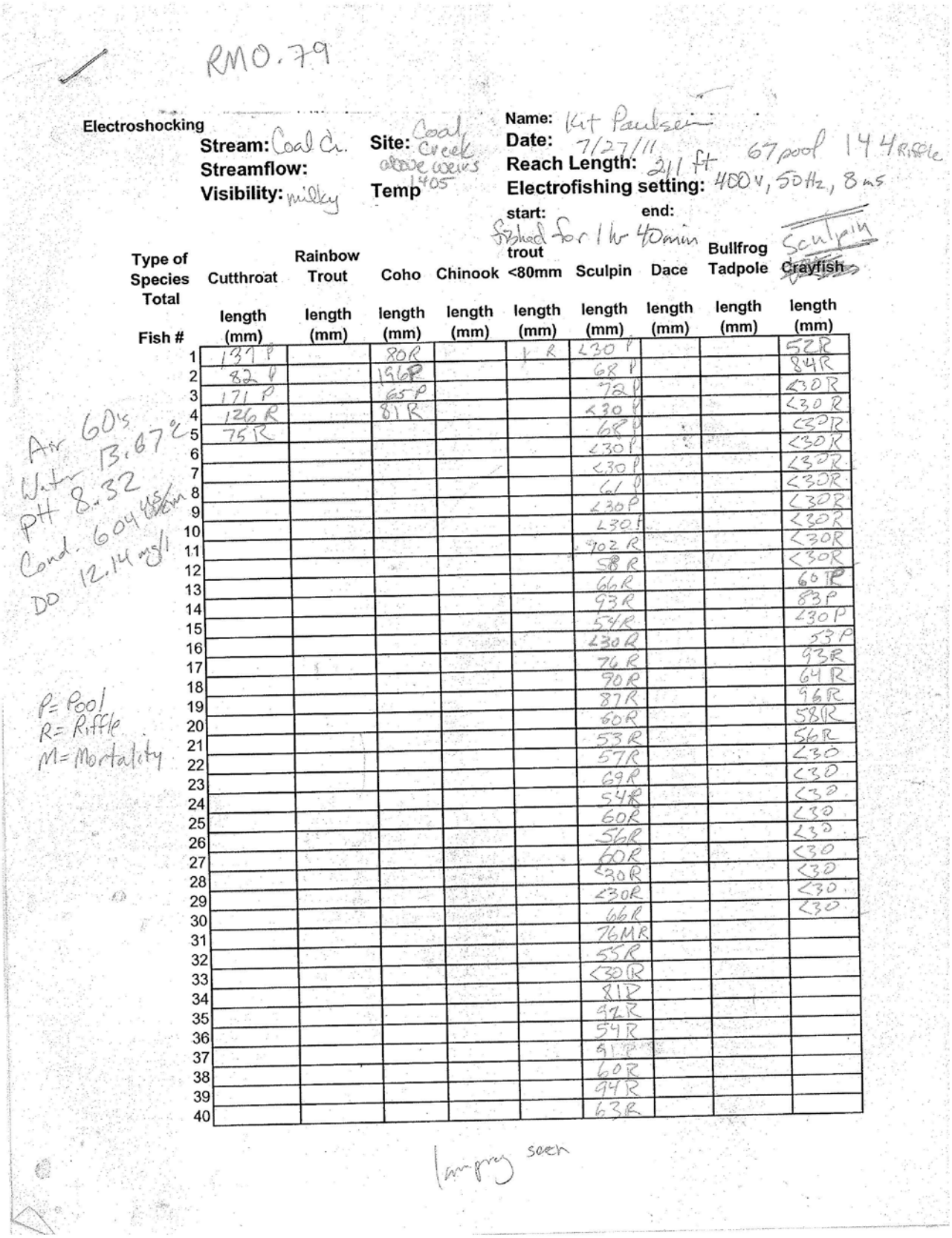
5.0 Literature Cited

Anderson, J.D. 2011. Coastal Cutthroat Trout in Washington State: Status and Management. Washington Department of Fish and Wildlife. 25 pp. Accessed via internet 12/21/2011: http://www.fishlib.org/library/Documents/CoastalCutthroatData/sn600028.pdf

Lucchetti, G., and R. Fuerstenberg, Robert. 1993. Management of coho salmon habitat in urbanizing landscapes of King County, Washington, USA. Pages 308 - 317 in L. Berg and P. Delaney, editors. Proceedings of a workshop on coho salmon. Canadian Dept. of Fisheries and Oceans, Vancouver, British Columbia.

[This page intentionally left blank.]

Appendix A – 2011 Field Sheets



RM 0.79

Electroshocking

Stream: Coal Cr. Site: Coal Creek above weirs
Streamflow:
Visibility: milky Temp 405

Name: Kit Paulsen
Date: 7/27/11
Reach Length: 211 ft 67 pool 144 Riffle
Electrofishing setting: 400V, 50Hz, 8ms
start: end: fished for 1hr 40min

Fish #	Type of Species Total	Cutthroat length (mm)	Rainbow Trout length (mm)	Coho length (mm)	Chinook length (mm)	trout <80mm length (mm)	Sculpin length (mm)	Dace length (mm)	Bullfrog Tadpole length (mm)	Crayfish length (mm)
1		137 P		80R		1 R	<30 P			52R
2		82 P		196P			68 P			84R
3		171 P		65P			72 P			<30R
4		126R		81R			<30 P			<30R
5		75R					68 P			<30R
6							<30 P			<30R
7							<30 P			<30R
8							64 P			<30R
9							<30P			<30R
10							<30P			<30R
11							102 R			<30R
12							58 R			<30R
13							66R			60R
14							93R			83P
15							54R			<30P
16							<30R			53P
17							76R			93R
18							90R			64R
19							87R			96R
20							60R			58R
21							53R			56R
22							57R			<30
23							69R			<30
24							54R			<30
25							60R			<30
26							56R			<30
27							60R			<30
28							<30R			<30
29							<30R			<30
30							66R			
31							76MR			
32							55R			
33							<30R			
34							81R			
35							92R			
36							54R			
37							91R			
38							60R			
39							94R			
40							63R			

Air 60's
Water 13.67°C
pH 8.32
Cond. 604 µS/cm
DO 12.14 mg/l

P = Pool
R = Riffle
M = Mortality

lamprey seen

RM 4.07

Electroshocking

Stream: Coal Cr Site: Cinder-mines Name: Kit Paulsen
Streamflow: Date: 7-27-11
Visibility: clear Temp 13.83 C Reach Length: 96.5' 19.5 pool 77 riffle
Air 60s Electrofishing setting: 200V 50Hz 8ms
start: 13:30pm end: 14:40pm

Cond 182 µs/cm
D.O. 11.78 mg/l
pH 7.42

Fish #	Type of Species Total	Cutthroat length (mm)	Rainbow Trout length (mm)	Coho length (mm)	Chinook length (mm)	trout <80mm length (mm)	Sculpin length (mm)	Dace length (mm)	Bullfrog Tadpole length (mm)	Crayfish length (mm)
1		110 P		65 R		~~55~~				
2		65 R		71 R		2				
3		134 R		51 R						
4		110 R		64 R						
5		61 R		65 R						
6		70 R		69 P						
7		98 R		45 R						
8		186 P		60 R						
9				58 R						
10				63 L						
11				65 R						
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										

P = Pool
R = Riffle
M = mortality

Electroshocking

RM 3.81 **Stream:** Kelsey **Site:** Peltzer (Trend) **Name:** Kit Paulsen

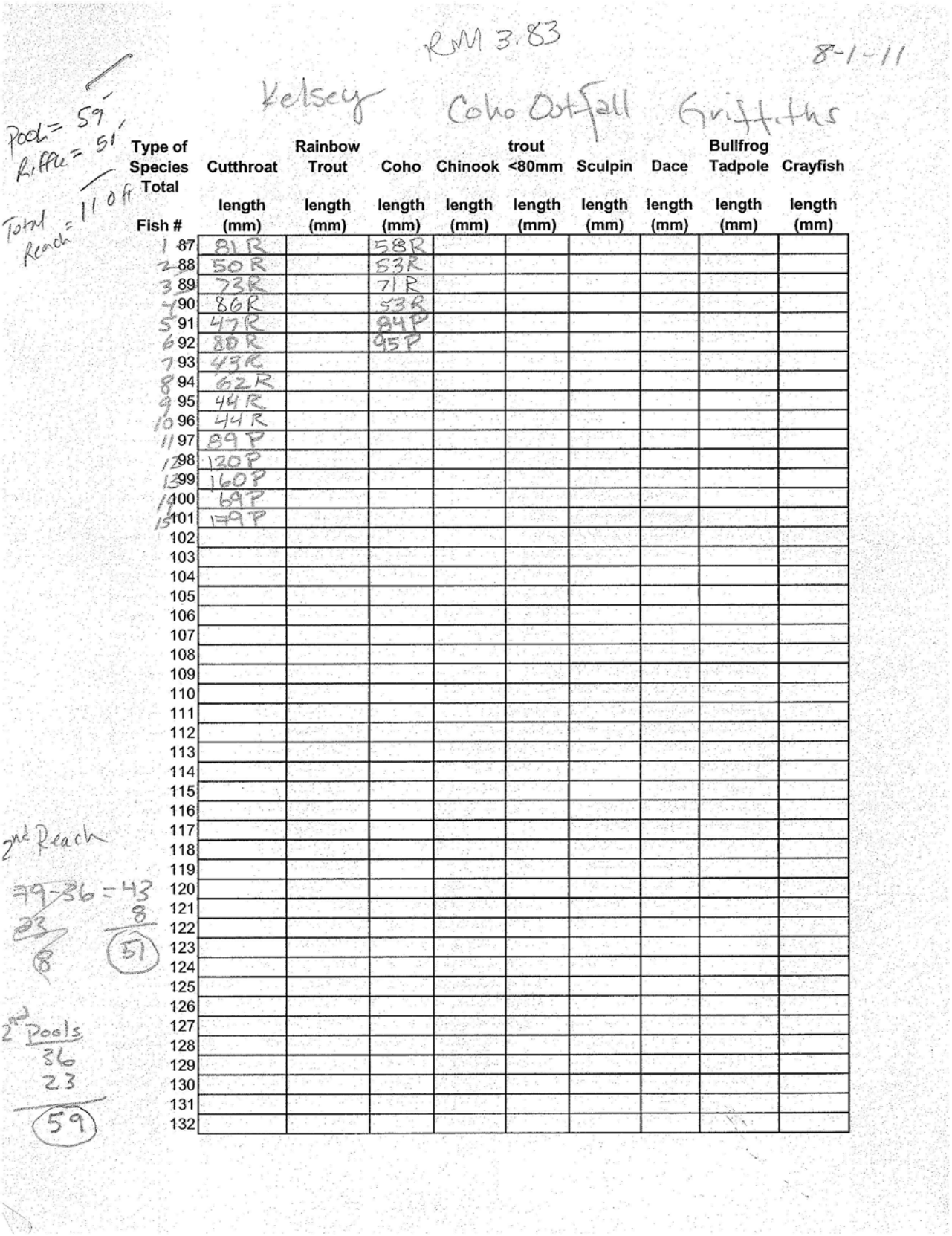
Streamflow: **Date:** 8-1-11

Visibility: **Temp** 60° Air, Water 13.9 °C **Reach Length:** 86' All riffle

pH 7.80 Conductivity 251 µS/cm D.O. 10.9 mg/L **Electrofishing setting:**

start: 9:50 am **end:**

Fish #	Cutthroat length (mm)	Rainbow Trout length (mm)	Coho length (mm)	Chinook length (mm)	trout <80mm length (mm)	Sculpin length (mm)	Dace length (mm)	Bullfrog Tadpole length (mm)	Crayfish length (mm)
1	83R		55R						
2	89R		60R						
3	75R								
4	82R								
5	102R								
6	138R								
7	82R								
8	65R								
9	63R								
10	73R								
11	45R								
12	44R								
13	57R								
14	66R								
15	55R								
16	65R								
17	60R								
18	77R								
19	56R								
20	62R								
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									



RM 3.83

8-1-11

Kelsey Coho Outfall Griffiths

Pool = 59'
Riffle = 51'
Total Reach = 110 ft

Fish #	Type of Species Total	Cutthroat length (mm)	Rainbow Trout length (mm)	Coho length (mm)	Chinook length (mm)	trout <80mm length (mm)	Sculpin length (mm)	Dace length (mm)	Bullfrog Tadpole length (mm)	Crayfish length (mm)
1	87	81 R		58 R						
2	88	50 R		53 R						
3	89	73 R		71 R						
4	90	86 R		53 R						
5	91	47 R		84 P						
6	92	80 R		95 P						
7	93	43 R								
8	94	62 R								
9	95	44 R								
10	96	44 R								
11	97	89 P								
12	98	120 P								
13	99	160 P								
14	100	69 P								
15	101	179 P								
	102									
	103									
	104									
	105									
	106									
	107									
	108									
	109									
	110									
	111									
	112									
	113									
	114									
	115									
	116									
	117									
	118									
	119									
	120									
	121									
	122									
	123									
	124									
	125									
	126									
	127									
	128									
	129									
	130									
	131									
	132									

2nd Reach

79-36 = 43
23
8
(51)

2nd Pools
36
23
(59)

RM 1.13

Electroshocking

Stream: Yarrow **Site:** off Northup Way **Name:**

Streamflow: **Date:** 7/28/11

Visibility: **Temp** 13.41°C **Reach Length:** 224 Ft

Electrofishing setting: 200 volts, 50Hz, 8 ms

start: **end:** Total time 70 min.

Pool = 42 ft
Riffle = 182 ft

Air 65°C
H_2O Temp 13.41°C
Cond. 218 ms/cm
pH 7.88
DO 12.15 mg/l

P = pool
R = riffle
M = mortality
S = sickly but not dead

Fish #	Type of Species Total	Cutthroat length (mm)	Rainbow Trout length (mm)	Coho length (mm)	Chinook length (mm)	trout <80mm length (mm)	Sculpin length (mm)	Dace length (mm)	Bullfrog Tadpole length (mm)	Crayfish length (mm)
1		51RS								
2		52R								
3		231R								
4		58R								
5		50R								
6		74R								
7		57R								
8		193R								
9		150R								
10		63R								
11		72R								
12		210R								
13		58R								
14		59R								
15		153R								
16		225R								
17		58R								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										

Appendix B – Project Photos

Electrofishing Coal Creek RM 0.79 (Start of reach)

Example of cutthroat captured at Coal Creek RM 0.79

Electrofishing on Coal Creek RM 0.79 (Mid-Reach)

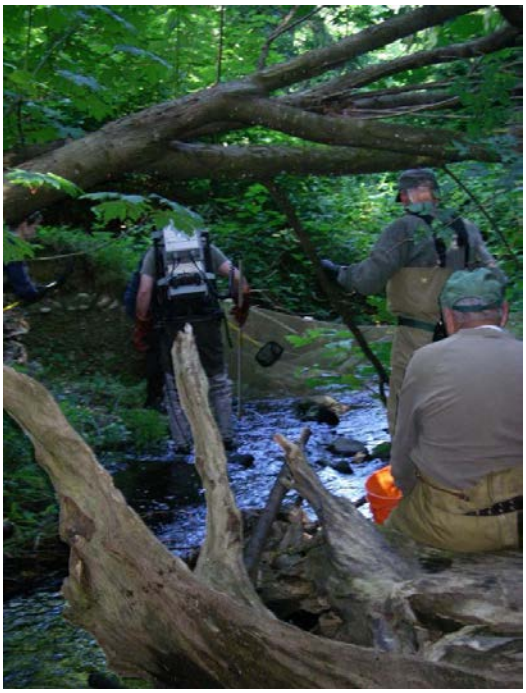
Example of sculpin caught at Coal Creek RM 0.79

Start of sampling reach at Coal Creek RM 4.07

Mid-reach at Coal Creek RM 4.07

Electrofishing at Yarrow Creek RM 1.13 (Mid-reach)

Example of cutthroat captured at Yarrow Creek RM 1.13



Electrofishing at Kelsey Creek RM 3.81
(Top end of reach)

Electrofishing at Kelsey Creek RM 3.83
(Top end of reach)

Example of juvenile cutthroat (on left) and yearling coho (on right) captured at Kelsey Creek.

[This page intentionally left blank.]