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BY ELIZABETH FLORY PHD

AQUATIC SCIENCE INC.
4546 RIVER ROAD
JUNEAU AK 99801

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1.0 Introduction

This report describes 2008 aquatic resource monitoring conducted for the Kensington Project, near Juneau, Alaska, as required by the National Pollutant Discharge Elimination System Permit (Permit No. AK-005057-1). Annual monitoring is conducted on Sherman, Johnson and Slate Creeks, adjacent to the project area, and includes toxicity testing of stream sediment, benthic invertebrate surveys, resident fish population estimates, counts of out-migrating salmon fry and returning adult salmon, analysis of spawning gravel quality, and aquatic vegetation surveys. Surveys were also carried out on Sweeny Creek in 2008 to collect baseline data for an alternative tailings plan.

2.0 Study Area

Sherman Creek drains an area of 10.59km^2 (4.09 mile^2) that ranges from 0 to 1,693m (5,552ft) in elevation (Konopacky 1992). It consists of four upper tributaries, Ivanhoe, Ophir, Upper Sherman and South Fork Sherman, which converge into a single channel approximately 1,500m from the stream mouth on the east shore of Lynn Canal (Figure 1). A permanent barrier to fish migration in the form of vertical falls exists 360m from the stream mouth. A tunnel connecting Kensington Mine with Jualin Mine on the Berners Bay side of the project was completed in July 2007. Mine drainage from the tunnel enters a water treatment facility before being discharged into Sherman Creek at permitted outfall 001, upstream of the confluence with Ivanhoe and Ophir tributaries (Figure 1). Sweeny Creek, 1 mile to the south of Sherman Creek, has a drainage area of 10.57km^2 (4.08 mile^2). Falls block fish passage 3,095m from the stream mouth, although passage of pink salmon (*Onchorhynchus gorbuscha*) and coho salmon (*Onchorhynchus kisutch*) is apparently inhibited by a log jam approximately 825m from the ocean.

Slate Creek and Johnson Creek drain into the north side of Berners Bay (Figure 1). Slate Creek drains an area of 11.61km^2 (4.48 mile^2) and has vertical fall barriers that prevent fish passage on both East and West forks approximately 1000m from the stream mouth. The East Fork of Slate Creek is unique among the streams in containing two lakes upstream. Johnson Creek drains an area of 19.97km^2 (7.71 mile^2) and has impassable barrier falls approximately 1,200m upstream from the confluence with Berners Bay.

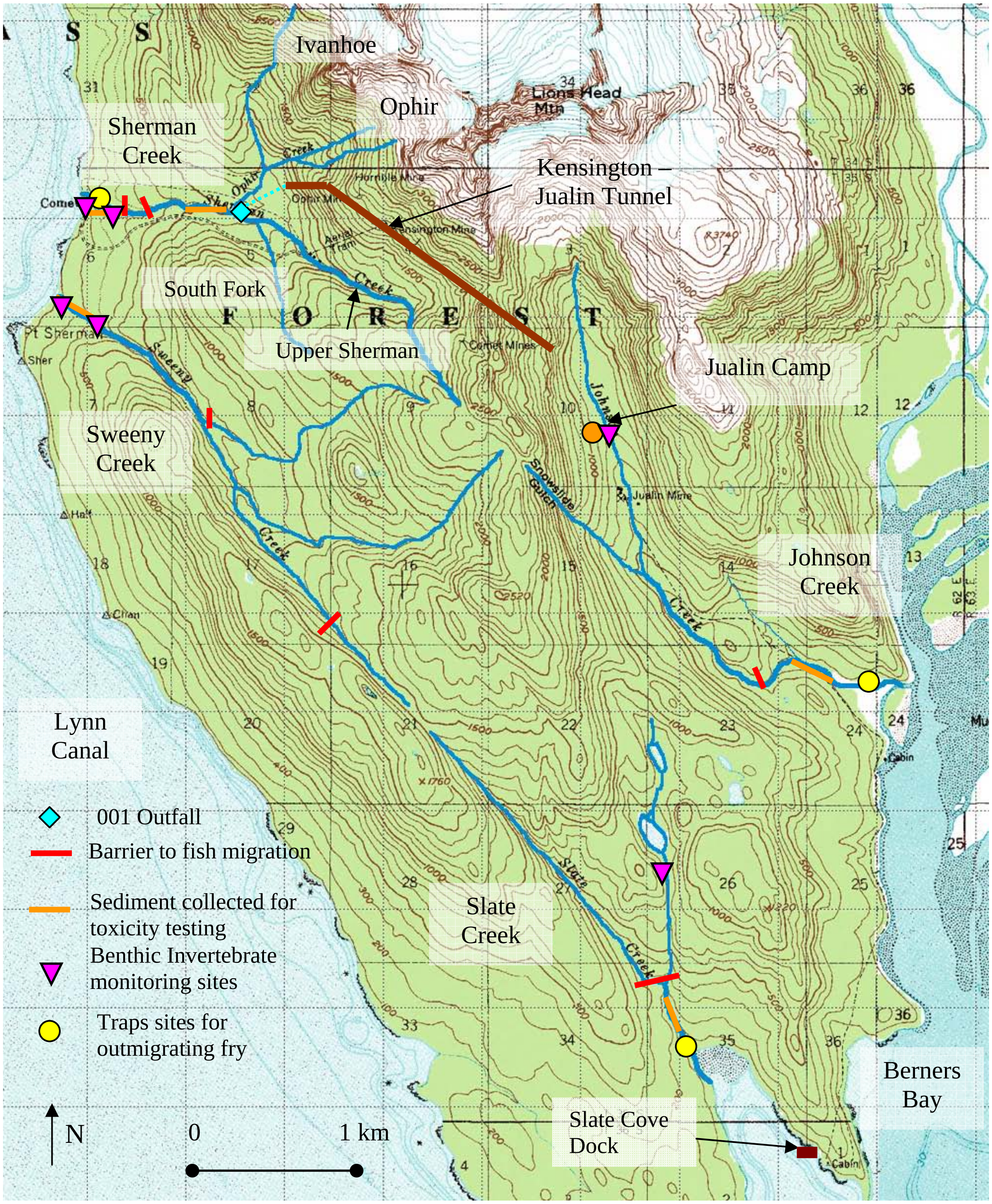


Figure 1: Location of streams near Kensington Mine included in 2008 aquatic resource monitoring. Sediment toxicity testing, benthic invertebrate surveys, resident and anadromous fish surveys, analysis of spawning gravel and aquatic vegetations surveys were conducted in Sherman, Sweeny, Johnson and Slate Creeks.

3.0 Sediment Monitoring

3.1 Introduction

Stream sediment samples were collected in July 2008 and tested for biological toxicity and physical composition. Specific tests performed included: (1) 10-day whole sediment toxicity tests on the amphipod *Hyalella azteca,* and the midge *Chironomus dilutus* (formerly known as *Chironomus tentans*), (2) measures of total organic carbon, total solids, total volatile solids and total sulfide, (3) particle size analysis of sediment, and (4) analysis of metals in the sediment. Deposited stream sediment was collected in Lower and Middle reaches of Sherman Creek, Lower Sweeny Creek, Lower Slate Creek and Lower Johnson Creek (Figure 1). Metals tend to adhere to fine clay particles, but there a very few areas of fine sediment deposition in any of the streams. A few areas on the stream margins were found with fine deposits of mud trapped behind boulders. Sediment was collected from several of these areas until a composite sample of fine material had been collected from each reach.

3.2 Methods

For each reach, sediment was collected by personnel using stainless steel scoops. The sediment was shaken through sieves with perforations of 1.68, 0.42 and 0.15mm to separate coarse and fine sediment. The fine sediment that passed through the smallest diameter sieve was then poured into an Imhoff cone and allowed to settle for at least 10 minutes. Water was then decanted off the top and the finest sediment left in the bottom of the cone was collected for the sample. This process was repeated until approximately 2L of fine sediment was obtained for each site.

100ml of the sediment was placed in pre-cleaned glass containers provided by the laboratory (ENSR, Fort Collins, Colorado). This sample was analyzed to determine the physical composition of the sediment (metal concentration, grain size etc). The remainder of the sample was placed in 2L pre-cleaned high-density polypropylene containers and sent to the laboratory for toxicity testing. Sampling equipment (stainless steel scoops, sieves) was cleaned between sites by rinsing with site water and ethyl alcohol.

Particle size was determined for each creek using ASTM D422: Standard Test Method for Particle-Size Analysis of Soils. The distribution of particle sizes larger than 75 µm (retained on the No. 200 sieve) was determined by sieving, while the distribution of particle sizes smaller than 75 µm was determined by a sedimentation process using a hydrometer (Table 1).

Table 1: Physical Composition of Sediment Samples.

Particle Size %	Lower Sherman	Middle Sherman	Lower Sweeny	Lower Johnson	Lower Slate
Sand	64	72	64	72	60
Silt	36	24	32	24	32
Clay	<0.1	4	4	4	8
Coarse material (>2mm)	<0.05	<0.05	<0.05	<0.05	<0.05
Texture	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam
Total Solids %	73.67	76.38	75.04	74.27	71.93
Total Volatile solids %	2.47	2.52	2.78	2.92	3.93
Total Sulfide (umoles/g)	<12	<12	<12	<12	<12
Total Organic Carbon %	1.92	2.82	4.69	0.78	8.65

Samples from the five sites were similar in their size composition, ranging from 60% sand at Slate Creek to 72% sand at Middle Sherman and Lower Johnson. Clay content was highest at Slate Creek (8%) and lowest at Lower Sherman (<0.1%). Total Solids, Total Volatile Solids, Total Sulfide, and were analyzed using Standard Methods 2540B, 2540E and Total Organic Carbon was determined using the Organic Matter Walkley-Black Method. Concentrations of total organic carbon ranged from 0.8% in Johnson Creek sediment to 8.6% in Slate Creek sediment. Total volatile solids ranged from 2.5% in Lower Sherman sediment to 3.9% in Slate Creek samples. Sulfide was not detected in any of the samples (12 µmoles/g MDL). The laboratory reports are attached to this report as Appendix 1a and b.

3.3 Sediment Metal Concentration

Total metals (aluminum, chromium, zinc) were determined using EPA method 6010B, inductivity-coupled plasma-atomic emission spectrometry (ICP-AES). Solid sample analysis of the metals arsenic, cadmium, copper, nickel, silver, lead and selenium was carried out using method 6020, inductivity-coupled plasma-mass spectrometry (ICP-MS) and mercury content was determined by method 7471B, manual cold-vapor technique. Table 2 summarizes metal concentrations in the sediment collected from each stream.

Table 2: Concentrations of metals in stream sediment, (mg/kg).

Analyte	Lower Sherman	Middle Sherman	Lower Sweeny	Lower Johnson	Slate Creek
Aluminum	16,900	13,300	14,000	13,700	15,800
Arsenic	25.6	58.3	28.8	21.9	32.6
Cadmium	0.528	0.401	0.371	0.296	11.00
Chromium	37.5	26.9	23.6	28.1	20.3
Copper	81.5	103	57.4	93.3	111
Lead	8.43	17.1	15.4	11.4	21.9
Mercury	0.0434	0.103	0.0517	0.0546	0.149
Nickel	31.9	29.9	27.3	23.3	71.1
Selenium	1.18	1.02	1.07	0.413	3.73
Zinc	100	101	83.2	94.2	739
Silver	0.302	0.443	0.467	1.24	0.807

Seven out of the eleven metals showed the highest concentration in Lower Slate Creek (cadmium, copper, lead, mercury, nickel, selenium and zinc). Four metals showed lowest concentrations in Johnson Creek. All five sites had high concentrations of aluminum (over 13,000 mg/kg). Zinc and copper were the next most abundant metals after aluminum (Figure 2). Zinc made up 74% of the metal content (excluding aluminum) in the Lower Slate Creek sample. Zinc and copper each made up 35% of the sample at Lower Johnson; zinc comprised 36% of Lower Sherman and Lower Sweeny sediment; copper made up over 25% of the samples from Sherman, Sweeny and Johnson.

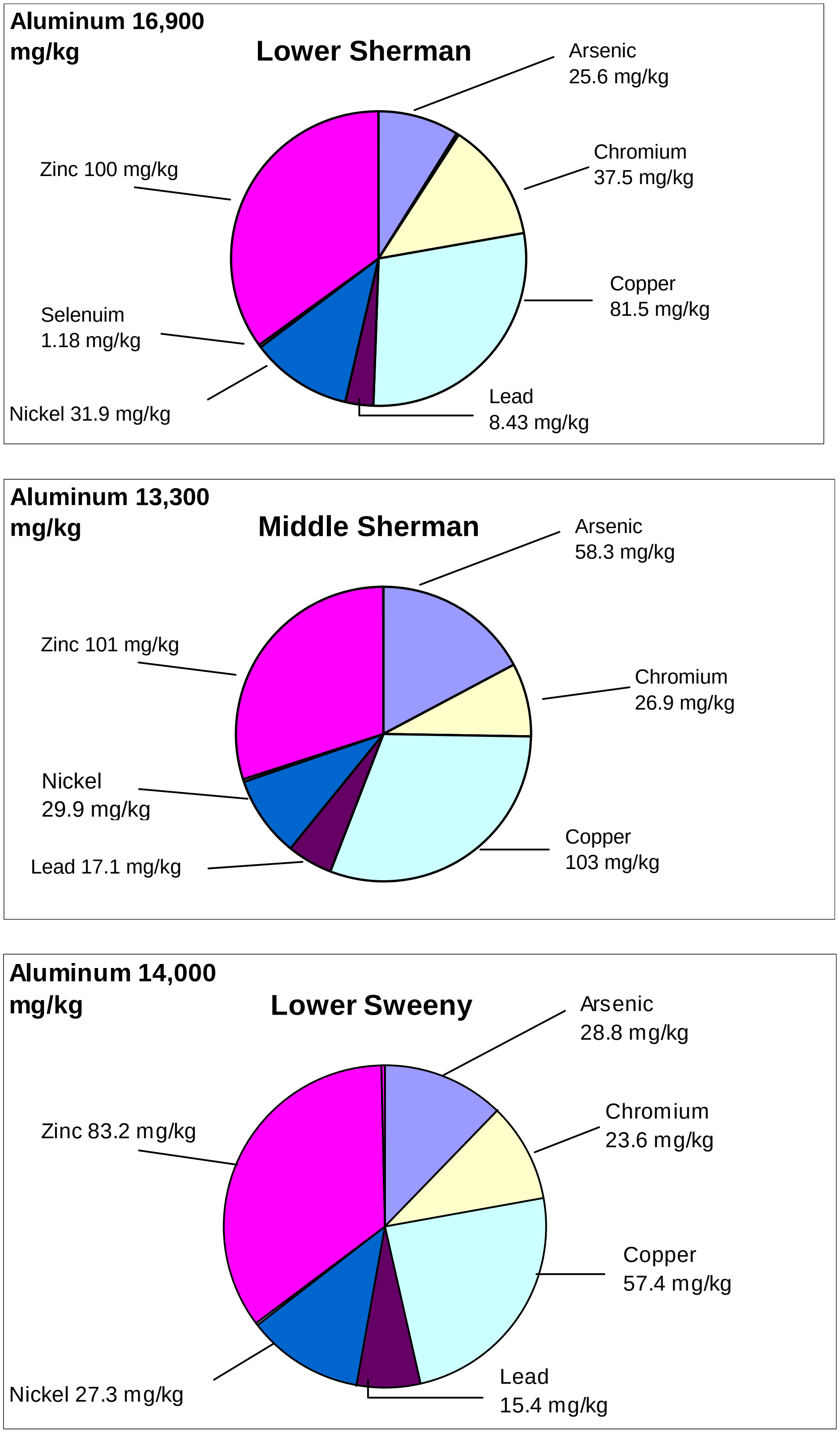
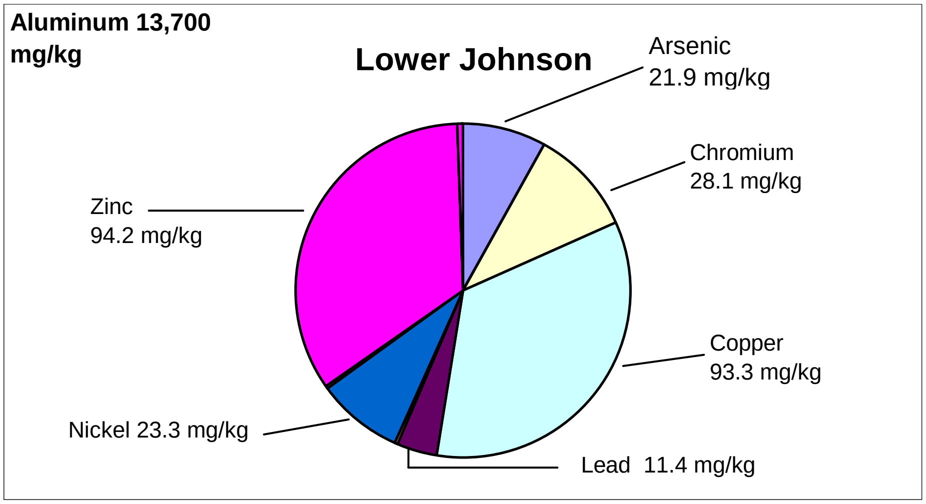


Figure 2: Metal content of stream sediment.



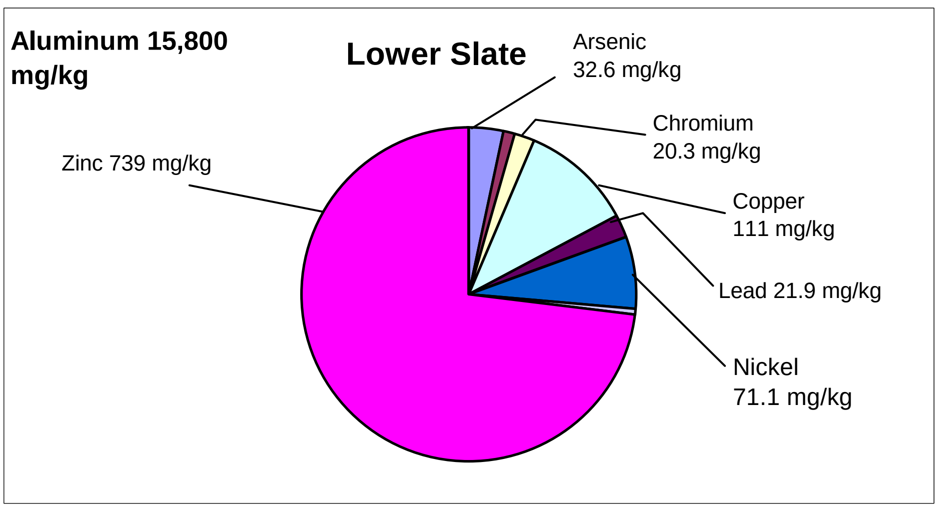


Figure 2 cont. Metal content of stream sediment.

3.4 Sediment Toxicity Testing

Short-term toxicity testing was conducted using the amphipod *Hyalella azteca* and 3rd instar midge *Chironomus dilutus* (formerly known as *Chrinomus tentans*). Any endemic organisms in the sediment were removed prior to testing. Eight replicates of stream sediment were used per treatment. The primary lab control sediment was silica sand and secondary control sediment was formulated with a smaller grain size and higher organic matter content (Appendix 1a, 1b).

Both organisms underwent 10 day toxicity tests using survival and growth (ash-free dry weight per organism) as endpoints. Physical parameters including dissolved oxygen temperature, pH, hardness, alkalinity, conductivity, and ammonia were monitored throughout the tests (Appendix 1a, 1b). Survival of *Hyalella azteca* was higher at all sites than the laboratory control sediment (Table 3). Survival of *Chironomus dilutus*, however, was lower at Lower Johnson (64%) and Middle Sherman (65%) than the lab formula (84%) but not the silica sand (35%). Other sites were not significantly different from the control sediment. Survival of *C. dilutus* was relatively high at Slate Creek despite the higher metal concentration found there (eg. cadmium, zinc), perhaps due to a higher amount of organic carbon, which can ameliorate the toxicity of some metals.

Table 3: Survival of organisms after 10-day exposure to sediment.

Biological Data			
Collection Date and Time	**Sample ID**	***Chironomus dilutus*** **Survival (%)**	***Hyalella azteca*** **Survival (%)**
7/30/08 11:00	Lower Sherman	**76.25**	**92.5**
7/30/08 9:30	Middle Sherman	**65.00**[a]	**97.5**
7/28/08 10:30	Lower Sweeny	**66.25**	**92.9**
7/23/08 11:45	Johnson Creek	**63.75**[a]	**90.0**
7/24/08 11:30	Slate Creek	**76.25**	**92.5**
	Sand - control	**35.00**	**8.75**
	Lab Sediment	**83.75**	**86.25**

[a] significantly lower than lab formulated sediment.

It appears that the batch of *C. dilutus* used by the lab did not perform well in material with high sand content and low organic matter eg. Middle Sherman, Lower Johnson, and the silica sand control. The sites with lower sand content and higher organic content showed higher survival. Middle Sherman and Lower Johnson had some of the lowest metal concentrations of all the sites, but there was less organic matter to offset potential toxicity. Survival of *H. azteca* was low at Middle Sherman in 2007, but in 2007 survival was also low in the control (Figure 3). *C. dilutus* survival at Johnson Creek in 2008 was similar to 2007. Survival of *C. dilutus* in Slate Creek sediment was 10% higher in 2008 than 2005. The survival of *Hyalella azteca* was higher at all sites in 2008 compared to previous years except Slate Creek was slightly higher in 2006.

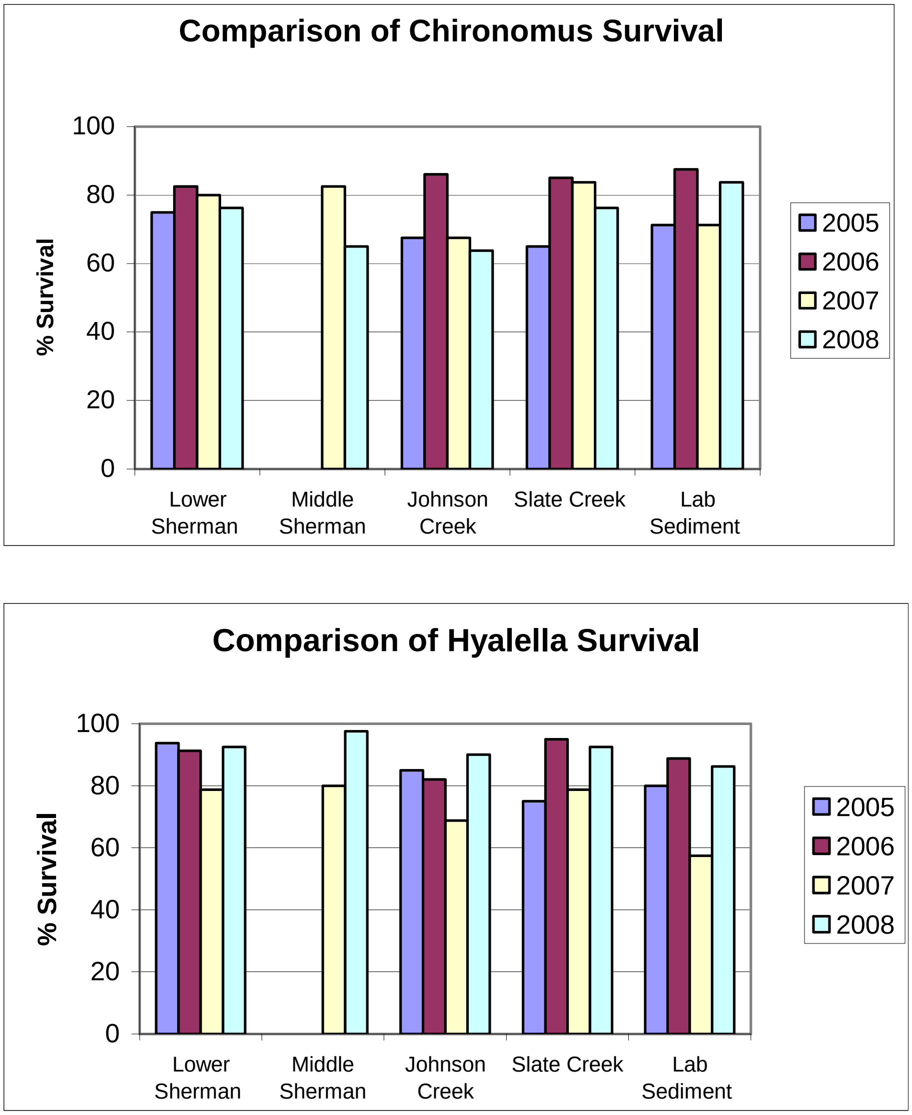


Figure 3: Comparison of toxicity tests with previous years

Growth of organisms is surmised from the remaining ash free dry weights at the end of the tests expressed per number of original organisms used at the start of the test and the number surviving at the end. Growth of *Hyalella azteca* was not significantly different in sediment from all sites compared to laboratory formulated sediment, however, growth of *Chironomus dilutus* was significantly lower than the laboratory formula at all sites (Table 4). In 2006 and 2007, the lowest growth was found in Lower Johnson sediment. In 2008, all sites showed low growth for *C. dilutus*. The silica sand control was not used in this comparison due to poor performance of organisms.

Table 4: Dry weights (growth) of organisms after 10-day exposure to sediment.

Sample ID	*Chironomus dilutus* Ash free dry weight (mg) per original organism	*Chironomus dilutus* Ash free dry weight (mg) per surviving organism	*Hyalella azteca* Ash free dry weight (mg) per original organism	*Hyalella azteca* Ash free dry weight (mg) per surviving organism
Lower Sherman	0.778	1.0474[b]	0.072	0.078
Middle Sherman	0.665	1.0477[b]	0.077	0.080
Lower Sweeny	0.654	1.0246[b]	0.068	0.073
Johnson Creek	0.664	1.0469[b]	0.069	0.077
Slate Creek	0.659	0.9111[b]	0.074	0.080
Sand - control	not measured	not measured	not measured	not measured
Lab Sediment	1.104	1.328	0.044	0.051

b = significantly different from lab control

Hyalella azteca performed consistently well in survival and growth in sediment from all sites in 2008. *Chironomus dilutus* showed significant effects in growth at all sites and significantly lower survival at Lower Johnson and Middle Sherman; survival of both organisms was poor in the sand control (9-35%), but satisfactory (>80% in lab formulated sediment, implying that test organisms were viable.

Lower Johnson sediment collected in 2008 contained higher levels of arsenic, copper, lead and cadmium than 2007, but similar levels were obtained in 2005 or 2006. Levels of arsenic, cadmium, copper and lead at Middle Sherman were higher in 2008 than 2007 when this site was first tested. Lower Johnson and Middle Sherman still had low metal concentrations compared to other sites in 2008, with the exception of high arsenic at Middle Sherman. Organic matter was lower at these sites, which might have lead to higher toxicity and affected survival of *C. dilutus* at these sites. *Hyalella azteca* showed no toxic effect at these or any other sites. The interaction of organic matter with toxicity of metals may differ between organisms. *C. dilutus* had similar survival rates in 2005 and 2007, but these tests showed no significant difference compared to the control sediment. The real difference is higher survival in the control in 2008. Lower Slate Creek sediment contained more nickel, cadmium, copper, lead and zinc than previous years, but organic carbon levels were also 3 times higher, which may have reduced toxicity levels. Survival of either organism was not significantly different at Slate Creek compared to the control sediment. Survival of *H. azteca* was actually higher in Slate Creek sediment than the lab control sediment.

4.0 Benthic Invertebrates

4.1 Site Description

Benthic invertebrates were collected from established sampling sites on Slate, Johnson, Sherman and Sweeny Creeks in April and May of 2008 (Figure 1). Samples were collected from Sherman Creek on April 15 and from Sweeny Creek on April 20 at sites used by Konopacky in 1995 (Konopacky 1996). Reach 1 of Sherman Creek lies between 3 and 29m upstream from the mouth while Reach 2 lies between 288 and 315m. Reach 1 of Sweeny Creek lies between 38 and 60m upstream and Reach 2 lies between 236 and 260m. Samples were collected from Slate Creek on May 7 and from Johnson Creek on May 8. At Slate Creek, the sampling site is 400m downstream from Lower Slate Lake, while at Johnson Creek samples are collected at the JS-1 flow monitoring site, upstream of the upper bridge crossing.

4.1 Sample Collection

Each reach was examined for all possible sampling sites, namely riffles with substrate particles greater than 20cm and water depth less than 0.5m. Every 3rd or 4th potential site was sampled until a total of 6 samples were obtained for the reach. Samples were collected using a $0.093m^2$ Surber sampler equipped with 300μm mesh (Figure 4), placed in labeled whirlpak bags and preserved with 70% ethyl alcohol.

4.2 Invertebrate identification

Sorting and identification of invertebrates was conducted by personnel from Aquatic Science Inc. Juneau, Alaska, with quality control performed by Elizabeth Flory PhD. who has performed previous invertebrate identification for Kensington Mine samples. Invertebrates were identified to genus level using appropriate taxonomic keys (Merritt & Cummins 1996, Thorp 2001, Clarke 1981) and numbers of each genus recorded for each sample. The number of genera at each site is given in Table 5 and the species composition of samples is given in Table 6.

4.3 Data Analysis

The area of stream bed enclosed by the Surber sampling frame is 0.093 m^2. The density of invertebrates expressed as total numbers of invertebrates per m^2 was calculated by dividing the number of invertebrates per sample by 0.093. Shannon Diversity (H) and Evenness (E) indices were calculated using the following equations:

$$H = \text{sum}(Pi \log10 \{Pi\})$$

$$E = H/\log10 (S)$$

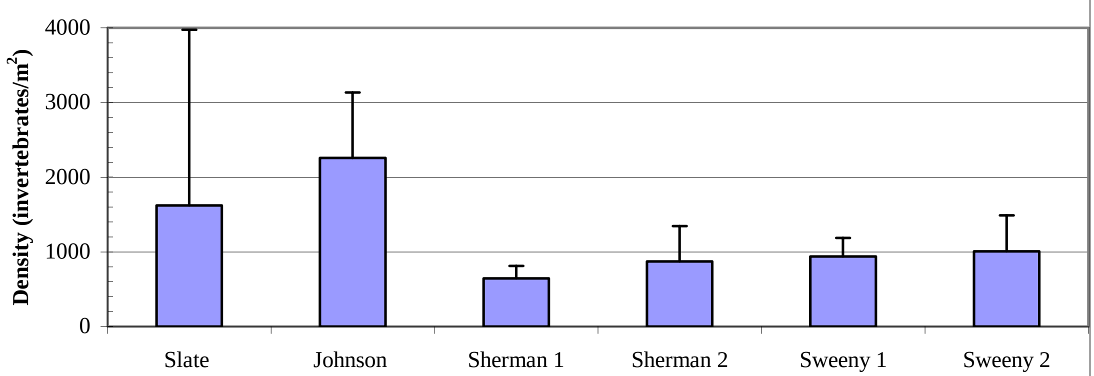
Where Pi is the number of organisms of a given species divided by the total number of organisms in the sample (the proportion of the sample comprised of species i), and S is the number of species or genera present in the sample. Diversity indices are presented in Table 7. The relative abundance of the EPT taxa, Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddis flies), in each sample was counted and the number of EPT taxa was expressed as a proportion of the total number of taxa present.

Figure 4: Collecting invertebrates with a Surber net at Sherman Creek, April 2008.

4.4 Densities and Taxa Present

Densities of invertebrates in Slate Creek samples varied widely, ranging from 204 invertebrates per m^2 to 6,430/m^2 with a mean of 1624/ m^2 (Figure 5, Table 5). Johnson Creek densities were significantly higher than Sherman or Sweeny Creeks ($p < 0.05$) ranging from 1355 to 3882/m^2 with a mean of 2260/m^2. Sherman Creek densities ranged from 366 to 1581/m^2 over both reaches with a mean density of 643/m^2 in Reach 1 and 871/m^2 in Reach 2. Sweeny Creek densities ranged from 473 to 1742/m^2 over both reaches with mean density of 937/m^2 for Reach 1 and 1009/m^2 for Reach 2.

Figure 5: Mean Invertebrate Densities 2008



Site	Density (inverts/m^2)	Mean # Taxa	Mean # EPT	Mean Ratio
Slate	1623.7	13.0	7.3	0.57
Johnson	2259.9	20.0	15.2	0.76
Sherman 1	643.4	11.2	8.2	0.73
Sherman 2	871.0	12.8	9.2	0.72
Sweeny 1	937.3	11.0	7.8	0.72
Sweeny 2	1009.0	12.3	8.8	0.71

Table 5: Invertebrate Densities and Mean Number of Taxa.

The mean number of taxa was significantly higher in Johnson Creek samples (20) than other sites (13 or less). There was no significant difference between mean numbers of taxa at other sites. Johnson Creek samples also had the highest mean number of Ephemeroptera, Plecoptera and Trichoptera (EPT taxa).

Overall, Slate Creek samples contained a total of 906 invertebrates from 25 genera, including 15 EPT taxa (Table 6). The overall ratio of EPT to non-EPT taxa was 0.6. Non-EPT taxa included three Chironomidae genera (non-biting midges), the common pea clam *Psidium*, two Tipulidae (crane fly) genera, two Brachycera, a Simulidae and an Oligochaetae. Johnson Creek samples contained 1261 invertebrates from 38 genera composed of 30 EPT taxa, four Chironomidae taxa, and one Tipulidae, one Empididae, one Simulidae and one Collembola, giving a ratio of EPT to non-EPT of 0.8.

Sherman Creek samples contained 359 individuals in Reach 1 and 486 individuals in Reach 2. Reach 1 samples contained 20 genera with 14 EPT taxa while Reach 2 samples contained 27 genera including 18 EPT taxa giving an EPT ratio of 0.7 for both reaches. Non-EPT taxa included two Chironomidae taxa, three Tipulidae, two Empididae, two other Diptera and one oligochaetae. Sweeny Creek samples contained 523 individuals in Reach 1 and 563 individuals in Reach 2. Sweeny Creek samples from Reach 1 contained 20 genera, with 14 of these EPT taxa, while Reach 2 samples contained 24 genera, with 16 of these EPT taxa.

Johnson Creek had the highest number of genera overall (38) and the highest number of EPT taxa (30). Slate Creek samples contained the highest number of non-EPT taxa (10), likely due to the presence of the lake upstream, which increases habitat diversity (Table 6).

Table 6: Total number of genera in each taxonomic group

	# Ephem.	# Plecop	# Trichop	# EPT	# non-EPT	# Total taxa	EPT ratio
Slate	4	8	3	15	10	25	0.60
Johnson	9	12	9	30	8	38	0.79
Sherman 1	6	5	3	14	6	20	0.70
Sherman 2	7	5	6	18	9	27	0.67
Sweeny 1	8	6	0	14	6	20	0.70
Sweeny 2	6	8	2	16	8	24	0.67

Class	Order	Family	Genus	Slate	Johnson	Sherm 1	Sherm 2	Sweeny 1	Sweeny 2
Insecta	Ephemeroptera	Baetidae	Baetis	1.2	88.0	13.3	15.8	12.8	18.0
			Acentrella		0.2				
			Diphetor		0.2				
		Heptageniidae	Epeorus		3.7	0.2	1.2	1.3	1.5
			Cinygmula	8.2	17.2	0.5	0.5	15.2	8.2
			Rithrogena		1.2	3.2	2.7	1.2	0.8
		Ephemerellidae	Attenella						
			Drunella	2.3	13.8	4.3	6.0	0.2	1.2
			Caudatella		9.3	1.5	1.8		
		Leptophlebiidae	Paraleptophlebia	1.3	1.0		0.2		
	Plecoptera	Chloroperlidae	Alaskaperla						
			Haploperla		1.2	0.5		0.2	0.7
			Suwallia	5.8					
			Kathroperla					0.5	0.3
			Plumiperla	1.3	0.8	4.0	5.0	10.3	11.3
			Neaviperla			0.2			
			Paraperla		0.3				
			Alloperla						
		Capniidae	Allocapnia	0.2	0.3				
			Paracapnia		0.2		0.3	1.8	2.3
			Eucanopsis						0.3
		Nemouridae	Nemoura	2.8	0.5				
			Zapada	2.2	9.0	1.8	2.3	1.2	
			Podmosta		0.2				
		Perlidae	Hesperoperla	0.2					
			Hansonoperla						
			Agnetina	0.2					
			Doroneuria						
			Neoperla						
			Claassenia	1.7					
		Perlodidae	Megarcys		0.5		0.2		
		Leuctridae	Paraleuctra		1.3				
			Despaxia		0.7				
			Perlomyia			0.3	0.2	0.8	1.5

Table 7: Mean numbers of each taxa present at each site.

Class	Order	Family	Genus	Slate	Johnson	Sherm 1	Sherm 2	Sweeny 1	Sweeny 2
Insecta	Trichoptera	Brachycentridae	Micrasema						
		Hydropsychidae	Parapsyche		2.7		0.3		0.3
			Arctopsyche		0.5				
		Glossosomatidae	Glossoma		2.8				
			Anagapetus						
		Polycentropidae	Neureclipses	0.3	0.7		0.2		
			Paranyctiophylax	0.2	0.8				
			Cyrnellus		0.2				
			Polyplectropus		0.2				
		Rhyacophilidae	Rhyacophila	0.2	20.5	1.5	2.5		0.3
		Phryganiidae	Hagenalla						
			Yphria		0.2				
		Lepidostomatidae	Theliopysche						
		Limnephilidae	Apatania			1.2	0.5		
			Moselyana				0.5		
			Grensia			0.2	0.3		
	Diptera								
	Chironomidae	Orthocladiinae	Eukiefferiella	0.2	13.3	24.7	30.3	37.8	37.3
			Tvetenia		5.7	1.0	4.8	1.7	2.8
			Parachaetocladius					0.3	
			Corynoneura					0.3	0.2
		Diamesinae	Pagastia	0.7	1.2				
		Podominae	Paraboreochlus						0.2
		Tanytarsini	Tanytarsus	6.2	7.0			0.2	0.5
			Stempellinella						
			Corynoneura						
	Simuliidae	Simuliidae	Prosimulium	22.7	4.0				
	Nematocera	Tipulidae	Dicranota	0.3		0.2			
			Tipula	0.3	1.2			0.8	1.8
			Antocha		7.0				
			Polymera				0.2		
			Holorusia				0.2		
		Psychodidae	Pericoma						
		Ptychopteridae	Ptychoptera				0.2		
	Brachycera	Ceratopogonidae	Probezzia	4.5					
			Leptoconops				0.2		
		Empididae	Clinocera	1.0	0.5	0.2	0.2		
			Oreogeton				0.2		
			Chelifera						0.2
	Collembola	Poduridae	Podura		0.2				
Annelida	Oligochaetae	Naididae		2.3		1.0	4.7	0.8	1.3
Bivalva	Sphaeriidae	Psidiinae	Psidium (pea clam)	84.8					

Table 7 continued.

The most abundant genera in Slate Creek were the mayflies *Cinygmula*, *Drunella*, the stoneflies, *Suwallia and Nemoura*, the pea clam *Psidium*, the Diptera *Probezzia*, the blackfly larvae *Prosimulium* and the midge *Tanytarsus* (Table 7). In Johnson Creek, the mayflies *Baetis*, *Cinygmula*, *Caudatella* and *Drunella*, the stonefly *Zapada* and the caddis fly *Rhyacophila* were the most numerous. In Sherman Creek the most abundant taxa were the mayflies *Baetis*, *Drunella*, and *Rithrogena*, and the stonefly *Plumiperla*. Sweeny Creek abundant fauna included the mayflies *Baetis*, and *Cinygmula*, and stoneflies *Plumiperla and Paracapnia* and midge *Eukiefferiella.* Most of these genera were also found to be numerous at the same sites in 2007.

4.5 Diversity Indices

The Shannon Diversity (H) and Evenness (E) Indices are commonly applied measures of diversity. The minimum value of H is 0, which would describe a community with a single species. The value increases as species richness (number of species) and species evenness (equal abundance of species) increase. A community with one very dominant species has low evenness and therefore lower diversity. Table 8 compares mean diversity and evenness indices between sites.

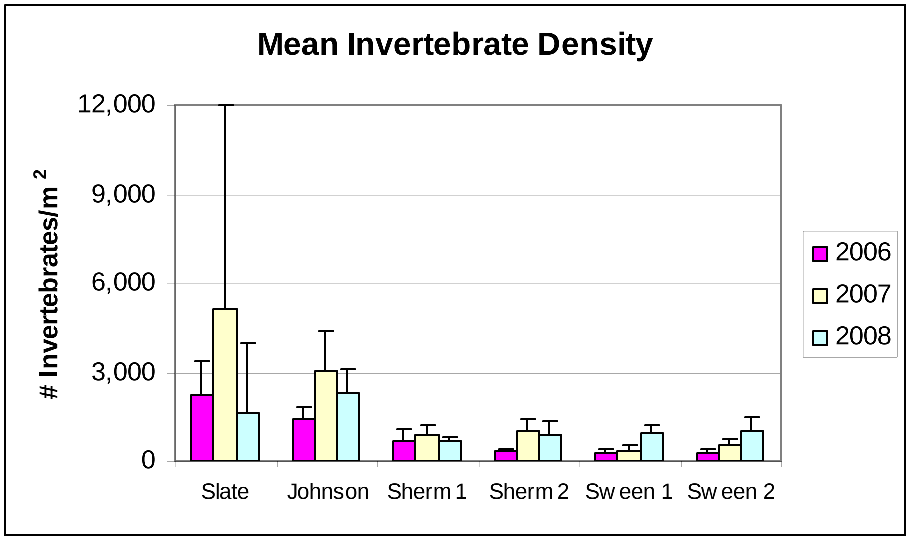
Diversity was significantly higher at Johnson Creek than the lower reaches of Sherman and Sweeny Creeks. There was no significant difference between Slate Creek and the upper reaches of Sherman and Sweeny Creeks. Diversity was low in one sample from both Sherman Reach 2 and Slate Creek due to few species present. There was no significant difference in evenness among sites, indicating that community composition was fairly similar among sites (Table 8). Johnson had a high number of genera, but large numbers of a few mayflies, particularly *Baetis*, which reduced the evenness index slightly. Reach 1 of Sweeny Creek had lower evenness due to high numbers of *Eukiefferiella* chironomids. Slate Creek evenness was reduced in one sample due to high numbers of pea clams.

	Diversity	Evenness		Diversity	Evenness
Slate			**Johnson**		
1	0.90	0.79	**1**	0.92	0.71
2	0.79	0.87	**2**	1.03	0.73
3	0.90	0.81	**3**	0.66	0.57
4	0.39	0.33	**4**	1.05	0.76
5	0.86	0.77	**5**	0.74	0.64
6	0.97	0.83	**6**	0.94	0.69
Mean	**0.80**	**0.73**	**Mean**	**0.89**	**0.68**
Sherm 1			**Sherm 2**		
1	0.93	0.86	**1**	0.90	0.83
2	0.73	0.68	**2**	0.93	0.74
3	0.67	0.71	**3**	0.82	0.65
4	0.64	0.54	**4**	0.80	0.80
5	0.67	0.79	**5**	0.95	0.88
6	0.66	0.64	**6**	0.42	0.50
Mean	**0.72**	**0.70**	**Mean**	**0.80**	**0.73**
Sween 1			**Sween 2**		
1	0.63	0.67	**1**	0.79	0.79
2	0.61	0.57	**2**	0.89	0.80
3	0.90	0.83	**3**	0.55	0.61
4	0.69	0.66	**4**	0.91	0.74
5	0.58	0.55	**5**	0.87	0.81
6	0.71	0.69	**6**	0.73	0.64
Mean	**0.69**	**0.66**	**Mean**	**0.62**	**0.88**

Table 8: Shannon Indices of Diversity and Evenness.

4.5 Comparison with Previous Years

Densities at Slate Creek vary widely between samples and differences are not significant between years (Figure 6). One sample in 2007 contained over 1700 invertebrates, but the average was less than 500. Invertebrate densities in Johnson Creek and Reach 2 of Sherman Creek were not significantly different from 2007 numbers. Sweeny Creek densities in both reaches were significantly higher in 2008 than in previous years ($p < 0.05$). Changes in density over time may be due to the timing of sampling with high flow events, which may scour invertebrates off rocks and reduce numbers. The number of taxa did not vary much at Slate or Johnson Creeks over time. Reach 1 of Sherman Creek had a higher number of taxa in 2007, while Sweeny Creek had more taxa in 2007 and 2008 than in 2006. Numbers of EPT taxa were very similar to the previous year (Table 9), but numbers of other groups varied. Fewer non-EPT taxa were found at Slate Creek in 2008 (10) compared to 2007 (14), but more were present at Johnson Creek in 2008 (8) versus 2007 (4).



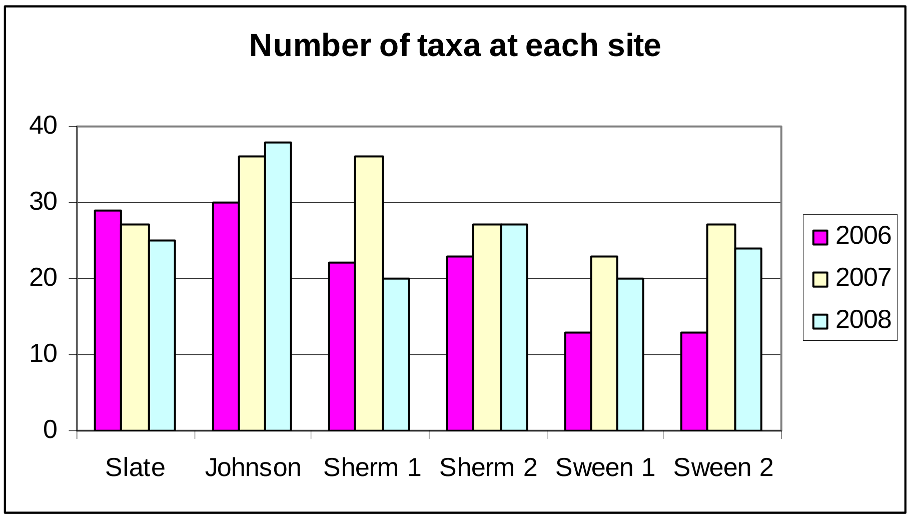


Figure 6: Invertebrate densities and number of taxa compared between years.

	2007 **# EPT**	2008 **# EPT**	2007 **# non-EPT**	2008 **# non-EPT**
Slate	15	15	14	10
Johnson	30	30	4	8
Sherman 1	14	14	8	6
Sherman 2	18	18	5	9
Sweeny 1	14	14	7	6
Sweeny 2	16	16	11	8

Table 9: Comparison of 2007 and 2008 Taxonomic Groups.

5.0 Resident Fish Population

5.1 Stream Reaches

Resident fish surveys were conducted on the four main stream systems around the mine site, namely, Sherman and Sweeny Creeks that flow into Lynn Canal, and Johnson and Slate Creeks that flow into Berners Bay (Figures 7A, B). Population surveys of resident fish were conducted in 2008 in lower, middle and upper reaches of each stream. Each reach is 360m in length. Sherman and Sweeny Creek reaches were designated during aquatic resource surveys in 1998 (Aquatic Science Inc. 1998) while Johnson and Slate reaches were delineated in 2005. All middle and upper strata, with the exception of Sweeny Creek, are located above barrier falls and are thereby inaccessible to sea-run fish. Dolly Varden char (*Salvelinus malma*), pink salmon (*Onchorhynchus gorbuscha*), chum salmon (*O. keta*), cutthroat trout (*O. clarki*) and coast-range sculpin (*Cottus aleuticus*) inhabit reaches below falls barriers. Dolly Varden are the only fish present above barrier falls and likely became established when sea levels were much higher.

Lower Sherman extends from the stream mouth to the barrier falls 360m upstream. Middle Sherman extends 360m downstream from the confluence of Sherman Creek and Ophir tributary. Upper Sherman extends 360m upstream from the road bridge across Upper Sherman Creek. Lower Sweeny extends 360m upstream from the stream mouth. Middle Sweeny begins approximately 1,200m from the stream mouth and extends 360m upstream. Upper Sweeny begins at the first stream confluence of Sweeny Creek and extends 360m upstream along the main river channel (south fork). Permanent markers are located at the start of strata if no permanent natural features occurred there (e.g. falls, stream confluence).

Lower Johnson begins at the forest/meadow border approximately 500m upstream from the confluence with Berners Bay. Middle Johnson begins at the confluence with the tributary draining Snowslide Gulch. Upper Johnson is located upstream of the mill site pad and above a braided section of river in the Jualin basin. Lower Slate begins 400m upstream from the mouth; Middle Slate begins 400m downstream from the proposed dam at Lower Slate Lake; Upper Slate begins at the mouth of the north inlet to Upper Slate Lake. GPS points for the start of each reach are given in Table 10.

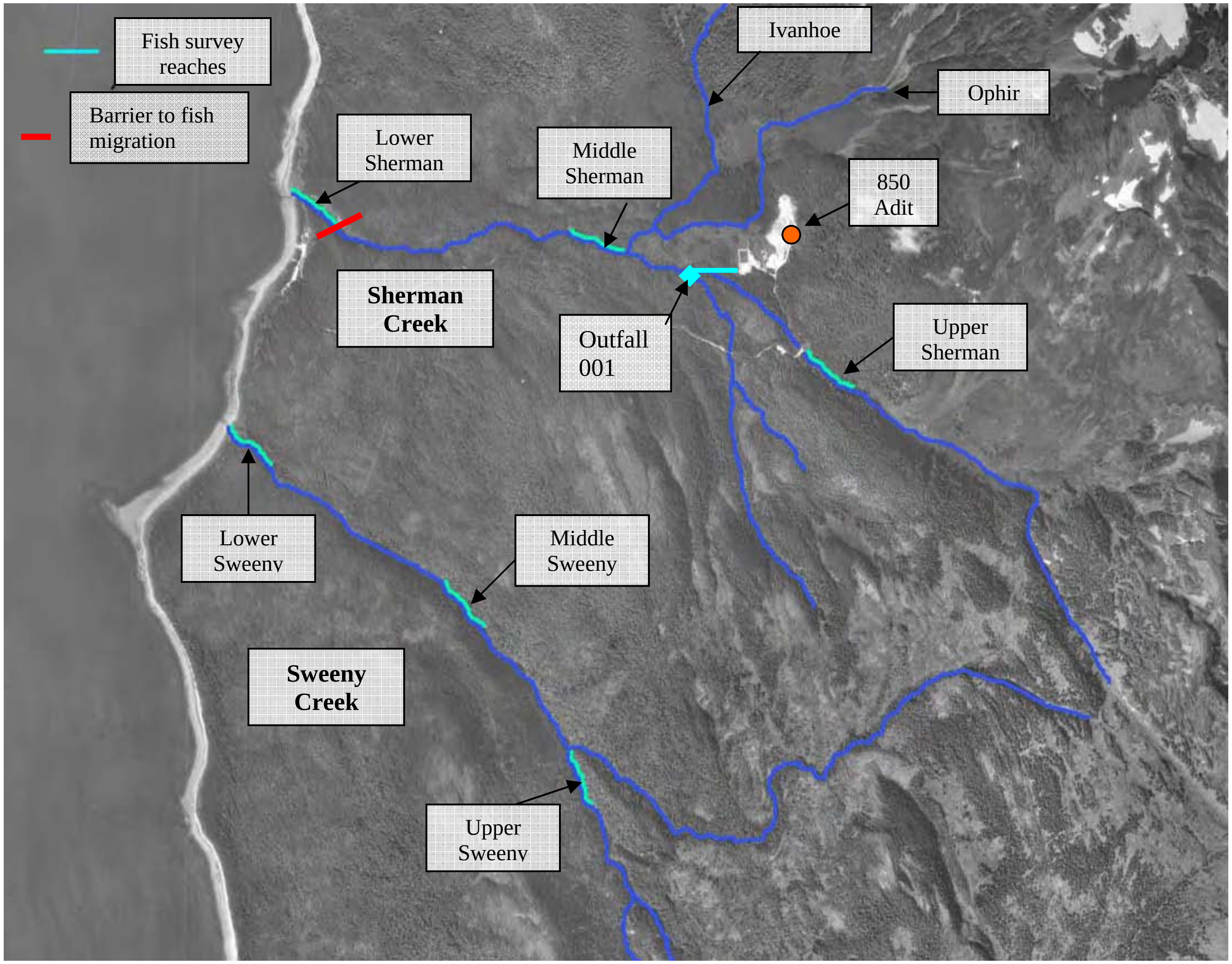


Figure 7A: Sherman and Sweeny Creek reaches used in 2008 Resident Fish Surveys.

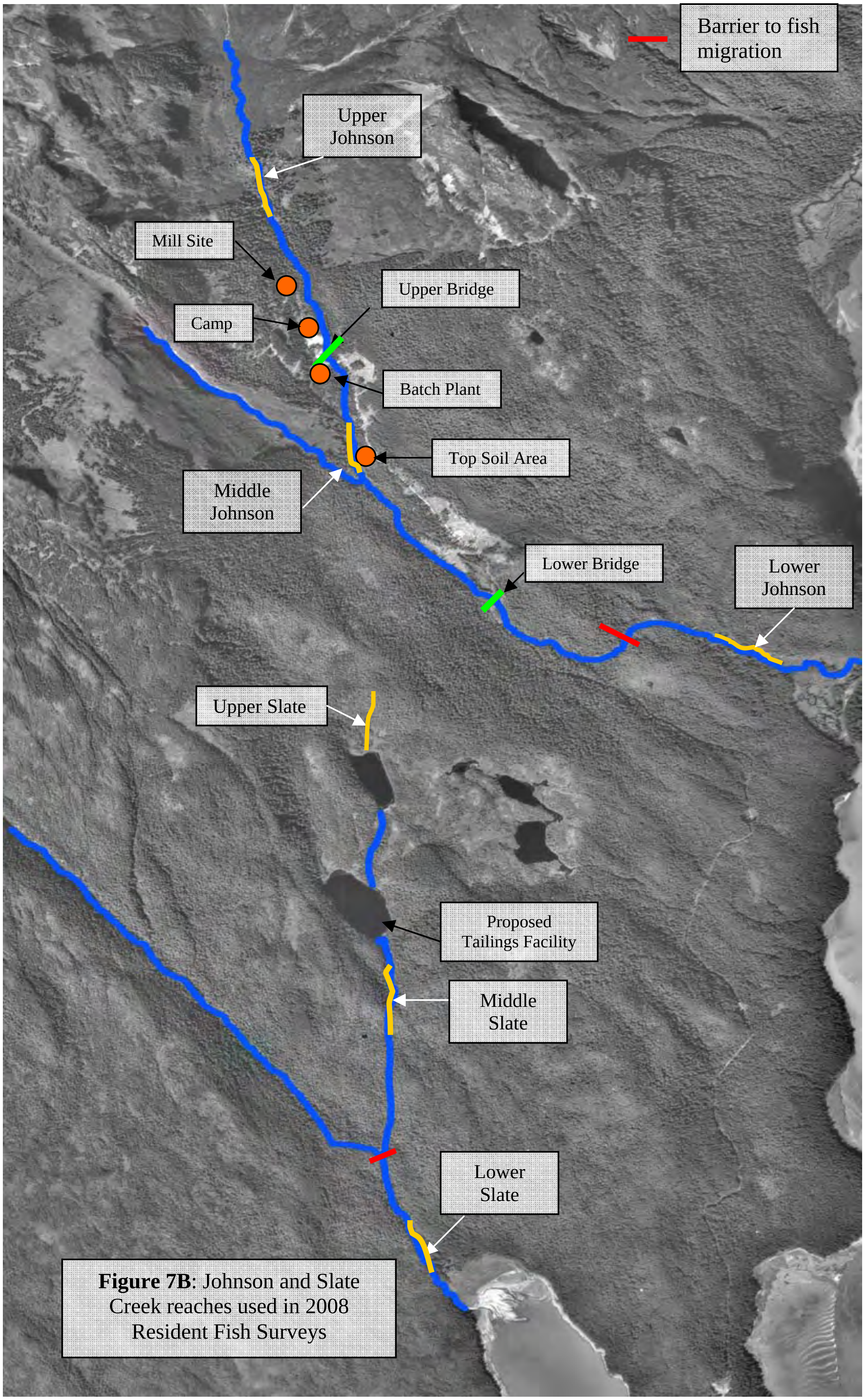


Figure 7B: Johnson and Slate Creek reaches used in 2008 Resident Fish Surveys

Table 10: GPS Coordinates (NAD 27) for resident fish strata.

	Stream Reach	Date Surveyed	Latitude	Longitude
1	Lower Sherman	7/22/2008	58.86908	-135.14005
2	Middle Sherman	8/6/2008	58.86774	-135.11430
3	Upper Sherman	8/5/2008	58.86342	-135.10025
4	Lower Sweeny	7/13/2008	58.85019	-135.12390
5	Middle Sweeny	8/19/2008	58.85294	-135.12592
6	Upper Sweeny	8/20/2008	58.84762	-135.11734
7	Lower Johnson	7/11/2008	58.82383	-134.99936
8	Middle Johnson	8/18/2003	58.83113	-135.03711
9	Upper Johnson	9/2/2008	58.85147	-135.04892
10	Lower Slate	7/14/2008	58.79628	-135.03716
11	Middle Slate	8/26/2008	58.80370	-135.03706
12	Upper Slate	8/27/2008	58.81412	-135.04030

5.2 Resident fish population survey methods

The number of fish within each stratum was estimated using the methods of Hankin and Reeves (1988) as in previous surveys (Aquatic Science 1998-2007). Resident fish surveys were conducted between July 11 and September 2, 2008. Lower reaches were surveyed first prior to adult pink salmon entering streams to spawn in late July. Electro-fishing gear is not permitted in the presence of spawning salmonids, as stipulated in the Alaska Department of Fish and Game Fish Resource Permit (Appendix 3a).

In each reach, stream habitat units were first categorized as riffle, pool, glide or cascade following the classifications of Bisson et al (1981). At least every third riffle, pool and glide was selected for snorkeling. A fisheries biologist, equipped with dry suit and snorkel, quietly entered the water at the downstream end of a selected unit and proceeded upstream observing fish underwater. Two field technicians, following behind to minimize disturbance to fish, measured the length of each habitat unit to the nearest 0.1m using a metric hip chain, and recorded the fish counts. Habitat unit width was measured using a 15m tape measure and meter stick.

The accuracy of visual counts was verified by electro-fishing at least three units (if present) of each habitat type previously snorkeled. A three-member team proceeded upstream using a Smith-Root gasoline-powered backpack electro-fishing unit with output waves designed to minimize impact on fish.

All stunned fish were counted and as many as possible captured using dip nets to allow length and weight measurements to be taken. Minnow traps baited with cured salmon eggs were set in high density fish areas identified by snorkeling. This allowed some fish to be removed and counted prior to electro-fishing, thereby minimizing effects of the electric current on the fish population. Captured fish were anesthetized in a solution of MS222 (Tricanemethane Sulphonate), weighed to the nearest 0.1g and their total length measured to the nearest 1mm. The fish were then placed in a container of fresh stream water with a battery-powered aerator to recover before being returned to the habitat unit from which they were captured.

5.3 Data analysis methods

The number of fish within a reach was estimated by first applying a correction factor to the visual counts based on electro-fishing counts. It is assumed that electro-fishing counts are more accurate than snorkel counts since fish hiding between rocks might remain undetected by a diver, but can be captured by electro-fishing. The corrected counts for sampled units were then extrapolated over the total number of habitat units within a reach to give a total population estimate. Standard deviations and 95% confidence intervals for the population estimates were determined using equations (5) through (11) in Dolloff, Hankin & Reeves (1993). The precision of population estimates was calculated by expressing the 95% confidence intervals as a percentage of the estimated population size.

Definitions for equations used:

y_i = true number of fish in each unit; $i = 1,2,\ldots,N$,
Y = total number of fish in all units, d_i = count of fish by diver in unit i,
n' = number of units for which both diver and electrofishing counts are made
n = number of units for which diver counts only are made ($n>n'$).

The number of fish present is firstly estimated by $y_i = d_i R$(for i not in n') where R is the ratio of actual numbers present to diver counts, estimated by $R = \Sigma\, y/\Sigma\, d$ (for i in n') or the total electro-fishing counts to diver counts. The estimate is then extrapolated over all units using: $Y = N/n\ (\Sigma y_i)$.

An estimation of error is then made using the equation:

$$V(yd,r) = \frac{s^2y - 2Rsxy + R^2s^2x}{n'} + \frac{2Rsxy - R^2s^2x}{n} - \frac{S^2y}{N}$$

where $s^2y = \Sigma(yi - y')^2 / n'\text{-}1$,

$s^2x = \Sigma(xi - x')^2 / n'\text{-}1$, and

$sxy = \Sigma(xi - x')(yi - y') / n'\text{-}1$

The dimensions of each habitat unit in each reach are given in Appendix 3b. The total area of each habitat type was calculated and used in the computation of fish densities (number of fish per m^2). The minimum detectable difference (δ) in mean numbers of fish in each habitat unit or reach was calculated using the previously calculated estimation of error with the equation:

$$\delta = \sqrt{\frac{V(yd,r)}{n}} \quad (t_{\alpha(2),v} + t_{\beta(1),v})$$

Where $v = n$-1

A significance level (α) of 0.05, and a statistical power β of 0.01 were specified for the analysis, to determine the smallest difference in mean numbers of fish that are detectable 90% of the time with a 95% significance level. The t values were read from tables depending on sample size.

5.4 Population estimates

Numbers of fish counted by snorkeling and captured by electro-fishing and minnow trapping are summarized in Table 11. Population estimates by habitat type and by reach are presented in Table 12 and illustrated in Figures 8A and B. Dolly Varden were found in all stream reaches, while cutthroat trout were only present in the lower stream reaches, below barrier falls, with the exception of Sweeny Creek where cutthroat trout were found in all reaches. Dolly Varden numbers were highest in Middle and Upper Sherman Creek and Upper Sweeny Creek, particularly in pools. Cutthroat numbers were highest in Lower Sweeny Creek followed by Lower Slate and Middle Sweeny.

Table 11: Numbers of resident fish observed snorkeling and captured fishing.

			Snorkeling			Electrofishing/Trapping		
				Numbers Observed			Numbers Captured	
Stream Reach	Habitat Type	Total Units (N) in stratum	Number of Units (n) snorkled	Dolly	Cutthroat	Number of Units (n') fished	Dolly	Cutthroat
Lower Sherman	Pool	35	26	10	13	8	4	7
	Riffle	12	7	1	5	4	1	2
	Glide	0	0	0	0	0	0	0
	All Units	**47**	**33**	**11**	**18**	**12**	**5**	**9**
Middle Sherman	Pool	70	55	73	0	10	18	0
	Riffle	13	7	11	0	4	7	0
	Glide	0	0	0	0	0	0	0
	All Units	**83**	**62**	**84**	**0**	**14**	**25**	**0**
Upper Sherman	Pool	69	59	73	0	14	17	0
	Riffle	21	9	6	0	4	3	0
	Glide	2	2	7	0	2	7	0
	All Units	**92**	**70**	**86**	**0**	**20**	**27**	**0**
Lower Johnson	Pool	33	22	30	2	10	18	1
	Riffle	19	7	4	1	5	2	1
	Glide	8	5	8	0	4	9	0
	All Units	**60**	**34**	**42**	**3**	**19**	**29**	**2**
Middle Johnson	Pool	57	40	55	0	17	41	0
	Riffle	17	7	0	0	4	0	0
	Glide	0	0	0	0	0	0	0
	All Units	**74**	**47**	**55**	**0**	**21**	**41**	**0**
Upper Johnson	Pool	40	34	34	0	16	28	0
	Riffle	13	12	9	0	8	6	0
	Glide	2	2	0	0	2	0	0
	All Units	**55**	**48**	**43**	**0**	**26**	**34**	**0**
Lower Slate	Pool	24	18	2	27	9	2	18
	Riffle	21	5	1	10	3	1	1
	Glide	5	5	1	6	4	1	4
	All Units	**50**	**28**	**4**	**43**	**16**	**4**	**23**
Middle Slate	Pool	38	29	0	0	8	0	0
	Riffle	12	9	2	0	8	3	0
	Glide	2	2	1	0	2	1	0
	All Units	**52**	**40**	**3**	**0**	**18**	**4**	**0**
Upper Slate	Pool	57	44	18	0	19	20	0
	Riffle	31	20	6	0	12	8	0
	Glide	2	2	2	0	2	2	0
	All Units	**90**	**66**	**26**	**0**	**33**	**30**	**0**
Lower Sweeny	Pool	48	41	0	78	8	0	21
	Riffle	26	12	0	12	4	0	8
	Glide	0	0	0	0	0	0	0
	All Units	**74**	**53**	**0**	**90**	**12**	**0**	**29**
Middle Sweeny	Pool	52	45	15	45	10	5	12
	Riffle	22	13	6	12	4	1	2
	Glide	2	2	4	5	2	6	5
	All Units	**76**	**60**	**25**	**62**	**16**	**12**	**19**
Upper Sweeny	Pool	57	44	69	24	10	18	9
	Riffle	16	8	4	1	4	5	1
	Glide	4	3	4	0	3	4	0
	All Units	**77**	**55**	**77**	**25**	**17**	**27**	**10**

Table 12: Resident Fish Population Estimates, 95% Confidence and Precision of Estimate.

Sherman Creek Dolly Varden				
	Habitat	**Population**	**Confid.**	**Precision**
Reach	**Type**	**Estimate**	**Interval**	**%**
Lower	Riffles	1.7	1.36	79.4
	Pools	26.9	8.00	29.7
	Glides	-	-	-
	All Units	**35.6**	**7.44**	**20.9**
Middle	Riffles	20.4	11.32	55.4
	Pools	92.9	4.33	4.7
	Glides	-	-	-
	All Units	**115.3**	**4.81**	**4.2**
Upper	Riffles	14.0	5.00	35.7
	Pools	120.9	5.53	4.6
	Glides	7.0	0.00	0.0
	All Units	**127.8**	**5.83**	**4.6**

Sweeny Creek Dolly Varden				
	Habitat	**Population**	**Confid.**	**Precision**
Reach	**Type**	**Estimate**	**Interval**	**%**
Lower	Riffles	-	-	-
	Pools	-	-	-
	Glides	-	-	-
	All Units	-	-	-
Middle	Riffles	10.2	1.13	11.1
	Pools	30.0	2.49	8.3
	Glides	6.0	0.00	0.0
	All Units	**42.2**	**4.44**	**10.5**
Upper	Riffles	11.4	4.12	36.1
	Pools	107.3	4.71	4.4
	Glides	5.3	2.82	52.9
	All Units	**105.0**	**6.15**	**5.9**

Slate Creek Dolly Varden				
	Habitat	**Population**	**Confid.**	**Precision**
Reach	**Type**	**Estimate**	**Interval**	**%**
Lower	Riffles	4.2	1.53	36.4
	Pools	2.7	1.08	40.4
	Glides	1.0	0.00	0.0
	All Units	**7.1**	**1.91**	**26.8**
Middle	Riffles	4.0	1.93	48.3
	Pools	0.0	0.00	-
	Glides	1.0	0.00	0.0
	All Units	**5.2**	**2.26**	**43.4**
Upper	Riffles	18.6	4.23	22.8
	Pools	51.8	7.91	15.3
	Glides	2.0	0.00	0.0
	All Units	**88.6**	**10.40**	**11.7**

Johnson Creek Dolly Varden				
	Habitat	**Population**	**Confid.**	**Precision**
Reach	**Type**	**Estimate**	**Interval**	**%**
Lower	Riffles	7.2	3.97	54.9
	Pools	54.0	5.41	10.0
	Glides	14.4	4.71	32.7
	All Units	**84.3**	**8.17**	**9.7**
Middle	Riffles	0.0	0.00	-
	Pools	84.6	13.11	15.5
	Glides	-	-	
	All Units	**93.4**	**14.89**	**15.9**
Upper	Riffles	8.4	2.28	27.3
	Pools	43.1	5.13	11.9
	Glides	0.0	0.00	-
	All Units	**52.3**	**6.57**	**12.6**

Cutthroat Trout				
	Habitat	**Population**	**Confid.**	**Precision**
Creek	**Type**	**Estimate**	**Interval**	**%**
Sherman	Riffles	8.6	3.11	36.2
Lower	Pools	20.4	4.09	20.0
	Glides	-	-	-
	All Units	**28.8**	**4.06**	**14.1**
Johnson	Riffles	2.7	1.69	62.4
Lower	Pools	3.0	0.88	29.3
	Glides	0.0	0.00	-
	All Units	**8.8**	**1.42**	**16.1**
Slate	Riffles	21.0	3.74	17.8
Lower	Pools	38.1	2.60	6.8
	Glides	6.0	0.00	0.0
	All Units	**80.3**	**5.26**	**6.6**

Sweeny Creek Cutthroat				
	Habitat	**Population**	**Confid.**	**Precision**
Reach	**Type**	**Estimate**	**Interval**	**%**
Lower	Riffles	41.6	9.58	23.0
	Pools	115.6	7.21	6.2
	Glides	-	-	-
	All Units	**168.8**	**9.53**	**5.6**
Middle	Riffles	20.3	2.26	11.1
	Pools	60.0	3.46	5.8
	Glides	5.0	0.00	0.0
	All Units	**78.5**	**3.63**	**4.6**
Upper	Riffles	2.0	1.22	61.2
	Pools	40.0	3.21	8.0
	Glides	0.0	0.00	-
	All Units	**43.8**	**3.30**	**7.5**

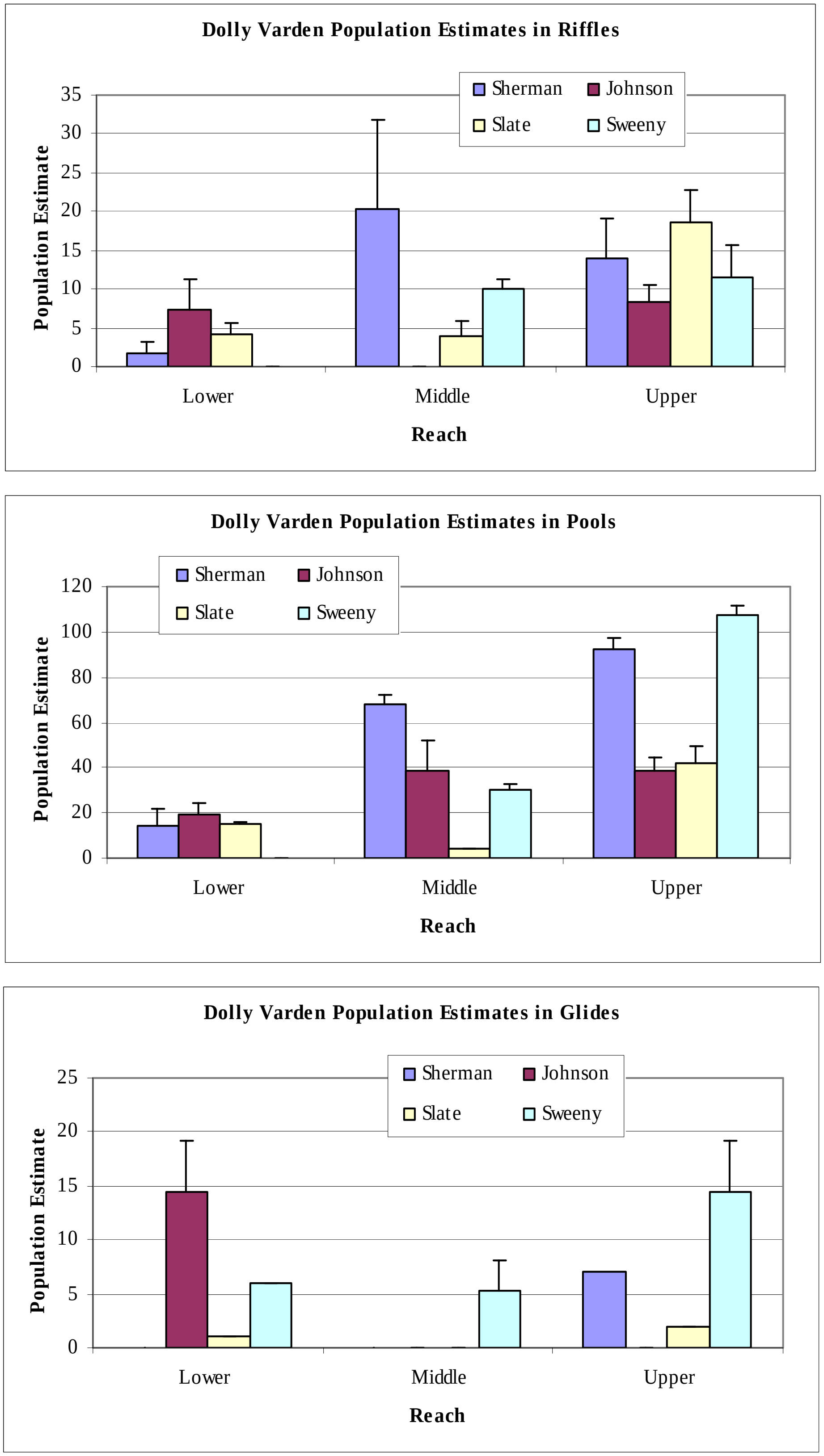
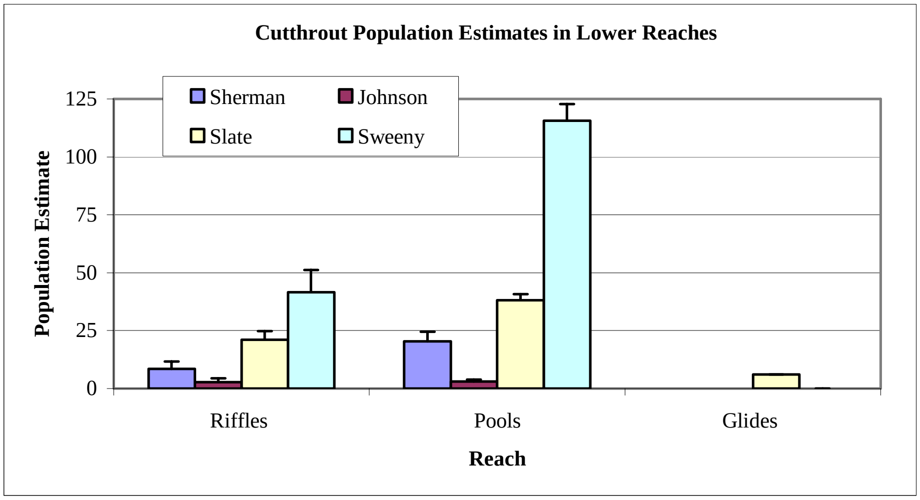
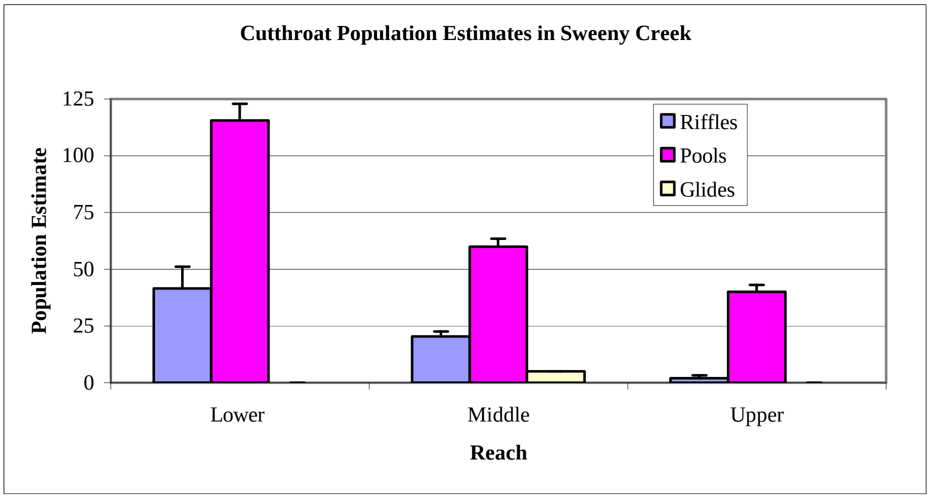


Figure 8A: Dolly Varden Population Estimates by Habitat Type.





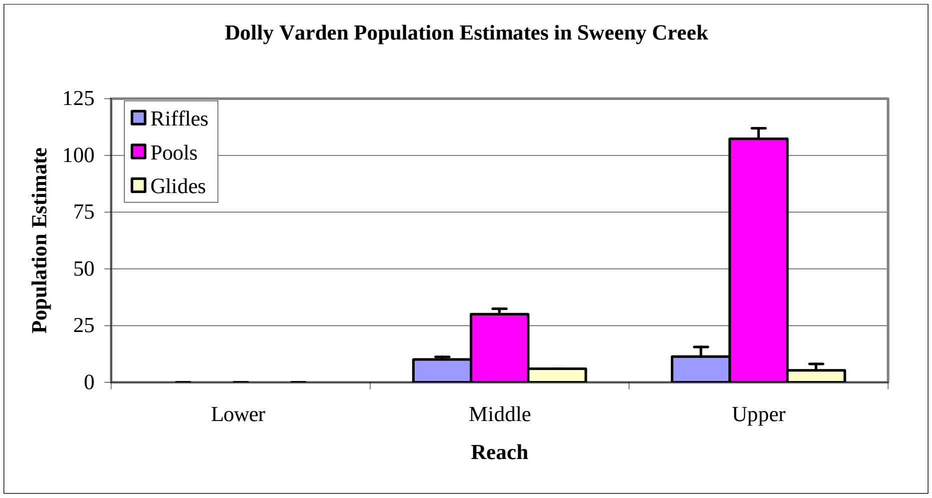


Figure 8B: Cutthroat Estimates and Resident Fish in Sweeny Creek.

Comparison of Dolly Varden numbers over time (Figures 9A, B) showed that numbers appeared to be slightly higher in 2008 in all reaches of Sherman Creek and in Lower and Middle Johnson than 2007. Numbers of Dolly Varden were slightly lower in Lower and Middle Slate Creek in 2008, but the number of cutthroats was still high and the number of total fish (Dolly Varden plus cutthroat trout together) was similar to previous years. Fish are able to move in and out of lower reaches via the stream mouth, which may explain changes in numbers of Dolly Varden and cutthroats in lower reaches over time. Fish may move in and out of lower reaches in response to changing stream flows or food availability. A large flood event in November 2005 followed by severe winter of 2006 may also have affected numbers in lower reaches. There is also natural variability in the population from year to year as well as differences in the numbers detected by snorkeling and electro-fishing, which in turn may be affected by differences in stream flow and temperature at the time of sampling.

The 50 Dolly Varden captured by electro-fishing and minnow trapping in the three reaches of Sherman Creek represented 17.9% of the total estimated Dolly Varden population of the three Sherman Creek reaches surveyed. The 6 cutthroat trout captured in Lower Sherman represented 20.7% of the estimated Sherman Creek cutthroat population. The 31 Dolly Varden captured in Sweeny Creek comprised 21.1% of the estimated Dolly Varden population there. The 88 Dolly Varden captured in Johnson Creek represented 38.3% of the estimated population of Johnson Creek. Only 1 cutthroat trout was captured in Lower Johnson, representing 11.1% of the total estimate. The 45 Dolly Varden captured in Slate Creek comprised 44.5% of the Slate Creek population estimate and the 12 cutthroats captured represented 15.0% of the Lower Slate population. Counts of fish observed by snorkeling and captured by electro-fishing and minnow trapping in each habitat unit are presented in Appendix 3c.

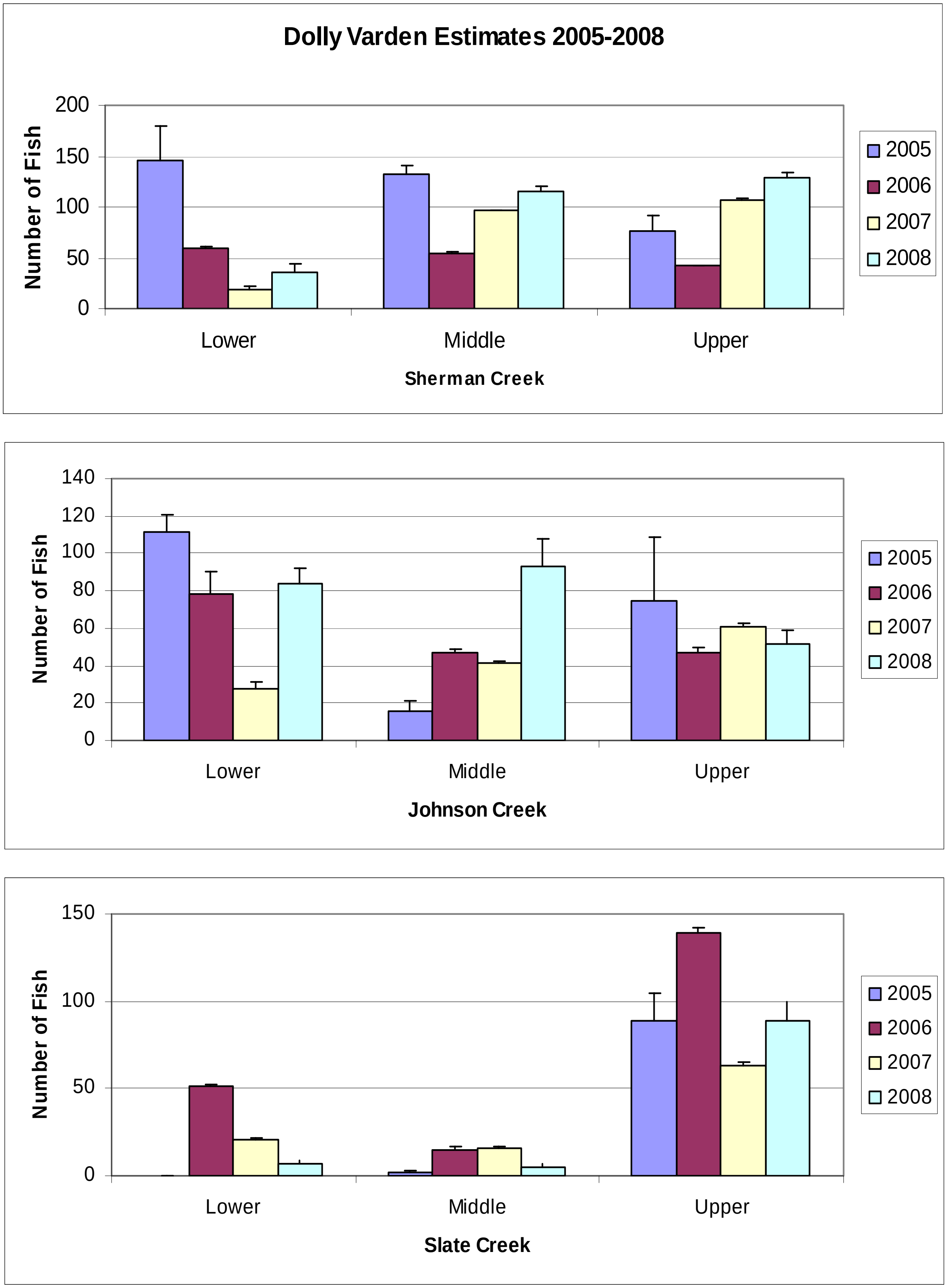
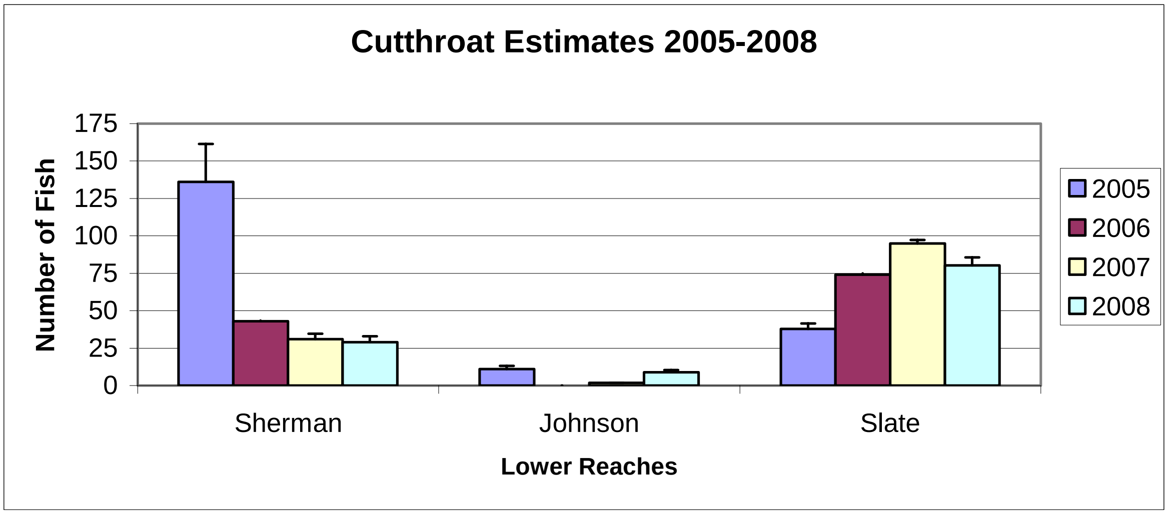


Figure 9A: Comparison of Dolly Varden numbers over time, 2005 to 2008.



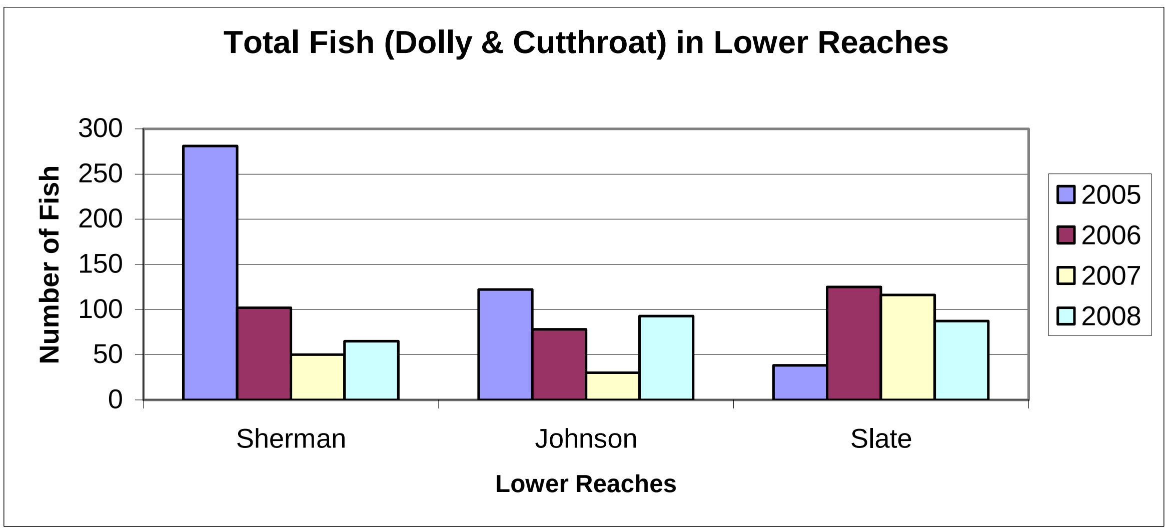


Figure 9B: Comparison of cutthroat trout and total fish numbers over time.

5.5 Minimum detectable differences in mean numbers of fish.

Mean numbers of fish in each habitat unit were used to compute hypothetical minimum detectable differences that could be detected for each mean. Table 13 gives the mean number of fish in each habitat type and the minimum detectable difference (MDD) resulting from comparing habitat types in each stream reach. A difference in means of 1 to 2 fish per habitat unit was detectable for Dolly Varden in most habitat types with the exception of Middle Sherman riffles (MDD = 7 fish) and Middle Johnson pools (MDD = 3 fish). In these reaches, a difference in mean number of fish per unit of three or more fish would be required before the change could be detected in the data. Results were similar for cutthroat trout with the exception of Lower Sweeny riffles (4 fish).

These habitats showed greater variability in numbers of fish with, for example, some pools containing as many as 28 fish, but other pools nearby having none. Glide habitat was limited, restricting the number of units that could be surveyed. The ability to detect small differences in numbers of fish is important in detecting changes in the population from year to year.

Figure 10: Cutthroat trout captured in Middle Sweeny Creek, August 2008.

Table 13: Mean number of Dolly Varden per habitat type and minimum detectable differences (MDD).

Sherman Creek Dolly Varden				Sweeny Creek Dolly Varden			
Reach	**Habitat Unit**	**Mean # Fish**	**MDD**	**Reach**	**Habitat Unit**	**Mean # Fish**	**MDD**
Lower	Riffles	0.143	0.817	**Lower**	Riffles	-	-
	Pools	0.769	2.239		Pools	-	-
	Glides	-	-		Glides	-	-
	All Units	**0.758**	1.969		**All Units**	-	-
Middle	Riffles	1.571	6.796	**Middle**	Riffles	0.46	0.348
	Pools	1.327	0.851		Pools	0.58	0.586
	Glides	-	-		Glides	3.00	0.000
	All Units	**1.389**	0.933		**All Units**	**0.56**	0.887
Upper	Riffles	0.667	2.521	**Upper**	Riffles	0.71	1.851
	Pools	1.753	1.099		Pools	1.88	1.042
	Glides	3.500	0.000		Glides	1.33	2.390
	All Units	**1.389**	1.050		**All Units**	**1.36**	1.304

Slate Creek Dolly Varden				Johnson Creek Dolly Varden			
Reach	**Habitat Unit**	**Mean # Fish**	**MDD**	**Reach**	**Habitat Unit**	**Mean # Fish**	**MDD**
Lower	Riffles	0.200	1.303	**Lower**	Riffles	0.38	2.101
	Pools	0.111	0.380		Pools	1.64	1.735
	Glides	0.200	0.000		Glides	1.80	2.853
	All Units	**0.143**	0.695		**All Units**	**1.41**	2.229
Middle	Riffles	0.333	1.008	**Middle**	Riffles	0.00	0.000
	Pools	0.000	0.000		Pools	1.48	3.254
	Glides	0.500	0.000		Glides	-	-
	All Units	**0.100**	0.563		**All Units**	**1.26**	3.451
Upper	Riffles	0.600	1.472	**Upper**	Riffles	0.64	0.993
	Pools	0.909	1.884		Pools	1.08	1.380
	Glides	1.000	0.000		Glides	0	0.000
	All Units	**0.985**	2.069		**All Units**	**0.95**	1.524

Cutthroat Trout				Sweeny Creek Cutthroat			
Creek	**Habitat Unit**	**Mean # Fish**	**MDD**	**Reach**	**Habitat Unit**	**Mean # Fish**	**MDD**
Sherman	Riffles	0.714	1.434	**Lower**	Riffles	1.60	4.027
Lower	Pools	0.583	1.145		Pools	2.41	1.603
	Glides	-	-		Glides	-	-
	All Units	**0.614**	1.060		**All Units**	**2.28**	1.987
Johnson	Riffles	0.143	1.018	**Middle**	Riffles	0.92	0.696
Lower	Pools	0.091	0.282		Pools	1.15	0.815
	Glides	0.000	0.000		Glides	2.50	0.000
	All Units	**0.147**	0.388		**All Units**	**1.03**	0.726
Slate	Riffles	1.000	1.677	**Upper**	Riffles	0.13	0.668
Lower	Pools	1.588	0.917		Pools	0.70	0.711
	Glides	1.200	0.000		Glides	0	0.000
	All Units	**1.606**	1.913		**All Units**	**0.57**	0.693

5.6 Fish density

Due to differences in the size of habitat areas sampled, population estimates were converted to numbers of fish per unit area for comparisons between reaches and habitat types. Dolly Varden density was highest in upper reaches where there is less habitat area available so fish are more concentrated (Table 14). Sweeny Creek had the highest fish densities, perhaps due to the abundance of deep pools and lack of barriers to fish migration (Figure 11). The lowest densities were observed in Middle Slate, which contains numerous impassable, bedrock cascades. The highest density of cutthroat trout was found at Lower Sweeny, where no Dolly Varden were observed. There is evidence from literature that Dolly Varden densities are suppressed when stream habitat is shared with cutthroat trout. *Oncorhynchus* (salmon and trout) tend to outcompete *Salvelinus* (char e.g. Dollys) when both are present (Hinder et al 1988, Hastings 2005). Densities of Dolly Varden in Sherman, Slate and Johnson Creeks were also lower in the reaches where cutthroat were present.

Table 14: Densities of fish by species, reach and habitat type.

Fish Density (number of fish/m^2)									
		Dolly Varden				Cutthroat Trout			
Creek	**Strata**	**Riffles**	**Pools**	**Glides**	**All**	**Riffles**	**Pools**	**Glides**	**All**
Sherman	Lower	0.001	0.036	-	**0.009**	0.005	0.052	-	**0.015**
	Middle	0.011	0.268	-	**0.055**				
	Upper	0.014	0.309	0.264	**0.115**				
Johnson	Lower	0.005	0.103	0.068	**0.035**	0.002	0.011	0.000	**0.003**
	Middle	0.000	0.160	-	**0.045**				
	Upper	0.023	0.140	0.000	**0.067**				
Slate	Lower	0.002	0.013	0.009	**0.004**	0.008	0.148	0.046	**0.036**
	Middle	0.007	0.000	0.016	**0.006**				
	Upper	0.029	0.257	0.167	**0.086**				
Sweeny	Lower	0.000	0.000	-	**0.000**	0.022	0.159	-	**0.077**
	Middle	0.008	0.040	0.125	**0.025**	0.016	0.113	0.125	0.055
	Upper	0.015	0.212	0.077	**0.094**	0.003	0.080	0.000	0.032

Table 15: Densities of Dolly Varden and Cutthroat Combined.

Fish Density (# of fish/m^2)					
		Dolly Varden and Cutthroat			
Creek	**Reach**	**Riffles**	**Pools**	**Glides**	**All Units**
Sherman	Lower	0.007	0.088	-	**0.024**
	Middle	0.011	0.268	-	**0.055**
	Upper	0.014	0.309	0.264	**0.115**
Johnson	Lower	0.006	0.114	0.068	**0.038**
	Middle	0.000	0.160	-	**0.045**
	Upper	0.023	0.140	0.000	**0.067**
Slate	Lower	0.010	0.161	0.056	**0.040**
	Middle	0.007	0.000	0.016	**0.006**
	Upper	0.029	0.257	0.167	**0.086**
Sweeny	Lower	0.022	0.159	-	**0.077**
	Middle	0.024	0.152	0.249	**0.080**
	Upper	0.019	0.292	0.077	**0.126**

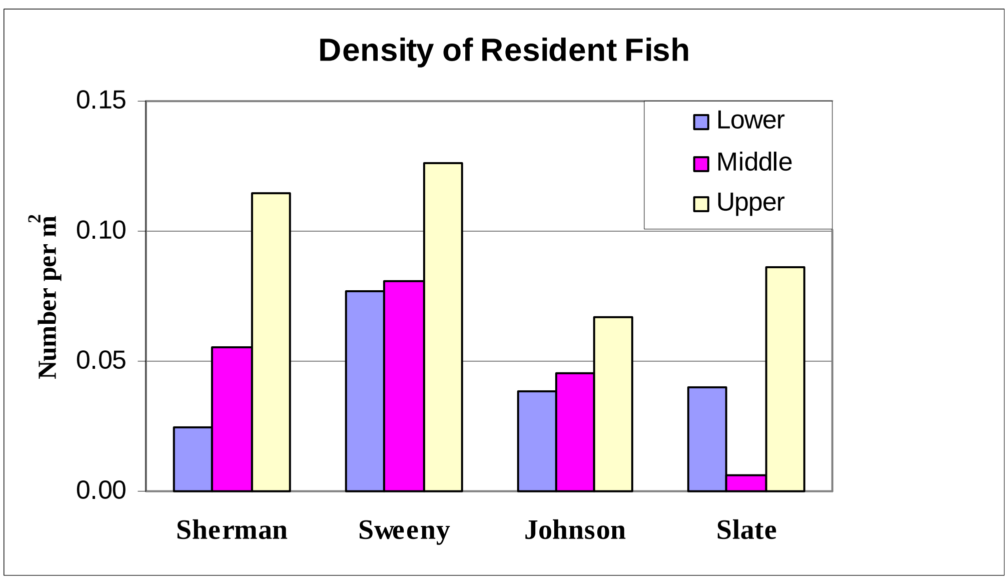
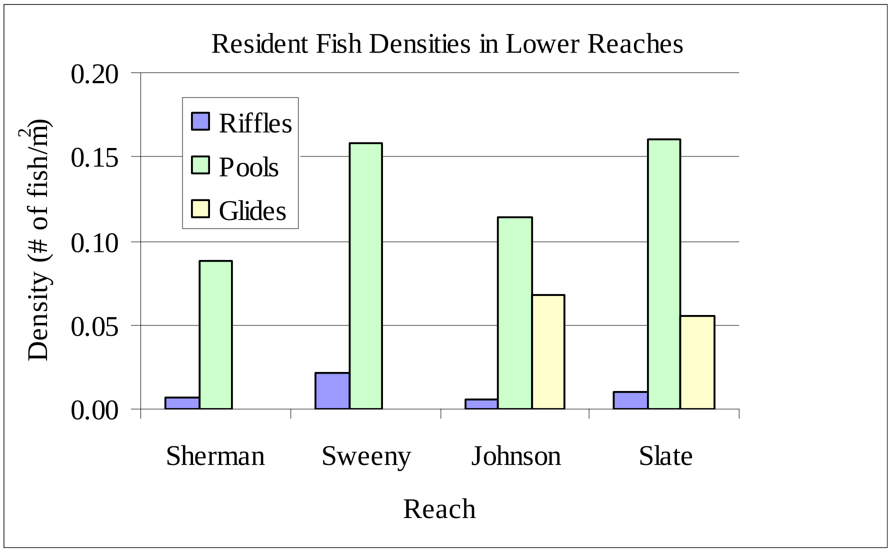
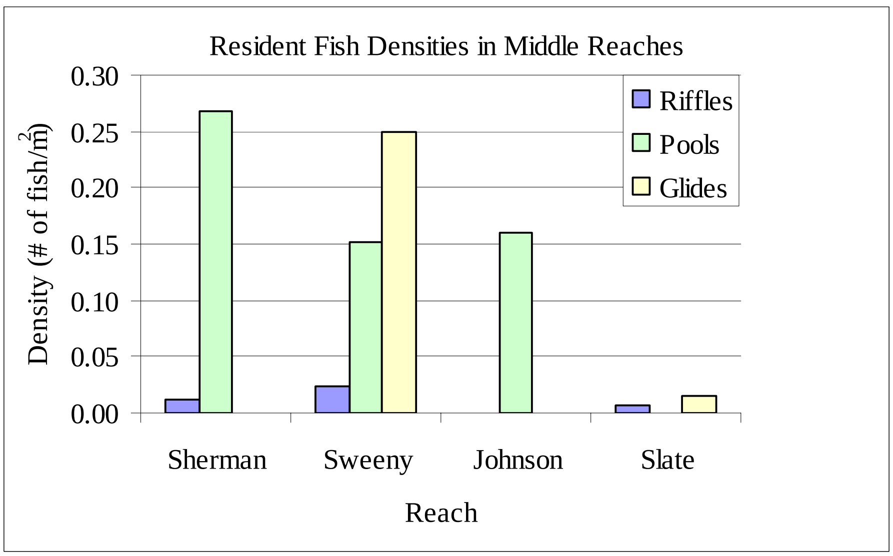


Figure 11: Densities of Resident Fish in Sherman, Sweeny, Johnson and Slate Creeks.

Both Dolly Varden and cutthroat density was much higher in pools and glides compared to riffles (Figure 12). Upper Sweeny and Upper Sherman showed the highest pool and overall densities. Densities of both fish species tended to be highest in pool habitat and increased from downstream to upstream as habitat areas are smaller in upper reaches.





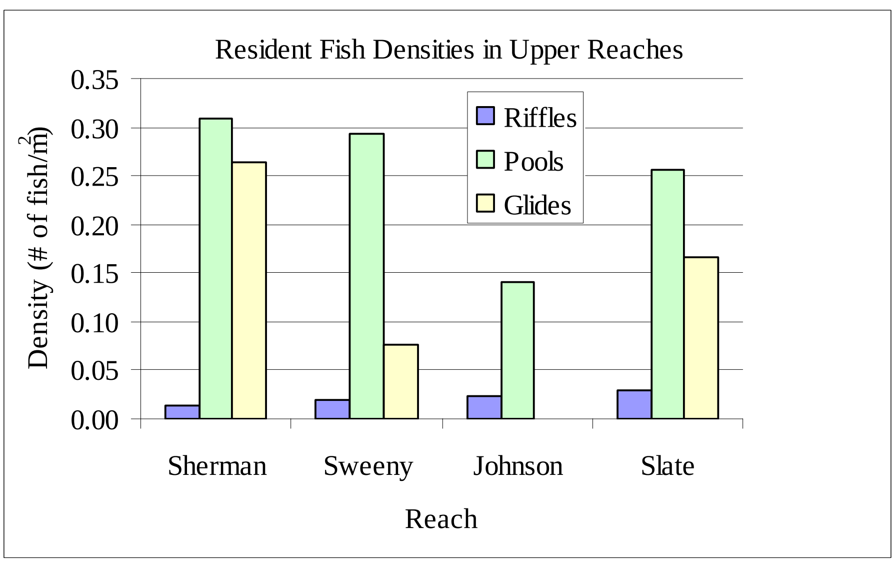


Figure 12: Resident Fish Densities by Habitat Type.

5.7 Fish condition

Fish condition is an index based on the ratio of fish length to weight and was determined from field measurements of fish captured by electro-fishing and minnow trapping. The histograms in Figure 12 show the size range of fish captured in each creek. The largest Dolly Varden was found in Upper Sweeny Creek and measured 311mm and 264g. The largest Cutthroat was found in Middle Sweeny and was 185mm and 63.2g. A large number of small Dolly Varden were captured in Upper Slate Creek, which provides a nursery and spawning area for the upper lake. Lengths and weights of fish were used to calculate Fulton's condition factor (K) using the equation given in Anderson & Neumann (1996):

$$K = W/L^3 \times 10{,}000$$

W = weight in g; L = total length in mm

The length, weight and condition factor of each fish are presented in Appendix 3d. Mean condition factors by stream reach are presented in Table 16 and Figure 13. Condition of Dolly Varden appeared slightly higher in Lower and Upper Sherman and Upper Johnson than other reaches, but the differences are not significant (95% level). Cutthroats had significantly greater condition in Lower Sweeny than Lower Johnson (only one captured) and Lower Slate perhaps due to the lack of competing Dolly Varden in Lower Sweeny. Both cutthroat and Dolly Varden showed fairly high condition in Lower Sherman, but density of both species was relatively low perhaps reducing competition for food there.

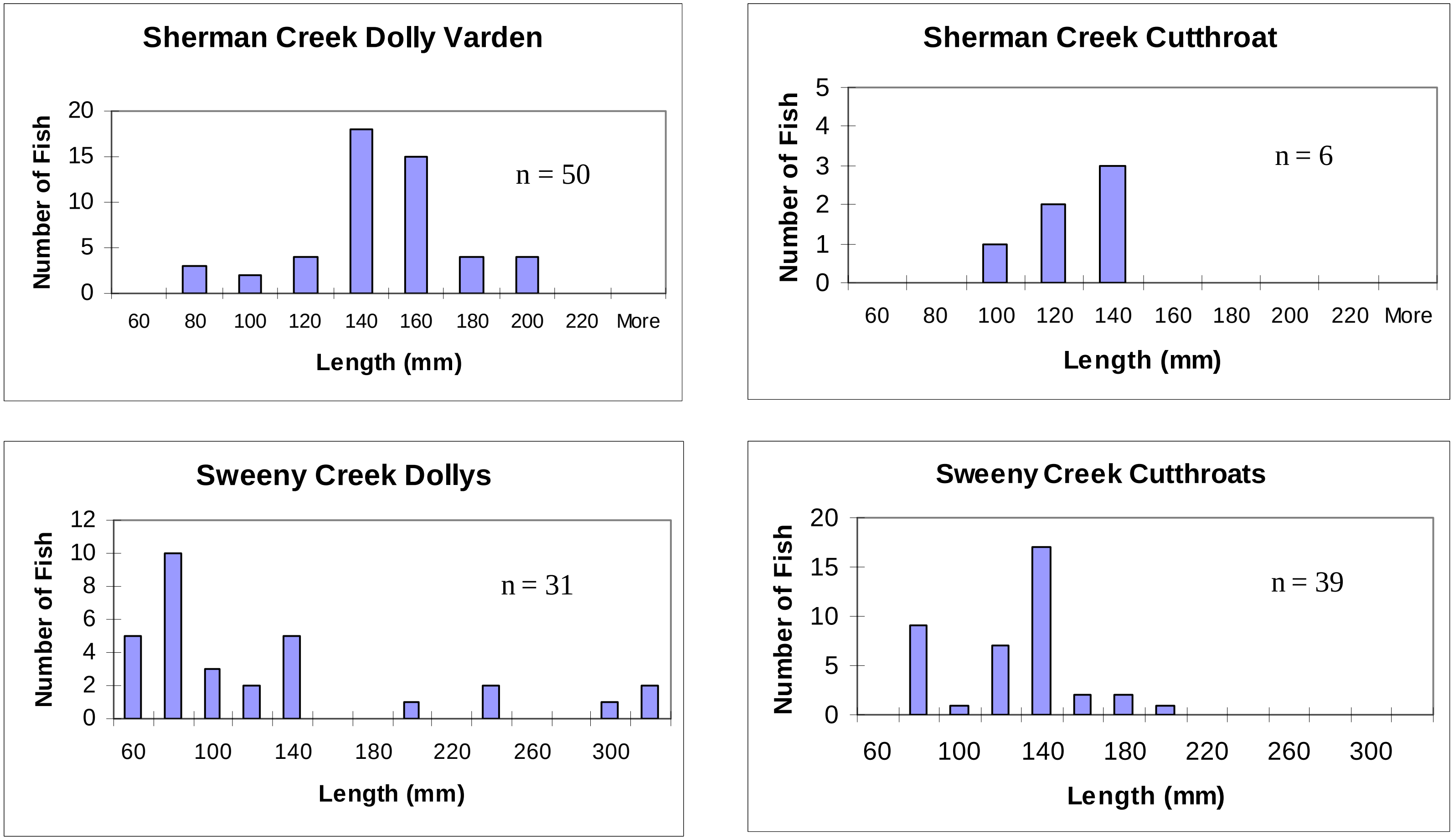
Table 16: Mean condition factor of Dolly Varden and cutthroats by reach.

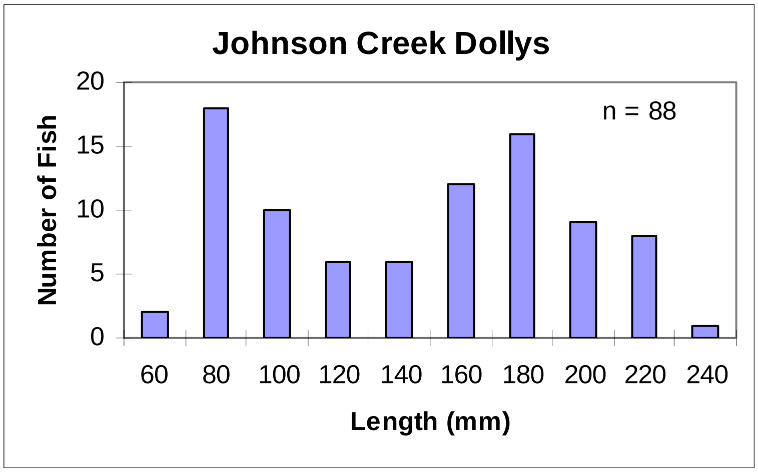
		Sherman		Sweeny	
Species	**Reach**	**Mean K**	**95% C.I.**	**Mean K**	**95% C.I.**
Dolly Varden	**Lower**	0.902	0.063	na	na
	Middle	0.852	0.048	0.834	0.038
	Upper	0.916	0.025	0.881	0.059
Cutthroat	**Lower**	0.899	0.103	0.912	0.035
	Middle	na	na	0.875	0.045
	Upper	na	na	0.868	0.031

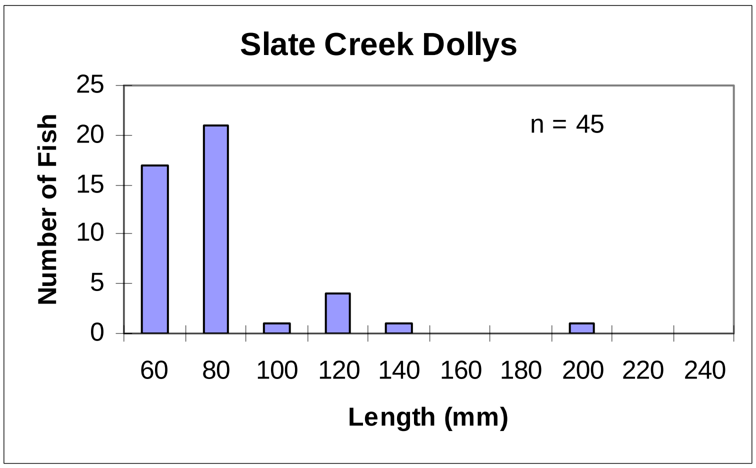
		Johnson		Slate	
Species	**Reach**	**Mean K**	**95% C.I.**	**Mean K**	**95% C.I.**
Dolly Varden	**Lower**	0.865	0.125	0.764	0.077
	Middle	0.849	0.030	0.870	0.019
	Upper	0.918	0.109	0.852	0.054
Cutthroat	**Lower**	0.744	na[1]	0.806	0.041
	Middle	na	na	na	na
	Upper	na	na	na	na

na[1] = only one fish caught

Figure 12: Length-frequency histograms for Dolly Varden and cutthroat trout captured in Sherman, Sweeny, Johnson and Slate Creeks in 2008.







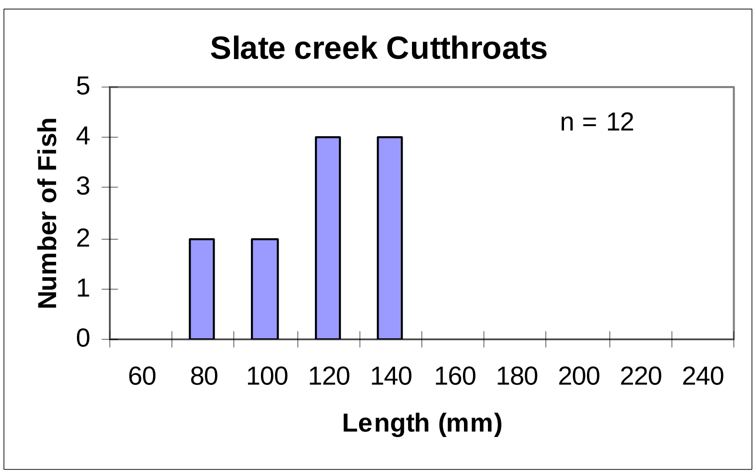
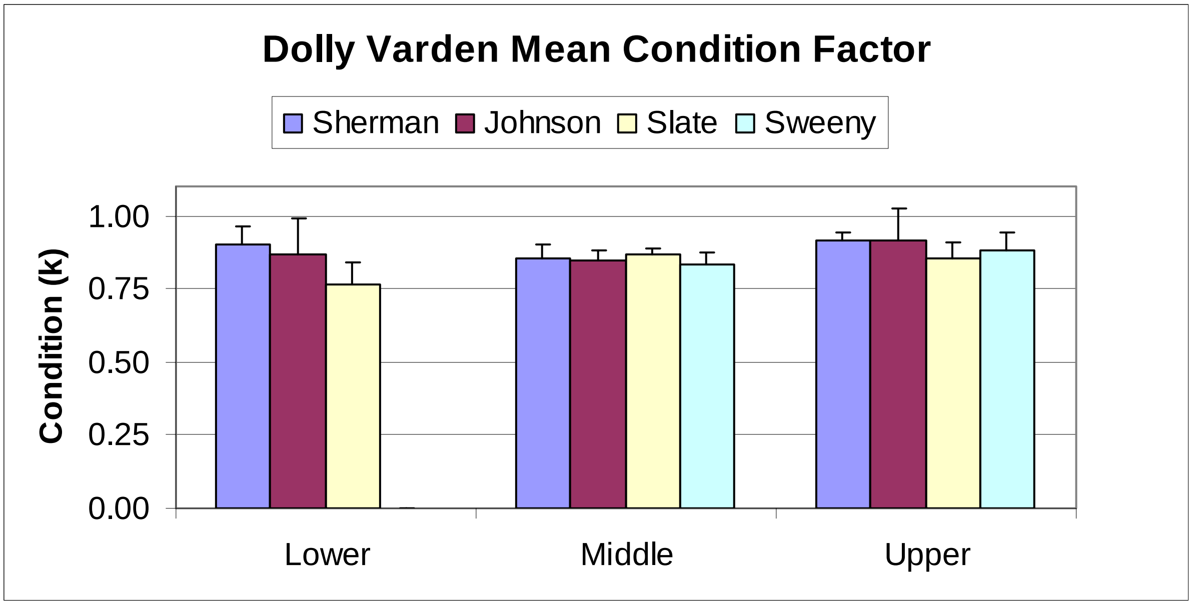


Figure 12: Histograms continued.



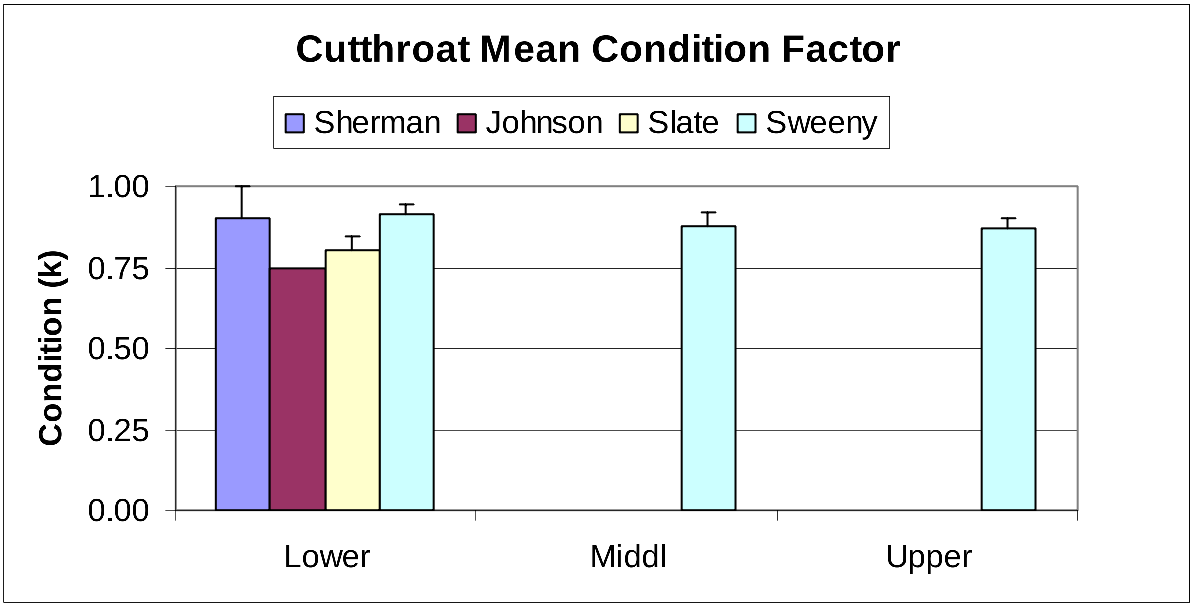
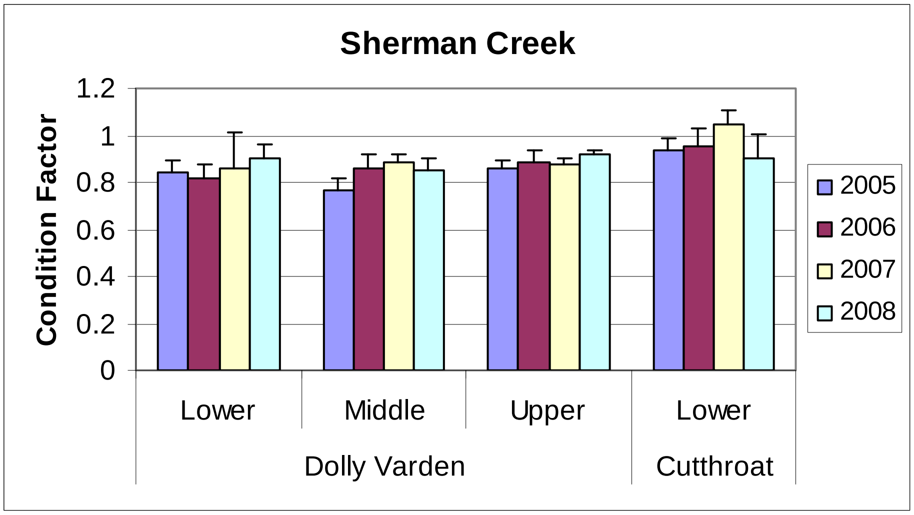
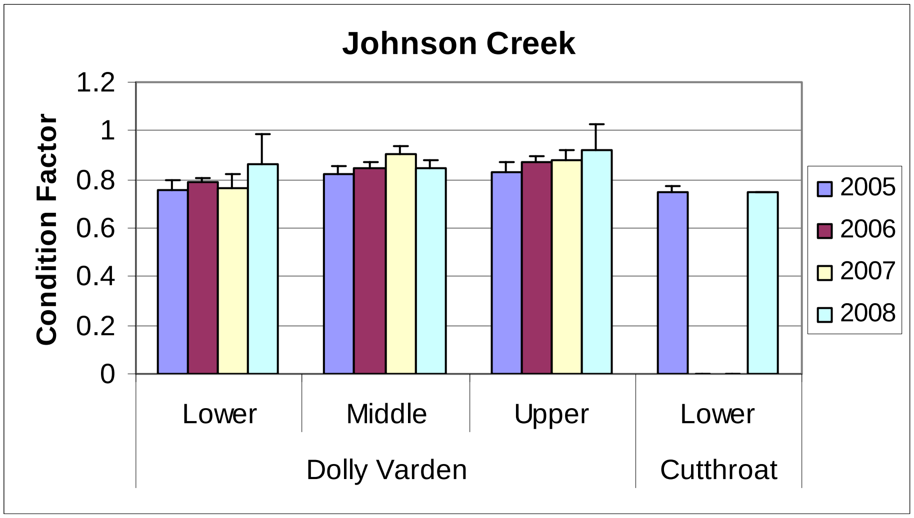


Figure 13: Mean Condition Factor of fish captured by electro-fishing in 2008.

Comparison with previous years did not reveal any significant changes in mean condition factor (Figure 14). Dolly Varden condition appeared higher in Upper Sherman in 2008, but was not significantly different in other reaches. Cutthroat condition was not significantly different from previous years at all sites.





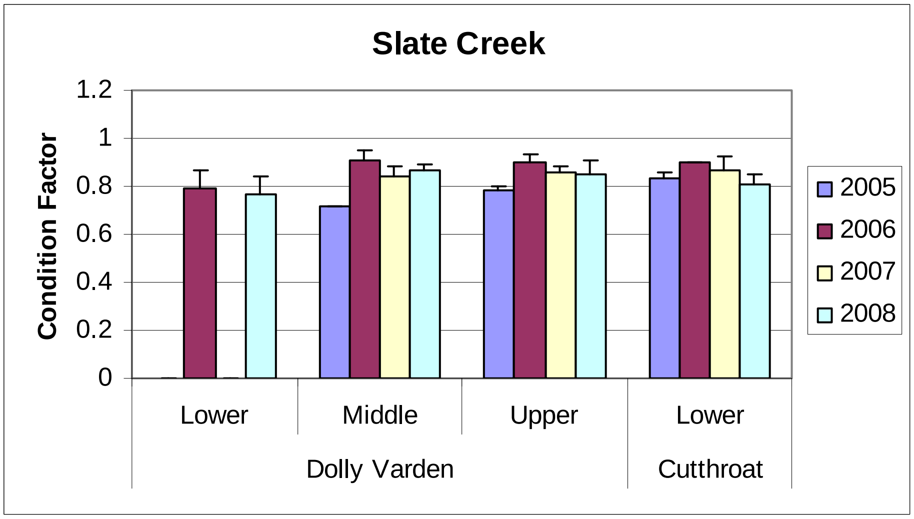


Figure 14: Comparison of mean condition factor from 2005 to 2008.

6.0 Anadromous Fish Monitoring

6.1 Pink Salmon Ecology

Pink salmon, also known as humpbacks or humpies for the exaggerated dorsal hump that develops in mature males, are the most abundant salmon species and also the smallest (about 2kg) at maturity. All pink salmon migrate to sea, are 2 years old at maturity and all die after spawning. This results in odd-year and even-year populations that do not interbreed (Quinn 2005). Around Southeast Alaska, even-year populations are generally larger than odd years. The differences between odd and even year populations may have originated during the last ice age when ice cover resulted in two distinct populations at northern (even) and southern (odd) glacial refuges. Odd-year populations are generally larger in the southern part of their range, perhaps being better adapted to warmer water.

Adult pink salmon migrate into coastal streams to spawn from July through September. Pink salmon tend to spawn closer to the ocean than other species, although when large numbers of salmon return at the same time, accessible sites further upstream will be utilized. Fertilized eggs are buried in a nest or redd of gravel that is dug and guarded by the female for 10-13 days after construction (Heard 1991). The embryos develop over the fall and winter and fry emerge from the gravel between the end of March and beginning of June, predominately at night and immediately migrate downstream to the ocean. The night migration is considered to be an avoidance of predator adaptation (Godin 1980). At emergence, pink salmon fry are fully adapted for seawater and migrate directly to sea, making essentially no use of freshwater for rearing. Overall freshwater survival of pink salmon from egg to emergent fry averages 11.5% (Quinn 2005).

6.2 Trapping Procedures

Previous studies on Sherman and Sweeny Creeks used a fence trap system followed by fyke nets (EVS 1998, 2000, Coeur Alaska Annual Report 2005-2007). Fence traps set across the entire stream channel resulted in high mortality, particularly at times of high flow, due to fish being impinged against wire mesh by the current. Fyke nets have been more successful with much lower mortality since only a portion of the stream was sampled and the angle of the net against the flow was much reduced.

Due to the distance between streams and the necessity of checking traps daily, two teams of field personnel are required to conduct the study. In 2008, Sherman Creek was accessed by one team traveling through the mine tunnel from Jualin Camp, approximately 5 miles away, while a second team accessed Johnson Creek via a trail from the Jualin road at mile 3, and Slate Creek via kayak from the Slate Cove dock (Figure 1). Fyke nets with adjustable wings constructed from 1/8 inch mesh were used to trap out-migrating salmon fry at each creek (Figure 15A). The width of each net opening was adjusted according to stream flow from 4 to 11 feet across by deploying the wings. The larger the proportion of stream sampled, the more accurate the population estimate should be, however, at high flow the pressure of water on the net wings when fully deployed resulted in some mortality of fry. The nets were therefore adjusted daily to minimize mortality as the flow increased or decreased. The percentage of stream flow sampled by the nets was estimated each day.

One net was set in Johnson Creek on April 1, 2008, about 100m from the confluence with the Lace River (Figure 1). A net was set in Slate Creek on April 5, about 25m above mean high water. The Sherman Creek net was set on April 8, approximately 50m upstream of the creek mouth at mean high water. The GPS co-ordinates of each trap are given in Table 17. Each net was attached to a live holding box that contained a partition to deflect the flow and allow fry to pass underneath to a compartment of low flow (Figure 15B). The live boxes were made of perforated aluminum and had adjustable legs that could be raised or lowered with stream flow so that moderate flow could be maintained inside the box.

6.3 Physical Data Collection

Water temperature and stream discharge were monitored throughout the sampling period on each stream by data-logging units that recorded measurements every 15 minutes. On Sherman Creek the data-logger was adjacent to the net; on Johnson and Slate Creeks the data-loggers were over 1km upstream, but still gave an indication of changes in flow and temperature when combined with measurements near the nets. Physical measurements of stream discharge were made at least once a week using a Pygmy flow meter. Measurements were taken at 12 to 15 intervals across the stream. Water level (stage) was also measured daily from a staff gauge in each stream. A stage-discharge relationship was developed to allow estimation of stream discharge on those days when it was not measured directly.

Figure 15A: Fyke net and live holding box in Sherman Creek.

Figure 15B: Salmon fry inside the holding box.

Stream	GPS Co-ordinates (NAD27 Alaska)
Sherman	N 58.86908 W 135.14005
Johnson	N 58.82383 W 134.99936
Slate	N 58.79628 W 135.03716

Table 17: GPS Co-ordinates of the trap sites at each stream.

6.4 Fish Data Collection

Prior to the beginning of field operations, a Fish Resource Permit was obtained from the Alaska Department of Fish and Game (Appendix 4a) which authorized sampling fish in each creek. In addition, Coeur Alaska holds a Fish Habitat Permit from the Alaska Department of Natural Resources permitting use of a trap structure in each stream (Appendix 4b).

The outmigration count began at Johnson Creek on April 2, Slate Creek on April 5 and Sherman Creek on April 9 and continued until negligible numbers of fish were being captured. Sampling was halted on May 11 at Slate Creek, May 25 at Sherman Creek and May 29 at Johnson Creek. Traps were visited daily to count and remove fish and clean any debris from nets. Before conducting the counts, a general assessment of the flow, debris accumulation, and number of dead fish in the traps was performed. Fish were scooped out of the holding box using 4 by 6 inch hand nets, identified using a field guide (Pollard et al 1997) and released back into the stream. Numbers of each fish species trapped were recorded every day.

6.5 Mark-Recapture Trials

Since fish are not randomly or evenly distributed within streams, estimates of total counts cannot be based simply on the percent of total discharge being sampled by the nets. The total number of daily migrants was estimated by firstly capturing and marking individuals from the migrating population, releasing marked fish upstream of the trap, and then re-sampling to determine what fraction of the total number caught are marked. This allowed calculation of the sampling efficiency of the nets in terms of the number of fish caught in the net verses the number passing by downstream.

Mark-recapture trials were conducted every 3-4 days to determine the total number of out-migrating fry based on the ratio between marked and unmarked individuals. Repeated trials were conducted since trap efficiency is likely to vary with fluctuating stream flow, with fish having less chance of capture at higher flows. The trials were separated by at least three days to avoid capturing marked fish from an earlier marking episode. Bismark Brown Y dye was used to mark fry because it is easily visible amongst large numbers of fish, does not harm fish, and is fast and simple to apply. Fish were immersed for 10 minutes in 1.5 gallons of water in which 0.6g of dye had been dissolved. A battery operated aerator was placed in the water with the fry to ensure they had sufficient oxygen. After immersion, fish were transferred to a container of fresh water for a few minutes to recover from the staining process and released approximately 30 to 50 m upstream of the nets. Marked fish were released by spreading them evenly across the current. Many marked fish were found in the live holding box immediately after release, so these were counted and released downstream the same day.

The number of fish marked depended on numbers initially captured each day. Ten mark-recapture trials were conducted at Slate Creek and fifteen at Johnson and Sherman Creeks with 100 to 150 fish marked (if available) on each occasion (Table 14). A few marking events resulted in a very low percentage of fish being recaptured in the holding boxes. Events with less than 5% of marked fish recaptured were not included in the population estimation.

6.6 Calculation of Population Estimate

The total daily number of outmigrating pink salmon fry was calculated using the ratio of marked to unmarked fish captured in the net. Marking experiments were conducted every 3 days and an average recapture rate calculated for every two successive experiments. The average recapture rate was then applied to the actual numbers captured each day. For example, at Sherman Creek on April 20, 150 marked fish were released and 72 were recaptured (48% of total released) while on April 24, 150 marked fish were released and 36 fish were captured (24%). The average of these two catch rates is 36%. A catch of 2466 fish on April 23 divided by 0.36 gives a total estimate of 6850 fish for that day. The estimated total catch was calculated in this way for each day and then a final total summed for the entire survey period. The actual recapture rates for the first and last trials were used to estimate fish numbers at the beginning and end of the study respectively.

6.7 Physical Data

Mean daily water temperature of Sherman Creek was 2 to 2.5 ^{o}C in the first part of April. By the time the transducer was working on May 21 it was 3.5 ^{o}C and increased to 4.5 ^{o}C by May 28 (Figure 18). Johnson Creek was also around 2.5 ^{o}C for the first three weeks of April, and increased to 4^{o}C during last week of May. Johnson Creek seems strongly influenced by groundwater that maintains a fairly even temperature year-round. Slate Creek showed a more dramatic change from less than 1^{o}C during April to over 6^{o}C by the end of May, coinciding with ice on the lakes melting then the larger surface area of lake water warming up.

Stage-discharge relationships were developed for each stream based on manual discharge measurements and staff gage readings near the fyke nets. These relationships were then used to calculate discharge for each day of the fry study (Figure 19). The flow at each creek was low at the beginning of the April, with Sherman Creek at around 5cfs, Johnson around 10cfs and Slate in between 5 and 10cfs. Rainfall events of more than 20mm occurred around April 12, April 28 and May 10, increasing flows sharply at each creek. Flows increased with rainfall to around 50cfs at Johnson Creek and around 30 cfs at Sherman and Slate Creeks. Flow was around 100cfs at both Johnson and Sherman around May 16 when rainfall exceeded 40mm in two days. At Johnson Creek flow exceeded 100 cfs during the last week of May, likely due to snowmelt associated with clear, sunny weather. At Slate Creek flow never exceeded 40 cfs before the study ended on May 11. The lakes upstream likely help to buffer high flow events at Lower Slate Creek.

The proportion of the flow sampled by the nets varied with discharge and creek, affecting the number of salmon fry captured. At Sherman Creek around 12% of the flow was sampled at high flow to around 50% at low flow. At Slate Creek only around 20% of the flow was sampled during high flow and 60% at low flow. At Johnson Creek 15-40% of the flow was sampled. High flow may either flush out more salmon fry from the gravel or result in a lower catch because the net had to be moved out of main channel.

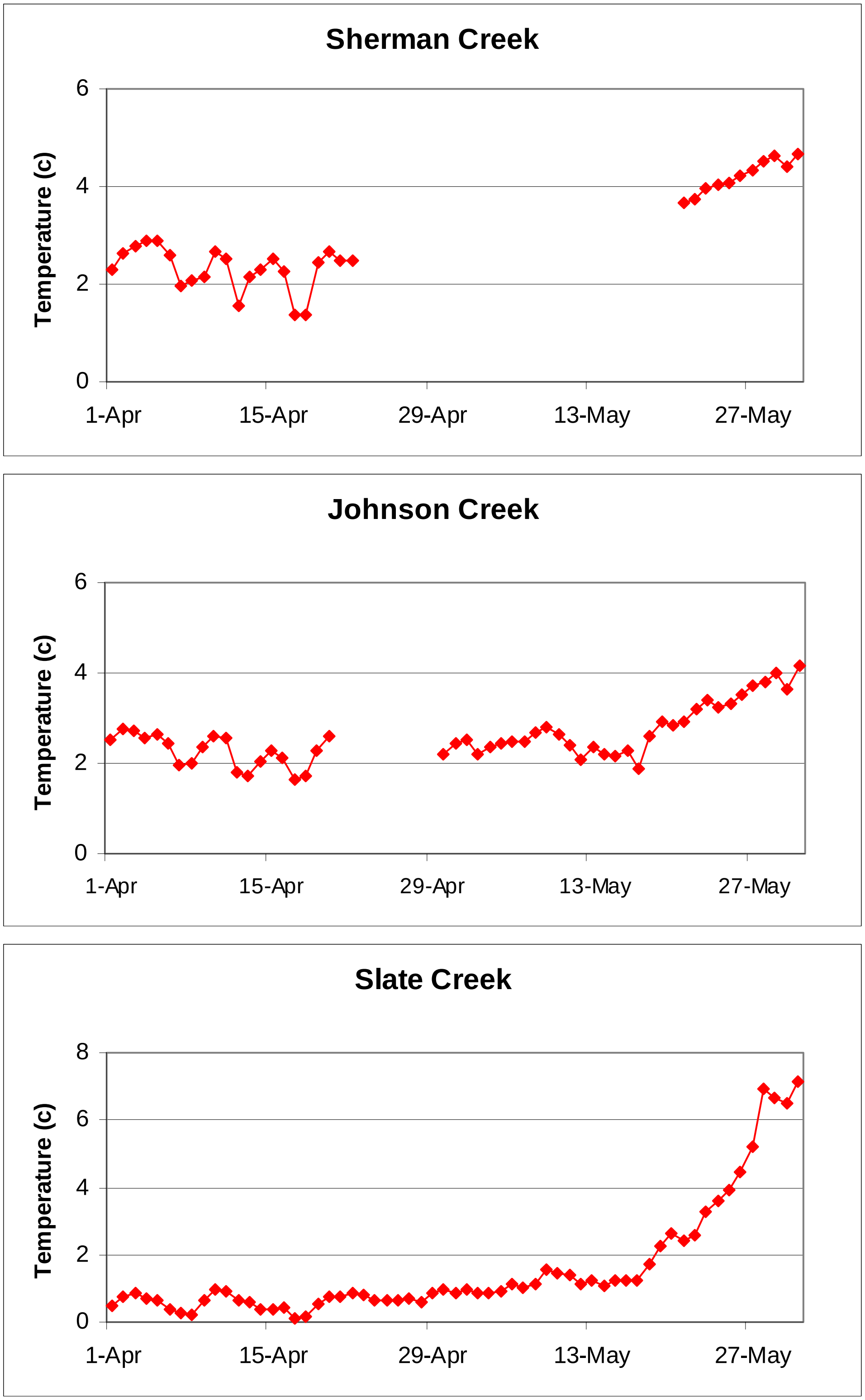


Figure 18: Mean Daily Water Temperature at each creek. Transducers at Sherman and Johnson Creeks failed for a limited time.

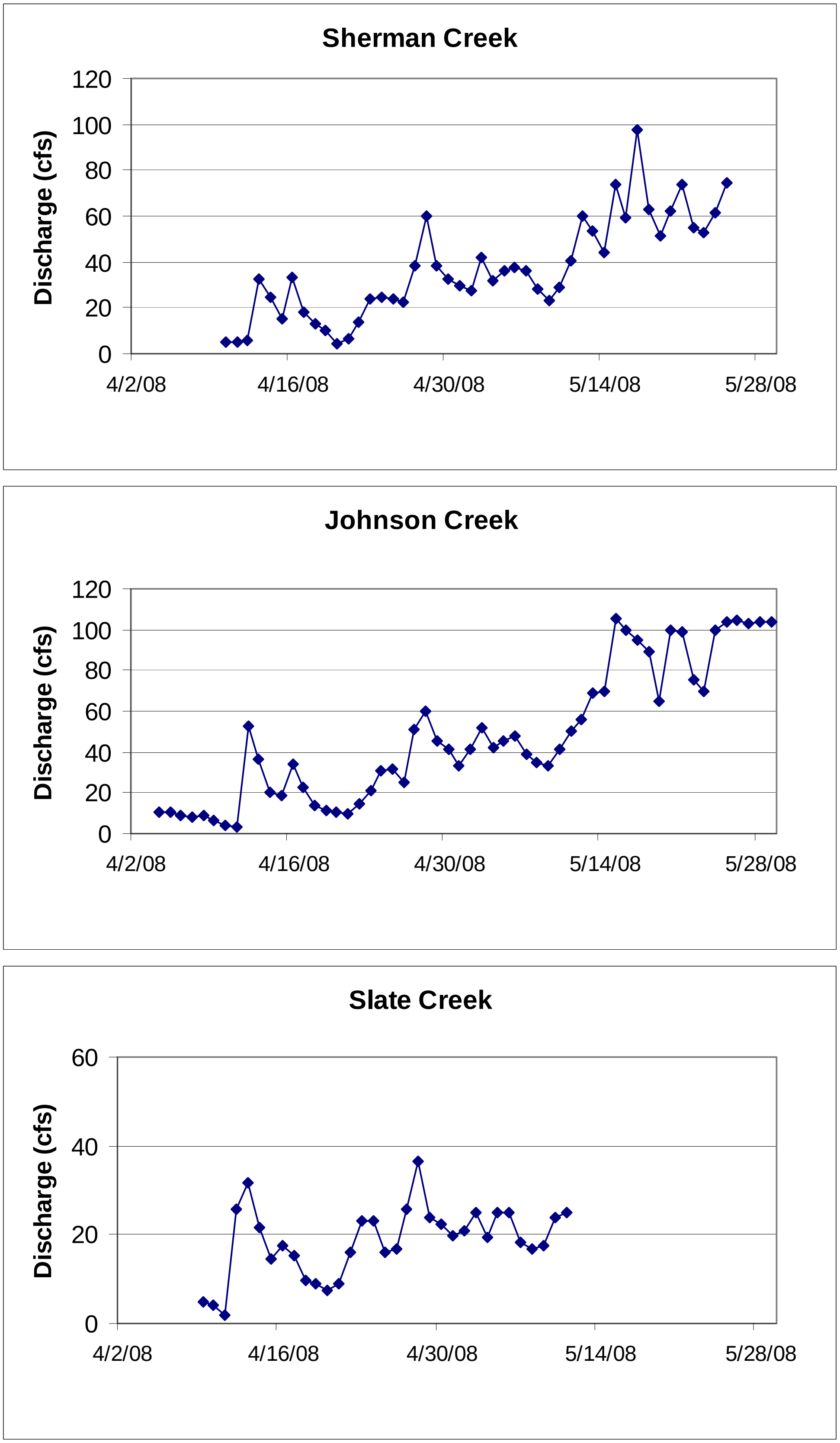


Figure 19: Stream flow based on daily staff gage readings, and manual discharge measurements.

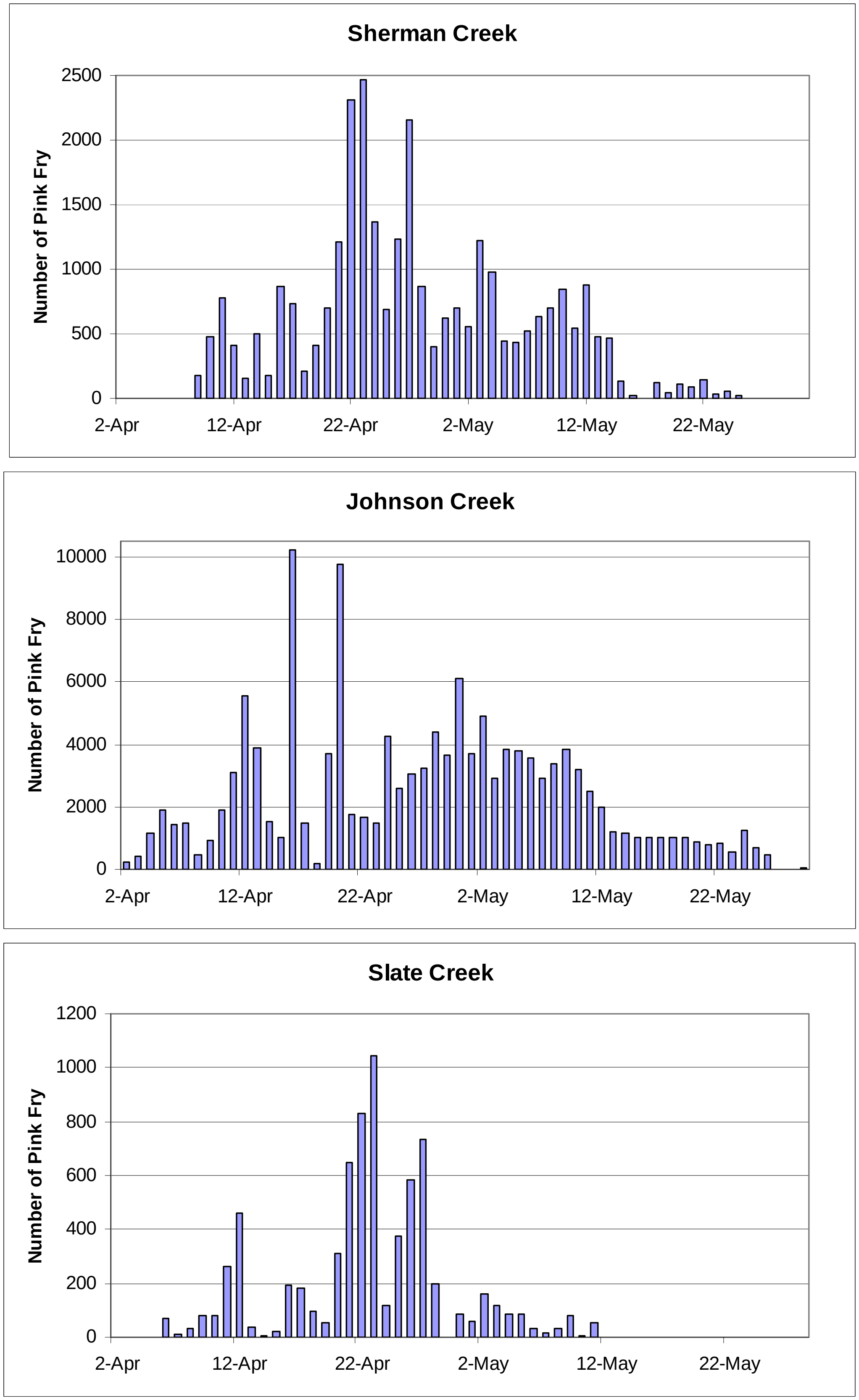


Figure 20: Daily catch of pink salmon fry April-May 2008.

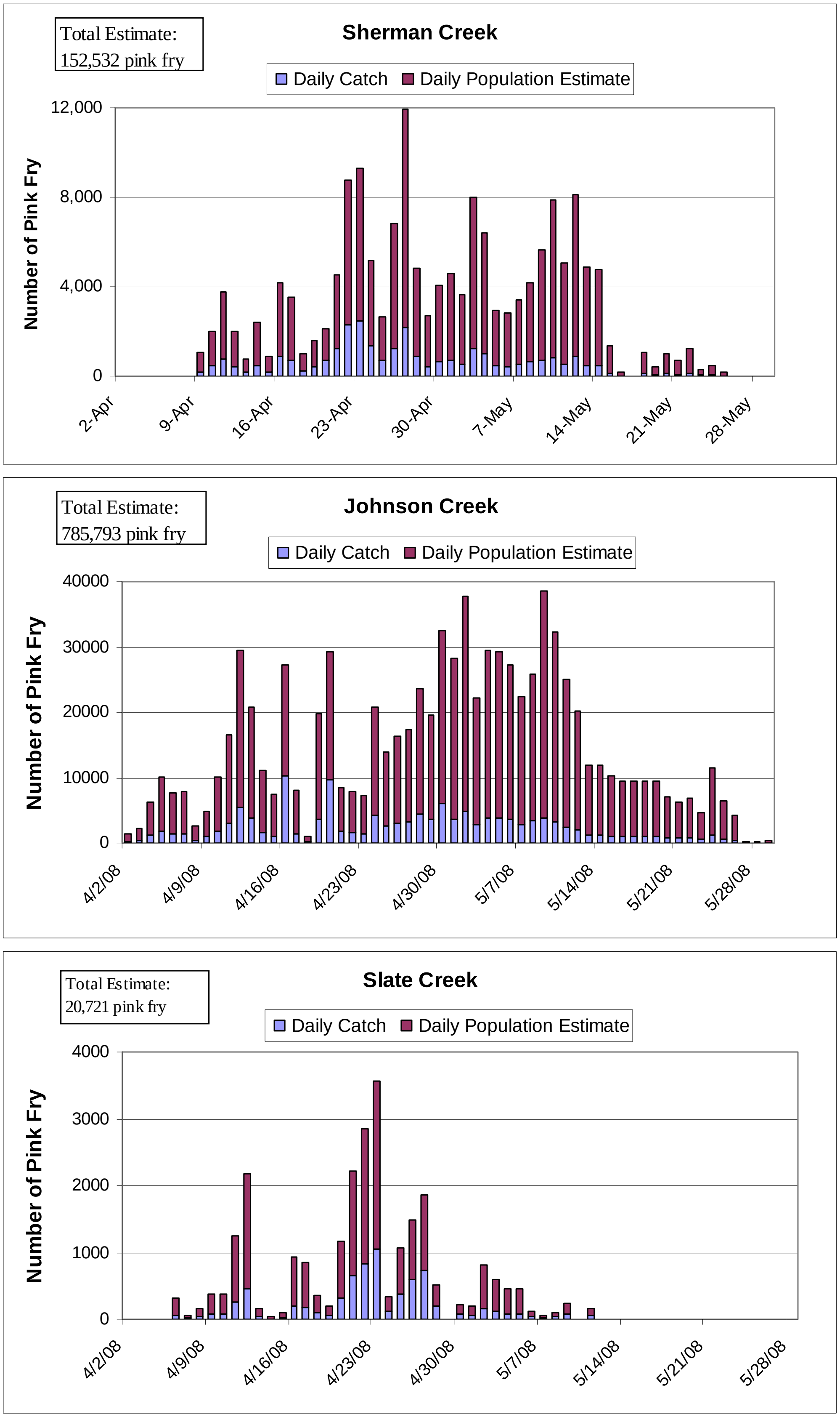


Figure 21: Estimated daily total pink fry migrating downstream.

6.8 Timing of Pink Salmon Outmigration

Numbers of captured fry increased steadily at Johnson Creek from around 250 fish in early April, rising to 10,000 in mid-April, then declining to low numbers at the end of May (Figure 20). Numbers were around 300 at Sherman Creek at the beginning of the study and increased to almost 2500 fish on April 23. Slate Creek numbers began at around 100 fish, peaked around 1000 fry, also on April 23, then petered out in Mid-May. Some periods of low fry capture at Sherman and Slate Creeks coincided with high flow (eg. April 12, April 29) when a lower proportion of the total stream flow was sampled by the nets. Low fry capture at Johnson Creek on April 18 might have been due to a bright full moon inhibiting fry emergence from the gravel. The 40mm rainfall event of May 16 caused nets to be washed out of the stream at Johnson and Sherman Creeks so fry catch had to be estimated from the previous and subsequent day's catch.

6.9 Daily Catch and Mark-Recapture Trials

The total catch at Johnson Creek was 4.5 times the magnitude of Sherman Creek while the catch at Sherman Creek was 4 times the magnitude at Slate Creek. The total catch from Sherman Creek was 29,180 pink salmon fry between April 9 and May 25 with a maximum daily catch of 2446 fry on April 23. Sherman Creek mark-recapture experiments resulted in an average of 11 to 36% recovery of marked fish with recapture rates varying with stream flow. Figure 21 shows the estimated daily total number of pink fry migrating downstream based on mark-recapture trials. The total population estimate for the survey period for Sherman Creek is 136,479 pink fry. Table 18 gives the daily catches of fry and daily population estimates.

Johnson Creek was sampled from April 2 to May 29 with a total catch of 136,103 pink fry and maximum daily catch of 10,215 on April 16. Johnson mark-recapture surveys resulted in 10% to 20% recovery giving a total population estimate of 714,357 pink fry. Slate Creek was sampled from April 6 to May 11 with a total catch of 7,245 pink fry, and maximum daily catch of 1042 on April 23. Average recapture rates of between 24 and 65% resulted in a total population estimate of 18,501 pink fry.

	Sherman Creek							
	Total PK Caught	Total PK Released	Total PK Recaptured					Total PK Population Estimate
	29180	**2010**	**349**					**136479**
Date	Total PK Caught	Total Released per event	Total Recaptured per day	% Recaptured per day	Total Recaptured per event	% Recaptured per event	Mean Recapture Rate	Daily Population Estimate
2-Apr								
3-Apr								
4-Apr								
5-Apr								
6-Apr								
7-Apr								
8-Apr								
9-Apr	273	100	20	20.00			0.31	881
10-Apr	479	0	11	11.00	31		0.31	1545
11-Apr	773	0	0	0.00		31.00	0.26	2973
12-Apr	408	100	11	11.00	11		0.26	1569
13-Apr	154	0	0	0.00		11.00	0.26	592
14-Apr	495	150	18	12.00			0.26	1904
15-Apr	180	0	2	1.33	20		0.26	692
16-Apr	863	0	0	0.00		13.33	0.26	3319
17-Apr	734	150	31	20.67			0.26	2823
18-Apr	209	0	1	0.67	32		0.26	804
19-Apr	416	0	0	0.00		21.33	0.35	1200
20-Apr	696	150	56	37.33			0.48	1450
21-Apr	1205	0	16	10.67	72		0.36	3347
22-Apr	2314	0	0	0.00			0.36	6428
23-Apr	2466	0	0	0.00		48.00	0.36	6850
24-Apr	1367	150	36	24.00	36		0.36	3797
25-Apr	693	0	0	0.00		24.00	0.36	1925
26-Apr	1232	150	20	13.33			0.22	5600
27-Apr	2150	0	10	6.67	30		0.22	9773
28-Apr	872	0	0	0.00			0.22	3964
29-Apr	412	0	0	0.00		20.00	0.18	2289
30-Apr	619	150	17	11.33	17		0.18	3439
1-May	703	0	0	0.00		11.33	0.18	3906
2-May	557	150	14	9.33			0.18	3094
3-May	1224	0	1	0.67	15		0.18	6800
4-May	978	0	0	0.00		10.00	0.18	5433
5-May	445	150	18	12.00			0.18	2472
6-May	432	0	1	0.67	19		0.18	2400
7-May	522	0	0	0.00		12.67	0.18	2900
8-May	635	149	23	15.44			0.18	3528
9-May	698	0	0	0.00	23		0.14	4967
10-May	846	0	0	0.00		15.44	0.12	7020
11-May	542	150	13	8.67			0.12	4497
12-May	876	0	0	0.00	13		0.12	7269
13-May	479	0	0	0.00		8.67	0.11	4508
14-May	468	150	15	10.00			0.11	4405
15-May	134	0	0	0.00			0.11	1261
16-May	18	0	0	0.00	15		0.13	138
17-May	0	0	0	0.00			0.13	0
18-May	123	0	0	0.00			0.13	946
19-May	46	0	0	0.00		10.00	0.13	354
20-May	113	106	14	13.21			0.13	869
21-May	84	0	0	0.00	14		0.13	646
22-May	141	0	0	0.00			0.13	1085
23-May	32	0	0	0.00		13.21	0.13	246
24-May	57	55	1	1.82	1		0.13	438
25-May	17	0	0	0.00		1.82	0.13	131

Table 18: Daily Catch and Estimated Daily Population Estimates.

	Johnson Creek							
	Total PK Caught	Total PK Released	Total PK Recaptured					Total PK Population Estimate
	136103	**2665**	**266**					**714357**
Date	Total PK Caught	Total Released per event	Total Recaptured per day	% Recaptured per day	Total Recaptured per event	% Recaptured per event	Mean Racapture Rate	Daily Population Estimate
2-Apr	248	120	0	0.00			0.23	1078
3-Apr	403	0	4	3.33	4		0.23	1752
4-Apr	1167	0	0	0.00		3.33	0.23	5074
5-Apr	1885	149	6	4.03			0.23	8196
6-Apr	1425	0	0	0.00	6		0.23	6196
7-Apr	1480	0	0	0.00		4.03	0.23	6435
8-Apr	480	150	0	0.00			0.23	2087
9-Apr	923	0	13	8.67	13		0.23	4013
10-Apr	1897	0	0	0.00			0.23	8248
11-Apr	3110	0	0	0.00		8.67	0.23	13522
12-Apr	5531	150	4	2.67	4		0.23	24048
13-Apr	3891	0	0	0.00		2.67	0.23	16917
14-Apr	1524	150	0	0.00			0.16	9525
15-Apr	1021	0	0	0.00	0		0.16	6381
16-Apr	10215	0	0	0.00			0.60	17025
17-Apr	1494	0	0	0.00		0.00	0.23	6496
18-Apr	202	150	15	10.00	34		0.23	878
19-Apr	3718	0	19	12.67		22.67	0.23	16165
20-Apr	9760	150	13	8.67			0.50	19520
21-Apr	1757	0	3	2.00	16		0.26	6758
22-Apr	1644	0	0	0.00		10.67	0.26	6323
23-Apr	1503	150	32	21.33			0.26	5781
24-Apr	4273	0	7	4.67	39		0.26	16435
25-Apr	2594	0	0	0.00		26.00	0.23	11278
26-Apr	3058	148	0	0.00			0.23	13296
27-Apr	3242	0	1	0.68	1		0.23	14096
28-Apr	4406	0	0	0.00		0.68	0.23	19157
29-Apr	3672	148	23	15.54			0.23	15965
30-Apr	6098	0	6	4.05	29		0.23	26513
1-May	3691	0	0	0.00		19.59	0.15	24607
2-May	4923	150	9	6.00			0.15	32820
3-May	2908	0	3	2.00	12		0.15	19387
4-May	3847	0	0	0.00		8.00	0.15	25647
5-May	3809	150	10	6.67			0.15	25393
6-May	3570	0	5	3.33	15		0.15	23800
7-May	2924	0	0	0.00		10.00	0.15	19493
8-May	3364	150	7	4.67			0.15	22427
9-May	3820	0	1	0.67	8		0.11	34727
10-May	3202	0	0	0.00		5.33	0.11	29109
11-May	2477	150	17	11.33			0.11	22518
12-May	2004	0	0	0.00	17		0.11	18218
13-May	1183	0	0	0.00		11.33	0.11	10755
14-May	1179	150	13	8.67			0.11	10718
15-May	1025	0	0	0.00			0.11	9318
16-May	1025	0	0	0.00	13		0.12	8542
17-May	1025	0	0	0.00			0.12	8542
18-May	1025	0	0	0.00		8.67	0.12	8542
19-May	1025	150	18	12.00			0.12	8542
20-May	871	0	0	0.00	19		0.14	6221
21-May	781	0	1	0.67		12.67	0.14	5579
22-May	842	150	22	14.67			0.14	6014
23-May	574	0	0	0.00	22		0.14	4100
24-May	1229	0	0	0.00		14.67	0.12	10242
25-May	684	150	12	8.00			0.12	5700
26-May	453	0	2	1.33			0.12	3775
27-May	11	0	0	0.00	14		0.12	92
28-May	11	0	0	0.00			0.12	92
29-May	34	0	0	0.00		9.33	0.12	283

Table 18 cont. Shaded area estimated as net washed out.

	Slate Creek							
	Total PK Caught	Total PK Released	Total PK Recaptured					Total PK Population Estimate
	7245	**1063**	**339**					**18501**
Date	Total PK Caught	Total Released per event	Total Recaptured per day	% Recaptured per day	Total Recaptured per event	% Recaptured per event	Mean Racapture Rate	Daily Population Estimate
2-Apr								
3-Apr								
4-Apr								
5-Apr								
6-Apr	68	0	0	0.00			0.27	253
7-Apr	11	0	0	0.00			0.27	41
8-Apr	32	30	0	0.00			0.27	119
9-Apr	79	0	0	0.00	0		0.27	294
10-Apr	78	0	0	0.00			0.27	291
11-Apr	264	0	0	0.00		0.00	0.27	983
12-Apr	461	150	2	0.00			0.27	1717
13-Apr	35	0	0	0.00			0.27	130
14-Apr	7	0	0	0.00	2		0.27	26
15-Apr	19	0	0	0.00			0.27	71
16-Apr	195	0	0	0.00		1.33	0.27	726
17-Apr	181	149	40	26.85			0.27	674
18-Apr	96	0	0	0.00	40		0.37	263
19-Apr	51	0	0	0.00		26.85	0.37	140
20-Apr	312	150	59	39.33			0.37	855
21-Apr	649	0	0	0.00	59		0.41	1570
22-Apr	832	0	0	0.00		39.33	0.41	2013
23-Apr	1042	150	65	43.33			0.41	2521
24-Apr	118	0	0	0.00	65		0.54	217
25-Apr	375	0	0	0.00		43.33	0.54	690
26-Apr	585	150	96	64.00			0.65	895
27-Apr	732	0	2	1.33	98		0.65	1120
28-Apr	200	0	0	0.00			0.65	306
29-Apr	0	0	0	0.00		65.33	0.65	0
30-Apr	86	75	16	21.33	49		0.65	132
1-May	61	0	0	0.00		65.33	0.45	136
2-May	159	135	33	24.44			0.24	650
3-May	117	0	0	0.00	33		0.24	479
4-May	88	0	0	0.00		24.44	0.24	360
5-May	88	45	11	24.44			0.24	360
6-May	32	0	0	0.00	11		0.38	84
7-May	18	0	0	0.00		24.44	0.38	47
8-May	32	29	13	44.83			0.52	62
9-May	83	0	2	0.00	15		0.52	160
10-May	3	0	0	0.00			0.52	6
11-May	56	0	0	0.00		51.72	0.52	108

Table 18 cont.

6.10 Total Population Estimates

Numbers of pink fry migrating downstream in the spring of 2008 were estimated from mark-recapture experiments as 136,479, 714,357 and 18,501 in Sherman, Johnson and Slate respectively. These estimates only include fry that hatched upstream of the traps. These estimates only include fry that hatched upstream of the traps. Sherman Creek has approximately 12% of total spawning habitat located downstream of the trap. If an equivalent proportion of fry emerged downstream of the trap, then the total out-migrating fry count would include an additional 12% or 16,343 fry bringing the total to 152,532. Johnson Creek has approximately 10% of the total spawning habitat downstream of the trap giving a final total estimate of 785,793. Slate Creek had an additional 12% of potential spawning habitat downstream of the trap giving a total estimate of 20,721 pink fry. Based on these numbers, total mortality caused by monitoring was 1% (1557 fry), 0.44% (3469 fry) and 1.25% (260 fry) of the total estimated outmigration in Sherman, Johnson and Slate Creeks, respectively.

The number of spawning pink salmon adults estimated in the fall of 2007 was 390 in Sherman Creek, 3,160 in Johnson Creek and 88 in Slate Creek. At Slate Creek, the majority of adult salmon were observed in the intertidal zone due to low flow inhibiting passage further upstream. Assuming a 1:1 sex ratio, the numbers of fry produced per adult female was 782 in Sherman Creek, 497 at Johnson Creek and 470 at Slate Creek. The Sherman Creek estimate seems rather high compared to published rates and previous year's studies. In 1998, the estimated number of fry produced per female in Sherman Creek was 194. In 2007, there were an estimated 368 fry per female in Sherman Creek, 374 in Johnson Creek and 762 in Slate Creek. Average pink salmon fry production over 15 brood years in Auke Creek, SE Alaska, was 12.3 fry per spawner (Fukushima 1996) or 25 fry per female. In other streams fry production varied between 50 and 200 (Chebanov 1989) and between 103 and 562 (Shershnev and Zhul'kov 1980). There is evidently large variability in fry production from year to year and from stream to stream.

It is possible that numbers of fry at Sherman Creek were overestimated by mark-recapture rates being affected by some unknown factor. Flow at Sherman Creek was often swift with little chance for fry to deliberately avoid the trap. The release site for marked fish is upstream of a deep pool that may shelter predators such as Dolly Varden. Predation could result in fewer marked fish being recaptured and inflated population estimates, although the lowest recapture rates were excluded from estimates. At times only 10% of the flow was sampled reducing the chance of recapturing marked fish. It is also possible that numbers of female adult salmon were underestimated in 2007. If the fry estimate were closer to 100,000 and adult female estimate closer to 300 then the number of fry per female would be 333, which seems more reasonable (Table 15).

The survival rate from egg to emergent fry can be estimated by assuming each female lays between 1500 and 2000 eggs (Heard 1991). For Sherman Creek, total egg production would lie between 292,500 eggs (195 females x 1500 eggs) and 390,000 eggs (195 females x 2000 eggs). If 152,532 fry emerged in April and May then between 39 and 52% survived from the egg stage. For Johnson Creek, an estimated 2,370,000 to 3,160,000 eggs produced 785,793 fry or between 24.9 and 33% survived. At Slate Creek, an estimated 66,000 to 88,000 eggs produced 20,721 fry so the survival rate was between 23.5 and 31.4%. Overall freshwater survival of pink salmon from egg to alevin, even in highly productive streams, commonly reaches only 10-20%, and at times is as low as 1% (Heard, 1991). In Sashin Creek, SE Alaska, egg to fry survival varied from 0.1 to 22 % (Heard, 1978) over a 28 year period. Quinn (2005) gives a rate of 11.5% as being typical. In 2000, survival rate at Sherman Creek was estimated as 0.6%. Survival rates for 2007 were 18-25% for Sherman and Johnson Creeks, and 38-51% for Slate Creek.

The egg-to-fry survival rate estimated for Sherman Creek in 2008 seems rather high. It could be that predators were selecting marked fish over unmarked fish before they reached the trap. The number of adult pink salmon in Sherman Creek could have been underestimated the previous summer. Predation of pink salmon by bears may affect the adult estimate, but since bears tend to select fresh salmon that have not yet spawned, this would lead to an over-estimate rather than under-estimate, or fewer salmon actually spawning than were counted. Using adjusted numbers of 300 female salmon laying 450,000 to 600,000 eggs that produced around 152,532 fry gives a survival rate of 25-34% which seems more realistic (Table 19). This rate is still high compared to published rates, but survival could have been high due to early and persistent snow fall that helped insulate eggs over the winter.

Stream	Adjusted estimate of outmigrating fry	Estimated number of adult females	Number of fry per female	Egg to fry survival rate
Sherman	152,532[a]	300[b]	333[b]	25-34%
Johnson	785,793[a]	1580	497	25-33%
Slate	20,721[a]	44	470[b]	24-31%

Table 19: Estimates adjusted for numbers hatching downstream of trap (a) and for realistic egg to fry survival rates (b).

6.11 Other Species Collected

In addition to pink salmon, six other species were caught in the fyke nets (Table 20). Around 11,900 chum salmon fry (*Oncorhynchus keta*) were captured in Johnson Creek during the study, but only one was caught in Slate Creek and none were captured in Sherman Creek. The only other species caught in Sherman Creek were a cutthroat trout, caught May 13 and a coast-range sculpin (*Cottus aleuticus*) captured May 3. A total of 571 coast-range sculpins were caught in Slate Creek and 68 caught in Johnson Creek. 76 juvenile coho salmon were caught in Johnson Creek and 24 caught in Slate Creek. One juvenile cutthroat trout (*O. clarki*) was captured in each of Johnson and Slate Creeks. 158 eulachon (*Thaleichtys pacificus*) were captured in Slate Creek during early May as they entered the stream to spawn.

Table 20: Other species captured in fyke nets at each creek.

	Sherman	Johnson	Slate
Chum salmon	0	11,898	1
Coho	0	76	24
Eulachon	0	0	158
Coast Range Sculpin	1	68	571
Dolly Varden	0	28	0
Cutthroat Trout	1	1	1

6.12 Discussion and Recommendations

The Johnson Creeks population estimate was a much great magnitude than that of Sherman and Slate Creek. Johnson Creek has more spawning habitat than the other creeks, with barrier falls located approximately 1.2km upstream from Berners Bay. Sherman Creek has barrier falls only 360m upstream from the ocean and Slate Creek has barrier falls approximately 900m from the ocean. The total anadromous area in Sherman Creek was measured as 1,944m^2 in July 2005 (Aquatic Science 2005). The anadromous area of Johnson Creek has not been measured, but can be estimated from the distance from stream mouth to falls (1.5km) multiplied by average stream width of 8m giving an area of roughly 12,000m^2. Slate Creek can be estimated by multiplying 900m by 9m giving 8100m^2. The difference in numbers of fry between Johnson Creek and Sherman Creek is in proportion to the difference in habitat area present.

Slate Creek had a lower population estimate than Sherman Creek in 2008 despite more spawning habitat because few adult salmon were able to migrate upstream during the dry August of 2007. Only six adults were observed upstream of the trap site in 2007, so it is likely that spawning took place downstream of the trap, but fry were flushed upstream at high tide.

Fukushima et al. (1998) found that use of limited spawning areas led to the loss of eggs and was roughly proportional to spawner abundance. Smirnov (1975) suggested that 1.5 - 2.0 m^2 of spawning area per female was necessary for effective use of spawning grounds. A total of 300 female spawners at Sherman Creek, would allow 6.5 m^2 per female and1580 females at Johnson Creek would allow 7.6m^2 per female. At Slate Creek, the majority of adults were observed in the first 100m of the creek, but even with 900m^2, the 44 females at Slate Creek would have had 20m^2 per female. Even though the spawning substrate available would be much less than the total stream area available, it appears that spawning area limitation was not a factor affecting fry survival.

Mortality due to sampling in Sherman, Slate and Johnson Creeks was around 1% of the total estimated population for each creek. Mortality occurs when high flow causes fry to become impinged against the net wall or large amounts of debris trap fry against the walls of the holding box. The height-adjustable legs of the holding boxes made it easy to accommodate a wide range of stream flows from day to day, helping reduce mortality rates.

7.0 Adult Salmon Counts

7.1 Surveys and Analysis

Counts of migrating adult pink salmon were made once a week in the anadromous reaches of Sherman, Sweeny, Johnson and Slate creeks from July 21 to September 17, 2008. Prior to the first survey, markers were placed along one bank of each creek at 50m intervals (Sherman and Sweeny Creeks) or 100m intervals (Slate Creek). Each survey on Sherman and Slate Creeks was conducted by biologists on foot, who began at the intertidal zone and proceeded upstream along the bank, recording live and dead salmon present in each reach. Johnson Creek was surveyed using a combination of foot surveys and aerial surveys from a helicopter. Reach numbers painted on sheet metal are located on various log jams and can be read from the air to locate reaches. Approximate stream flow (low, average, high) and water clarity (visibility of fish) were noted at the beginning of each survey.

Data gathered during weekly surveys was used to determine the abundance and distribution of returning adult salmon in each stream, as well as the timing of the spawning run. Total escapement (the number of salmon that return to their natal stream to spawn) for pink salmon was estimated using the methods of Neilson and Geen (1981), where the sum of all weekly counts is divided by the average residence time of adult spawners in the stream. Since each weekly count includes some fish counted in the previous survey, an adjustment was made to avoid overestimation of escapement. The number of times an individual fish may have been counted during consecutive surveys is assumed to equal the average residence time. A residence time of two weeks was used to compute escapement, as this has been used in previous studies in the area (Biotec 1998, USDA 1997). In a tagging study conducted by Pentec (1990), the residence time of pink salmon spawners in Sherman Creek ranged from one to three weeks. Chum and coho were only observed for one week so the total number observed was used as the escapement for these salmon.

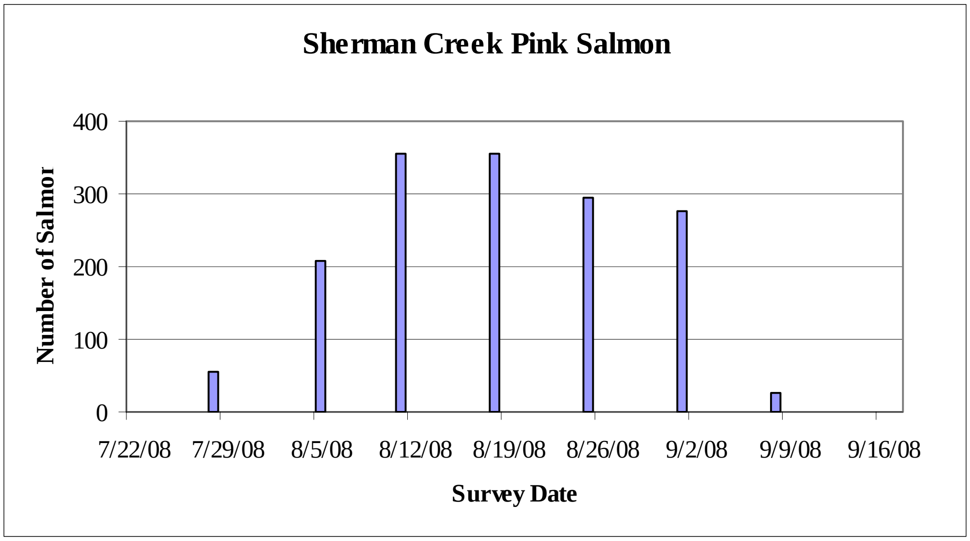
7.2 Adult Salmon Counts

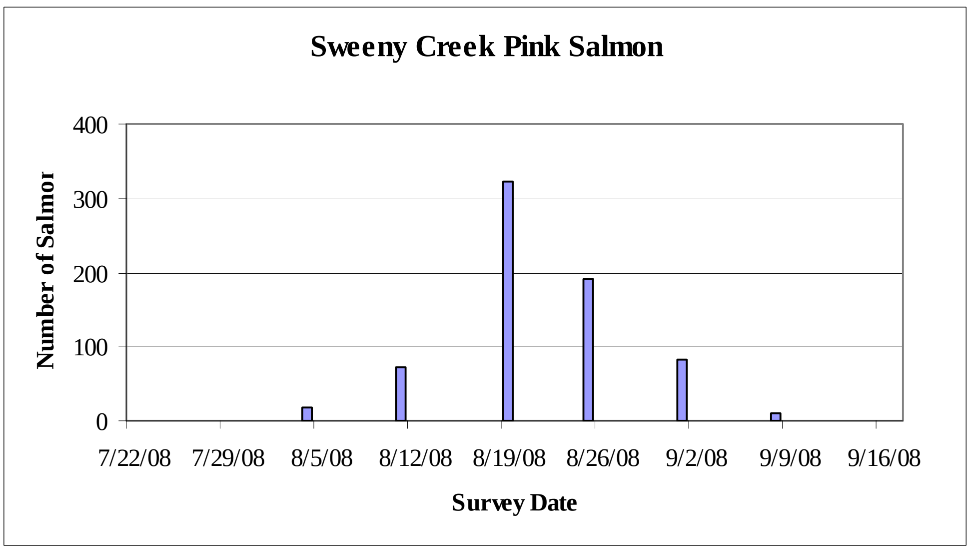
Weekly counts of adult salmon migrating into streams to spawn in 2008 are presented in Appendix 5. Figure 22 shows the magnitude and timing of the pink salmon spawning runs in Sherman, Sweeny, Johnson and Slate Creeks. Pink salmon were observed in Sherman Creek from July 28 to September 8 with a maximum of 354 individuals observed on August 11 and 18. No chum or coho salmon were observed in Sherman Creek. At Sweeny Creek, pink salmon were present from August 4 to September 8 with a maximum if 323 observed on August 19. No chum salmon were observed at Sweeny Creek. At Johnson Creek, pink salmon were observed from July 23 to September 8, with numbers peaking at around 5250 fish on August 11. Around 70 chum salmon were observed in Johnson Creek on July 28, around 250 on August 5, 200 on August 11, and 150 on August 11.

At Slate Creek, pinks were observed from July 29 to September 10 with numbers peaking at 1328 on August 21. No chum salmon were observed in Slate Creek in 2008. The stream mouth was visited in late October, but no coho were observed. Numbers of pink salmon reached a peak around mid-August in each stream. The magnitude of the pink salmon escapement in Johnson Creek was around 8 times that of Sherman Creek and 36 times that of Slate Creek (Table 21).

Table 21: Salmon Escapement by stream for 2008.

	Salmon Escapement			
	Sherman Creek	**Sweeny Creek**	**Johnson Creek**	**Slate Creek**
Pink	**784**	**348**	**7,954**	**1878**
Chum	**0**	**0**	**570**	**0**





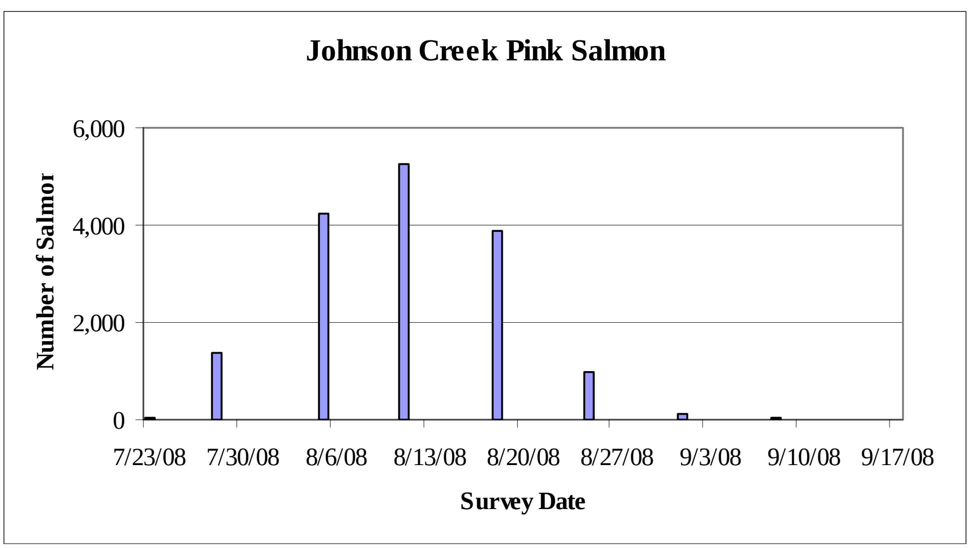


Figure 22: Weekly Counts of Adult Pink Salmon.

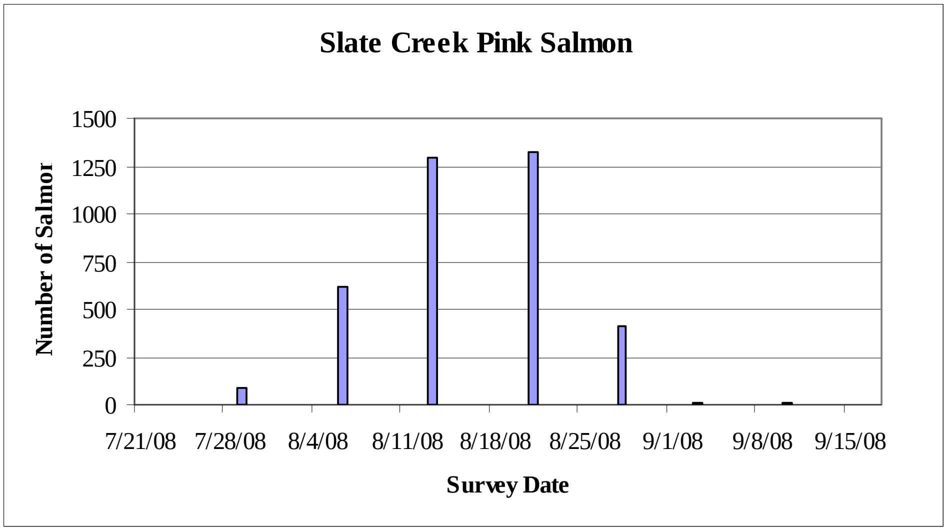
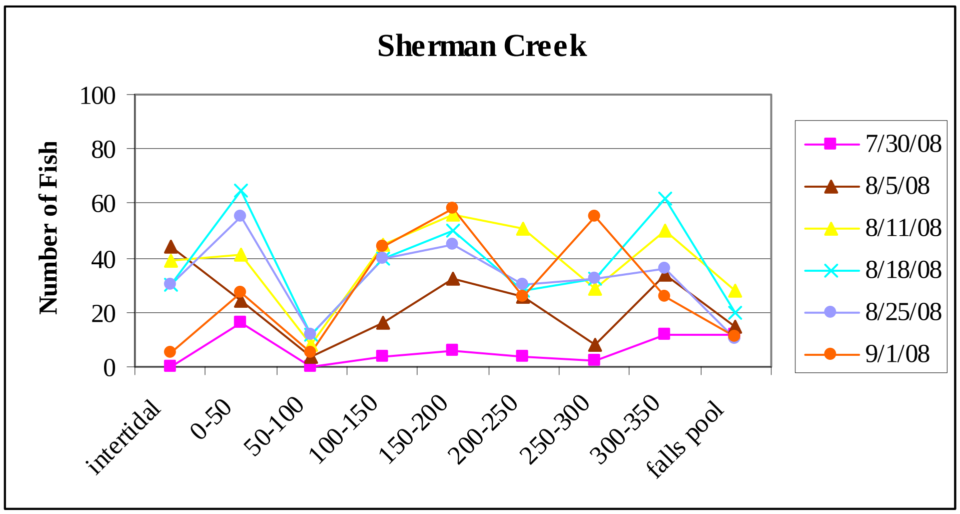


Figure 22 cont: Weekly Counts of Adult Pink Salmon.



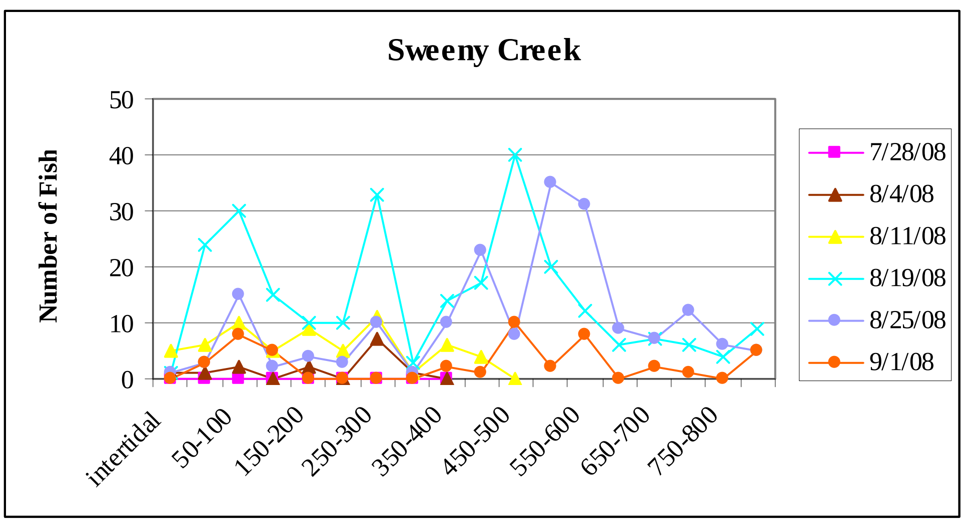
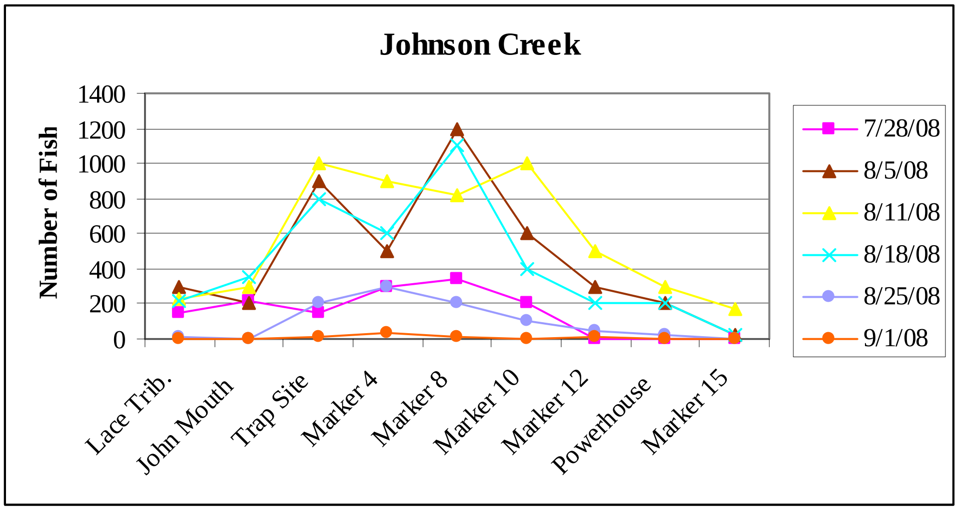


Figure 23: Distribution of pink salmon at Sherman and Sweeny Creeks.



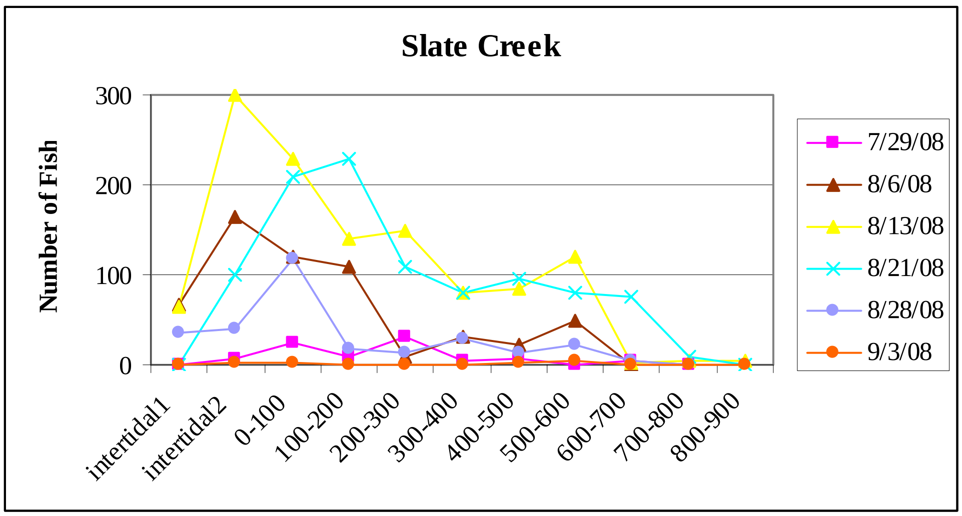


Figure 23 cont: Distribution of pink salmon at Johnson and Slate Creeks.

The distribution of salmon in each stream throughout the surveys is shown in Figure 23. Salmon were fairly evenly distributed throughout Sherman Creek on all survey dates except for low numbers between 50 and 100m, which is a reach dominated by fast riffle. Sweeny Creek showed clusters of salmon from 50 to 100m and from 250 to 300m associated with large pools below cascades. A large group of salmon also appeared to move upstream from below 500m to above 550m between August 19 and 25, perhaps due changes in flow. In Johnson Creek pink salmon were mostly observed in reaches 1 to 7, which lie between 0 and approximately 1km upstream. The stream changes here from gentle riffle and deep pools to faster, steeper riffle with less spawning habitat available. Similarly the majority of salmon at Slate Creek were observed below 600m, prior to the creek changing from gravel to bedrock substrate.

7.3 Pink Salmon Escapement Comparison

A comparison of pink salmon escapement between 2005 and 2008 is shown in Figure 24. In South-East Alaska, even-year pink salmon populations are generally larger than odd-year populations due to their 2 year life cycle. Further south in their range, pink salmon are more abundant in odd years. It is thought that the odd-year salmon populations are better adapted to warmer water. The last ice age may have divided populations into a warm-water adapted southern (odd-year) population and a cooler water northern (even-year) population. Populations of salmon from an even year have no opportunity to interbreed with salmon from an odd year because all pink salmon mature at 2 years of age and all die after spawning (Quinn 2005).

This pattern can be seen in the lower numbers returning to Johnson and Slate Creeks in 2005 and 2007 and higher returns 2006 and 2008. The pattern does not hold well in drier summers, particularly at Sherman and Slate Creeks where low flow inhibits upstream migration. Escapement at Sherman and Slate Creeks in 2007 appeared to be affected by low flows due to dry weather in August coinciding with the peak of the salmon run. Schools of pink salmon were observed in the intertidal zones of these streams, apparently unable to ascend upstream due to lack of water. Salmon returns in 2008 were higher than 2006 returns at Johnson Creek but not quite as high as 2006 runs at Sherman and Slate Creeks.

Sherman Creek does not seem to hold well to the high even-year return pattern since the highest return was in 2005. If odd years are higher here, then 2007 should also have been a high year, but 2007 did not have a high return due to low flow that inhibited access as salmon could not negotiate the falls near the mouth of the creek. A large flood event occurred in November of 2005, which may have scoured eggs out of their nests. Out-migrating fry numbers were relatively low the following spring compared to subsequent years. It may be that flash flood events in this steep, coastal stream can have a strong effect on salmon numbers. Johnson Creek appears to be fed partly by groundwater and is much less affected by dry weather and adult salmon migration did not seem to be impeded.

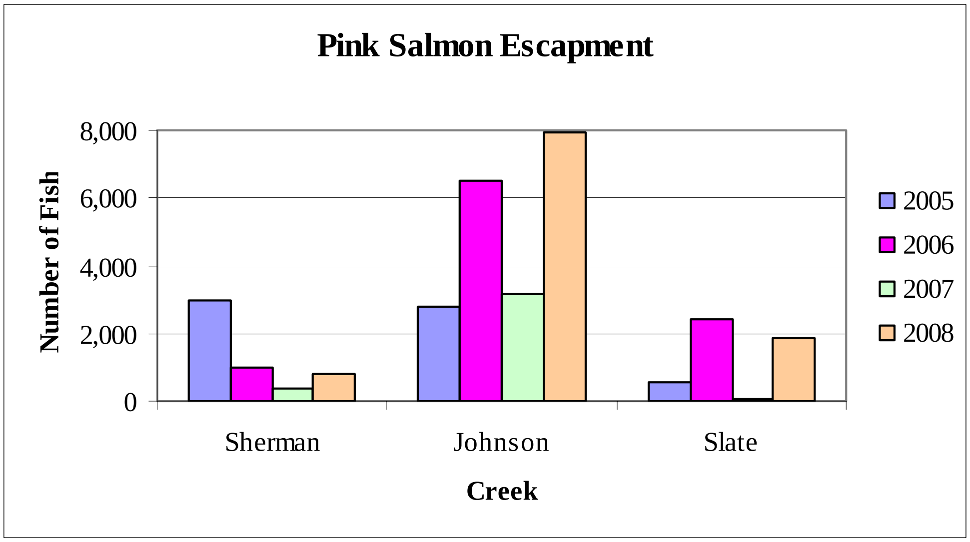


Figure 24: Estimated pink salmon escapement from 2005 to 2008.

Figure 25: Pink salmon observed in Johnson Creek by helicopter.

8.0 Quality of Spawning Substrate

8.1 Sample Collection and Analysis

Core samples of spawning gravel were collected from each of two reaches in Sherman Creek on July 21, Sweeny Creek on July 12, Slate Creek on July 15 and Johnson Creek on July 16, 2008. At Sherman Creek, Reach 1 lies between 3 and 29m, and Reach 2 lies between 288 and 315m from the stream mouth, while the Sweeny Creek reaches lie between 38 and 63m and 236 and 260m, as defined by Konopacky (1992). The two sampling reaches at Slate Creek are located between 125 and 150m, and between 175 and 200m from the stream mouth. At Johnson Creek the sampling reaches are located between 320 and 340m, and between 425 and 450m from the stream mouth. Four samples were collected from each reach using a McNeil-type sampler with a basal coring diameter of 15cm and a coring depth of 25cm (Figure 26). Individual sample sites were randomly chosen from all potential spawning areas that were suitable for sampling, namely, substrate size less than 15cm and water depth less than 30cm as described by Valentine (1995).

Figure 26: Inserting the McNeil sampler into the streambed at Sherman Creek.

Collected substrate was wet-sieved on site through the following sieve sizes in mm: 101.6, 50.8, 25.4, 12.7, 6.35, 1.68, 0.42, and 0.15, which were used by Konopacky (1992) for baseline sampling. The contents of each sieve were allowed to drain and then measured by volume of water displaced to the nearest 5ml for the 101.6 to 0.42mm sieve sizes and to the nearest 1ml for the 0.15mm sieve. Fine material that passed through the smallest sieve was poured into Imhoff cones to settle out; and this volume read directly from each cone.

Figure 27: Fine sediment settling out in Imhoff cones at Sweeny Creek.

Due to the presence of interstitial and surface water in each sample, the volumetric measurements were converted to dry weights using correction factors determined by Shirazi et al (1981) assuming a gravel density of 2.6g/cm^3. The geometric mean particle size and sorting coefficient (the distribution of grain sizes present) were calculated for each sample using methods from Lotspeich & Everest (1981). The geometric mean particle size (d_g) is an index of the textural composition. The grain size at the midpoint of each size class is raised to a power equal to the decimal fraction of its volume. In other words, the volumes of sediment in each size class are converted to percentages of the whole sample then the midpoint of each size class is raised to this power.

The products of each size class are then multiplied together to obtain the geometric mean, d_g:

$$d_g = (d_1^{v1} \times d_2^{v2} \ldots\ldots\ldots\ldots\ldots \times d_n^{vn})$$

where: dg = geometric mean particle size

d = midpoint diameter of particles retained by a given sieve

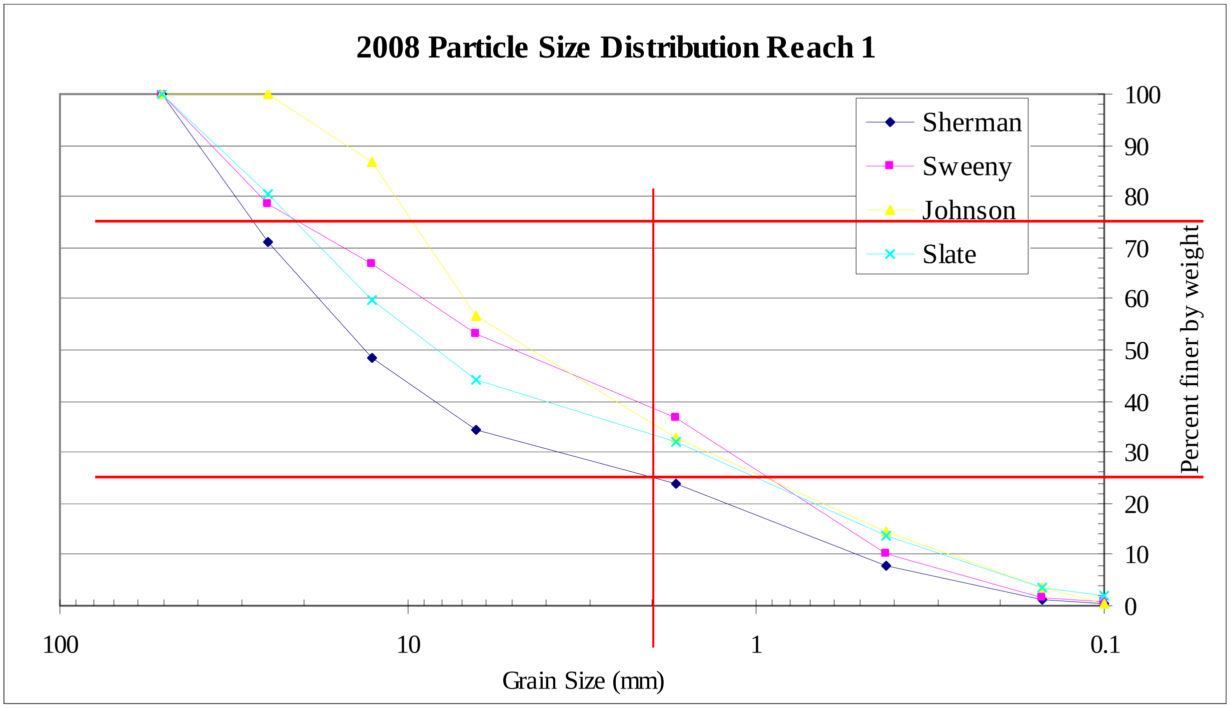
v = decimal fraction by volume of particles retained by a given sieve

Sediment texture does not control survival to emergence of embryos directly, but the influence of texture on pore size and permeability affects embryo survival (Lotspeich & Everest 1981). The sorting coefficient (S_o) is an index of the size distribution of sediment particles in a sample and provides a useful indicator of the permeability of gravel for salmonid spawning. The grain size at the 75th percentile of total sample volume is divided by that at the 25th percentile. The square root of the result provides the sorting coefficient. A gravel consisting of only one grain size has a S_o of 1. A S_o greater than 1 represents gravel made up of several grain sizes with the smaller grains filling up pores between larger ones. S_o is therefore inversely proportional to permeability (Lotspeich & Everest 1981). The Fredle index (F_i), or stream quality index, is a ratio of geometric mean particle size and sorting coefficient and provides a measure of the quality of spawning gravel for salmonid reproduction (Lotspeich and Everest, 1981). As the magnitude of the Fredle index increases, both pore size and permeability increase.

$$F_i = d_g/S_o$$

8.2 Spawning Gravel Composition

The volumetric measurements of gravel sizes retained by sieves are presented in Appendix 4. The geometric mean particle size (d_g), grain size percentiles (75th and 25th), sorting coefficient (S_o), Fredle index (F_i), and Embryo Survival Prediction (%) are presented in Table 22. Embryo survival predictions and grain size percentiles are obtained graphically from Lotspeich & Everest (1981). The average geometric mean particles size at Sherman Creek was 12.72mm at Reach 1 and 12.96mm at Reach 2. Average d_g at Sweeny Creek was 11.6mm at Reach 1 and 12mm at Reach 2. At Johnson Creek, Average d_g ranged from 11.0 to 11.2 mm and Slate Creek from 11.6 to 12.1mm. The streams had similar gravel composition with the exception of Johnson Reach 1 which lacked the largest size classes (Figure 29).



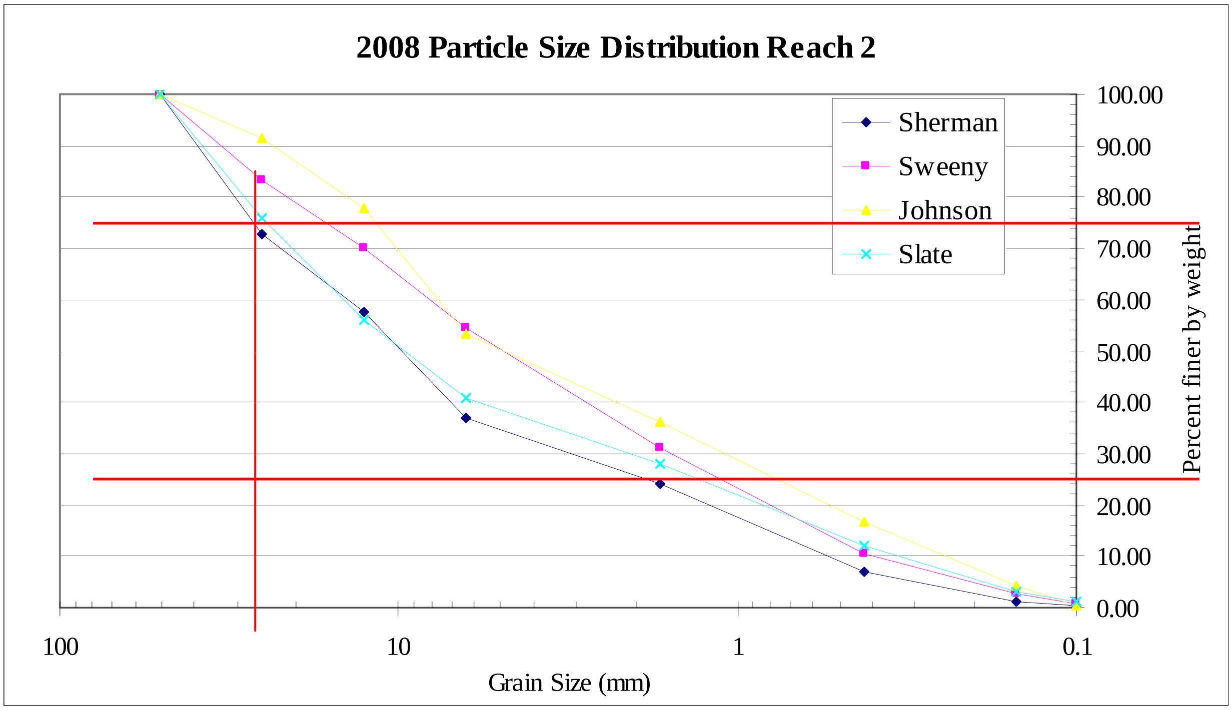


Figure 29: Cumulative size distribution curves for gravel samples collected in 2008.

Sediment texture affects salmonid embryo survival by influencing the pore size and permeability of the gravel. These properties regulate oxygen transport to incubating embryos and control the movement of alevins within the gravel. An excess of fine sediments in spawning gravel is a direct cause of embryo and alevin mortality (Shirazi et al, 1981). The higher the numerical value of the geometric mean the higher is the survival percentage of salmonid embryos.

		Geometric Mean (mm)	Grain size percentile (75th and 25th)		Sorting Coefficient	Fredle Index	Embryo Survival-to-Emergence Prediction
Sample		dg	d75	d25	So	(dg/So)	(%)
Sherman Creek							
Reach 1	1	12.20	50	5	10.00	1.22	8.0
	2	12.77	48	8.2	5.85	2.18	32.0
	3	11.50	52	8.2	6.34	1.81	22.0
	4	14.40	67	6.5	10.31	1.40	12.0
	Mean	**12.72**	**54.25**	**6.98**	**8.13**	**1.65**	**18.5**
	Standard Deviation	1.23	8.66	1.54	2.35	0.43	10.8
	95% Conf. Interval	1.21	8.48	1.51	2.31	0.42	10.5
Reach 2	1	12.34	31	10	3.10	3.98	55.0
	2	13.99	62	5.6	11.07	1.26	8.5
	3	11.50	39	3.8	10.26	1.12	7.0
	4	14.01	62	10	6.20	2.26	30.0
	Mean	**12.96**	**48.50**	**7.35**	**7.66**	**2.16**	**25.1**
	Standard Deviation	1.25	15.93	3.15	3.71	1.32	22.5
	95% Conf. Interval	1.22	15.61	3.08	3.64	1.29	22.1
Sweeny Creek							
Reach 1	1	11.58	38	4.1	9.27	1.25	8.0
	2	10.58	11	2.8	3.93	2.69	40.0
	3	13.10	64	3.9	17.30	0.80	1.0
	4	12.53	39	4.1	9.51	1.32	10.0
	Mean	**11.95**	**38.00**	**3.68**	**10.00**	**1.50**	**14.8**
	Standard Deviation	1.11	21.65	0.61	5.50	0.83	17.3
	95% Conf. Interval	1.08	21.22	0.60	5.39	0.81	16.9
Reach 2	1	11.03	34	2.5	13.60	0.81	1.0
	2	11.37	13	5.5	2.36	4.81	67.0
	3	13.10	60	7	8.57	1.53	15.0
	4	10.96	25	3.5	7.14	1.53	15.0
	Mean	**11.61**	**33.00**	**4.63**	**7.92**	**2.17**	**24.5**
	Standard Deviation	1.00	19.95	2.02	4.62	1.79	29.1
	95% Conf. Interval	0.98	19.55	1.98	4.53	1.76	28.5

Table 22. Calculated indices for gravel samples collected from Sherman, Sweeny, Johnson, and Slate Creeks in July 2008. Geometric mean particle sizes are expressed in mm.

Sample		Geometric Mean (mm) dg	Grain size percentile (75th and 25th) d75	d25	Sorting Coefficient So	Fredle Index (dg/So)	Embryo Survival-to-Emergence Prediction (%)
Johnson Creek							
Reach 1	1	10.75	16	3.4	4.71	2.28	32.0
	2	11.53	21	4.7	4.47	2.58	36.0
	3	11.68	19	4.7	4.04	2.89	45.0
	4	10.90	18	3	6.00	1.82	25.0
	Mean	**11.22**	**18.50**	**3.95**	**4.80**	**2.39**	**34.5**
	Standard Deviation	0.46	2.08	0.88	0.84	0.46	8.3
	95% Conf. Interval	0.45	2.04	0.86	0.83	0.45	8.2
Reach 2	1	10.63	18	2.7	6.67	1.59	18.5
	2	10.96	18	2.8	6.43	1.70	20.0
	3	11.68	39	6	6.50	1.80	24.0
	4	10.81	25	2.7	9.26	1.17	8.5
	Mean	**11.02**	**25.00**	**3.55**	**7.21**	**1.57**	**17.8**
	Standard Deviation	0.46	9.90	1.63	1.37	0.28	6.6
	95% Conf. Interval	0.45	9.70	1.60	1.34	0.27	6.5
Slate Creek							
Reach 1	1	11.73	40	5.5	7.27	1.61	18.5
	2	11.80	21	4.8	4.38	2.70	40.0
	3	11.81	59	8	7.38	1.60	18.5
	4	11.20	28	2.7	10.37	1.08	4.5
	Mean	**11.64**	**37.00**	**5.25**	**7.35**	**1.75**	**20.4**
	Standard Deviation	0.29	16.63	2.19	2.45	0.68	14.7
	95% Conf. Interval	0.28	16.30	2.14	2.40	0.67	14.4
Reach 2	1	13.02	59	8	7.38	1.77	21.0
	2	12.19	18	2.8	6.43	1.90	25.0
	3	11.81	47	4.1	11.46	1.03	1.0
	4	11.38	37	3.7	10.00	1.14	4.5
	Mean	**12.10**	**40.25**	**4.65**	**8.82**	**1.46**	**12.9**
	Standard Deviation	0.70	17.35	2.30	2.32	0.44	11.9
	95% Conf. Interval	0.68	17.00	2.25	2.28	0.43	11.7

Table 22 continued: Calculated indices for gravel samples collected from Sherman, Sweeny, Johnson, and Slate Creeks. Geometric mean particle sizes are expressed in mm.

Based on published relationships between these indices and salmon embryo survival rates (Chapman 1988; Lotspeich and Everest 1981), the calculated indices for 2008 gravel samples, predict embryo survival to range from 15 to 25% for Sherman and Sweeny Creeks and from 13% to 35% for Johnson and Slate Creeks. The Fredle index is lower than previous years due to less medium-sized gravel present at all sites, but actual survival based on fry counts appeared high. The amount of fine material in the gravel was lower at Sherman and Johnson Creeks, but higher at Slate Creek.

Geometric Mean (*dg*) mm

Site	2005	2006	2007	2008	p value
Sherman Reach 1	9.57	9.34	12.64	12.72	0.0004*
Sherman Reach 2	10.74	14.57	12.54	12.96	0.0176*
Johnson Reach 1	10.8	10.98	11.11	11.22	0.8028
Johnson Reach 2	12.2	12.24	11.28	11.02	0.3127
Slate Reach 1	12.3	11.87	11.55	11.64	0.3637
Slate Reach 2	14.23	12.01	12.29	12.1	0.1249

*significant at 95% level

Table 23: Comparison of *dg* for 2005 -2008.

8.3 Comparison with Geometric Mean for previous years.

The geometric mean particle size of samples from each site was compared with samples collected in 2005 through 2008 by applying a single factor ANOVA to the data. Table 23 shows geometric means for 2005 to 2008 and p values from ANOVA. Both reaches of Sherman Creek showed significant differences in geometric mean particle size over time with *dg* at Reach 1 being higher in 2007 and 2008 than previous years and Reach 2 high in 2006. A larger geometric mean particle size indicates samples contain less fine material and are more suitable for salmon spawning. There were no significant differences in *dg* at other sites over time.

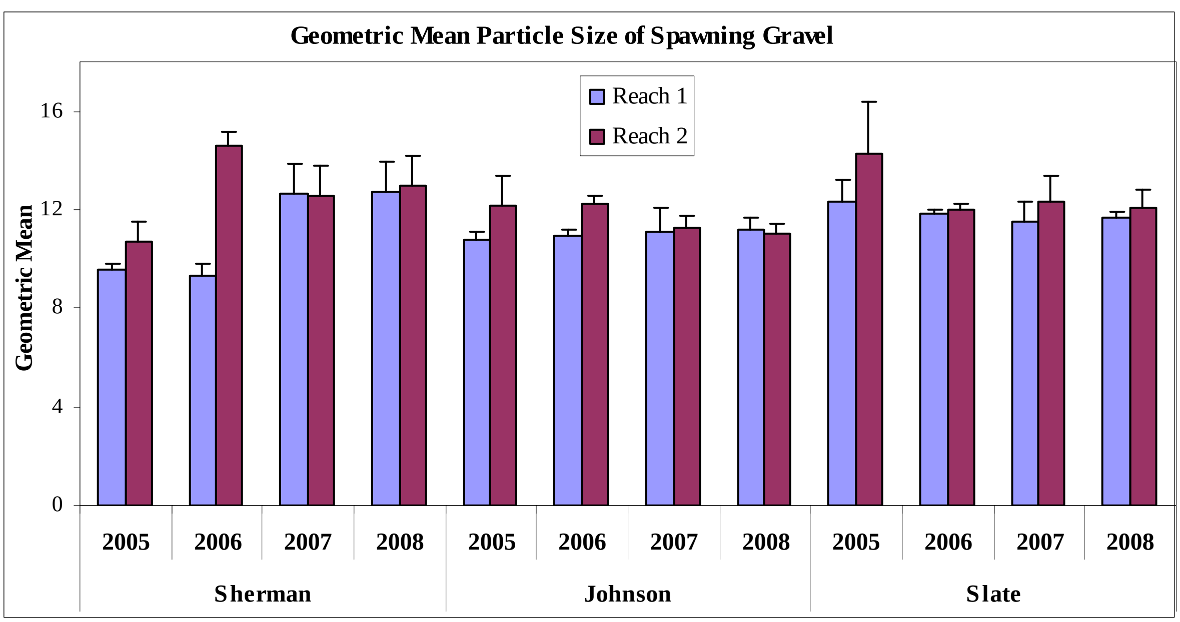


Figure 30: A comparison of geometric mean from 2005 to 2008.

9.0 Aquatic Vegetation

A visual survey of instream vegetation was carried out in the lower and middle reaches of Sherman, Sweeny, Johnson, and Slate Creeks in July and August 2008 during resident fish surveys. These reaches are downstream of outfall 001 (Sherman Creek), adjacent to the proposed Paste Tailings Facility (Sweeny Creek), the proposed outfall 002 (Slate Creek) and the mill process site (Johnson Creek). In Sherman Creek, aquatic vegetation consisted of a single layer of green algae on the larger, more stable rocks (Figure 31).

Figure 31: Algae on large boulders in lower Sherman Creek.

Sweeny Creek had very little instream vegetation, though mosses were present on bedrock exposed to air (Figure 32). Johnson and Slate Creeks showed very little aquatic vegetation on the substrate (Figures 33 and 34). Middle Slate has a light covering of green algae growing on bedrock with moss on the stream margins. Periodic high flows in these steep, coastal streams likely disturb the substrate and restrict aquatic plant growth. Some mosses and ferns are present in the splash zone, particularly near waterfalls. Spawning salmon in the lower reaches of streams may remove algae from rocks when they dig their redds.

Figure 32: Mossy bedrock and salmon carcass, Sweeny Creek.

Figure 33: Negligible aquatic vegetation in middle Johnson Creek.

Figure 34: Middle Slate Creek has a sparse covering of green algae on bedrock in summer with mosses growing on the margins.

10.0 2008 Summary

Survival of *Hyalella azteca* was higher at all sites than the laboratory control sediment, but survival of *Chironomus dilutus*, however, was lower at Lower Johnson and Middle Sherman than lab formulated sediment, but not the silica sand control. *C. dilutus* survival at Lower Johnson was similar to 2005 and 2007, but these tests showed no significant difference compared to the control sediment. The real difference is higher survival in the control in 2008. The growth of *C. dilutus* was significantly lower at all sites compared to one of the lab controls, but growth of *Hyalella azteca* was not significantly different at any site compared to the control. Analysis of stream sediment showed that some metals were elevated at Lower Slate compared to previous years, but no toxic effects were apparent from this.

The mean number of benthic invertebrate taxa was significantly higher in Johnson Creek samples than other sites. Johnson Creek samples also had the highest mean number of Ephemeroptera, Plecoptera and Trichoptera (EPT taxa). Slate Creek samples contained the highest number of non-EPT taxa, likely due to the presence of the lake upstream, which increases habitat diversity. Slate Creek has been sampled more frequently due to elevated levels of dissolved metals, but no effect on the invertebrate population has been detected (Aquatic Science Inc. 2008, 2009). Numbers of EPT taxa at Slate and Johnson Creeks were identical to numbers in 2007; fewer non-EPT taxa were found at Slate Creek in 2008 (10) compared to 2007 (14), but more were present at Johnson Creek in 2008 (8) versus 2007 (4). A decline in water quality would be expected to reduce EPT numbers and replace them with non-EPT taxa.

Sweeny Creek had the highest fish densities, likely due to the abundance of deep pools and lack of barriers to fish migration. The lowest densities were observed in Middle Slate, which contains numerous impassable, bedrock cascades and part of this reach was disturbed by windfall trees in fall 2007. The highest density of cutthroat trout was found at Lower Sweeny, where no Dolly Varden were observed. Dolly Varden densities may be suppressed when stream habitat is shared with cutthroat trout. *Oncorhynchus* (salmon and trout) tend to outcompete *Salvelinus* (char e.g. Dollys) when both are present. Only cutthroat trout were detected in Lower Slate in 2005, but both Dollys and cutthroat were observed in subsequent years. The highest Dolly Varden numbers in Lower Slate were in 2006, perhaps due to fish moving downstream during construction activity at the lake. Competition from cutthroat trout may have lead to lower Dolly numbers since then, or the change may simply be due to fish moving in and out of the lower reach via the ocean in response to changing flows or food supply. There is natural variability in the population from year to year as well as differences in the numbers detected by snorkeling and electro-fishing, which in turn may be affected by differences in stream flow and temperature at the time of sampling.

Pink salmon populations are generally larger around Southeast Alaska in even-years than odd-years. Numbers of both adult and juvenile (fry) salmon show this pattern in the streams near Kensington. Rainfall was low at the site during August 2007, which limited the number of adult salmon migrating into Sherman and Slate Creeks, with only six adult fish observed upstream of the Slate Creek fry trap site. Johnson Creek appears to have more groundwater influence and salmon still have access to this creek during low flow. The number of fry migrating out of the creek in spring 2008 was expected to be very low due to the small number of spawners, however, the population estimate was over 20,000. The majority of spawning must have taken place downstream of the trap in the intertidal area, with emerging fry pushed upstream by the tide. Numbers of adults and juveniles are in proportion to the amount of spawning habitat available at each creek.

The quality of salmon spawning gravel has not changed much over time. Only Sherman Creek has shown significant change in geometric mean particle size, which was higher at Reach 1 in 2007 and 2008 than 2005/2006 and higher at Reach 2 in 2006. A larger geometric mean particle size indicates less fine material and higher suitability for spawning. The amount of fine material in the gravel in 2008 was lower at Sherman and Johnson Creeks, but higher at Slate Creek. The Fredle index was slightly lower in 2008 than previous years due to less medium-sized gravel present at all sites, but actual survival based on fry counts appeared high.

Overall, populations of invertebrates, resident and anadromous fish and aquatic vegetation do not appear altered in any way by changes in water quality or loss of habitat. All populations appear healthy and unimpaired by human activity.

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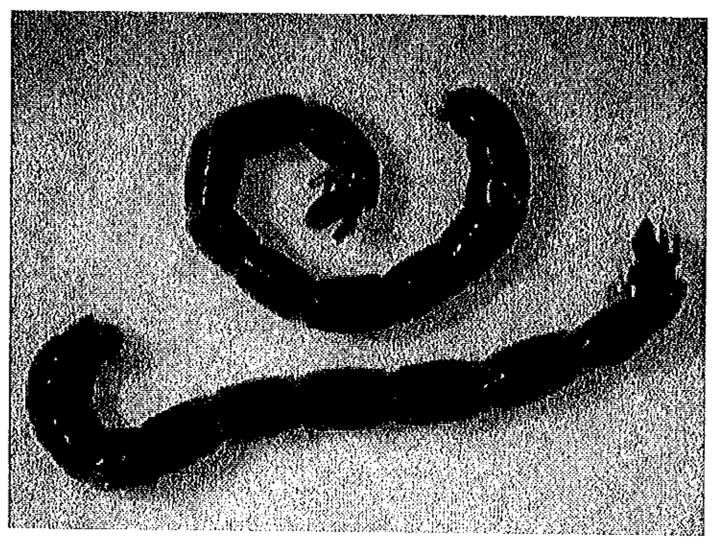
APPENDIX 1A: TOXICITY LAB REPORT FOR *Chironomus dilutus*

Coeur Alaska, Inc.
Juneau, Alaska

Report of Short-Term Toxicity of Whole Sediment to *Chironomus dilutus*

Prepared by

AECOM



AECOM Environment
Environmental Toxicology
Fort Collins, CO

08503-131-058-(027, 029, 031, 033, 035)
August 2008

Report of Short-Term Toxicity of Whole Sediment to Chironomus dilutus

Project IDs: 08503-131-058-(027, 029, 031, 033, 035)
August 2008

Sponsor and Laboratory Information

Sponsor	Coeur Alaska Inc. Kensington Mine 3031 Clinton Drive Suite 202 Juneau, Alaska 99801
Project Officer	John Randolph (907) 789-1591
Testing Facility	AECOM Environment Fort Collins Environmental Toxicology Laboratory 4303 West LaPorte Ave. Fort Collins, CO 80521 Fax: (970) 490-2963 State of Florida NELAP Laboratory ID: E87972
Study Director	David A. Pillard (970) 416-0916, ext. 310

Test Information

Test	Short-term chronic screening toxicity test of sediment	
Basis	USEPA (2000) and ASTM (2006)	
Test Protocol	CT3AK.TIE058.006	
Test Period	August 8, 2008 @ 1300 to August 18, 2008 @ 1300 - 1800	
Test Length	10 days	
Species	*Chironomus dilutus*	
Test Material	Whole sediment	
Sediment ID	Sample ID	ENSR Laboratory ID
	Lower Johnson	22016
	Lower Slate	22018
	Lower Sherman	22019
	Lower Sweeny	22015
	Middle Sherman	22017
Control Sediments	Silica Sand and Laboratory Formulated Sediment	
Overlying water	Moderately hard reconstituted water prepared according to USEPA (2002), augmented with approximately 50 mg/L Cl^- (as NaCl)	
Test Concentrations	0 (control) and 100% of each test sediment	

Sediment Collection and Receipt

Sample ID	Collection Date and Time	AECOM No.	Date of Receipt	Temp. at Arrival (°C)
Lower Johnson	07/23/08 @ 1145	22016	08/05/08	16
Lower Slate	07/24/08 @ 1130	22018	08/05/08	16
Lower Sherman	07/30/08 @ 1100	22019	08/05/08	16
Lower Sweeny	07/28/08 @ 1030	22015	08/05/08	16
Middle Sherman	07/30/08 @ 0930	22017	08/05/08	16

Note: See Appendix A for copies of chain of custody records

Control Sediment

The primary control sediment was silica sand, obtained from a local commercial supplier. A second control sediment, with a smaller grain size and higher organic matter content, was prepared in the laboratory. The composition of the formulated sediment is given in the following table (Kemble et al. 1999).

Composition of Laboratory Formulated Sediment (Control)

Material	Source	Pre-Treatment	Weight (g)
White Quartz Sand	U.S. Silica. Berkely Springs, West Virginia.	Rinsed with gentle mixing in Horsetooth water until water ran clear, then rinsed for 5 min with Milli-Q water. Air dried or dried in oven.	1242
Silt/Clay (ASP400)	Mozel, St. Louis, MO. Distributor = Englehardt	None	219
Dolomite	Grey Rock Clay Center, Ft. Collins, CO.	None	7.5
α-cellulose	Sigma	None	77.3
Humic Acid	Fluka	None	0.15
Total			1545.95

Test Sediment Preparation

Sample ID	Date Homogenized	Time Homogenized
Lower Johnson	August 7, 2008	1746 – 1750
Lower Slate		1741 – 1744
Lower Sherman		1725 – 1729
Lower Sweeny		1630 – 1636
Middle Sherman		1710 - 1714

Test Conditions

Test Type	Static sediment with continuous replacement of overlying water
Test Duration	10 days
Overlying Water Delivery System	Continuous renewal (flow-through) [a]
Test Endpoints	Survival, AFDW[b] per original and surviving organism
Test Chambers	500 ml glass beakers
Test Sediment Volume	100 ml
Overlying Water Volume	175 ml
Replicates per Treatment	8
Organisms per Replicate	10
Test Temperature	23 ± 1°C; see Protocol Deviations
Lighting	Fluorescent, 16 hours light:8 hours dark
Chamber Placement	Randomized
Test Sediment Renewal	None
Test Overlying Water Renewal	Approximately two volume additions per test chamber per day

[a] Continuous replacement via a drip system
[b] Ash-Free Dry Weight
Note: See Appendix B for the Test Protocol

Test Organism

From the lot of *Chironomus dilutus* received for use in the test, 20 were collected, preserved, and used to determine head capsule widths. The mean head capsule width of lot 08-043 was 0.38 mm. All organisms were, therefore, young third instars according to the range given in USEPA (2000).

Species and Lot Number	*Chironomus tentans*, Lot 08-043
Age	3rd instar
Source	Aquatic BioSystems (ABS), Fort Collins, CO
Overlying Water	Moderately Hard Reconstituted Water with added chloride (52 mg/L) as NaCl, RW # 8768
Reference Toxicant Testing	Initiated August 8, 2008 using sodium chloride (NaCl)

TEST RESULTS

Biological Data – Survival and Ash Free Dry Weights

Sample ID	Percent Survival[a]	Ash Free Dry Weight (mg)[a]	
		Per original organism	Per surviving organism
Sand Control	35.00	N/A	N/A
Lab. Formulated Sediment Control	83.75	1.1043	1.3281
Lower Johnson	63.75[b]	0.6636[c]	1.0469[c]
Lower Slate	76.25	0.6594[c]	0.9111[c]
Lower Sherman	76.25	0.7781[c]	1.0474[c]
Lower Sweeny	66.25	0.6539[c]	1.0246[c]
Middle Sherman	65.00[b]	0.6650[c]	1.0477[c]
Control Performance	Acceptable[d]	N/A	N/A

[a] Because of the poor survival of organisms in the sand control, all statistical comparisons were made against the formulated sediment control
[b] Significantly lower survival compared to the formulated sediment control
[c] Significantly lower weight compared to the formulated sediment control
[d] Survival in the Sand Control was unacceptable (<70%); this treatment was excluded from statistical analyses
Note: See Appendix C for test data sheets

Data Analysis

Survival in the sand control was much lower than the acceptable limit of 70%. Because of this poor performance, survival and growth data for field-collected samples were compared to the formulated sediment control data to determine statistical differences.

Biological Endpoint	Comparison[a]	Procedure
Survival	Normality	Shapiro-Wilk's Test (α=0.01)
	Homogeneity of Variance	Bartlett's Test (α=0.01)
	Significant Reduction Relative to the Formulated Sediment Control	Dunnett's Test (α = 0.05)
Growth (AFDW per Original Organism)	Normality	Shapiro-Wilk's Test (α=0.01)
	Homogeneity of Variance	Bartlett's Test (α=0.01)
	Significant Reduction Relative to the Formulated Sediment Control	Dunnett'sTest (α = 0.05)
Growth (AFDW per Surviving Organism)	Normality	Shapiro-Wilk's Test (α=0.01)
	Homogeneity of Variance	Bartlett's Test (α=0.01)
	Significant Reduction Relative to the Formulated Sediment Control	Dunnett'sTest (α = 0.05)

[a] Using Toxstat Version 3.5 (WEST, Inc. and Gulley 1996)

Analytical Data

Parameter	Sample Identification				
	Lower Johnson	Lower Slate	Lower Sherman	Lower Sweeny	Middle Sherman
Metals (mg/Kg-dry)[a]					
Aluminum	13,700	15,800	16,900	14,000	13,300
Chromium	28.1	20.3**J**	37.5	23.6	26.9
Zinc	94.2	739	100	83.2	101
Arsenic	21.9	32.6	25.6	28.8	58.3
Cadmium	0.296	11.0	0.528	0.371	0.401
Copper	93.3	111	81.5	57.4	103
Lead	11.4	21.9	8.43	15.4	17.1
Nickel	23.3	71.1	31.9	27.3	29.9
Selenium	0.413**J**	3.73	1.18	1.07	1.02
Silver	1.24	0.807	0.302	0.467	0.443
Mercury	0.0546**J**	0.149**J**	0.0434**J**	0.0517**J**	0.103**J**
Particle Size (%)[b]					
Clay	4.0	8.0	ND	4.0	4.0
Sand	72.0	60.0	64.0	64.0	72.0
Silt	24.0	32.0	36.0	32.0	24.0
Texture	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam
Coarse Material	ND	ND	ND	ND	ND
TOC (%-dry)[c]	0.78	8.65	1.92	4.69	2.82
Acid Volatile Sulfide (umoles/g)	ND	ND	ND	ND	ND

[a] Al, Cr and Zn by SW-846 Method 6010B; As, Cd, Cu, Pb, Ni, Se and Ag by SW-846 Method 6020; Hg by SW-846 7471B (USEPA 1986)
[b] Particle size was determined using ASTM Method D422 and Modified ASA 15-5
[c] TOC was determined using the Walkley Black Method
J = The concentration was below the Reporting Limit but above the Method Detection Limit
ND = Not Detected at the Method Detection Limit; see Appendix D for detection limits
Note: See Appendix D for a copy of the report from the analytical laboratory (MSE-TA Analytical Laboratory, Butte, MT)

Total and Total Volatile Solids

Sample ID	Percent Total Solids[a]	Percent Total Volatile Solids[b]
Lower Johnson	74.27	2.92
Lower Slate	71.93	3.98
Lower Sherman	76.38	2.47
Lower Sweeny	75.04	2.78
Middle Sherman	76.38	2.52

[a] Total solids were determined using Standard Methods 2540B (APHA 1989)
[b] Total volatile solids were determined using Standard Methods 2540E (APHA 1989)
All values are means of two analyzed samples
Note: See Appendix D for data sheets (these parameters were determined at the AECOM/FCETL)

Physical and Chemical Data (Min/Max)

Sample ID	pH (units)	DO (mg/L)	Cond. (µS/cm)	Temp. (°C)[a]	Ammonia as N (mg/L)	Hardness (mg/L as $CaCO_3$)	Alkalinity (mg/L as $CaCO_3$)
Sand Control	7.6/8.0	5.8/6.9	415/554	23/25	<1.0	96/108	60/82
Lab. Form. Sed.	7.7/8.1	5.2/6.9	496/558	23/25	<1.0	70/112	76/101
Lower Johnson	7.3/8.0	4.8/6.4	401/517	22/25	<1.0/2.9	76/94	58/71
Lower Slate	7.6/8.0	5.4/5.9	440/533	23/25	1.6/2.9	78/106	76/86
Lower Sherman	7.6/8.0	5.1/6.1	439/544	22/24	<1.0/2.8	92/106	83/87
Lower Sweeny	7.4/8.0	5.0/6.0	387/514	23/25	<1.0/1.8	64/94	57/71
Middle Sherman	7.5/7.9	5.3/6.4	424/529	22/25	<1.0	86/100	78/161

[a] Temperature in test chambers; see Protocol Deviations

Reference Toxicant Test Results for *C. tentans*

Organism Lot Number	Test Dates	96-Hour LC_{50}	AECOM/FCETL Historical 95% Control Limits	
			Low	High
08-043	08/08/08 to 08/12/08	5035	3601	6659

Note: Values are expressed as mg/L chloride

Protocol Deviations

Temperature as measured directly in overlying water was 25°C on days 1 and 2 for several treatments, outside the range specified in the protocol (23±1°C). Temperature was within the range specified by the protocol on all other days of the test. This deviation is not likely to have had any impact on test outcome.

Bath temperature (continuously measured) ranged from 21.4 to 26.2°C during testing, which is outside of the range of 22 to 24°C specified in the protocol. The water bath temperatures do not necessarily represent test chamber temperature, therefore the slightly cooler or warmer temperatures measured in the water bath should not be considered to be deviations from the protocol.

Ammonia in overlying water was not measured in the Lower Slate treatment on day 10 due to a shortage of water. This deviation did not affect test outcome.

To the best of the Study Director's knowledge, no further deviations from the test protocol occurred during these studies.

References

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WEST, Inc. and D.D. Gulley. 1996. Toxstat Version 3.5. Western EcoSystems Technology, Inc., Cheyenne, WY.

Statement of Procedural Compliance

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, accurate and complete.

David A. Pillard 14 Nov 2008

David A. Pillard, Ph.D. Date
Study Director

Statement of Quality Assurance

The test data were reviewed by the Quality Assurance Unit to assure that the study was performed in accordance with standard operating procedures, and that the resulting data and report meet the requirements of the NELAC standards. This report is an accurate reflection of the raw data.

Anita Rehner November 14, 2008

Quality Assurance Unit Date

APPENDIX A

Chain of Custody

ENSR | AECOM

CHAIN OF CUSTODY RECORD

Client/Project Name: Coeur Alaska

Project Location: Alaska

Project Number: 08503-131-058

Field Logbook No.:

Sampler (Print Name)/(Affiliation): LIZ FLORY AQUATIC SCIENCE

Chain of Custody Tape Nos.: 41021 (intact)

Signature: E. Flory

Send Results/Report to: LIZ FLORY, AQUATIC SCIENCE 4546 RIVER ROAD, JNU

TAT: 30 DAYS AFTER TESTS COMPLETE

Container Type: P – Plastic; A – Amber Glass; G – Clear Glass; V – VOA Vial; O – Other; E – Encore

Preservation: 1 – HCl, 4°; 2 – H2SO4, 4°; 3 – HNO3, 4°; 4 – NaOH, 4°; 5 – NaOH/ZnAc, 4°; 6 – Na2S2O3, 4°; 7 – 4°

Matrix Codes: DW – Drinking Water; WW – Wastewater; GW – Groundwater; SW – Surface Water; ST – Storm Water; W – Water; S – Soil; SL – Sludge; SD – Sediment; SO – Solid; A – Air; L – Liquid; P – Product

Analysis Requested

Field Sample No./Identification	Date	Time	COMP	GRAB	Sample Container (Size/Mat'l)	Matrix	Preserv.	Field Filtered Sieved	TOXICITY HYALELLA 10-DAY	TOXICITY CHIRONOMUS 10-DAY	METALS	Lab I.D.	Remarks
LOWER SWEENY	7-28-08	10:30	X		4L×2 P	SD	COOL	1.7 MM	X	X		22015	16°C
LOWER SWEENY	7-28-08	10:36	X		8oz A	SD	"	"			X	22015	16°C
LOWER JOHNSON	7-23-08	11:45	X		4L P	SD	"	"	X	X		22016	16°C
LOWER JOHNSON	7-23-08	11:45	X		8oz A	SD	"	"			X	22016	16°C

Relinquished by: (Print Name)/(Affiliation)	Date/Time	Received by: (Print Name)/(Affiliation)	Date/Time
LIZ FLORY, AQUATIC SCIENCE Signature: E. Flory	Date: 7-31-08 Time: 10:00	AMBER ROBERTS Signature: Amber Roberts	Date: 8/5/08 Time: 1030
Signature:	Date: Time:	Signature:	Date: Time:
Signature:	Date: Time:	Signature:	Date: Time:

Analytical Laboratory (Destination): rec on ice via Fedex
ENSR Toxicology Lab
4303 W. Laporte Avenue
Fort Collins, CO 80521
(970) 416-0916
(970) 490-2963 (FAX)

Sample Shipped Via: UPS (FedEx) Courier Other

Temp blank: Yes No

Serial No.№ 48789

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ENSR | AECOM

CHAIN OF CUSTODY RECORD

Page ____ of ____

Client/Project Name: Coeur Alaska

Project Location: Alaska

Project Number: 08503-131-058

Field Logbook No.:

Sampler (Print Name)/(Affiliation): Liz Flory, Aquatic Science Inc.

Chain of Custody Tape Nos.:

Signature: E. Flory

Send Results/Report to: Liz Flory, Aquatic Science Inc. 4546 River Rd, Juneau

TAT: 30 days after tests complete ok

Analysis Requested

Container Type: P – Plastic; A – Amber Glass; G – Clear Glass; V – VOA Vial; O – Other; E – Encore

Preservation: 1 – HCl, 4°; 2 – H2SO4, 4°; 3 – HNO3, 4°; 4 – NaOH, 4°; 5 – NaOH/ZnAc, 4°; 6 – Na2S2O3, 4°; 7 – 4°

Matrix Codes: DW – Drinking Water; WW – Wastewater; GW – Groundwater; SW – Surface Water; ST – Storm Water; W – Water; S – Soil; SL – Sludge; SD – Sediment; SO – Solid; A – Air; L – Liquid; P – Product

Field Sample No./Identification	Date	Time	COMP	GRAB	Sample Container (Size/Mat'l)	Matrix	Preserv.	Field Filtered Seived	Toxicity Hyalella 10-Day	Toxicity Chironomus 10-Day	Metals								Lab I.D.	Remarks
LOWER SLATE	7/24/08	11:30	X		4L×2P	SD	COOL	1.7 MM	X	X									22018	16°C
LOWER SLATE	7/24/08	11:30	X		8oz A	SD	"	"			X								~~22008~~ 22018	16°C
LOWER SHERMAN	7/30/08	11:00	X		4L P	SD	"	"	X	X									2019	16°C
LOWER SHERMAN	7/30/08	11:00	X		8oz A	SD	"	"			X								2019	16°C
MIDDLE SHERMAN	7/30/08	9:30	X		4L×2P	SD	"	"	X	X									22017	16°C
MIDDLE SHERMAN	7/30/08	9:30	X		8oz A	SD	"	"			X								22017	16°C

Relinquished by: (Print Name)/(Affiliation) Liz Flory, Aquatic Science
Signature: E. Flory
Date: 7-31-08 Time: 10:00

Received by: (Print Name)/(Affiliation) Amber Roberts
Signature: Amber Roberts
Date: 8/5/08 Time: 1020

Relinquished by: (Print Name)/(Affiliation)
Signature:
Date:
Time:

Received by: (Print Name)/(Affiliation)
Signature:
Date:
Time:

Relinquished by: (Print Name)/(Affiliation)
Signature:
Date:
Time:

Received by: (Print Name)/(Affiliation)
Signature:
Date:
Time:

Analytical Laboratory (Destination): Rec. on ice via Fex ed.
ENSR Toxicology Lab
4303 W. Laporte Avenue
Fort Collins, CO 80521
(970) 416-0916
(970) 490-2963 (FAX)

Sample Shipped Via: UPS (FedEx) Courier Other

Temp blank: Yes No

Serial No. № 48790

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Date 8/5/08 CF

APPENDIX B

Test Protocol

Title: Short-Term Chronic Toxicity of Bulk Sediment to the Midge, *Chironomus dilutus*

Study Sponsor:

Coeur Alaska Inc.
Kensington Mine
3031 Clinton Drive
Suite 202
Juneau, Alaska 99801
Phone: (907) 789-1591

John Randolph

Testing Facility

Fort Collins Environmental Toxicology Laboratory
4303 West LaPorte Avenue
Fort Collins, Colorado 80521
Phone: (970) 416-0916, Ext. 310
Fax: (970) 490-2963
Project Manager/Study Director: David Pillard, Ph.D.

1.0 INTRODUCTION

1.1 Objective

To determine the short-term chronic toxicity of sediment samples to the midge, *Chironomus tentans*.

1.2 Test Substance

The sediment samples will be collected by the Study Sponsor or an agent of the Study Sponsor and shipped to ENSR's Fort Collins Laboratory. At the laboratory, sediment samples will be stored under refrigeration (4°C) until used in testing. Each sample will be mechanically homogenized prior to use in testing (ENSR SOP #5208). Endemic organisms observed in the sediment will be removed manually.

2.0 BASIS AND TEST ORGANISM

2.1 Basis

This protocol is based on USEPA (2000) guidelines and ASTM Method E 1706-05 (ASTM 2006).

2.2 Test Organism

1. Species - *Chironomus dilutus*
2. Age - *Chironomus dilutus* will be 2nd to 3rd instar (approximately 10 days). Age will be confirmed by measuring the head capsule width on a minimum of 20 organisms selected from the test population.
3. Source - Test organisms will be obtained from a commercial supplier.
4. Feeding - *Chironomus dilutus* will be fed 1.5 ml of a 4 g dry solids/L (4,000 mg/1) Tetrafin® suspended in moderately hard water per exposure chamber daily.

3.0 TEST SYSTEM

3.1 Overlying Water

The overlying water used in the toxicity test will be laboratory moderately hard reconstituted water augmented prepared according to USEPA (2002), but augmented with 50 mg/L Cl^-.

3.2 Test Temperature

Test temperature will be 23 ± 1°C. Testing will be conducted in an environmental chamber or a temperature controlled water bath.

3.3 Test Containers

Test containers will be 500-ml beakers containing 100 ml of sediment and 175 ml of overlying water.

3.4 Photoperiod

The photoperiod will be 16-hours light and 8-hours dark.

3.5 Dissolved Oxygen Concentrations

Dissolved oxygen concentrations in the overlying water will be maintained >2.5 mg/L. If the dissolved oxygen concentration approaches this level, all test chambers will be gently aerated throughout the remainder of the test. If aeration is initiated, the aeration pipette will be appropriately positioned so as to avoid disturbance of the sediment.

3.6 Reference Toxicant Testing

In addition to the test material exposures, reference toxicant tests will be conducted using sodium chloride (NaCl) to determine the sensitivity range of the test organisms. Reference toxicant exposures will be conducted monthly or at the time of test initiation for in-house or commercially-supplied organisms. Reference toxicant testing will be performed according to USEPA (2000; 2002) methods.

4.0 TEST DESIGN

4.1 Test Treatments

The test concentration will be 100 percent of each test sediment. A 100 percent laboratory control sediment (see section 4.3) exposure will be conducted concurrently.

4.2 Sediment/Water Mixture

Sediment (100 ml) will be placed in each test chamber. After addition of sediment, 175 ml of overlying water will be poured into each beaker. The beakers will be left unaerated overnight to allow sediment to settle and to reduce turbidity prior to addition of test organisms.

4.3 Reference/Control Sediments

In addition to any field-collected reference sediment, at least one laboratory control sediment will be tested concurrently. The laboratory control sediment may be clean, field-collected sediment and/or a formulated sediment.

4.4 Number of Test Organisms

Eighty *Chironomus dilutus* will be exposed to each treatment. Ten organisms will be assigned to each test chamber and eight replicates will be tested per treatment.

4.5 Test Initiation/Renewal Frequency

Testing will be initiated by addition of the test organisms after the overnight settling period. Each chamber will be renewed with approximately 2 volume additions per day, beginning on day 0 (after overlying water is characterized but before organisms are added).. This will be accomplished with either a flow-through drip system or a renewal box that can be filled with overlying water and allowed to drain into the test chambers.

4.6 Chemical and Physical Monitoring

At a minimum, the following measurements will be made:

1. Dissolved oxygen, temperature, and pH will be measured in the overlying water of each treatment and the control each day of testing.
2. Hardness, alkalinity, conductivity, and ammonia will be measured in the laboratory reconstituted water (used as overlying water) on day 0.
3. Hardness, alkalinity, conductivity, and ammonia will be measured in overlying water from each treatment at test initiation (just prior to renewal on day 0 or 1) and at test termination.
4. Ammonia will also be measured in each treatment on days 3 and 7.

4.7 Biological Monitoring

After ten days of exposure, sediment from each test chamber will be removed and sieved or sorted to recover living test organisms. Organisms not recovered at test termination will be presumed dead. Dry weight will be determined at 60-90°C for 24 hours, followed by ash-free dry weight determination (550°C for at least 2 hours).

4.8 Test Duration

Test duration will be 10 days. At test termination, the surviving organisms in each test chamber will be counted and preserved in preparation for ash-free dry weight (AFDW) determination according to ENSR SOP #5033.

4.9 Calculations

Survival data will be transformed by arcsine squareroot. Normality and homogeneity assumptions for survival data will be evaluated by the Shapiro-Wilk's test and Bartlett's test, respectively (α = 0.01). Data will then be evaluated (α = 0.05) using either parametric or nonparametric methods depending upon the outcome of the normality and homogeneity assessments.

Analysis of growth (AFDW) will occur in the same manner as for survival, although the weights will not be transformed using arcsine squareroot.

4.10 Quality Criterion

Survival in the controls should be 70 percent or greater and the mean weight per surviving control organism should be at least 0.48 mg AFDW. If mortality in one or more of the control treatments exceeds 30 percent or a mean control weight is less than 0.48 mg AFDW, then the test will be reviewed to determine if certain chemical or physical characteristics of the test sediment (e.g., low dissolved oxygen or unusual pH) may have contributed to poor survival. Upon review by ENSR and the Sponsor, test data may be found acceptable.

5.0 TEST REPORT

The report will be a typed document describing the results of the test and will be signed by the Study Director and Quality Assurance Unit. The report will include, but not be limited to, the following:

- A copy of all raw data.
- Name of test, Study Director, and laboratory, and date test was begun.
- A detailed description of the sediments, including their source, time of collection, composition, known physical or chemical properties, and any information that appears on the sample container or has been provided by the Sponsor.
- The source of the overlying water, its chemical characteristics.
- Detailed information about the test organisms, including scientific name, age, life stage, source, history, acclimation procedure, and food used.
- A description of the experimental design and the test chambers, the volume of solution in the chambers, the way the test was begun, the number of organisms per treatment, and the lighting.
- A description of any aeration performed on test solutions before or during the test.
- Definition of the criterion used to determine the effect and a summary of general observations on other effects or symptoms.
- Percentage of organisms that died or showed an effect.
- The minimum dissolved oxygen concentration, range in tests temperature and pH, all visual observations of test solutions.
- Any deviations from the protocol.

6.0 LITERATURE CITED

ASTM. 2006. Standard Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Fresh Water Invertebrates. Method E 1706-05 In *2006 Annual Book of ASTM Standards, Section 11, Water and Environmental Technology, Volume 11.06, Biological Effects and Environmental Fate; Biotechnology*. American Society of Testing and Materials. Conshohocken, PA.

USEPA. 2000. Methods for Measuring Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates. Second Edition. EPA/600/R-99/064.

USEPA. 2002. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Fourth Edition. EPA-821-R-02-013.

7.0 PROCEDURAL COMPLIANCE

All test procedures, documentation, records, and reports will comply with USEPA (2000, 2002) general guidance on quality assurance related to effluent and sediment toxicity testing. To this end, random audits of the test may be scheduled while the test is in progress. The raw data will be checked and compared to protocol requirements and Standard Operating Procedures, and the final report will be audited for accuracy and signed, if satisfactory, by both the Study Director and an individual from the Quality Assurance Unit.

8.0 PROTOCOL AMENDMENTS AND DEVIATIONS

All changes (i.e., amendments, deviations, and final report revisions) of the approved protocol plus the reasons for the changes must be documented in writing. The changes will be signed and dated by the Study Director and maintained with the protocol. All amendments must be authorized in advance by the Sponsor.

9.0 SPONSOR AND STUDY DIRECTOR APPROVAL

Sponsor Approval: ______________________ Date: __________

Study Director: David A. Pillard Date: 8 Aug. 2008

APPENDIX C

Data Sheets

DEP 11-12-08
ARA 11/14/08

C tentans 10-day Survival and Growth, Testing Cover Page

Project Number:	8503-131-058 -(027,029,031,033,035)	Protocol #:	CT3AK.TIE058.00~~5~~6 ②
Test Substance:	Sediment		
Test Species:	C. ~~tentans~~ dilutus ① Lot #: 08-043	Age:	3rd Instar Supplier: ABS
Test Type:	Chronic, Static Renewal		
Dilution Water:	Mod Hard with 50 mg/L Chloride (RW 8768)	Investigators:	V / AK / SB / AE / DAP
Sampling Date(s):	7/28/08, 7/24/08, 7/30/08	Sampling Time(s):	
FCETL Sample #(s):	22015, 22016, 22017, 22018, 22019		
Test Initiation Date/Time:	8/8/08 @ 1300		
Test Termination Date/Time:	8/18/08 @ 1300-1800		

Renewal Frequency:	Cont. drip, 2+ vol/day	Feeding Freq:	daily	Food Type/Amount:	1.5 ml of 4g/L Tetrafin	Test Temp:	23 +/- 1 deg C
Test Chamber Capacity:	500-ML	Test Soltn. Vol:	100 mL sed/175 mL H2O	# Repl's/Trtmnt:	8		
Test Duration:	10 days	# Org.'s/Repl:	10	Env. Chmbr/Bath:	5		

Water Characterization: Minimum of Hardness, Alkalinity, & Conductivity on days 0 and 10; Ammonia on days 0, 3, 7, and 10; No TRC; pH, temperature & DO daily on overlying water
aerate if dissolved oxygen <2.5 mg/L

Test Sediment (s):

1)	2) Sand (cont)	3) Form sed (cont)	Lower Johnson (Test 029)
4)	5) Lower Slate (027)	6) Lower Sherman (031)	Lower Sweeny (035)
7)	8) Middle Sherman (033)	9)	
10)	11)		

Reference Tox. Dates:	8/8/08-8/12/08	LC50:	5035 mg Cl-/L	Hist. Limits:	3601-6659 Method: S-K
Study Director Initials:	DAP	Date:	8/8/08		

Overlying water added at a minimum of 2 volume additions/day; equivalent to >350 ml/day or >0.24 ml/min

① DAP 9/8/08 CF formerly C. tentans
② ARA for DAP 11/14/08 CF
③ DAP 11/14/08 E

Sample Numbers:
Lower Johnson: 22016
Lower Slate: 22018
Lower Sherman: 22019
Lower Sweeny: 22015
Middle Sherman: 22017

DAP 11-12-08
QA: AR 11/14/08

BIOLOGICAL DATA (08/18/08) *C.* ~~tentans~~ dilutus (3) Chronic, Static Renewal Project 8503-131-058 - (027, 029, 031, 033, 035)

Sediment	Test Termination	A	B	C	D	E	F	G	H	Remarks:
Sand (cont)	# Surviving	3	2	3	3	2	4	7	4	35%
	# Observed Dead	1	6	1	5	4	1	1	1	
	# Not Found	6	2	6	2	4	5	2	5	
Form sed (cont)	# Surviving	9	8	10	9	8	9	7	7	83.75%
	# Observed Dead	0	0	0	0	0	0	0	0	
	# Not Found	1	2	0	1	2	1	3	~~0~~ 3 (4)	
Lower Johnson	# Surviving	6	8	7	4	5	8	7	6	63.75 %
	# Observed Dead	0	0	0	1*	0	0	0	1	
	# Not Found	4	2	3	5	5	2	3	3	
Lower Slate	# Surviving	10	6	9	8	4	7	9	8	76.25 %
	# Observed Dead	0	0	0	0	0	0	0	0	
	# Not Found	0	4	1	2	6	3	1	2	
Lower Sherman	# Surviving	9	7	9	6	9*	5	8	8	76.25 %
	# Observed Dead	0	0	0	0	0	0	1	0	
	# Not Found	1	3	1*	4	1	5	(4) ~~0~~ 1	2	
Lower Sweeny	# Surviving	8	3	7	9	7	7	5	7	66.25 %
	# Observed Dead	0	0	0	0	0	0	0	0	
	# Not Found	(4) ~~0~~ 2	(2) ~~0~~ 7	3	(2) ~~0~~ 1	3 ~~8~~ (1)	3	5	3	
Middle Sherman	# Surviving	8	7	3	9	5	7	6	7	65 %
	# Observed Dead	0	0	1	0	1 •	1	0	0	
	# Not Found	(2) ~~0~~ 2	3	6	1	4 ▲	2	4	3	
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
	8/18/08									
	@ ~~1130~~ 1100 (1)									

* 1 pupae ▲ 1 exuvia found • partial org found

(1) 8/18/08 WP (2) DAP 8/24/08 CF (3) AR 11/14/08 CF

(4) DAP 11/14/08 E

DAP 11/12/08
AR 11/14/08

CHEMICAL DATA (Composite of Overlying Water) C. ~~tentans~~ dilutus ④ Chronic, Static Renewal Project 8503-131-058 - (027, 029, 031, 033, 035)

Parameter	Sediment	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day	Meter	Date	Time	Initials
Dissolved	Sand (cont)	6.9	6.5	6.3	6.2	6.2	6.0	5.8	6.1	5.8	6.1	6.1	0	5	8/8/08	0955	N
Oxygen	Form sed (cont)	6.9	5.8	5.7	6.2	5.2	5.2	5.5	5.3	5.6	5.5	5.2	1	9	8/9/08	1630	AK
(mg/l)	Lower Johnson	6.1	6.4	5.9	6.0	5.5	4.8	6.0	5.6	5.5	5.8	6.2	2	5	8/10/08	1500	AK
	Lower Slate	5.8	5.9	5.7	5.9	5.5	~~6.8~~ 5.7	5.4	~~4.9~~ 5.5	5.6	5.6	5.5	3	5	8/11/08	1710	AP
	Lower Sherman	5.9	5.2	5.5	5.9	5.4	6.1	5.5	6.0	5.2	5.6	6.1	4	5	8/12/08	1110	AP
	Lower Sweeny	6.0	5.7	5.8	6.0	5.5	5.0	5.3	6.0	5.3	5.5	5.9	5	9	8/13/08	1150	AP
	Middle Sherman	6.1	5.5	5.8	6.1	5.4	5.3	5.3	5.5	5.7	5.5	6.4	6	5	8/14/08	1110	AP
	0												7	5	8/15/08	1130	RS
	0												8	5	8/16/08	1210	AP
	0												9	5	8/17/08	1340	AP
													10	5	8/18/08	1330	DAP
Temp	Sand (cont)	23	24	25	24	24	24	23	23	23	23	23	0	D-32	8/8/08	0955	N
(deg C)	Form sed (cont)	23	25	25	24	24	24	23	23	23	23	23	1	D-32	8/9/08	1630	AK
	Lower Johnson	23	23	24	24	23	24	24	23	23	23	22	2	D-36	8/10/08	1445	AK
	Lower Slate	23	25	24	24	24	24	23	23	23	23	23	3	D37	8/11/08	1710	AP
	Lower Sherman	23	24	24	24	24	24	24	23	23	23	22	4	D36	8/12/08	1100	AP
	Lower Sweeny	23	25	25	24	24	24	23	23	23	23	23	5	D42	8/13/08	1145	AP
	Middle Sherman	23	25	25	24	23	24	23	23	23	23	22	6	D37	8/14/08	1100	AP
	0												7	D40	8/15/08	1110	AP
	0												8	D40	8/16/08	1150	AP
	0												9	D42	8/17/08	1320	AP
													10	③ ~~D30~~ D42	8/18/08	1330	DAP
pH	Sand (cont)	7.9	8.0	7.8	8.0	8.0	8.0	7.9	8.0	7.6	8.0	7.9	0	12	8/8/08	0955	N
	Form sed (cont)	7.9	8.0	8.0	8.1	7.7	7.7	7.8	7.9	7.7	7.7	7.7	1	12	8/9/08	1630	AK
	Lower Johnson	7.3	7.4	7.6	7.7	7.5	7.5	7.5	8.0	7.5	7.7	7.8	2	12	8/10/08	1500	AK
	Lower Slate	7.6	7.9	7.8	7.9	7.7	7.7	7.6	8.0	7.7	7.7	7.7	3	12	8/11/08	1710	SC
	Lower Sherman	7.7	7.7	7.8	7.9	7.7	7.7	7.7	8.0	7.6	7.7	7.9	4	12	8/12/08	1120	AP
	Lower Sweeny	7.4	7.5	7.6	7.7	7.4	7.4	7.5	8.0	7.5	7.6	7.7	5	12	8/13/08	1140	AP
	Middle Sherman	7.8	7.8	7.9	7.9	7.6	7.6	7.7	7.9	7.5	7.7	7.9	6	12	8/14/08	1050	AP
	0												7	16	8/15/08	1120	RS
	0												8	16	8/16/08	1800	AP
	0												9	16	8/17/08	1330	AP
	Replicate:		A	B	C	D	E	F	G	H	A	B	10	16	8/18/08	1330	DAP

① AP 8/13/08 E
② RS 8/15/08 E
③ DAP 8/18/08 E
④ AR 11/14/08 CF
⑤ DAP 11/14/08

OVERLYING WATER CHARACTERIZATION C. ~~tentans~~ dilutus (1) Chronic, Static Renewal Project No. 8503-131-058 - (027, 029, 031, 033, 035)

	Conductivity (s/cm)		Hardness (mg/L as CaCO3)		Alkalinity (mg/l as CaCO3)		Ammonia (mg/l)			
Sediment	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10	Day 0	Day 3	Day 7	Day 10
Sand (cont)	415	554	108	96	60	82	<1.0	<1.0	<1.0	<1.0
Form sed (cont)	496	558	70	112	76	101	<1.0	<1.0	<1.0	<1.0
Lower Johnson	401	517	76	94	58	71	1.4	2.9	1.1	<1.0
Lower Slate	440	533	78	106	86	76	1.6	2.9	2.9	Nm
Lower Sherman	439	544	92	106	83	87	1.8	2.8	1.4	<1.0
Lower Sweeny	387	514	64	94	57	71	<1.0	1.8	<1.0	<1.0
Middle Sherman	424	529	86	100	161	78	<1.0	<1.0	<1.0	<1.0
Mod Hard (RW)										
0										
0										
Meter #	15	15	Titr	Titr	Titr	Titr	~~HA#1~~	HA #1	HA#1	HA#1
Date:	8/8/08	8/18/08	8/8/08	8/18/08	8/8/08	8/18/08	8/8/08	8/11/08	8/15/08	8/18/08
Time:	0955	1700	1010	1700	1010	1700	1010	1740	1510	1700
Initials:	✓	AK	SD	DAP For AK	SD	DAP For AK	SD	[illegible]	KS	DAP For AK

(1) AR 11/14/08 CF
(2) DAP 11/14/08 E

FCETL QA Form No.108
Revision 0
Effective 08/99

DAP 11/12/08
corr: DAP 11/14/08

TEST ORGANISM DRY WEIGHT AND ASH-FREE DRY WEIGHT (AFDW)

Project No: 8503-131-058 → (027, 031, 029, 033, 035)
Species: C. dilutus
Lot/Batch No.: 08-043
Analytical Balance ID: Sart#1

TARE: Date/time: 8/27/08 @ 1015 Analyst: [initials]
DRY GROSS: Date/time: 9/10/08 @ 1245 Analyst: DAP
ASHED GROSS: Date/time: 9/11/08 @ 1100 Analyst: DAP

Dried in Oven # 3 from Date: 9/3/08 Time: 1310
Oven °C: 65 to Date: 9/10/08 Time: 0915
Ashed in Furnace from Date: 9/10/08 Time: 1340
Furnace °C: 550 to Date: 9/10/08 Time: 1550

Indicate mean weight is **Dry Weight** or **AFDW** (Circle one)

Boat No.	Treatment	Rep	Tare Weight (g) A	Dry Gross Weight (g) B	Dry Net Weight (g) (B-A)	Adjusted Dry Net Weight (g)[1]	Ashed Gross Weight (g) (D)	AFDW (g) (B-D)	No. of Original Org.	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Org.	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
1	Sand	A	2.17950	2.18270			2.17978		10			3		
2		B	2.19983	2.20031			2.19984		10			2		
3		C	1.97078	1.97154			1.97087		10			3		
4		D	2.22818	2.22868			2.22822		10			3		
5		E	2.35705	2.35739			2.35706		10			2		
6		F	1.95058	1.95170			1.95068		10			4		
7		G	2.03167	2.03361			2.03181		10			7		
8		H	2.18223	2.18296			2.18225		10			4		
Blank	A		2.35269	2.35266			2.35269							

[1] Add in weight loss of blank boat, if appropriate.

① DAP 11-14-08 E

DAP 11-12-08
QA: AEM 11/14/08

TEST ORGANISM DRY WEIGHT AND ASH-FREE DRY WEIGHT (AFDW)

→ (027, 029, 031, 033, 035)

Project No: 8503-137059
Species: C. dilutus
Lot/Batch No.: 08-043
Analytical Balance ID: Sart #1

TARE: Date/time: 8/27/08 @1015 Analyst: [initials]
DRY GROSS: Date/time: 9/10/08 @ 1245 Analyst: DAP
ASHED GROSS: Date/time: 9/11/08 @ 1100 Analyst: DAP

Dried in Oven # 3 from Date: 9/3/08 Time: 1310 to Date: 9/10/08 Time: 0915
Oven °C: 65
Ashed in Furnace from Date: 9/10/08 Time: 1340 to Date: 9/10/08 Time: 1550
Furnace °C: 550

Indicate mean weight is **Dry Weight** or **AFDW** (Circle one)

Boat No.	Treatment	Rep	Tare Weight (g) A	Dry Gross Weight (g) B	Dry Net Weight (g) (B-A)	Adjusted Dry Net Weight (g)[1]	Ashed Gross Weight (g) (D)	AFDW (g) (B-D)	No. of Original Org.	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Org.	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
9	Form	A	1.94345	1.95981			1.94686		10			9		
10	Sed	B	2.21539	2.23171			2.21963		10			8		
11		C	2.26890	2.28536			2.27392		10			10		
12		D	2.35050	2.37020			2.36024		10			9		
13		E	1.99155	2.00794			1.99537		10			8		
14		F	2.21719	2.23254			2.22191		10			9		
15		G	2.29084	2.30386			2.29407		10			7		
16		H	1.96480	1.97701			1.96809		10			7		
Blank	A		2.35269	2.35266			2.35269							

[1] Add in weight loss of blank boat, if appropriate. ① DAP 11-14-08 E

DAP 11-12-08
QA: ARU 11/14/08

TEST ORGANISM DRY WEIGHT AND ASH-FREE DRY WEIGHT (AFDW)

→ (027, 029, 031, 033, 035)

Project No: 8503-131058
Species: C. dilutus
Lot/Batch No.: 08-043
Analytical Balance ID: Sart #1

TARE: Date/time: 8/27/08 @ 1015 Analyst: [initials]
DRY GROSS: Date/time: 9/10/08 @ 1245 Analyst: DAP
ASHED GROSS: Date/time: 9/11/08 @ 1100 Analyst: DAP

Dried in Oven # 3 from Date: 9/3/08 Time: 1310 to Date: 9/10/08 Time: 0915
Oven °C: 65
Ashed in Furnace from Date: 9/10/08 Time: 1340 to Date: 9/10/08 Time: 1550
Furnace °C: 550

Indicate mean weight is **Dry Weight** or **AFDW** (Circle one)

Boat No.	Treatment	Rep	Tare Weight (g) A	Dry Gross Weight (g) B	Dry Net Weight (g) (B-A)	Adjusted Dry Net Weight (g)[1]	Ashed Gross Weight (g) (D)	AFDW (g) (B-D)	No. of Original Org.	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Org.	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
17	Lower	A	2.20063	2.21017			2.20348		10			6		
18	Johnson	B	1.87904	1.88906			1.88213		10			8		
19		C	2.11455	2.12636			2.11849		10			7		
20		D	2.37666	2.38187			2.37822		10			4		
21		E	2.33450	2.34360			2.33704		10			5		
22		F	1.82777	1.83823			1.82993		10			8		
23		G	1.84595	1.85721			1.84989		10			7		
24		H	2.09772	2.10637			2.10060		10			6		
Blank	B		2.26186	2.26185			~~2.26189~~ (1) ← 2.26186							

[1] Add in weight loss of blank boat, if appropriate. (1) DAP 9/11/08 E (2) DAP ~~9/~~ (2) 11/14/08 E

DAP 11-12-08
QA: ARW 11/14/08

TEST ORGANISM DRY WEIGHT AND ASH-FREE DRY WEIGHT (AFDW)

(027, 029, 031, 033, 035)

Project No: 8503.13L058	TARE: Date/time: 8/27/08@1015 Analyst: [initials]	Dried in Oven # 3 from Date: 9/3/08 Time: 1310
Species: C. dilutus	DRY GROSS: Date/time: 9/10/08 @ 1245 Analyst: DAP	Oven °C: 65 to Date: 9/10/08 Time: 0915
Lot/Batch No.: 08-043		Ashed in Furnace from Date: 9/10/08 Time: 1340
Analytical Balance ID: Sart #1	ASHED GROSS: Date/time: 9/11/08 @ 1100 Analyst: DAP	Furnace °C: 550 to Date: 9/10/08 Time: 1550

Indicate mean weight is **Dry Weight** or **AFDW** (Circle one)

Boat No.	Treatment	Rep	Tare Weight (g) A	Dry Gross Weight (g) B	Dry Net Weight (g) (B-A)	Adjusted Dry Net Weight (g)[1]	Ashed Gross Weight (g) (D)	AFDW (g) (B-D)	No. of Original Org.	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Org.	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
25	Lower	A	2.03555	2.04606			2.03830		10			10		
26	Slate	B	1.98154	1.98896			1.98299		10			6		
27		C	1.98008	1.98999			1.98259		10			9		
28		D	2.20961	2.21952			2.21209		10			8		
29		E	2.24435	2.25077			2.24512		10			4		
30		F	2.05887	2.06795			2.06130		10			7		
31		G	2.23125	2.23863			2.23275		10			9		
32		H	1.85404	1.86219			1.85618		10			8		
Blank	B													

[1] Add in weight loss of blank boat, if appropriate. ① DAP 11-14-08 E

DAP 11-12-08
QA: MZU 11/14/08

TEST ORGANISM DRY WEIGHT AND ASH-FREE DRY WEIGHT (AFDW)

→ (027, 029, 031, 033, 035

Project No: 8503-131-058
Species: C. dilutus
Lot/Batch No.: 08-043
Analytical Balance ID: Sart #1

TARE: Date/time: ~~8~~ 9/2/08 @ 1015 Analyst: [initials]
DRY GROSS: Date/time: 9/10/08 @ 1245 Analyst: DAP
ASHED GROSS: Date/time: 9/11/08 @ 1100 Analyst: DAP

Dried in Oven # 3 from Date: 9/3/08 Time: 1310
Oven °C: 65 to Date: 9/10/08 Time: 0915
Ashed in Furnace from Date: 9/10/08 Time: 1340
Furnace °C: 550 to Date: 9/10/08 Time: 1550

Indicate mean weight is **Dry Weight** or **AFDW** (Circle one)

Boat No.	Treatment	Rep	Tare Weight (g) A	Dry Gross Weight (g) B	Dry Net Weight (g) (B-A)	Adjusted Dry Net Weight (g)[1]	Ashed Gross Weight (g) (D)	AFDW (g) (B-D)	No. of Original Org.	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Org.	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
33	Lower	A	2.24049	2.25961			2.25087		10			9		
34	Sherman	B	1.93107	1.94287			1.93349		10			7		
35		C	2.21169	2.22288			2.21579		10			9		
36		D	2.02142	2.03017			2.02390		10			6		
37		E	2.16465	2.17638			2.16873		(2) ~~9~~ ~~8~~ 9 (3)			8		
38		F	1.97775	1.98660			1.9~~7~~8000 (1)		10			5		
39		G	1.97046	1.98100			1.97424		10			8		
40		H	1.75874	1.77241			1.76350		10			8		
Blank														

[1] Add in weight loss of blank boat, if appropriate.

(1) DAP 9-11-08 E (2) 9 Alive, but 1 was a pupae & not included in weight analysis DAP
(3) 9 included as # of original DAP (4) DAP 11-14-08 E

DAP 11-12-08
QA: ARH 11/14/08

TEST ORGANISM DRY WEIGHT AND ASH-FREE DRY WEIGHT (AFDW)

→ (027, 029, 031, 033, 035)

Project No: 8503-131-058

Species: C. dilutus
Lot/Batch No.: 08-043

Analytical Balance ID: Sart #1

TARE: Date/time: 8/27/08 @ 1015 Analyst: [illegible]

DRY GROSS: Date/time: 9/10/08 @ 1245 Analyst: DAP

ASHED GROSS: Date/time: 9/11/08 @ 1100 Analyst: DAP

Dried in Oven # 3 from Date: 9/3/08 Time: 1310
Oven °C: 65 to Date: 9/10/08 Time: 0915

Ashed in Furnace from Date: 9/10/08 Time: 1340
Furnace °C: 550 to Date: 9/10/08 Time: 1550

Indicate mean weight is **Dry Weight** or **AFDW** (Circle one)

Boat No.	Treatment	Rep	Tare Weight (g) A	Dry Gross Weight (g) B	Dry Net Weight (g) (B-A)	Adjusted Dry Net Weight (g)[1]	Ashed Gross Weight (g) (D)	AFDW (g) (B-D)	No. of Original Org.	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Org.	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
41	Lower	A	1.88184	1.89224			1.88587		10			8		
42	Sweeny	B	1.93575	1.94165			1.93783		10			3		
43		C	2.29733	2.30967			2.30226		10			7		
44		D	2.24500	2.25623			2.24846		10			9		
45		E	2.24054	2.25311			2.24517		10			7		
46		F	1.87041	1.87967			1.87284		10			7		
47		G	1.87598	1.88460			1.87836		10			5		
48		H	1.98055	1.98933			1.98340		10			7		
Blank	B													

[1] Add in weight loss of blank boat, if appropriate.

① DAP 11-14-08 E

FCETL QA Form No.108
Revision 0
Effective 08/99

DAP 11-12-08
QA ~ ACW 11/14/08

TEST ORGANISM DRY WEIGHT AND ASH-FREE DRY WEIGHT (AFDW)

(027, 029, 031, 033, 035)

Project No: 9503-131-050
Species: C. dilutus
Lot/Batch No.: 08-043
Analytical Balance ID: Sart #1

TARE: Date/time: 8/27/08 @ 1015 Analyst: [initials]
DRY GROSS: Date/time: 9/10/08 @ 1245 Analyst: DAP
ASHED GROSS: Date/time: 9/11/08 @ 1100 Analyst: DAP

Dried in Oven # 3 from Date: 9/3/08 Time: 1310
Oven °C: 65 to Date: 9/10/08 Time: 0915
Ashed in Furnace from Date: 9/10/08 Time: 1340
Furnace °C: 550 to Date: 9/10/08 Time: 1550

Indicate mean weight is **Dry Weight** or **AFDW** (Circle one)

Boat No.	Treatment	Rep	Tare Weight (g) A	Dry Gross Weight (g) B	Dry Net Weight (g) (B-A)	Adjusted Dry Net Weight (g)[1]	Ashed Gross Weight (g) (D)	AFDW (g) (B-D)	No. of Original Org.	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Org.	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
49	Middle	A	2.12139	2.13287			2.12541		10			8		
50	Sherman	B	2.13013	2.14110			2.13336		10			7		
53		C	1.96442	1.96912			1.96568		10			3		
54		D	2.08136	2.09293			2.08522		10			9		
55		E	1.85796	~~1.9~~ ② 1.86491			1.85953		10			5		
57		F	1.877~~30~~ ① 39	1.88545			1.87901		10			7		
60		G	2.06066	2.07245			2.06419		10			6		
64		H	2.15891	2.16830			2.16153		10			7		
Blank	B													

[1] Add in weight loss of blank boat, if appropriate.

① [initials] 8/27/08 E ② DAP 9-10-08 E ③ DAP 11-14-08 E

Spreadsheet for AFDW

DAP 11-12-08
AP ARM 11/14/08

Test Start Date:	8/8/2008	**Test End Date:**	8/18/2008
Test Number(s):	8503-131-058-(027, 029, 031, 033, 035))	**Test Material:**	Sediment
Species:	*C. dilutus*	**Entered by:**	DAP

Boat #	Treatment	Rep	Tare wt (dry) (g)	Gross wt (dry) (g)	Dry net wt (g)	Dry adjusted net wt (g)	Ashed gross wt (g)	AFDW (g)	Adjusted AFDW (g)	Number original organisms	Mean wt per orig (mg) AFDW	Mean wt per treatment (orig) (mg) AFDW	Number surviving ②	Mean wt per surviving AFDW	Mean wt per treatment (surv) (mg) AFDW
1	Sand cont	A	2.17950	2.18270	0.00320	0.00323	2.17978	0.00292	0.00292	10	0.2920	0.1048	3	0.9733	0.3050
2	Sand cont	B	2.19983	2.20031	0.00048	0.00051	2.19984	0.00047	0.00047	10	0.0470		2	0.2350	
3	Sand cont	C	1.97078	1.97154	0.00076	0.00079	1.97087	0.00067	0.00067	10	0.0670		3	0.2233	
4	Sand cont	D	2.22818	2.22868	0.00050	0.00053	2.22822	0.00046	0.00046	10	0.0460		3	0.1533	
5	Sand cont	E	2.35705	2.35739	0.00034	0.00037	2.35706	0.00033	0.00033	10	0.0330		2	0.1650	
6	Sand cont	F	1.95058	1.95170	0.00112	0.00115	1.95068	0.00102	0.00102	10	0.1020		4	0.2550	
7	Sand cont	G	2.03167	2.03361	0.00194	0.00197	2.03181	0.00180	0.00180	10	0.1800		7	0.2571	
8	Sand cont	H	2.18223	2.18296	0.00073	0.00076	2.18225	0.00071	0.00071	10	0.0710		4	0.1775	
9	Form sed	A	1.94345	1.95981	0.01636	0.01639	1.94686	0.01295	0.01295	10	1.2950	1.1043	9	1.4389	1.3281
10	Form sed	B	2.21539	2.23171	0.01632	0.01635	2.21963	0.01208	0.01208	10	1.2080		8	1.5100	
11	Form sed	C	2.26870	2.28536	0.01666	0.01669	2.27392	0.01144	0.01144	10	1.1440		10	1.1440	
12	Form sed	D	2.35650	2.37020	0.01370	0.01373	2.36024	0.00996	0.00996	10	0.9960		9	1.1067	
13	Form sed	E	1.99155	2.00794	0.01639	0.01642	1.99537	0.01257	0.01257	10	1.2570		8	1.5713	
14	Form sed	F	2.21719	2.23254	0.01535	0.01538	2.22191	0.01063	0.01063	10	1.0630		9	1.1811	
15	Form sed	G	2.29084	2.30386	0.01302	0.01305	2.29407	0.00979	0.00979	10	0.9790		7	1.3986	
16	Form sed	H	1.96480	1.97701	0.01221	0.01224	1.96809	0.00892	0.00892	10	0.8920		7	1.2743	
Blank	A		2.35269	2.35266	-3E-05		2.35269	0.00003							

Note: Any loss of crucible weight upon ashing (column O) should be added to the ASH WEIGHT, and thus **subtracted** from the ASH FREE DRY WEIGHT. Because the weight loss is a negative number,

① DAP 11-14-08 E

② DAP 11-14-08 CF

Spreadsheet for AFDW

DAP 11-12-08
QA: AR 11/14/08

Test Start Date:	8/8/2008	Test End Date:	8/18/2008
Test Number(s):	8503-131-058-(027, 029, 031, 033, 035))	Test Material:	Sediment
Species:	*C. dilutus*	Entered by:	DAP

AFDW AFDW ② AFDW AFDW

Boat #	Treatment	Rep	Tare wt (dry) (g)	Gross wt (dry) (g)	Dry net wt (g)	Dry adjusted net wt (g)	Ashed gross wt (g)	AFDW (g)	Adjusted AFDW (g)	Number original organisms	Mean wt per orig (mg)	Mean wt per treatment (orig) (mg)	Number surviving	Mean wt per surviving	Mean wt per treatment (surv) (mg)
17	Lower Johnson	A	2.20063	2.21017	0.00954	0.00955	2.20348	0.00669	0.00669	10	0.6690	0.6636	6	1.1150	1.0469
18	Lower Johnson	B	1.87904	1.88906	0.01002	0.01003	1.88213	0.00693	0.00693	10	0.6930	-	8	0.8662	-
19	Lower Johnson	C	2.11455	2.12636	0.01181	0.01182	2.11849	0.00787	0.00787	10	0.7870	-	7	1.1243	-
20	Lower Johnson	D	2.37666	2.38187	0.00521	0.00522	2.37822	0.00365	0.00365	10	0.3650	-	4	0.9125	-
21	Lower Johnson	E	2.33450	2.34360	0.00910	0.00911	2.33704	0.00656	0.00656	10	0.6560	-	5	1.3120	-
22	Lower Johnson	F	1.82777	1.83823	0.01046	0.01047	1.82993	0.00830	0.00830	10	0.8300	-	8	1.0375	-
23	Lower Johnson	G	1.84595	1.85721	0.01126	0.01127	1.84989	0.00732	0.00732	10	0.7320	-	7	1.0457	-
24	Lower Johnson	H	2.09772	2.10637	0.00865	0.00866	2.10060	0.00577	0.00577	10	0.5770		6	0.9617	
25	Lower Slate	A	2.03555	2.04606	0.01051	0.01052	2.03830	0.00776	0.00776	10	0.7760	0.6594	10	0.7760	0.9111
26	Lower Slate	B	1.98154	1.98896	0.00742	0.00743	1.98299	0.00597	0.00597	10	0.5970		6	0.9950	
27	Lower Slate	C	1.98008	1.98999	0.00991	0.00992	1.98259	0.00740	0.00740	10	0.7400		9	0.8222	
28	Lower Slate	D	2.20961	2.21952	0.00991	0.00992	2.21209	0.00743	0.00743	10	0.7430		8	0.9288	
29	Lower Slate	E	2.24435	2.25077	0.00642	0.00643	2.24512	0.00565	0.00565	10	0.5650		4	1.4125	
30	Lower Slate	F	2.05887	2.06795	0.00908	0.00909	2.06130	0.00665	0.00665	10	0.6650		7	0.9500	
31	Lower Slate	G	2.23125	2.23863	0.00738	0.00739	2.23275	0.00588	0.00588	10	0.5880		9	0.6533	
32	Lower Slate	H	1.85404	1.86219	0.00815	0.00816	1.85618	0.00601	0.00601	10	0.6010		8	0.7513	
33	Lower Sherman	A	2.24649	2.25961	0.01312	0.01313	2.25087	0.00874	0.00874	10	0.8740	0.7781	9	0.9711	1.0474
34	Lower Sherman	B	1.93107	1.94287	0.01180	0.01181	1.93349	0.00938	0.00938	10	0.9380		7	1.3400	
35	Lower Sherman	C	2.21168	2.22288	0.01120	0.01121	2.21579	0.00709	0.00709	10	0.7090		9	0.7878	
36	Lower Sherman	D	2.02142	2.03017	0.00875	0.00876	2.02390	0.00627	0.00627	10	0.6270		6	1.0450	
37	Lower Sherman	E	2.16465	2.17638	0.01173	0.01174	2.16873	0.00765	0.00765	9	0.8500		8	0.9562	
38	Lower Sherman	F	1.97775	1.98660	0.00885	0.00886	1.98000	0.00660	0.00660	10	0.6600		5	1.3200	
39	Lower Sherman	G	1.97046	1.98100	0.01054	0.01055	1.97424	0.00676	0.00676	10	0.6760		8	0.8450	
40	Lower Sherman	H	1.75874	1.77241	0.01367	0.01368	1.76350	0.00891	0.00891	10	0.8910		8	1.1138	
41	Lower Sweeny	A	1.88184	1.89224	0.01040	0.01041	1.88587	0.00637	0.00637	10	0.6370	0.6539	8	0.7962	1.0246
42	Lower Sweeny	B	1.93575	1.94165	0.00590	0.00591	1.93783	0.00382	0.00382	10	0.3820		3	1.2733	
43	Lower Sweeny	C	2.29733	2.30967	0.01234	0.01235	2.30226	0.00741	0.00741	10	0.7410		7	1.0586	
44	Lower Sweeny	D	2.24500	2.25623	0.01123	0.01124	2.24846	0.00777	0.00777	10	0.7770		9	0.8633	
45	Lower Sweeny	E	2.24054	2.25311	0.01257	0.01258	2.24517	0.00794	0.00794	10	0.7940		7	1.1343	
46	Lower Sweeny	F	1.87041	1.87967	0.00926	0.00927	1.87284	0.00683	0.00683	10	0.6830	-	7	0.9757	-
47	Lower Sweeny	G	1.87598	1.88460	0.00862	0.00863	1.87836	0.00624	0.00624	10	0.6240	-	5	1.2480	-
48	Lower Sweeny	H	1.98055	1.98933	0.00878	0.00879	1.98340	0.00593	0.00593	10	0.5930		7	0.8471	
49	Middle Sherman	A	2.12139	2.13287	0.01148	0.01149	2.12541	0.00746	0.00746	10	0.7460	0.6650	8	0.9325	1.0477
50	Middle Sherman	B	2.13013	2.14110	0.01097	0.01098	2.13336	0.00774	0.00774	10	0.7740	-	7	1.1057	-
51	Middle Sherman	C	1.96442	1.96912	0.00470	0.00471	1.96568	0.00344	0.00344	10	0.3440	-	3	1.1467	-
52	Middle Sherman	D	2.08136	2.09293	0.01157	0.01158	2.08522	0.00771	0.00771	10	0.7710	-	9	0.8567	-
53	Middle Sherman	E	1.85796	1.86491	0.00695	0.00696	1.85953	0.00538	0.00538	10	0.5380	-	5	1.0760	-
54	Middle Sherman	F	1.87741	1.88545	0.00804	0.00805	1.87901	0.00644	0.00644	10	0.6440	-	7	0.9200	-
55	Middle Sherman	G	2.06066	2.07245	0.01179	0.01180	2.06419	0.00826	0.00826	10	0.8260	-	6	1.3767	-
56	Middle Sherman	H	2.15891	2.16830	0.00939	0.00940	2.16153	0.00677	0.00677	10	0.6770		7	0.9671	
Blank	B		2.26186	2.26185	-1E-05		2.26186	0.00001							

① DAP 11-14-08 E

② DAP 11-14-08 CF

DAILY TESTING LOG C. *tentans* Chronic, Static Renewal Project No. 8503-131-058 -(027, 029, 031, 033, 035)

Day	Bath CT	Range	Feeding	Initials/Date
Day -1	8/7/08, Cl⁻ of RW 8768 = 52 mg/L			
Day 0	- Homogenized sediment & added sed. to test beakers - Covered sed with ≈175 ml overlying water		N/A	DAP 8/8/08
Day 1	25.6 °C	25.0 - 26.2 °C	1645 AK	AK 8/9/08
Day 2	25.6 °C	25.4 - 26.2 °C	1445 AK	AK 8/10/08
Day 3	25.4 °C removed 1 dead from Sand G+F	25.0 - 25.8 °C	1710 [illegible]	[illegible] 8/11/08
Day 4	25.4 °C	24.6 - 25.8 °C	1640 AK	AK 8/12/08
Day 5	25.2°C	24.4 - 25.8°C	1725 AK	DAP for AK 8/13/08
Day 6	25.2°C	24.4 - 25.8°C	1535 AK	DAP for AK 8/14/08
Day 7	23.6°C	22.8 - 25.4°C	1430 [illegible]	[illegible] 8/15/08
Day 8	23.4°C	22.6 - 25.0°C	1430 [illegible]	[illegible] 8/16/08
Day 9	22.6°C	21.8 - 23.6°C	1640 DH	DH 8/17/08
Day 10	22.8°C	21.4 - 24.0°C	N/A	DAP 8/18/08

① DAP 11-14-08 E

8503-131-058-027 thru-035

SEDIMENT/SOIL PREPARATION (add'l studies) DSP 11/14/08 QA: ARZ 11/14/08

Artificial soil	
Constituent/source	**Amount added (g)**
White quartz Sand	1242
Silt/Clay ASP 400 / Engelhard Corp.	219
Dolomite / chemical Lime Co.	7.5
α-cellulose / Sigma	77.3
Humic acid / Fluka	0.15

Notes: Container was placed into tumbler for a minimum of an hour to homogenize prior to use

Soil/sediment	FCETL#	Homogenization			
		Date	From	To	Analyst
Lower Sweeney	22015	8/7/08	1630	1636	RS
Middle Sherman	22017	8/7/08	1710	1714	RS
Lower Sherman	22019 1 of 2	8/7/08	1725	1729	RS
Lower Slate	22018 1 of 3	8/7/08	1741	1744	EMA
Lower Johnson	22016 1 of 2	8/7/08	1746	1750	RS

① RS 8/7/08 E

Length/Width of Objects using a Micrometer

DAP 11-12-08
QA: AR 11/14/08

Project/Study Number:	08503-131-058 → (027, 029, 031, 033, 035)	Project Name:	Coeur
Study Initiation Date:	8/8/08	Species:	Chironomus dilutus
Source of Organisms:	ABS	Organism Batch/Lot #:	08-043
Collected by:	K. Tapp	Date Collected:	8/8/08
Analyzed by:	D. Pillard	Date Analyzed:	11-7-08

Specimen Number	Magnif.	# of Squares	Length of One Square (mm)	Total (mm)	Remarks
1	40x	2	0.175	0.35	
2	40x	3.5	↓	0.61	
3	40x	4		0.70	
4	40x	2.25		0.39	
5	40x	2		0.35	
6	40x	2.1		0.37	
7	40x	2		0.35	
8	40x	1.75		0.31	
9	40x	2		0.35	
10	40x	2		0.35	
11	40x	1.75		0.31	
12	40x	2		0.35	
13	40x	2		0.35	
14	40x	1.9		0.33	
15	40x	2		0.35	
16	40x	2		0.35	
17	40x	2		0.35	
18	40x	2		0.35	
19	40x	2.1		0.37	
20	40x	2		0.35	
Total				7.59	
Mean				0.3795	

①DAP 11-14-08 E

3rd Instar Mean = 0.38 mm
" " Range = 0.33 - 0.45

DAP 8-25-08
QA: AR 11/14/08

Title: 8503-131-058 [027,029,031,033,035] C. dilutus 10-day survival
File: 058CHIR .SUR Transform: NO TRANSFORMATION
Number of Groups: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Form Control	1	0.9000	0.9000
1	Form Control	2	0.8000	0.8000
1	Form Control	3	1.0000	1.0000
1	Form Control	4	0.9000	0.9000
1	Form Control	5	0.8000	0.8000
1	Form Control	6	0.9000	0.9000
1	Form Control	7	0.7000	0.7000
1	Form Control	8	0.7000	0.7000
2	L Johnson	1	0.6000	0.6000
2	L Johnson	2	0.8000	0.8000
2	L Johnson	3	0.7000	0.7000
2	L Johnson	4	0.4000	0.4000
2	L Johnson	5	0.5000	0.5000
2	L Johnson	6	0.8000	0.8000
2	L Johnson	7	0.7000	0.7000
2	L Johnson	8	0.6000	0.6000
3	L Slate	1	1.0000	1.0000
3	L Slate	2	0.6000	0.6000
3	L Slate	3	0.9000	0.9000
3	L Slate	4	0.8000	0.8000
3	L Slate	5	0.4000	0.4000
3	L Slate	6	0.7000	0.7000
3	L Slate	7	0.9000	0.9000
3	L Slate	8	0.8000	0.8000
4	L Sherman	1	0.9000	0.9000
4	L Sherman	2	0.7000	0.7000
4	L Sherman	3	0.9000	0.9000
4	L Sherman	4	0.6000	0.6000
4	L Sherman	5	0.9000	0.9000
4	L Sherman	6	0.5000	0.5000
4	L Sherman	7	0.8000	0.8000
4	L Sherman	8	0.8000	0.8000
5	L Sweeny	1	0.8000	0.8000
5	L Sweeny	2	0.3000	0.3000
5	L Sweeny	3	0.7000	0.7000
5	L Sweeny	4	0.9000	0.9000
5	L Sweeny	5	0.7000	0.7000
5	L Sweeny	6	0.7000	0.7000
5	L Sweeny	7	0.5000	0.5000
5	L Sweeny	8	0.7000	0.7000
6	M Sherman	1	0.8000	0.8000
6	M Sherman	2	0.7000	0.7000
6	M Sherman	3	0.3000	0.3000
6	M Sherman	4	0.9000	0.9000
6	M Sherman	5	0.5000	0.5000
6	M Sherman	6	0.7000	0.7000
6	M Sherman	7	0.6000	0.6000
6	M Sherman	8	0.7000	0.7000

(1) DAP 11-14-08 E

DAP 8-25-08

QA: AR 11/14/08

Title: 8503-131-058- 027,029,031,033,035 C. dilutus 10-day survival
File: 058CHIR .SUR Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Form Control	8	0.7000	1.0000	0.8375
2	L Johnson	8	0.4000	0.8000	0.6375
3	L Slate	8	0.4000	1.0000	0.7625
4	L Sherman	8	0.5000	0.9000	0.7625
5	L Sweeny	8	0.3000	0.9000	0.6625
6	M Sherman	8	0.3000	0.9000	0.6500

Title: 8503-131-058- C. dilutus 10-day survival
File: 058CHIR .SUR Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Form Control	0.0112	0.1061	0.0375	12.6646
2	L Johnson	0.0198	0.1408	0.0498	22.0845
3	L Slate	0.0370	0.1923	0.0680	25.2146
4	L Sherman	0.0227	0.1506	0.0532	19.7500
5	L Sweeny	0.0341	0.1847	0.0653	27.8764
6	M Sherman	0.0343	0.1852	0.0655	28.4868

① DAP 11-14-08 E

DAP 8-25-08
QA: MR 11/14/08

Title: 8503-131-058- → 027, 029, 031, 033, 035 C. dilutus 10-day survival
File: 058CHIR .SUR Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

D = 1.4659
W = 0.9577

Critical W = 0.9290 (alpha = 0.01 , N = 48)
W = 0.9470 (alpha = 0.05 , N = 48)

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: 8503-131-058- C. dilutus 10-day survival
File: 058CHIR .SUR Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 2.1514 (p-value = 0.8278)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Critical B = 15.0863 (alpha = 0.01, df = 5)
= 11.0705 (alpha = 0.05, df = 5)

① DAP 11-14-08 E

DAP 8-25-08
QA: MCH 11/14/08

Title: 8503-131-058- C. dilutus 10-day survival (handwritten: 027, 029, 031, 033, 035)
File: 058CHIR .SUR Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Form Control	8	0.9912	1.4120	1.1695
2	L Johnson	8	0.6847	1.1071	0.9299
3	L Slate	8	0.6847	1.4120	1.0858
4	L Sherman	8	0.7854	1.2490	1.0780
5	L Sweeny	8	0.5796	1.2490	0.9607
6	M Sherman	8	0.5796	1.2490	0.9476

Title: 8503-131-058- C. dilutus 10-day survival
File: 058CHIR .SUR Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Form Control	0.0213	0.1460	0.0516	12.4832
2	L Johnson	0.0222	0.1489	0.0526	16.0119
3	L Slate	0.0529	0.2300	0.0813	21.1838
4	L Sherman	0.0314	0.1771	0.0626	16.4251
5	L Sweeny	0.0406	0.2015	0.0712	20.9744
6	M Sherman	0.0411	0.2027	0.0717	21.3870

Title: 8503-131-058- C. dilutus 10-day survival
File: 058CHIR .SUR Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA Table

SOURCE	DF	SS	MS	F
Between	5	0.3718	0.0744	2.1305
Within (Error)	42	1.4659	0.0349	
Total	47	1.8377		

(p-value = 0.0804)

Critical F = 3.4882 (alpha = 0.01, df = 5,42)
= 2.4377 (alpha = 0.05, df = 5,42)

Since F < Critical F FAIL TO REJECT Ho: All equal (alpha = 0.05)

① DAP 11-14-08 E

DAP 8-25-08
QA: AR 11/14/08

→ 027, 029, 031, 033, 035

Title: 8503-131-058- C. dilutus 10-day survival
File: 058CHIR .SUR Transform: ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	TRANS T STAT	SIG 0.05
1	Form Control	1.1695	0.8375		
2	L Johnson	0.9299	0.6375	2.5651	*
3	L Slate	1.0858	0.7625	0.8958	
4	L Sherman	1.0780	0.7625	0.9791	
5	L Sweeny	0.9607	0.6625	2.2346	
6	M Sherman	0.9476	0.6500	2.3752	*

Dunnett critical value = 2.3100 (1 Tailed, alpha = 0.05, df [used] = 5,40)
(Actual df = 5,42)

Title: 8503-131-058- C. dilutus 10-day survival
File: 058CHIR .SUR Transform: ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	Form Control	8			
2	L Johnson	8	0.1823	21.5	0.2000
3	L Slate	8	0.1823	21.5	0.0750
4	L Sherman	8	0.1823	21.5	0.0750
5	L Sweeny	8	0.1823	21.5	0.1750
6	M Sherman	8	0.1823	21.5	0.1875

① DAP 11-14-08 E

Title: 8503-131-058-(027, 029, 031, 033, 035)
Chironomus dilutus 10-day test, (AFDW) wt/orig

DAP 11-12-08
QA: ARU 11/14/08

File: 058CDWT .ORG Transform: NO TRANSFORMATION

Shapiro - Wilk's Test for Normality

D = 0.7419
W = 0.9376

Critical W = 0.9290 (alpha = 0.01 , N = 48)
W = 0.9470 (alpha = 0.05 , N = 48)

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: 8503-131-058 Chironomus dilutus 10-day test, wt/orig
File: 058CDWT .ORG Transform: NO TRANSFORMATION

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 2.9153 (p-value = 0.7130)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Critical B = 15.0863 (alpha = 0.01, df = 5)
= 11.0705 (alpha = 0.05, df = 5)

① DAP 11-14-08 E

Title: 8503-131-058- (027, 029, 031, 033, 035)

Chironomus dilutus 10-day test, (AFDW) wt/orig

DAP 11-12-08
AP: MRU 11/14/08

File: 058CDWT .ORG Transform: NO TRANSFORMATION

Number of Groups: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Form Sed	1	1.2950	1.2950
1	Form Sed	2	1.2080	1.2080
1	Form Sed	3	1.1440	1.1440
1	Form Sed	4	0.9960	0.9960
1	Form Sed	5	1.2570	1.2570
1	Form Sed	6	1.0630	1.0630
1	Form Sed	7	0.9790	0.9790
1	Form Sed	8	0.8920	0.8920
2	Lower Johnson	1	0.6690	0.6690
2	Lower Johnson	2	0.6930	0.6930
2	Lower Johnson	3	0.7870	0.7870
2	Lower Johnson	4	0.3650	0.3650
2	Lower Johnson	5	0.6560	0.6560
2	Lower Johnson	6	0.8300	0.8300
2	Lower Johnson	7	0.7320	0.7320
2	Lower Johnson	8	0.5770	0.5770
3	Lower Slate	1	0.7760	0.7760
3	Lower Slate	2	0.5970	0.5970
3	Lower Slate	3	0.7400	0.7400
3	Lower Slate	4	0.7430	0.7430
3	Lower Slate	5	0.5650	0.5650
3	Lower Slate	6	0.6650	0.6650
3	Lower Slate	7	0.5880	0.5880
3	Lower Slate	8	0.6010	0.6010
4	Lower Sherman	1	0.8740	0.8740
4	Lower Sherman	2	0.9380	0.9380
4	Lower Sherman	3	0.7090	0.7090
4	Lower Sherman	4	0.6270	0.6270
4	Lower Sherman	5	0.8500	0.8500
4	Lower Sherman	6	0.6600	0.6600
4	Lower Sherman	7	0.6760	0.6760
4	Lower Sherman	8	0.8910	0.8910
5	Lower Sweeny	1	0.6370	0.6370
5	Lower Sweeny	2	0.3820	0.3820
5	Lower Sweeny	3	0.7410	0.7410
5	Lower Sweeny	4	0.7770	0.7770
5	Lower Sweeny	5	0.7940	0.7940
5	Lower Sweeny	6	0.6830	0.6830
5	Lower Sweeny	7	0.6240	0.6240
5	Lower Sweeny	8	0.5930	0.5930
6	Middle Sherman	1	0.7460	0.7460
6	Middle Sherman	2	0.7740	0.7740
6	Middle Sherman	3	0.3440	0.3440
6	Middle Sherman	4	0.7710	0.7710
6	Middle Sherman	5	0.5380	0.5380
6	Middle Sherman	6	0.6440	0.6440
6	Middle Sherman	7	0.8260	0.8260
6	Middle Sherman	8	0.6770	0.6770

① DAP 11/14/08 E

DAP 11-12-08
QA: ARW 11/14/08

Title: 8503-131-058 → 027, 029, 031, 033, 035 Chironomus dilutus 10-day test, (AFDW) wt/orig
File: 058CDWT .ORG Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Form Sed	8	0.8920	1.2950	1.1043
2	Lower Johnson	8	0.3650	0.8300	0.6636
3	Lower Slate	8	0.5650	0.7760	0.6594
4	Lower Sherman	8	0.6270	0.9380	0.7781
5	Lower Sweeny	8	0.3820	0.7940	0.6539
6	Middle Sherman	8	0.3440	0.8260	0.6650

Title: 8503-131-058 Chironomus dilutus 10-day test, wt/orig
File: 058CDWT .ORG Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Form Sed	0.0209	0.1445	0.0511	13.0884
2	Lower Johnson	0.0207	0.1440	0.0509	21.7032
3	Lower Slate	0.0069	0.0832	0.0294	12.6141
4	Lower Sherman	0.0150	0.1223	0.0432	15.7141
5	Lower Sweeny	0.0174	0.1320	0.0467	20.1927
6	Middle Sherman	0.0251	0.1583	0.0560	23.8006

Title: 8503-131-058 Chironomus dilutus 10-day test, wt/orig
File: 058CDWT .ORG Transform: NO TRANSFORMATION

ANOVA Table

SOURCE	DF	SS	MS	F
Between	5	1.2666	0.2533	14.3408
Within (Error)	42	0.7419	0.0177	
Total	47	2.0085		

(p-value = 0.0000)

Critical F = 3.4882 (alpha = 0.01, df = 5,42)
= 2.4377 (alpha = 0.05, df = 5,42)

Since F > Critical F REJECT Ho: All equal (alpha = 0.05)

① DAP 11-14-08 E

DAP 11-12-08
QA: AR 11/14/08

Title: 8503-131-058 ↗027, 029, 031, 033, 035 Chironomus dilutus 10-day test, (AFDW) wt/orig
File: 058CDWT .ORG Transform: NO TRANSFORMATION

Dunnett's Test - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG 0.05
1	Form Sed	1.1043	1.1043		
2	Lower Johnson	0.6636	0.6636	6.6306	*
3	Lower Slate	0.6594	0.6594	6.6945	*
4	Lower Sherman	0.7781	0.7781	4.9076	*
5	Lower Sweeny	0.6539	0.6539	6.7773	*
6	Middle Sherman	0.6650	0.6650	6.6099	*

Dunnett critical value = 2.3100 (1 Tailed, alpha = 0.05, df [used] = 5,40)
(Actual df = 5,42)

Title: 8503-131-058 Chironomus dilutus 10-day test, wt/orig
File: 058CDWT .ORG Transform: NO TRANSFORMATION

Dunnett's Test - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	Form Sed	8			
2	Lower Johnson	8	0.1535	13.9	0.4406
3	Lower Slate	8	0.1535	13.9	0.4449
4	Lower Sherman	8	0.1535	13.9	0.3261
5	Lower Sweeny	8	0.1535	13.9	0.4504
6	Middle Sherman	8	0.1535	13.9	0.4392

① DAP 11-14-08 E

DAP 11-12-08
QA: ARU 11/14/08

Title: 8503-131-058- (027, 029, 031, 033, 035)
Chironomus dilutus 10-day test, (AFDW) wt/surv
File: 058CDWT .SUR Transform: NO TRANSFORMATION

Shapiro - Wilk's Test for Normality

D = 1.4529
W = 0.9465

Critical W = 0.9290 (alpha = 0.01 , N = 48)
W = 0.9470 (alpha = 0.05 , N = 48)

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: 8503-131-058 Chironomus dilutus 10-day test, wt/surv
File: 058CDWT .SUR Transform: NO TRANSFORMATION

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 1.9155 (p-value = 0.8607)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Critical B = 15.0863 (alpha = 0.01, df = 5)
= 11.0705 (alpha = 0.05, df = 5)

① DAP 11-14-08 E

Title: 8503-131-058- (027, 029, 031, 033, 035) DAP 11-12-08

Chironomus dilutus 10-day test, (AFDW) wt/surv QA: 11/14/08

File: 058CDWT .SUR Transform: NO TRANSFORMATION

Number of Groups: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Form Sed	1	1.4389	1.4389
1	Form Sed	2	1.5100	1.5100
1	Form Sed	3	1.1440	1.1440
1	Form Sed	4	1.1067	1.1067
1	Form Sed	5	1.5713	1.5713
1	Form Sed	6	1.1811	1.1811
1	Form Sed	7	1.3986	1.3986
1	Form Sed	8	1.2743	1.2743
2	Lower Johnson	1	1.1150	1.1150
2	Lower Johnson	2	0.8662	0.8662
2	Lower Johnson	3	1.1243	1.1243
2	Lower Johnson	4	0.9125	0.9125
2	Lower Johnson	5	1.3120	1.3120
2	Lower Johnson	6	1.0375	1.0375
2	Lower Johnson	7	1.0457	1.0457
2	Lower Johnson	8	0.9617	0.9617
3	Lower Slate	1	0.7760	0.7760
3	Lower Slate	2	0.9950	0.9950
3	Lower Slate	3	0.8222	0.8222
3	Lower Slate	4	0.9288	0.9288
3	Lower Slate	5	1.4125	1.4125
3	Lower Slate	6	0.9500	0.9500
3	Lower Slate	7	0.6533	0.6533
3	Lower Slate	8	0.7513	0.7513
4	Lower Sherman	1	0.9711	0.9711
4	Lower Sherman	2	1.3400	1.3400
4	Lower Sherman	3	0.7878	0.7878
4	Lower Sherman	4	1.0450	1.0450
4	Lower Sherman	5	0.9562	0.9562
4	Lower Sherman	6	1.3200	1.3200
4	Lower Sherman	7	0.8450	0.8450
4	Lower Sherman	8	1.1138	1.1138
5	Lower Sweeny	1	0.7962	0.7962
5	Lower Sweeny	2	1.2733	1.2733
5	Lower Sweeny	3	1.0586	1.0586
5	Lower Sweeny	4	0.8633	0.8633
5	Lower Sweeny	5	1.1343	1.1343
5	Lower Sweeny	6	0.9757	0.9757
5	Lower Sweeny	7	1.2480	1.2480
5	Lower Sweeny	8	0.8471	0.8471
6	Middle Sherman	1	0.9325	0.9325
6	Middle Sherman	2	1.1057	1.1057
6	Middle Sherman	3	1.1467	1.1467
6	Middle Sherman	4	0.8567	0.8567
6	Middle Sherman	5	1.0760	1.0760
6	Middle Sherman	6	0.9200	0.9200
6	Middle Sherman	7	1.3767	1.3767
6	Middle Sherman	8	0.9671	0.9671

(1) DAP 11-14-08 E

DAP 11-12-08
QA: ARC 11/14/08

→ 027, 029, 031, 033, 035 (AFDW)

Title: 8503-131-058 Chironomus dilutus 10-day test, wt/surv
File: 058CDWT .SUR Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Form Sed	8	1.1067	1.5713	1.3281
2	Lower Johnson	8	0.8662	1.3120	1.0469
3	Lower Slate	8	0.6533	1.4125	0.9111
4	Lower Sherman	8	0.7878	1.3400	1.0474
5	Lower Sweeny	8	0.7962	1.2733	1.0246
6	Middle Sherman	8	0.8567	1.3767	1.0477

Title: 8503-131-058 Chironomus dilutus 10-day test, wt/surv
File: 058CDWT .SUR Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Form Sed	0.0310	0.1760	0.0622	13.2538
2	Lower Johnson	0.0199	0.1409	0.0498	13.4593
3	Lower Slate	0.0541	0.2325	0.0822	25.5184
4	Lower Sherman	0.0410	0.2024	0.0716	19.3273
5	Lower Sweeny	0.0339	0.1840	0.0651	17.9604
6	Middle Sherman	0.0278	0.1668	0.0590	15.9212

Title: 8503-131-058 Chironomus dilutus 10-day test, wt/surv
File: 058CDWT .SUR Transform: NO TRANSFORMATION

ANOVA Table

SOURCE	DF	SS	MS	F
Between	5	0.7635	0.1527	4.4141
Within (Error)	42	1.4529	0.0346	
Total	47	2.2164		

(p-value = 0.0025)

Critical F = 3.4882 (alpha = 0.01, df = 5,42)
= 2.4377 (alpha = 0.05, df = 5,42)

Since F > Critical F REJECT Ho: All equal (alpha = 0.05)

① DAP 11-14-08 E

→027,029,031,033,035 (AFDW) DAP 11-12-08
QA: AR 11/14/08

Title: 8503-131-058 Chironomus dilutus 10-day test, wt/surv
File: 058CDWT .SUR Transform: NO TRANSFORMATION

Dunnett's Test - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG 0.05
1	Form Sed	1.3281	1.3281		
2	Lower Johnson	1.0469	1.0469	3.0243	*
3	Lower Slate	0.9111	0.9111	4.4838	*
4	Lower Sherman	1.0474	1.0474	3.0189	*
5	Lower Sweeny	1.0246	1.0246	3.2641	*
6	Middle Sherman	1.0477	1.0477	3.0156	*

Dunnett critical value = 2.3100 (1 Tailed, alpha = 0.05, df [used] = 5,40)
(Actual df = 5,42)

Title: 8503-131-058 Chironomus dilutus 10-day test, wt/surv
File: 058CDWT .SUR Transform: NO TRANSFORMATION

Dunnett's Test - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	Form Sed	8			
2	Lower Johnson	8	0.2148	16.2	0.2813
3	Lower Slate	8	0.2148	16.2	0.4170
4	Lower Sherman	8	0.2148	16.2	0.2808
5	Lower Sweeny	8	0.2148	16.2	0.3036
6	Middle Sherman	8	0.2148	16.2	0.2804

①
DAP 11-14-08 E

APPENDIX D

Analytical Data

FCETL QA Form No.131
Revision 0
Effective 10/06

PERCENT TOTAL SOLIDS AND PERCENT TOTAL VOLATILE SOLIDS (TVS)

QA: ARH 9/14/08

Project No: 08503-131-058

Analytical Balance ID: AND

TARE: Date/time: 9/5/08 1425 Analyst: DAP
DRY GROSS: Date/time: 9/8/08 1115 Analyst: DAP
ASHED GROSS: Date/time: 9/8/08 1630 Analyst: DAP

Dried in Oven # 2 from Date: 9/5/08 Time: 1530 to Date: 9/8/08 Time: 0800
Oven °C: 100
Ashed in Furnace from Date: 9/8/08 Time: 1300 to Date: 9/8/08 Time: 1425
Furnace °C: 550

Dish No.	Treatment ②	Rep	Tare Weight of Dish (g) A	Dish + Wet Sample (g) B	Dry Gross Weight (g) (dish + dry sample) C	% Total Solids (g) [(C-A)(100)]/(B-A)	Ashed Gross Weight (dish + sample)(g) D	% Total Volatile Solids (g) [(C-D)(100)]/(C-A)
1A	22015	A	12.4276	25.3734	22.1271	74.92	21.8748	2.60
11A	22015	B	12.5302	24.7745	21.7341	75.17	21.4619	2.96
2A	22016	A	12.3628	22.8185	20.1564	74.54	19.9345	2.85
12A	22016	B	10.7979	20.9484	18.3089	74.00	18.0849	2.98
3A	22017	A	10.4476	19.6001	17.4374	76.37	17.2605	2.53
13A	22017	B	12.1450	21.4642	19.2649	76.40	19.0857	2.52
4A	22018	A	10.7727	20.2776	17.6129	71.96	17.3521	3.81
14A	22018	B	12.3598	21.4699	18.9101	71.90	18.6391	4.14
5A	22019	A	12.0064	24.2200	21.0076	73.70	20.7731	2.60
15A	22019	B	12.4941	26.2194	22.6010	73.64	22.3639	2.34
Blank			12.6770		12.6770		12.6770	

[1] Add in weight loss of blank boat, if appropriate.

② 22015 = Lower Sweeny
22016 = Lower Johnson
22017 = Middle Sherman
22018 = Lower State
22019 Lower Sherman

Monday, September 22, 2008

MSE
Analytical Laboratory

Dave Pillard
ENSR International
4303 W. LaPorte Ave
Fort Collins, CO 80521

RE: COEUR

Work Order: 0808169

Dear Dave Pillard:

MSE Lab Services received 5 sample(s) on 8/20/2008 for the analyses presented in the following report.

Please find enclosed analytical results for the sample(s) received at the MSE Laboratory.

If you have any questions regarding these test results, please feel free to call.

Sincerely,

Marcee Cameron

Marcee Cameron
Laboratory Director/ Chemist
406-494-7371

Enclosure

MSE Lab Services

Date: *22-Sep-08*

CLIENT:	ENSR International	**Client Sample ID:**	22015 LOWER SWEENEY
Lab Order:	0808169	**Collection Date:**	7/28/2008 10:30:00 AM
Project:	COEUR		
Lab ID:	0808169-001	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **mc/kh**
Aluminum	14000	19.6		mg/Kg-dry	1	9/8/2008
Chromium	23.6	16.3		mg/Kg-dry	1	9/8/2008
Zinc	83.2	16.3		mg/Kg-dry	1	9/8/2008
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	28.8	0.483		mg/Kg-dry	2	9/8/2008
Cadmium	0.371	0.032		mg/Kg-dry	2	9/8/2008
Copper	57.4	0.403		mg/Kg-dry	2	9/8/2008
Lead	15.4	0.064		mg/Kg-dry	2	9/8/2008
Nickel	27.3	0.322		mg/Kg-dry	2	9/8/2008
Selenium	1.07	0.644		mg/Kg-dry	2	9/8/2008
Silver	0.467	0.322		mg/Kg-dry	2	9/8/2008
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**AVS-SEM**		Analyst: **kgw**
Mercury	0.0517	0.274	J	mg/Kg-dry	1	9/4/2008
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **sh**
TOC	4.69	0.02		%-dry	1	9/12/2008
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **sh**
1" Gradation	ND	0.05		%	1	9/11/2008
2mm Gradation	ND	0.05		%	1	9/11/2008
Percent Coarse Material	ND	0.05		%	1	9/11/2008
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: **sh**
% Clay	4.0	0.1		%	1	9/16/2008
% Sand	64.0	0.1		%	1	9/16/2008
% Silt	32.0	0.1		%	1	9/16/2008
Soil Class	SANDY LOAM			%	1	9/16/2008
ACID VOLATILE SULFIDE		**AVS-SEM**				Analyst: **kgw**
Sulfide	ND	12.0	H	umoles/g	1	8/27/2008
PERCENT MOISTURE		**D2216**				Analyst: **BO**
Percent Moisture	38.6	0.05		wt%	1	9/4/2008

SW Review

Qualifiers:				
	H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
	Limit	Instrument Reporting Limit	MDL	Method Detection Limit
	ND	Not Detected at the Method Detection Limit (MDL)		

MSE Lab Services

Date: *22-Sep-08*

CLIENT:	ENSR International	**Client Sample ID:**	22016 LOWER JOHNSON
Lab Order:	0808169	**Collection Date:**	7/23/2008 11:46:00 AM
Project:	COEUR		
Lab ID:	0808169-002	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **mc/kh**
Aluminum	13700	16.1		mg/Kg-dry	1	9/8/2008
Chromium	28.1	13.4		mg/Kg-dry	1	9/8/2008
Zinc	94.2	13.4		mg/Kg-dry	1	9/8/2008
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	21.9	0.396		mg/Kg-dry	2	9/8/2008
Cadmium	0.296	0.026		mg/Kg-dry	2	9/8/2008
Copper	93.3	0.330		mg/Kg-dry	2	9/8/2008
Lead	11.4	0.053		mg/Kg-dry	2	9/8/2008
Nickel	23.3	0.264		mg/Kg-dry	2	9/8/2008
Selenium	0.413	0.527	J	mg/Kg-dry	2	9/8/2008
Silver	1.24	0.264		mg/Kg-dry	2	9/8/2008
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**AVS-SEM**		Analyst: **kgw**
Mercury	0.0546	0.245	J	mg/Kg-dry	1	9/4/2008
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **sh**
TOC	0.78	0.01		%-dry	1	9/12/2008
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **sh**
1" Gradation	ND	0.05		%	1	9/11/2008
2mm Gradation	ND	0.05		%	1	9/11/2008
Percent Coarse Material	ND	0.05		%	1	9/11/2008
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: **sh**
% Clay	4.0	0.1		%	1	9/16/2008
% Sand	72.0	0.1		%	1	9/16/2008
% Silt	24.0	0.1		%	1	9/16/2008
Soil Class	SANDY LOAM			%	1	9/16/2008
ACID VOLATILE SULFIDE		**AVS-SEM**				Analyst: **kgw**
Sulfide	ND	12.0	H	umoles/g	1	8/27/2008
PERCENT MOISTURE		**D2216**				Analyst: **BO**
Percent Moisture	25.3	0.05		wt%	1	9/4/2008

SW Review

Qualifiers:				
	H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
	Limit	Instrument Reporting Limit	MDL	Method Detection Limit
	ND	Not Detected at the Method Detection Limit (MDL)		

MSE Lab Services

Date: *22-Sep-08*

CLIENT:	ENSR International	**Client Sample ID:**	22017 MIDDLE SHERMAN
Lab Order:	0808169	**Collection Date:**	7/30/2008 9:30:00 AM
Project:	COEUR		
Lab ID:	0808169-003	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **mc/kh**
Aluminum	13300	20.4		mg/Kg-dry	1	9/8/2008
Chromium	26.9	17.0		mg/Kg-dry	1	9/8/2008
Zinc	101	17.0		mg/Kg-dry	1	9/8/2008
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	58.3	0.504		mg/Kg-dry	2	9/8/2008
Cadmium	0.401	0.034		mg/Kg-dry	2	9/8/2008
Copper	103	0.420		mg/Kg-dry	2	9/8/2008
Lead	17.1	0.067		mg/Kg-dry	2	9/8/2008
Nickel	29.9	0.336		mg/Kg-dry	2	9/8/2008
Selenium	1.02	0.672		mg/Kg-dry	2	9/8/2008
Silver	0.443	0.336		mg/Kg-dry	2	9/8/2008
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**AVS-SEM**		Analyst: **kgw**
Mercury	0.103	0.283	J	mg/Kg-dry	1	9/4/2008
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **sh**
TOC	2.82	0.02		%-dry	1	9/12/2008
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **sh**
1" Gradation	ND	0.05		%	1	9/11/2008
2mm Gradation	ND	0.05		%	1	9/11/2008
Percent Coarse Material	ND	0.05		%	1	9/11/2008
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: **sh**
% Clay	4.0	0.1		%	1	9/16/2008
% Sand	72.0	0.1		%	1	9/16/2008
% Silt	24.0	0.1		%	1	9/16/2008
Soil Class	SANDY LOAM			%	1	9/16/2008
ACID VOLATILE SULFIDE		**AVS-SEM**				Analyst: **kgw**
Sulfide	ND	12.0	H	umoles/g	1	8/27/2008
PERCENT MOISTURE		**D2216**				Analyst: **BO**
Percent Moisture	41.2	0.05		wt%	1	9/4/2008

SW **Review**

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Lab Services

Date: *22-Sep-08*

CLIENT:	ENSR International	**Client Sample ID:**	22018 LOWER SLATE
Lab Order:	0808169	**Collection Date:**	7/24/2008 11:30:00 AM
Project:	COEUR		
Lab ID:	0808169-004	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **mc/kh**
Aluminum	15800	24.9		mg/Kg-dry	1	9/8/2008
Chromium	20.3	20.7	J	mg/Kg-dry	1	9/8/2008
Zinc	739	20.7		mg/Kg-dry	1	9/8/2008
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	32.6	0.622		mg/Kg-dry	2	9/8/2008
Cadmium	11.0	0.041		mg/Kg-dry	2	9/8/2008
Copper	111	0.518		mg/Kg-dry	2	9/8/2008
Lead	21.9	0.083		mg/Kg-dry	2	9/8/2008
Nickel	71.1	0.414		mg/Kg-dry	2	9/8/2008
Selenium	3.73	0.829		mg/Kg-dry	2	9/8/2008
Silver	0.807	0.414		mg/Kg-dry	2	9/8/2008
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**AVS-SEM**		Analyst: **kgw**
Mercury	0.149	0.384	J	mg/Kg-dry	1	9/4/2008
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **sh**
TOC	8.65	0.02		%-dry	1	9/12/2008
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **sh**
1" Gradation	ND	0.05		%	1	9/11/2008
2mm Gradation	ND	0.05		%	1	9/11/2008
Percent Coarse Material	ND	0.05		%	1	9/11/2008
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: **sh**
% Clay	8.0	0.1		%	1	9/16/2008
% Sand	60.0	0.1		%	1	9/16/2008
% Silt	32.0	0.1		%	1	9/16/2008
Soil Class	SANDY LOAM			%	1	9/16/2008
ACID VOLATILE SULFIDE		**AVS-SEM**				Analyst: **kgw**
Sulfide	ND	12.0	H	umoles/g	1	8/27/2008
PERCENT MOISTURE		**D2216**				Analyst: **BO**
Percent Moisture	51.8	0.05		wt%	1	9/4/2008

SW Review

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Lab Services

Date: *22-Sep-08*

CLIENT:	ENSR International	**Client Sample ID:**	22019 LOWER SHERMAN
Lab Order:	0808169	**Collection Date:**	7/30/2008 11:00:00 AM
Project:	COEUR		
Lab ID:	0808169-005	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **mc/kh**
Aluminum	16900	18.0		mg/Kg-dry	1	9/8/2008
Chromium	37.5	15.0		mg/Kg-dry	1	9/8/2008
Zinc	100	15.0		mg/Kg-dry	1	9/8/2008
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	25.6	0.448		mg/Kg-dry	2	9/8/2008
Cadmium	0.528	0.030		mg/Kg-dry	2	9/8/2008
Copper	81.5	0.373		mg/Kg-dry	2	9/8/2008
Lead	8.43	0.060		mg/Kg-dry	2	9/8/2008
Nickel	31.9	0.298		mg/Kg-dry	2	9/8/2008
Selenium	1.18	0.597		mg/Kg-dry	2	9/8/2008
Silver	0.302	0.298		mg/Kg-dry	2	9/8/2008
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**AVS-SEM**		Analyst: **kgw**
Mercury	0.0434	0.243	J	mg/Kg-dry	1	9/4/2008
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **sh**
TOC	1.92	0.01		%-dry	1	9/12/2008
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **sh**
1" Gradation	ND	0.05		%	1	9/11/2008
2mm Gradation	ND	0.05		%	1	9/11/2008
Percent Coarse Material	ND	0.05		%	1	9/11/2008
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: **sh**
% Clay	ND	0.1		%	1	9/16/2008
% Sand	64.0	0.1		%	1	9/16/2008
% Silt	36.0	0.1		%	1	9/16/2008
Soil Class	SANDY LOAM			%	1	9/16/2008
ACID VOLATILE SULFIDE		**AVS-SEM**				Analyst: **kgw**
Sulfide	ND	12.0	H	umoles/g	1	8/27/2008
PERCENT MOISTURE		**D2216**				Analyst: **BO**
Percent Moisture	33.2	0.05		wt%	1	9/4/2008

Review

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 22-Sep-08
Report Date: 22-Sep-08

QA/QC SUMMARY REPORT

Client: ENSR International **Work Order:** 0808169
Project: COEUR **BatchID:** 2017

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: 2017-PB-UNFILTERED			*Method: SW6010B*		*Batch ID: 2017*			*Analysis Date:*	*9/8/2008*	
Aluminum	ND	12.0	mg/Kg							
Chromium	ND	10.0	mg/Kg							
Zinc	ND	10.0	mg/Kg							
Sample ID: 2017-PB-FILTERED			*Method: SW6010B*		*Batch ID: 2017*			*Analysis Date:*	*9/8/2008*	
Aluminum	ND	12.0	mg/Kg							
Chromium	ND	10.0	mg/Kg							
Zinc	ND	10.0	mg/Kg							
Sample ID: 2017-LCS			*Method: SW6010B*		*Batch ID: 2017*			*Analysis Date:*	*9/8/2008*	
Aluminum	88.2	12.0	mg/Kg	115.0	76.7	80	120			S+
Chromium	20.8	10.0	mg/Kg	27.10	76.6	80	120			S+
Zinc	43.5	10.0	mg/Kg	47.50	91.5	80	120			
Sample ID: 0808169-002A MS			*Method: SW6010B*		*Batch ID: 2017*			*Analysis Date:*	*9/8/2008*	
Aluminum	13300	16.1	mg/Kg-dry	154.1	-234	75	125			NA
Chromium	53.0	13.4	mg/Kg-dry	36.30	68.7	75	125			S+
Zinc	149	13.4	mg/Kg-dry	63.63	86.9	75	125			
Sample ID: 0808169-002A MSD			*Method: SW6010B*		*Batch ID: 2017*			*Analysis Date:*	*9/8/2008*	
Aluminum	13200	16.1	mg/Kg-dry	154.1	-309	75	125	0.874	20	NA
Chromium	53.1	13.4	mg/Kg-dry	36.30	68.9	75	125	0.125	20	S+
Zinc	152	13.4	mg/Kg-dry	63.63	90.9	75	125	1.71	20	
Sample ID: 0808169-002A MST			*Method: SW6010B*		*Batch ID: 2017*			*Analysis Date:*	*9/8/2008*	
Aluminum	13600	16.1	mg/Kg-dry	154.1	-40.4	75	125	2.21	20	NA
Chromium	54.3	13.4	mg/Kg-dry	36.30	72.3	75	125	2.44	20	S+
Zinc	148	13.4	mg/Kg-dry	63.63	84.5	75	125	1.02	20	

Review

Qualifiers:
S — Spike Recovery outside accepted recovery limits
NA — Sample conc. is > 4*spike level
S+ — Spike within Manufacturer's Limits

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 22-Sep-08
Report Date: 22-Sep-08

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR
Work Order: 0808169
BatchID: 2018

Sample ID: ***2018-PB-UNFILTERED*** *Method:* ***SW6020*** *Batch ID:* ***2018*** *Analysis Date:* ***9/8/2008***

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Arsenic	ND	0.150	mg/Kg							
Cadmium	ND	0.010	mg/Kg							
Copper	ND	0.125	mg/Kg							
Lead	ND	0.020	mg/Kg							
Nickel	ND	0.100	mg/Kg							
Selenium	ND	0.200	mg/Kg							
Silver	ND	0.100	mg/Kg							

Sample ID: ***2018-PB-FILTERED*** *Method:* ***SW6020*** *Batch ID:* ***2018*** *Analysis Date:* ***9/8/2008***

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Arsenic	ND	0.150	mg/Kg							
Cadmium	ND	0.010	mg/Kg							
Copper	ND	0.125	mg/Kg							
Lead	ND	0.020	mg/Kg							
Nickel	ND	0.100	mg/Kg							
Selenium	ND	0.200	mg/Kg							
Silver	ND	0.100	mg/Kg							

Sample ID: ***2018-LCS*** *Method:* ***SW6020*** *Batch ID:* ***2018*** *Analysis Date:* ***9/8/2008***

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Arsenic	243	0.298	mg/Kg	250.9	97.0	80	120			
Cadmium	11.3	0.020	mg/Kg	10.81	105	80	120			
Copper	1520	0.248	mg/Kg	1755	86.5	80	120			
Lead	58.4	0.040	mg/Kg	56.43	104	80	120			
Nickel	17.8	0.198	mg/Kg	16.16	110	80	120			
Selenium	10.3	0.397	mg/Kg	9.917	104	80	120			
Silver	6.34	0.198	mg/Kg	5.851	108	80	120			

Sample ID: ***0808169-002A MS*** *Method:* ***SW6020*** *Batch ID:* ***2018*** *Analysis Date:* ***9/8/2008***

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Arsenic	364	0.397	mg/Kg-dry	334.6	102	75	125			
Cadmium	17.0	0.026	mg/Kg-dry	14.41	116	75	125			
Copper	2340	0.331	mg/Kg-dry	2341	95.8	75	125			
Lead	94.3	0.053	mg/Kg-dry	75.24	110	75	125			
Nickel	44.3	0.264	mg/Kg-dry	21.55	97.5	75	125			
Selenium	14.5	0.529	mg/Kg-dry	13.22	106	75	125			
Silver	7.88	0.264	mg/Kg-dry	7.802	85.1	75	125			

Sample ID: ***0808169-002A MSD*** *Method:* ***SW6020*** *Batch ID:* ***2018*** *Analysis Date:* ***9/8/2008***

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Arsenic	298	0.398	mg/Kg-dry	335.4	82.3	75	125	20.1	20	
Cadmium	15.0	0.026	mg/Kg-dry	14.45	102	75	125	12.3	20	
Copper	2090	0.331	mg/Kg-dry	2347	85.0	75	125	11.2	20	
Lead	84.8	0.053	mg/Kg-dry	75.44	97.3	75	125	10.5	20	
Nickel	42.4	0.265	mg/Kg-dry	21.61	88.3	75	125	4.45	20	
Selenium	13.5	0.530	mg/Kg-dry	13.26	98.8	75	125	7.00	20	
Silver	6.54	0.265	mg/Kg-dry	7.822	67.7	75	125	18.6	20	S+

Review

Qualifiers:
S Spike Recovery outside accepted recovery limits
NA Sample conc. is > 4*spike level
S+ Spike within Manufacturer's Limits

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 22-Sep-08
Report Date: 22-Sep-08

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR
Work Order: 0808169
BatchID: 2018

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: 0808169-002A MST			*Method: SW6020*		*Batch ID: 2018*		*Analysis Date:*	*9/8/2008*		
Arsenic	306	0.395	mg/Kg-dry	333.2	85.4	75	125	17.3	20	
Cadmium	15.6	0.026	mg/Kg-dry	14.36	107	75	125	8.47	20	
Copper	2080	0.329	mg/Kg-dry	2331	85.4	75	125	11.3	20	
Lead	86.8	0.053	mg/Kg-dry	74.95	101	75	125	8.18	20	
Nickel	42.4	0.263	mg/Kg-dry	21.47	88.8	75	125	4.45	20	
Selenium	13.3	0.527	mg/Kg-dry	13.17	97.5	75	125	8.87	20	
Silver	7.65	0.263	mg/Kg-dry	7.771	82.5	75	125	2.87	20	

Review

Qualifiers:
S Spike Recovery outside accepted recovery limits
NA Sample conc. is > 4*spike level
S+ Spike within Manufacturer's Limits

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 22-Sep-08
Report Date: 22-Sep-08

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR
Work Order: 0808169
BatchID: 2022

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: 2022-PB			*Method: E245.5*		*Batch ID: 2022*		*Analysis Date: 9/4/2008*			
Mercury	ND	0.00400	mg/Kg							
Sample ID: LCS-2022			*Method: E245.5*		*Batch ID: 2022*		*Analysis Date: 9/4/2008*			
Mercury	4.31	0.194	mg/Kg	4.310	100	80	120			
Sample ID: 0808169-005A-MS			*Method: E245.5*		*Batch ID: 2022*		*Analysis Date: 9/4/2008*			
Mercury	7.87	0.538	mg/Kg-dry	6.455	121	75	125			
Sample ID: 0808169-005A-MSD			*Method: E245.5*		*Batch ID: 2022*		*Analysis Date: 9/4/2008*			
Mercury	7.84	0.483	mg/Kg-dry	6.455	121	75	125	0.390	20	

Review

Qualifiers: S Spike Recovery outside accepted recovery limits NA Sample conc. is > 4*spike level

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 22-Sep-08
Report Date: 22-Sep-08

QA/QC SUMMARY REPORT

Client: ENSR International **Work Order:** 0808169
Project: COEUR **BatchID:** R7680

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***0808169-002A-D***			*Method:* ***AVS-SEM***	*Batch ID:* ***R7680***			*Analysis Date:*		***8/27/2008***	
Sulfide	ND	12.0	umoles/g					0	20	
Sample ID: ***0808169-002A-S***			*Method:* ***AVS-SEM***	*Batch ID:* ***R7680***			*Analysis Date:*		***8/27/2008***	
Sulfide	12.0	12.0	umoles/g	8.388	99.1	75	125			
Sample ID: ***LCS R2331***			*Method:* ***AVS-SEM***	*Batch ID:* ***R7680***			*Analysis Date:*		***8/27/2008***	
Sulfide	5.0	12.0	umoles/g	4.194	119	80	120			J
Sample ID: ***PB***			*Method:* ***AVS-SEM***	*Batch ID:* ***R7680***			*Analysis Date:*		***8/27/2008***	
Sulfide	ND	12.0	umoles/g							

Review

Qualifiers: S Spike Recovery outside accepted recovery limits NA Sample conc. is > 4*spike level

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 22-Sep-08
Report Date: 22-Sep-08

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR
Work Order: 0808169
BatchID: R7694

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: 0808169-002A-D			*Method: D2216*		*Batch ID: R7694*			*Analysis Date:*	*9/4/2008*	
Percent Moisture	25.2	0.05	wt%					0.398	20	

Review

Qualifiers: S Spike Recovery outside accepted recovery limits NA Sample conc. is > 4*spike level

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 22-Sep-08
Report Date: 22-Sep-08

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR
Work Order: 0808169
BatchID: R7730

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
*Sample ID: **0808169-001A-D***			*Method: **OM_WALKLE***	*Batch ID: **R7730***			*Analysis Date:*	***9/12/2008***		
TOC	4.65	0.02	%-dry					0.872	20	
*Sample ID: **LCS Q5040***			*Method: **OM_WALKLE***	*Batch ID: **R7730***			*Analysis Date:*	***9/12/2008***		
TOC	0.36	0.01	%	0.3220	110	80	120			
*Sample ID: **A-Blk***			*Method: **OM_WALKLE***	*Batch ID: **R7730***			*Analysis Date:*	***9/12/2008***		
TOC	ND	0.01	%							

Review

Qualifiers: S Spike Recovery outside accepted recovery limits NA Sample conc. is > 4*spike level

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 22-Sep-08
Report Date: 22-Sep-08

QA/QC SUMMARY REPORT

Client: ENSR International
Work Order: 0808169
Project: COEUR
BatchID: R7751

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***0808169-001A-D***			*Method:* ***MSA15-5***		*Batch ID:* ***R7751***		*Analysis Date:*	***9/16/2008***		
% Clay	8.0	0.1	%					66.7	20	R
% Sand	60.0	0.1	%					6.45	20	
% Silt	32.0	0.1	%					0	20	
Soil Class	SANDY LOAM		%					0		

Review

Qualifiers: S Spike Recovery outside accepted recovery limits NA Sample conc. is > 4*spike level

APPENDIX 1B: TOXICITY LAB REPORT FOR *Hyalella azteca*

Coeur Alaska, Inc.
Juneau, Alaska

Report of Short-Term Toxicity of Whole Sediment to *Hyalella azteca*

Prepared by

AECOM

AECOM Environment
Environmental Toxicology
Fort Collins, CO

08503-131-058-(026, 028, 030, 032, 034)
August 2008

Report of Short-Term Toxicity of Whole Sediment to Hyalella azteca

Project IDs: 08503-131-058-(026, 028, 030, 032, 034)
August 2008

Sponsor and Laboratory Information

Sponsor	Coeur Alaska Inc. Kensington Mine 3031 Clinton Drive Suite 202 Juneau, Alaska 99801
Project Officer	John Randolph (907) 789-1591
Testing Facility	AECOM Environment Fort Collins Environmental Toxicology Laboratory 4303 West LaPorte Ave. Fort Collins, CO 80521 Fax: (970) 490-2963 State of Florida NELAP Laboratory ID: E87972
Study Director	David A. Pillard (970) 416-0916, ext. 310

Test Information

Test	Short-term chronic screening toxicity test of sediment	
Basis	USEPA (2000) and ASTM (2006)	
Test Protocol	HA3AK.TIE058.007	
Test Period	August 8, 2008 @ 1300 to August 18, 2008 @ 1300 - 1800	
Test Length	10 days	
Species	*Hyalella azteca*	
Test Material	Whole sediment	
Sediment ID	Sample ID	AECOM Laboratory ID
	Lower Johnson	22016
	Lower Slate	22018
	Lower Sherman	22019
	Lower Sweeny	22015
	Middle Sherman	22017
Control Sediments	Silica Sand and Laboratory Formulated Sediment	
Overlying water	Moderately hard reconstituted water prepared according to USEPA (2002), augmented with approximately 50 mg/L Cl^- (as NaCl)	
Test Concentrations	0 (control) and 100% of each test sediment	

Sediment Collection and Receipt

Sample ID	Collection Date and Time	AECOM No.	Date of Receipt	Temp. at Arrival (°C)
Lower Johnson	07/23/08 @ 1145	22016	08/05/08	16
Lower Slate	07/24/08 @ 1130	22018	08/05/08	16
Lower Sherman	07/30/08 @ 1100	22019	08/05/08	16
Lower Sweeny	07/28/08 @ 1030	22015	08/05/08	16
Middle Sherman	07/30/08 @ 0930	22017	08/05/08	16

Note: See Appendix A for copies of chain of custody records

Control Sediment

The primary control sediment was silica sand, obtained from a local commercial supplier. A second control sediment, with a smaller grain size and higher organic matter content, was prepared in the laboratory. The composition of the formulated sediment is given in the following table (Kemble et al. 1999).

Composition of Laboratory Formulated Sediment (Control)

Material	Source	Pre-Treatment	Weight (g)
White Quartz Sand	U.S. Silica. Berkely Springs, West Virginia.	Rinsed with gentle mixing in Horsetooth water until water ran clear, then rinsed for 5 min with Milli-Q water. Air dried or dried in oven.	1242
Silt/Clay (ASP400)	Mozel, St. Louis, MO. Distributor = Englehardt	None	219
Dolomite	Grey Rock Clay Center, Ft. Collins, CO.	None	7.5
α-cellulose	Sigma	None	77.3
Humic Acid	Fluka	None	0.15
Total			1545.95

Test Sediment Preparation

Sample ID	Date Homogenized	Time Homogenized
Lower Johnson	August 7, 2008	1746 – 1750
Lower Slate		1741 – 1744
Lower Sherman		1725 – 1729
Lower Sweeny		1630 – 1636
Middle Sherman		1710 - 1714

Test Conditions

Test Type	Static sediment with continuous replacement of overlying water
Test Duration	10 days
Overlying Water Delivery System	Continuous renewal (flow-through) [a]
Test Endpoints	Survival, dry weight per original and surviving organism
Test Chambers	500 ml glass beakers
Test Sediment Volume	100 ml
Overlying Water Volume	175 ml
Replicates per Treatment	8
Organisms per Replicate	10
Test Temperature	23 ± 1°C; see Protocol Deviations
Lighting	Fluorescent, 16 hours light:8 hours dark
Chamber Placement	Randomized
Test Sediment Renewal	None
Test Overlying Water Renewal	Approximately two volume additions per test chamber per day

[a] Continuous replacement via a drip system
Note: See Appendix B for the Test Protocol

Test Organism

Species and Lot Number	*Hyalella azteca*, FCETL Lot 08-042
Age	8 – 10 days
Source	Aquatic BioSystems (ABS), Fort Collins, CO
Overlying Water	Moderately Hard Reconstituted Water with added chloride (52 mg/L) as NaCl, RW # 8768
Reference Toxicant Testing	Initiated August 8, 2008 using sodium chloride (NaCl)

TEST RESULTS

Biological Data – Survival and Dry Weight

Sample ID	Percent Survival[a]	Dry Weight (mg)[a]	
		Per original organism	Per surviving organism
Sand Control	8.75	NM[b]	NM[b]
Lab. Formulated Sediment Control	86.25	0.044	0.051
Lower Johnson	90	0.069	0.077
Lower Slate	92.5	0.074	0.080
Lower Sherman	92.5	0.072	0.078
Lower Sweeny	92.9	0.068	0.073
Middle Sherman	97.5	0.077	0.080
Control Performance	Acceptable[c]	N/A	N/A

[a] Because of the poor survival of organisms in the sand control, all statistical comparisons were made against the formulated sediment control
[b] Dry weight not measured in sand control due to very poor organism survival
[c] Survival in the Sand Control was unacceptable (<70%); this treatment was excluded from statistical analyses
Note: See Appendix C for test data sheets

Data Analysis

Because of poor performance in the sand control (<70% survival), survival and growth data for field-collected samples were compared to the formulated sediment control data. Since dry weights of all field-collected sediments were greater than the control weights, there were no growth effects (defined as a significant reduction in dry weight).

Biological Endpoint	Comparison	Procedure
Survival	Normality	N/A
	Homogeneity of Variance	N/A
	Significant Reduction Relative to the Formulated Sediment Control	Inspection
Growth (Dry Wt. per Original Organism)	Normality	N/A
	Homogeneity of Variance	N/A
	Significant Reduction Relative to the Formulated Sediment Control	Inspection
Growth (Dry Wt. per Surviving Organism)	Normality	N/A
	Homogeneity of Variance	N/A
	Significant Reduction Relative to the Formulated Sediment Control	Inspection

Analytical Data

Parameter	Sample Identification				
	Lower Johnson	Lower Slate	Lower Sherman	Lower Sweeny	Middle Sherman
Metals (mg/Kg-dry)[a]					
Aluminum	13,700	15,800	16,900	14,000	13,300
Chromium	28.1	20.3**J**	37.5	23.6	26.9
Zinc	94.2	739	100	83.2	101
Arsenic	21.9	32.6	25.6	28.8	58.3
Cadmium	0.296	11.0	0.528	0.371	0.401
Copper	93.3	111	81.5	57.4	103
Lead	11.4	21.9	8.43	15.4	17.1
Nickel	23.3	71.1	31.9	27.3	29.9
Selenium	0.413**J**	3.73	1.18	1.07	1.02
Silver	1.24	0.807	0.302	0.467	0.443
Mercury	0.0546**J**	0.149**J**	0.0434**J**	0.0517**J**	0.103**J**
Particle Size (%)[b]					
Clay	4.0	8.0	ND	4.0	4.0
Sand	72.0	60.0	64.0	64.0	72.0
Silt	24.0	32.0	36.0	32.0	24.0
Texture	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam
Coarse Material	ND	ND	ND	ND	ND
TOC (%-dry)[c]	0.78	8.65	1.92	4.69	2.82
Acid Volatile Sulfide (umoles/g)	ND	ND	ND	ND	ND

[a] Al, Cr and Zn by SW-846 Method 6010B; As, Cd, Cu, Pb, Ni, Se and Ag by SW-846 Method 6020; Hg by SW-846 7471B (USEPA 1986)
[b] Particle size was determined using ASTM Method D422 and Modified ASA 15-5
[c] TOC was determined using the Walkley Black Method
J = The concentration was below the Reporting Limit but above the Method Detection Limit
ND = Not Detected at the Method Detection Limit; see Appendix D for detection limits
Note: See Appendix D for a copy of the report from the analytical laboratory (MSE-TA Analytical Laboratory, Butte, MT)

Total and Total Volatile Solids

Sample ID	Percent Total Solids[a]	Percent Total Volatile Solids[b]
Lower Johnson	74.27	2.92
Lower Slate	71.93	3.98
Lower Sherman	76.38	2.47
Lower Sweeny	75.04	2.78
Middle Sherman	76.38	2.52

[a] Total solids were determined using Standard Methods 2540B (APHA 1989)
[b] Total volatile solids were determined using Standard Methods 2540E (APHA 1989)
All values are means of two analyzed samples
Note: See Appendix D for data sheets (these parameters were determined at the AECOM/FCETL)

Physical and Chemical Data (Min/Max)

Sample ID	pH (units)	DO (mg/L)	Cond. (µS/cm)	Temp. (°C)[a]	Ammonia as N (mg/L)	Hardness (mg/L as $CaCO_3$)	Alkalinity (mg/L as $CaCO_3$)
Sand Control	8.0/8.2	6.2/7.0	395/582	23/24	<1.0/1.6	106/108	55/82
Lab. Form. Sed.	7.8/8.4	5.9/6.8	531/593	22/25	<1.0	74/116	85/100
Lower Johnson	7.4/7.8	5.9/6.4	398/571	23/25	<1.0/2.4	68/108	52/76
Lower Slate	7.6/8.0	5.7/6.6	456/602	22/25	<1.0/2.0	106/120	88/94
Lower Sherman	7.7/8.0	5.6/6.5	429/559	23/25	<1.0/1.6	88/114	76/89
Lower Sweeny	7.5/7.9	6.0/6.5	393/581	23/24	<1.0/1.0	58/106	64/78
Middle Sherman	7.7/8.1	5.9/6.5	421/567	23/25	<1.0	90/108	71/84

[a] Temperature in test chambers; see Protocol Deviations

Reference Toxicant Test Results for *H. azteca*

Organism Lot Number	Test Dates	96-Hour LC_{50}	AECOM/FCETL Historical 95% Control Limits	
			Low	High
08-042	08/08/08 to 08/12/08	1924	879	3038

Note: Values are expressed as mg/L chloride

Protocol Deviations

Temperature as measured directly in overlying water was 25°C on days 1 and 2 for several treatments and on day 5 in Lower Slate, which is outside the range specified in the protocol (23±1°C). Temperature was within the range specified by the protocol on all other days of the test. This deviation is not likely to have had any impact on test outcome.

Bath temperature (continuously measured) ranged from 21.4 to 26.2°C during testing, which is outside of the range of 22 to 24°C specified in the protocol. The water bath temperatures do not necessarily represent test chamber temperature, therefore the slightly cooler or warmer temperatures measured in the water bath should not be considered to be deviations from the protocol.

To the best of the Study Director's knowledge, no further deviations from the test protocol occurred during these studies.

References

APHA. 1989. Standard Methods for the Examination of Water and Wastewater. Amer. Public Health Assoc., Amer. Water Works Assoc., Water Pollut. Control Fed., APHA, Washington, DC.

ASTM. 2006. Standard Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Fresh Water Invertebrates. Method E 1706-05 In *2006 Annual Book of ASTM Standards, Section 11, Water and Environmental Technology, Volume 11.06, Biological Effects and Environmental Fate; Biotechnology*. American Society of Testing and Materials. Conshohocken, PA.

Kemble, N.E., F.J. Dwyer, C.G. Ingersoll, T.D. Dawson, and T.J. Norberg-King. 1999. Tolerance of Freshwater Test Organisms to Formulated Sediments for Use as Control Materials in Whole-Sediment Toxicity Test. *Environ. Toxicol. Chem.* 18:222-230.

USEPA. 1986. Test Methods for Evaluating Solid Waste. Third Edition. SW-846.

USEPA. 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates. EPA/600/R-99/064.

USEPA. 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. Fifth Edition. EPA-821-R-02-012.

Statement of Procedural Compliance

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, accurate and complete.

David A. Pillard 20 Nov 2008

David A. Pillard, Ph.D. Date
Study Director

Statement of Quality Assurance

The test data were reviewed by the Quality Assurance Unit to assure that the study was performed in accordance with standard operating procedures, and that the resulting data and report meet the requirements of the NELAC standards. This report is an accurate reflection of the raw data.

Anita Reliner November 20, 2008

Quality Assurance Unit Date

APPENDIX A

Chain of Custody

ENSR | AECOM

CHAIN OF CUSTODY RECORD

Page ____ of ____

Client/Project Name: Coeur Alaska

Project Location: Alaska

Project Number: 08503-131-058

Field Logbook No.:

Sampler (Print Name)/(Affiliation): LIZ FLORY AQUATIC SCIENCE

Chain of Custody Tape Nos.: 41021 (intact)

Signature: E. Flory

Send Results/Report to: LIZ FLORY, AQUATIC SCIENCE 4546 RIVER ROAD, JNU

TAT: 30 DAYS AFTER TESTS COMPLETE

Analysis Requested

Container Type: P – Plastic; A – Amber Glass; G – Clear Glass; V – VOA Vial; O – Other; E – Encore

Preservation: 1 – HCl, 4°; 2 – H2SO4, 4°; 3 – HNO3, 4°; 4 – NaOH, 4°; 5 – NaOH/ZnAc, 4°; 6 – Na2S2O3, 4°; 7 – 4°

Matrix Codes: DW – Drinking Water; WW – Wastewater; GW – Groundwater; SW – Surface Water; ST – Storm Water; W – Water; S – Soil; SL – Sludge; SD – Sediment; SO – Solid; A – Air; L – Liquid; P – Product

Field Sample No./Identification	Date	Time	COMP	GRAB	Sample Container (Size/Mat'l)	Matrix	Preserv.	Field Filtered Sieved	TOXICITY HYALELLA 10-DAY	TOXICITY CHIRONOMUS 10-DAY	METALS							Lab I.D.	Remarks
LOWER SWEENY	7-28-08	10:30	X		4L×2 P	SD	COOL	1.7 MM	X	X								22015	16°C
LOWER SWEENY	7-28-08	10:36	X		8oz A	SD	"	"			X							22015	16°C
LOWER JOHNSON	7-23-08	11:45	X		4L P	SD	"	"	X	X								22016	16°C
LOWER JOHNSON	7-23-08	11:45	X		8oz A	SD	"	"			X							22016	16°C

Relinquished by: (Print Name)/(Affiliation)	Date/Time	Received by: (Print Name)/(Affiliation)	Date/Time
LIZ FLORY, AQUATIC SCIENCE Signature: E. Flory	Date: 7-31-08 Time: 10:00	AMBER ROBERTS Signature: Amber Roberts	Date: 8/5/08 Time: 1030
Signature:	Date: Time:	Signature:	Date: Time:
Signature:	Date: Time:	Signature:	Date: Time:

Analytical Laboratory (Destination): rec. on ice via FedEx
ENSR Toxicology Lab
4303 W. Laporte Avenue
Fort Collins, CO 80521
(970) 416-0916
(970) 490-2963 (FAX)

Sample Shipped Via: UPS (FedEx) Courier Other

Temp blank: Yes No

Serial No. № 48789

ENSR | AECOM

CHAIN OF CUSTODY RECORD

Page ____ of ____

Client/Project Name: Coeur Alaska

Project Location: Alaska

Project Number: 08503-131-058

Field Logbook No.:

Sampler (Print Name)/(Affiliation): LIZ FLORY, AQUATIC SCIENCE INC.

Chain of Custody Tape Nos.:

Signature: E. Flory

Send Results/Report to: Liz Flory, Aquatic Science Inc., 4546 River Rd, Juneau

TAT: 30 days after tests complete ok

Analysis Requested

Container Type: P – Plastic; A – Amber Glass; G – Clear Glass; V – VOA Vial; O – Other; E – Encore

Preservation: 1 – HCl, 4°; 2 – H2SO4, 4°; 3 – HNO3, 4°; 4 – NaOH, 4°; 5 – NaOH/ZnAc, 4°; 6 – Na2S2O3, 4°; 7 – 4°

Matrix Codes: DW – Drinking Water; WW – Wastewater; GW – Groundwater; SW – Surface Water; ST – Storm Water; W – Water; S – Soil; SL – Sludge; SD – Sediment; SO – Solid; A – Air; L – Liquid; P – Product

Field Sample No./Identification	Date	Time	COMP	GRAB	Sample Container (Size/Mat'l)	Matrix	Preserv.	Field Filtered / Seived	TOXICITY HYALELLA 10-DAY	TOXICITY CHIRONOMUS 10-DAY	METALS							Lab I.D.	Remarks
LOWER SLATE	7/24/08	11:30	X		4L×2 P	SD	COOL	1.7 MM	X	X								22018	16°C
LOWER SLATE	7/24/08	11:30	X		8oz A	SD	"	"			X							~~2201~~ 22018	16°C
LOWER SHERMAN	7/30/08	11:00	X		4L P	SD	"	"	X	X							⊛	22019	16°C
LOWER SHERMAN	7/30/08	11:00	X		8oz A	SD	"	"			X						⊛	22019	16°C
MIDDLE SHERMAN	7/30/08	9:30	X		4L×2 P	SD	"	"	X	X								22017	16°C
MIDDLE SHERMAN	7/30/08	9:30	X		8oz A	SD	"	"			X							22017	16°C

Relinquished by: (Print Name)/(Affiliation)	Date/Time	Received by: (Print Name)/(Affiliation)	Date/Time
LIZ FLORY, AQUATIC SCIENCE; Signature: E. Flory	Date: 7-31-08; Time: 10:00	AMBER ROBERTS; Signature: Amber Roberts	Date: 8/5/08; Time: 1020
Signature:	Date: Time:	Signature:	Date: Time:
Signature:	Date: Time:	Signature:	Date: Time:

Analytical Laboratory (Destination): Rec. on ice via Fex ed.

ENSR Toxicology Lab
4303 W. Laporte Avenue
Fort Collins, CO 80521
(970) 416-0916
(970) 490-2963 (FAX)

Sample Shipped Via: UPS (FedEx) Courier Other

Temp blank: Yes No

⊛ # should be 22019, not 2019 (AR 11/19/08, cf)

Serial No. № 48790

Q:\@LOOSE FILES\PSI\Chain-of-Custody_Ft. Collins_10_07.doc

Date 8/5/08 cf

APPENDIX B

Test Protocol

ENSR | AECOM

Title: Short-Term Chronic Toxicity of Bulk Sediment to the Amphipod, *Hyalella azteca*

Study Sponsor:

Coeur Alaska Inc.
Kensington Mine
3031 Clinton Drive
Suite 202
Juneau, Alaska 99801
Phone: (907) 789-1591

John Randolph

Testing Facility

Fort Collins Environmental Toxicology Laboratory
4303 West LaPorte Avenue
Fort Collins, Colorado 80521
Phone: (970) 416-0916, Ext. 310
Fax: (970) 490-2963
Project Manager/Study Director: David Pillard, Ph.D.

1.0 INTRODUCTION

1.1 Objective

To determine the short-term chronic toxicity of sediment samples to the amphipod, *Hyalella azteca*.

1.2 Sediment Sample

The sediment samples will be collected by the Study Sponsor or an agent of the Study Sponsor and shipped to ENSR's Fort Collins Laboratory. At the laboratory, sediment samples will be stored under refrigeration (4°C) until used in testing (preferably less than 4 weeks of storage). Each sample will be mechanically homogenized prior to use in testing (ENSR SOP #5208). Endemic organisms observed in the sediment will be removed manually.

2.0 BASIS AND TEST ORGANISM

2.1 Basis

This protocol is based on USEPA (2000) guidelines and ASTM Method E 1706-05 (ASTM 2006).

2.2 Test Organism

1. Species - *Hyalella azteca*
2. Age – 7-14 days old at the start of the test. Initial dry weight will be determined on a minimum of eighty organisms selected from the test population at test initiation.
3. Source - Test organisms will be obtained from a commercial supplier.
4. Feeding - *Hyalella azteca* will be fed 1.0 ml of a yeast-trout chow-Cerophyl suspension (YTC; USEPA 2002) per test chamber on a daily basis.

3.0 TEST SYSTEM

3.1 Overlying Water

The overlying water used in the toxicity test will be laboratory moderately hard reconstituted water prepared according to USEPA (2002). The water will be augmented with 50 mg/L Cl^-. Previous research has indicated that added Cl^- may be critical for maintaining organism health during the test.

3.2 Test Temperature

Test temperature will be 23 ± 1°C. Testing will be conducted in a temperature-controlled water bath or in an environmental chamber.

3.3 Test Containers

Test containers will be 500-ml beakers containing 100 ml of sediment and 175 ml of overlying water.

3.4 Photoperiod

The photoperiod will be 16-hours light and 8-hours dark.

3.5 Dissolved Oxygen Concentrations

Dissolved oxygen concentrations in the overlying water will be maintained >2.5 mg/L. If the dissolved oxygen concentration in the overlying water approaches this level, all test chambers will be gently aerated throughout the remainder of the test. If aeration is initiated, the aeration pipette will be appropriately positioned so as to avoid disturbance of the sediment.

3.6 Reference Toxicant Testing

In addition to the test material exposures, reference toxicant tests will be conducted using sodium chloride (NaCl) to determine the sensitivity range of the test organisms. Reference toxicant exposures will be conducted monthly or at the time of test initiation for in-house or commercially-supplied organisms. Reference toxicant testing will be performed according to USEPA (2000; 2002) methods.

4.0 TEST DESIGN

4.1 Test Concentrations

The test concentration will be 100 percent of each test sediment. A 100 percent laboratory control sediment (see section 4.3) exposure will be conducted concurrently.

4.2 Sediment/Water Mixture

Sediment (100 ml) will be placed in each test chamber. After addition of sediment, 175 ml of overlying water will be poured into each beaker. The beakers will be left unaerated overnight to allow sediment to settle and to reduce turbidity prior to addition of test organisms.

4.3 Reference/Control Sediment

In addition to any field-collected reference sediment, at least one laboratory control sediment will be tested concurrently. The laboratory control sediment may be clean, field-collected sediment and/or a formulated sediment.

4.4 Number of Test Organisms

Eighty *Hyalella azteca* will be exposed to each treatment. Ten organisms will be randomly assigned to each test chamber and eight replicates will be tested per treatment.

4.5 Test Initiation/Renewal Frequency

Testing will be initiated by addition of the test organisms after the overnight settling period. Each chamber will be renewed with approximately 2 volume additions per day, beginning on day 0 (after overlying water is characterized but before organisms are added). This will be accomplished with either a flow-through drip system or a renewal box that can be filled with overlying water and allowed to drain into the test chambers.

4.6 Chemical and Physical Monitoring

At a minimum, the following measurements will be made:

1. Dissolved oxygen, temperature, and pH will be measured in the overlying water of each treatment and the control each day of testing.
2. Hardness, alkalinity, conductivity, and ammonia will be measured in the laboratory reconstituted water (used as overlying water) on day 0.
3. Hardness, alkalinity, conductivity, and ammonia will be measured in overlying water from each treatment at test initiation (just prior to renewal on day 0 or 1) and at test termination.
4. Ammonia will also be measured in each treatment on days 3 and 7.

4.7 Biological Monitoring

After ten days of exposure, sediment from each test chamber will be removed and sieved or sorted to recover living test organisms. Organisms not recovered at test termination will be presumed dead. Dry weight will be determined at 60-90°C.

4.8 Test Duration

The test duration is 10 days. At test termination, the surviving organisms in each test chamber will be counted and transferred to a tared weighing boat and dried at 60-90°C for a minimum of 24 hours. Immediately after removal from the drying oven, the weigh boats will be placed in a dessicator to prevent absorption of moisture from the air, until they can be weighed. Weights will be measured to the nearest 0.01mg.

4.9 Calculations

Survival data will be transformed by arcsine squareroot. Normality and homogeneity assumptions for survival data will be evaluated by the Shapiro-Wilk's test and Bartlett's test, respectively (α = 0.01). Data will then be evaluated (α = 0.05) using either parametric or nonparametric methods, depending upon the outcome of the normality and homogeneity assessments.

Analysis of growth (dry weight) will occur in the same manner as for survival, although the weights will not be transformed using arcsine squareroot.

4.10 Quality Criterion

The test will not be considered acceptable if mortality in the control sediment exceeds 20 percent or if there is no measurable growth of test organisms in the control sediment. If mortality in one or more of the control treatments exceeds 20 percent or there is no measurable growth in the control, then the test will be reviewed to determine if certain chemical or physical characteristics of the test sediment (e.g., low dissolved oxygen or unusual pH) may have contributed to poor performance. Upon review by ENSR and the Sponsor, test data may be found acceptable.

5.0 TEST REPORT

The report will be a typed document describing the results of the test and will be signed by the Study Director and Quality Assurance Unit. The report will include, but not be limited to, the following:

- A copy of all raw data.
- Name of test, Study Director, and laboratory, and date test was begun.
- A detailed description of the sediment, including its source, time of collection, composition, known physical or chemical properties, and any information that appears on the sample container or has been provided by the Sponsor.
- The source of the overlying water, its chemical characteristics, and a description of any pretreatment.
- Detailed information about the test organisms, including scientific name, age, life stage, source, history, acclimation procedure, and food used.
- A description of the experimental design and the test chambers, the volume of solution in the chambers, the way the test was begun, the number of organisms per treatment, and the lighting.
- A description of any aeration performed on test solutions before or during the test.
- Definition of the criterion used to determine the effect and a summary of general observations on other effects or symptoms.
- Percentage of organisms that died or showed the effect.
- Anything unusual about the test, any deviations from the protocol, and any other relevant information.

6.0 LITERATURE CITED

ASTM. 2006. Standard Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Fresh Water Invertebrates. Method E 1706-05 In *2006 Annual Book of ASTM Standards, Section 11, Water and Environmental Technology, Volume 11.06, Biological Effects and Environmental Fate; Biotechnology.* American Society of Testing and Materials. Conshohocken, PA.

USEPA. 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates. Second Edition. EPA/600/R-99/064.

USEPA. 2002. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Fourth Edition. EPA-821-R-02-013.

7.0 PROCEDURAL COMPLIANCE

All test procedures, documentation, records, and reports will comply with USEPA (2000, 2002) general guidance on quality assurance related to effluent and sediment toxicity testing. To this end, random audits of the test may be scheduled while the test is in progress. The raw data will be checked and compared to protocol requirements and Standard Operating Procedures, and the final report will be audited for accuracy and signed, if satisfactory, by both the Study Director and an individual from the Quality Assurance Unit.

8.0 PROTOCOL AMENDMENTS AND DEVIATIONS

All changes (i.e., amendments, deviations, and final report revisions) of the approved protocol plus the reasons for the changes must be documented in writing. The changes will be signed and dated by the Study Director and maintained with the protocol. All amendments must be authorized in advance by the Sponsor.

9.0 SPONSOR AND STUDY DIRECTOR APPROVAL

Sponsor Approval: ______________________ Date: __________

Study Director: David A. Pillard Date: 8 Aug. 2008

APPENDIX C

Data Sheets

DAP 11/18/08
AR 11/19/08

H. azteca 10-day Survival and Growth, Testing Cover Page

Project Number:	8503-131-058 – (026, 028, 030, 032, 034)		Protocol #:	HA3AK.TIE058.006 7 ①	
Test Substance:	Sediment				
Test Species:	*H. azteca*	Lot #: ~~0~~ ① 08-042	Age:	8-10 d	Supplier: ABS
Test Type:	Chronic, Static Renewal				
Dilution Water:	Mod Hard with 50 mg/L Chloride (RW 8768)		Investigators:	AK/SS/AP/DAP/OU/RS/AA	
Sampling Date(s):	7/23/08, 7/24/08, 7/30/08, 7/23/08		Sampling Time(s):	see COCs	
FCETL Sample #(s):	22015, 22016, 22017, 22018, 22019				
Test Initiation Date/Time:	8/8/08 @ 1300				
Test Termination Date/Time:	8/18/08 @ 1300-1800				

Renewal Frequency:	Cont. drip, 2+ vol/da	Feeding Freq:	daily	Food Type/Amount:	1 ml YTC daily	Test Temp:	23 +/- 1 deg C
Test Chamber Capacity:	500-ML	Test Soltn. Vol:	100 mL sed/175 mL H2O	# Repl's/Trtmnt:	8		
Test Duration:	10 days	# Org.'s/Repl:	10	Env. Chmb/(Bath):	5		

Water Characterization: Minimum of Hardness, Alkalinity, & Conductivity on days 0 and 10; Ammonia on days 0, 3, 7, and 10; No TRC; pH, temperature & DO daily on overlying water
aerate if dissolved oxygen <2.5 mg/L

Test Sediment (s):

1)	Sand (cont)	2)	Form sed (cont)	3)	Lower Johnson
4)	Lower Slate	5)	Lower Sherman	6)	Lower Sweeny
7)	Middle Sherman	8)		9)	
10)		11)			

Reference Tox. Dates:	8/8-8/12/08	LC50:	1924 mg Cl⁻/L	Hist. Limits:	879-3038 Method:
Study Director Initials:	DAP	Date:	8/8/08		

Overlying water added at a minimum of 2 volume additions/day; equivalent to >350 ml/day or >0.24 ml/min

① DAP 11/14/08 E

② DAP 11/17/08 E

Sample Numbers: ~~22016~~ ②
Lower Johnson: ~~22018~~ ② 22016
Lower Slate: 22018
Lower Sherman: 22019
Lower Sweeny: 22015
Middle Sherman: 22017

DAP 11/18/08
QA: [illegible] 11/19/08

BIOLOGICAL DATA   *H. azteca*   Chronic, Static Renewal   Project 8503-131-058 - 026, 028, 030, 032, 035

Observations made on 08/18/08

Sediment	Test Termination	A	B	C	D	E	F	G	H	Remarks:
Sand (cont)	# Surviving	0	0	0	1	0	0	0	6	8.75%
	# Observed Dead	4	9	2	0	4	2	0	0	
	# Not Found	6	1	8	9	6	8	10	4	
Form sed (cont)	# Surviving	7	9	11	9	8	9	10	7	86.25%
	# Observed Dead	0	0	0	0	0	0	0	0	
	# Not Found	3	1	0	1	2	1	0	3	
Lower Johnson	# Surviving	10	9	9	10	10	7	① X 8	9	90%
	# Observed Dead	0	0	0	0	0	0	0	0	
	# Not Found	0	1	1 ③	0	0	3	2	1	
Lower Slate	# Surviving	10	10	9	10	8 ①	7	10	10	~~* only 7 in pan~~ ①
	# Observed Dead	0	0	0	0	0	0	0	0	
	# Not Found	0	0	1	0	2	3	0	0	92.5%
Lower Sherman	# Surviving	10	9 ③ *	9	10	9	10	8	9	* only 8 in pan
	# Observed Dead	0	③ 0 1	0	0	0	0	0	0	92.5%
	# Not Found	0	③ X 0	1	0	1	0	2	1	
Lower Sweeny	# Surviving	9	0 ②	10	9	7	10	10	10	92.9%
	# Observed Dead	0	0	0	0	0	0	0	0	
	# Not Found	1	10	0	1 ③	3	0	0	0	
Middle Sherman	# Surviving	9	9	10	10	10	10	10	10	97.5%
	# Observed Dead	0	0	0	0	0	0	0	0	
	# Not Found	1	1	0	0	0	0	0	0	
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
	# Surviving									
	# Observed Dead									
	# Not Found									

8/18/08 @ 1440-1900 ①81 8/18/08 WA, E

③ DAP 11-18-08 E

② Rep. B of Lower Sweony dropped from analysis as outlier; probably not seeded. DAP 8-25-08

DAP 11-18-08
[illegible]

CHEMICAL DATA (Composite of Overlying Water) *H. azteca* Chronic, Static Renewal Project 8503-131-058 – 026, 028, 030, 032, 034

Parameter	Sediment	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day	Meter	Date	Time	Initials
Dissolved Oxygen (mg/l)	Sand (cont)	6.9	6.6	6.8	6.7	6.8	6.6	6.7	~~7.0~~ 6.8	7.0	6.2	6.6	0	5	8/8/08	1000	[illegible]
	Form sed (cont)	6.8	6.2	6.3	6.4	~~7.6~~ 6.4	6.4	6.1	6.4	6.8	5.9	6.2	1	5	8/9/08	1700	AK
	Lower Johnson	6.1	5.9	6.1	6.2	6.0	6.3	6.4	6.1	6.4	5.9	6.4	2	5	8/10/08	1505	AK
	Lower Slate	5.8	5.7	5.9	6.1	6.2	6.5	6.3	6.3	6.5	5.9	6.6	3	5	8/11/08	1720	SP
	Lower Sherman	5.9	5.6	5.9	6.0	5.9	6.0	6.1	6.0	6.5	6.0	6.2	4	5	8/12/08	1140	[illegible]
	Lower Sweeny	6.1	6.1	6.1	6.1	6.4	6.1	6.2	6.1	6.4	6.0	6.5	5	5	8/13/08	1150	[illegible]
	Middle Sherman	6.0	5.9	6.2	6.3	6.3	5.9	6.2	6.1	6.4	6.2	6.5	6	5	8/14/08	1110	[illegible]
	0												7	5	8/15/08		[illegible]
	0												8	5	8/16/08	1210	[illegible]
	0												9	5	8/17/08	1345	[illegible]
													10	5	8/18/08	1330	DAP
Temp (deg C)	Sand (cont)	24	24	24	24	24	24	24	23	23	23	23	0	D32	8/8/08	1000	[illegible]
	Form sed (cont)	23	24	25	24	24	24	24	23	23	23	22	1	D32	8/9/08	1700	AK
	Lower Johnson	23	25	24	23	24	24	24	23	23	23	23	2	D36	8/10/08	1505	AK
	Lower Slate	23	25	25	24	24	25	24	23	23	23	22	3	D37	8/11/08	1715	[illegible]
	Lower Sherman	24	25	24	24	24	24	23	23	23	23	23	4	D36	8/12/08	1120	[illegible]
	Lower Sweeny	23	24	24	24	24	24	24	23	23	23	23	5	D42	8/13/08	1140	[illegible]
	Middle Sherman	23	25	24	24	24	24	24	23	23	23	23	6	D37	8/14/08	1100	[illegible]
	0												7	D40	8/15/08	1110	[illegible]
	0												8	D40	8/16/08	1150	[illegible]
	0												9	D42	8/17/08	1330	[illegible]
													10	D42	8/18/08	1330	DAP
pH	Sand (cont)	8.0	8.2	8.2	8.2	8.2	8.2	8.1	8.1	8.1	8.2	8.2	0	12	8/8/08	1000	[illegible]
	Form sed (cont)	8.0	8.2	8.4	8.2	8.1	8.2	8.0	8.0	8.0	8.0	7.8	1	12	8/9/08	1700	AK
	Lower Johnson	7.4	7.5	7.7	7.6	~~8.7~~ 7.6	7.7	7.8	7.8	7.7	7.7	7.8	2	12	8/10/08	1505	AK
	Lower Slate	7.6	7.9	8.0	7.9	7.9	7.9	7.9	8.0	7.8	7.8	8.0	3	12	8/11/08	1720	SP
	Lower Sherman	7.7	7.9	8.0	7.9	7.8	7.9	7.9	7.9	7.8	7.8	7.8	4	12	8/12/08	1130	[illegible]
	Lower Sweeny	7.5	7.6	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.7	7.9	5	12	8/13/08	1150	[illegible]
	Middle Sherman	7.7	8.0	8.0	7.9	7.9	7.9	7.9	8.0	7.8	7.8	8.1	6	12	8/14/08	1100	[illegible]
	0												7	12	8/15/08		RS
	0												8	16	8/16/08	1200	[illegible]
	0												9	16	8/17/08	1335	[illegible]
	Replicate		A	B	C	D	E	F	G	H	A	B	10	16	8/18/08	1330	DAP

① DAP 8/12/08 up
② RS 8/15/08 E

DAP 11-18-08

OVERLYING WATER CHARACTERIZATION *H. azteca* Chronic, Static Renewal Project No. 8503-131-058 -027, 028, 030, 032, 034

an ARW 11/19/08

	Conductivity (s/cm)		Hardness (mg/L as CaCO3)		Alkalinity (mg/l as CaCO3)		Ammonia (mg/l)			
Sediment	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10	Day 0	Day 3	Day 7	Day 10
Sand (cont)	395	582	106	108	55	82	<1.0	<1.0	<1.0	1.6
Form sed (cont)	531	593	74	116	85	100	<1.0	<1.0	<1.0	<1.0
Lower Johnson	398	571	68	108	52	76	1.6	2.4	<1.0	<1.0
Lower Slate	456	602	106	120	88	94	2.0	1.7	<1.0	<1.0
Lower Sherman	429	559	88	114	76	89	1.6	1.1	<1.0	<1.0
Lower Sweeny	393	581	58	106	64	78	<1.0	1.0	<1.0	<1.0
Middle Sherman	421	567	90	108	71	84	<1.0	<1.0	<1.0	<1.0
Mod Hard (RW 8768)	484		94		68		NM			
0										
0										
Meter #	15	15	Titr	Titr	Titr	Titr	HA#1	HA#1	HA#1	HA#1
Date:	8/8/08	8/18/08	8/8/08	8/18/08	8/8/08	8/18/08	8/8/08	8/11/08	8/15/08	8/18/08
Time:	1000	1700	1010	1700	1010	1700	1010	1730	1515	1700
Initials:	[illegible]	AK	[illegible]	DAP for AK	[illegible]	DAP for AK	[illegible]	[illegible]	RS	DAP for AK

FCETL QA Form No.010
Revision 5
Effective 08/99
DAP 11-18-08
QA: AEN 11/19/08

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

026, 028, 030, 032, 034

Project Number: 08503-131-058	Test Substance: Sediment	Comments:
Species: Hyalella azteca	Analyst Tare: SR / Analyst Gross: CW	Analytical Balance ID: SARТ#1
Date/Time of Tare Wt.: 8/18/08 @ 1740	Date/Time of Gross Wt.: 8/21/08 @ 1620	Dried in Oven # 3 from Date: 8/20 Time: 1040 to Date: 8/21 Time: 1530

Weight Type (Circle): Wet Blot Dry ~~Dry (>100°C)~~ (circled; corrected to 60-90°C ⑤) AFDW (>500°C)

Lot (circled) or Batch Number: 08-042

Boat No.	Treatment	Rep.	Length Units:	Tare Weight (g)	Gross Weight (g)	Net Weight (g)	Adjusted Net Weight (g)[1]	No. of Orig. Organisms	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Organisms	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
	Form(cont)	A		0.91846	0.91878 ~~0.000320~~ ~~0.918786~~ ~~0.918530~~	0.00032 ~~0.000320~~ ~~0.000076~~		10			~~0~~ ~~10~~ 7		
		B		0.91711	0.91783	0.00072		10			① ~~9~~ 9		
		C		0.91811	0.91846	0.00035*		11			① ~~8~~ 11		
		D		0.91940	0.91979	0.00039		10			9		
		E		0.92132	0.92169	0.00037		10			8		
		F		0.92211	0.92295	0.00084		10			9		
		G		0.92098	0.92128	0.00030		8 ②			8 ②		
		H		0.92189	0.92209	0.00020		10			7		
	L. John	A		0.91787	0.91853	0.00066		10			10		
		B		0.91813	0.91887	0.00074		10			9		
		C		0.92109	0.92158	0.00049		9 ③			8 ③		
		D		0.91428	0.91505	0.00077		9 ④			9 ④		
Blank				0.92458	0.92459	0.00001							
Range													
Mean													

Test Solution Volume:	Loading Rate:

[1] Add in weight loss of blank boat, if appropriate.

① CW 8/21/08 WP

* weighed twice due to low weight and got the same value CW

② 10 alive, but only 8 in weighing pan due to transfer loss (DAP)

③ 9 alive, but I lost during transfer to pan (DAP)

④ 10 alive, but I lost during transfer to pan (DAP)

⑤ AEN 11/19/08 CF

①

DAP 11-18-08
QA: ARN 11/19/08

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

Project Number: 08503-131-038 — 026, 028, 030, 032, 034

Test Substance: Sediment

Comments:
Analytical Balance ID: SART #1
Dried in Oven # 3 from Date: 8/20 Time: 1040 to Date: 8/21 Time: 1530

Species: Hyalella azteca

Analyst Tare: SI Analyst Gross: CW

Date/Time of Tare Wt.: ~~8/21/08~~ ① 8/18/08 @ 1740

Date/Time of Gross Wt.: 8/21/08 @ 1620

Weight Type (Circle): Wet Blot Dry **Dry (~~>100°C~~ 60-90 ⑥)** AFDW (>500°C)

Lot or Batch Number: 08-042

Boat No.	Treatment	Rep.	Length Units:	Tare Weight (g)	Gross Weight (g)	Net Weight (g)	Adjusted Net Weight (g)[1]	No. of Orig. Organisms	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Organisms	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
	L. John (cont)	E		0.91283	0.91364	0.00081	② ~~10~~	10			② ~~11~~ 10		
		F		0.92797	0.92860	0.00063	③ ~~10~~	10			7		
		G		0.92455	0.92515	0.00060		10			② ~~9~~ 8		
		H		0.91910	0.91977	0.00067	③ ~~10~~	10			9		
	L Slate	A		0.92621	0.92704	0.00083	③ ~~10~~	10			10		
		B		0.91920	0.91998	0.00078	③ ~~10~~	10			10		
		C		0.91673	0.91737	0.00064		9 ④			8 ④		
		D		0.92304	0.92378	0.00074	③ ~~10~~	10			10		
		E		0.92152	0.92213	0.00061	③ ~~10~~	10			8		
		F		0.92340	0.92396	0.00056	③ ~~10~~	10			7		
		G		0.92129	0.92204	0.00075	③ ~~10~~	10			10		
		H		0.91820	0.91906	0.00086		9 ⑤			9 ⑤		
Blank													
Range													
Mean													

Test Solution Volume:

Loading Rate:

[1] Add in weight loss of blank boat, if appropriate.

① CW 8/21/08 WP
② DAP 11/13/08 E
③ DAP 11/13/08 WP
④ 9 alive, but 1 lost during transfer (DAP)
⑤ 10 Alive, but 1 lost during transfer (DAP)
⑥ ARN 11/19/08 CF

DAP 11-18-08
QA: AR 11/19/08

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

026, 028, 030, 032, 034

Project Number: 08503-131-058-	Test Substance: Sediment	Comments:
Species: Hyalella azteca	Analyst Tare: SD Analyst Gross: CW	Analytical Balance ID: SARTT#1
Date/Time of Tare Wt.: 8/18/08 @ 1740	Date/Time of Gross Wt.: 8/21/08 @ 1620	Dried in Oven # 3 from Date: 8/20 Time: 1040 to Date: 8/21 Time: 1530

Weight Type (Circle): Wet Blot Dry (Dry (>~~100~~ 60-90 °C)) ⑥ AFDW (>500°C)

(Lot) or Batch Number: 08-042

Boat No.	Treatment	Rep.	Length Units:	Tare Weight (g)	Gross Weight (g)	Net Weight (g)	Adjusted Net Weight (g)[1]	No. of Orig. Organisms	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Organisms	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
	LJSherm	A		0.92216	0.92298 ~~0.91700~~ ①	0.00082		~~9~~ ② ~~10~~ 9			9 ②		
		B		0.92194	0.92258	0.00064		9 ④			③ ~~9~~ 8 ~~⑧~~ ④		
		C		0.92141	0.92203	0.00062		10			9		
		D		0.92110	0.92188	0.00078		10			10		
		E		0.91711	0.91785	0.00074		10			9		
		F		0.91825	0.91894	0.00069		10			10		
		G		0.92330	0.92397	0.00067		10			8		
		H		0.92464	0.92529	0.00065		10			9		
	LSweeny	A		0.91630	0.91700	0.00070		10			9		
		B		0.92228	~~0.0~~ ①						~~9~~ ①		
		C		0.92667	0.92728	0.00061		9 ⑤			9		
		D		0.92629	0.92684	0.00055		~~9~~ ~~10~~ ⑦ ~~⑥~~ 10			9 ~~⑥~~ ⑦		
Blank													
Range													
Mean													

Test Solution Volume:

Loading Rate:

[1] Add in weight loss of blank boat, if appropriate.

① CW 8/21/08 WP
⑦ DAP 11/19/08 E
② 10 alive, but 1 lost during transfer (DAP)
③ DAP 11/13/08 E
④ [illegible] lost during transfer (DAP)
⑤ 10 alive, but 1 lost during transfer (DAP)
⑥ AR 11/19/08 CE

③

FCETL QA Form No.010
Revision 5
Effective 08/99
DAP 11-18-08
QA: AR 11/19/08

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

Project Number: 08503-131-058 — 026, 028, 030, 032, 034
Species: Hyalella azteca
Date/Time of Tare Wt.: 8/18/08 @ 1740
Test Substance: Sediment
Analyst Tare: SP Analyst Gross: CN
Date/Time of Gross Wt.: 8/21/08 @ 1620
Comments:
Analytical Balance ID: SART #1
Dried in Oven # 3 from Date: 8/20 Time: 1040 to Date: 8/21 Time: 1530

Weight Type (Circle): Wet Blot Dry **(Dry (>100°C))** (60-80 ⑥) AFDW (>500°C)
Lot or Batch Number: 08-042

Boat No.	Treatment	Rep.	Length Units:	Tare Weight (g)	Gross Weight (g)	Net Weight (g)	Adjusted Net Weight (g)[1]	No. of Orig. Organisms	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Organisms	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
	Lowery	E		0.92602	0.92656	0.00054		10			~~8~~ ① 7		
	Sweeny	F		0.92153	0.92219	0.00066		8 ②			8 ②		
		G		0.92696	0.92763	0.00067		9 ③			9 ③		
		H		0.92271	0.92344	0.00073		10			10		
	M Sherm	A		0.92335	0.92418	0.00083		9 ~~8~~ ④			8 ④		
		B		0.91442	0.91511	0.00069		9 ~~8~~ ④			8 ④		
		C		0.92533	0.92616	0.00083		10			10		
		D		0.92584	0.92650	0.00066		10			10		
		E		0.92862	0.92930	0.00068		10			10		
		F		1.10958	1.10998	0.00040		7 ⑤			7 ⑤		
		G		0.93065	0.93150	0.00085		10			10		
		H		0.93243	0.93325	0.00082		9 ③			9 ③		
Blank													
Range													
Mean													

Test Solution Volume:
Loading Rate:

[1] Add in weight loss of blank boat, if appropriate.

① CN 8/21/08 WP
⑤ ~~9~~ 10 alive but 3 lost during transfer (DAP)
② 10 alive, but 2 lost during transfer (DAP)
③ 10 alive, but 1 lost during transfer (DAP)
⑥ AR 11/19/08 CF
④ 9 alive, but 1 lost during transfer (DAP)

aA: AR 11/20/08

Spreadsheet for Determining Dry Weight of Hyalella azteca

Test Start Date:	8/8/2008	Test End Date:	8/18/2008
Test Number(s):	08503-131-058- (026, 028, 030, 032, 034)	Test Material:	Sediment
Species:	Hyalella azteca (Lot 08-042)	Entered by:	Pillard

Boat #	Treatment	Rep	Length	Tare wt (dry) (g)	Gross wt (dry) (g)	Dry Net wt (g)	Dry adjusted net wt (g)	Number Original Organisms	Mean wt per orig (mg)	Mean wt per treatment (orig) (mg)	Number Surviving	Mean wt per surviving (mg)	Mean wt per treatment (surv) (mg)
1	Formulated Sed	A		0.91846	0.91878	0.00032	0.00032	10	0.032	-	7	0.045714286	-
2	Formulated Sed	B		0.91711	0.91783	0.00072	0.00072	10	0.072	-	9	0.08	-
3	Formulated Sed	C		0.91811	0.91846	0.00035	0.00035	11	0.032	-	11	0.031818182	-
4	Formulated Sed	D		0.91940	0.91979	0.00039	0.00039	10	0.039	-	9	0.043333333	-
5	Formulated Sed	E		0.92132	0.92169	0.00037	0.00037	10	0.037	-	8	0.04625	-
6	Formulated Sed	F		0.92211	0.92295	0.00084	0.00084	10	0.084	-	9	0.093333333	-
7	Formulated Sed	G		0.92098	0.92128	0.00030	0.00030	8	0.037	-	8	0.0375	-
8	Formulated Sed	H		0.92189	0.92209	0.00020	0.00020	10	0.020	0.044164773	7	0.028571429	0.05081507
9	Lower Johnson	A		0.91787	0.91853	0.00066	0.00066	10	0.066	-	10	0.066	-
10	Lower Johnson	B		0.91813	0.91887	0.00074	0.00074	10	0.074	-	9	0.082222222	-
11	Lower Johnson	C		0.92109	0.92158	0.00049	0.00049	9	0.054	-	8	0.06125	-
12	Lower Johnson	D		0.91428	0.91505	0.00077	0.00077	9	0.086	-	9	0.085555556	-
13	Lower Johnson	E		0.91283	0.91364	0.00081	0.00081	10	0.081	-	10	0.081	-
14	Lower Johnson	F		0.92797	0.92860	0.00063	0.00063	10	0.063	-	7	0.09	-
15	Lower Johnson	G		0.92455	0.92515	0.00060	0.00060	10	0.060	-	8	0.075	-
16	Lower Johnson	H		0.91910	0.91977	0.00067	0.00067	10	0.067	0.068875	9	0.074444444	0.076934028
17	Lower Slate	A		0.92621	0.92704	0.00083	0.00083	10	0.083	-	10	0.083	-
18	Lower Slate	B		0.91920	0.91998	0.00078	0.00078	10	0.078	-	10	0.078	-
19	Lower Slate	C		0.91673	0.91737	0.00064	0.00064	9	0.071	-	8	0.08	-
20	Lower Slate	D		0.92304	0.92378	0.00074	0.00074	10	0.074	-	10	0.074	-
21	Lower Slate	E		0.92152	0.92213	0.00061	0.00061	10	0.061	-	8	0.07625	-
22	Lower Slate	F		0.92340	0.92396	0.00056	0.00056	10	0.056	-	7	0.08	-
23	Lower Slate	G		0.92129	0.92204	0.00075	0.00075	10	0.075	-	10	0.075	-
24	Lower Slate	H		0.91820	0.91906	0.00086	0.00086	9	0.096	0.074208333	9	0.095555556	0.080225694
25	Lower Sherman	A		0.92216	0.92298	0.00082	0.00082	9	0.091	-	9	0.091111111	-
26	Lower Sherman	B		0.92194	0.92258	0.00064	0.00064	9	0.071	-	8	0.08	-
27	Lower Sherman	C		0.92141	0.92203	0.00062	0.00062	10	0.062	-	9	0.068888889	-
28	Lower Sherman	D		0.92110	0.92188	0.00078	0.00078	10	0.078	-	10	0.078	-
29	Lower Sherman	E		0.91711	0.91785	0.00074	0.00074	10	0.074	-	9	0.082222222	-
30	Lower Sherman	F		0.91825	0.91894	0.00069	0.00069	10	0.069	-	10	0.069	-
31	Lower Sherman	G		0.92330	0.92397	0.00067	0.00067	10	0.067	-	8	0.08375	-
32	Lower Sherman	H		0.92464	0.92529	0.00065	0.00065	10	0.065	0.072152778	9	0.072222222	0.078149306
33	Lower Sweeny	A		0.91630	0.91700	0.00070	0.00070	10	0.070		9	0.077777778	-
34	Lower Sweeny	B				0.00000	0.00000		-	-		-	-
35	Lower Sweeny	C		0.92667	0.92728	0.00061	0.00061	9	0.068	-	9	0.067777778	-
36	Lower Sweeny	D		0.92629	0.92684	0.00055	0.00055	10	0.055	-	9	0.061111111	-
37	Lower Sweeny	E		0.92602	0.92656	0.00054	0.00054	10	0.054	-	7	0.077142857	-
38	Lower Sweeny	F		0.92153	0.92219	0.00066	0.00066	8	0.082	-	8	0.0825	-
39	Lower Sweeny	G		0.92696	0.92763	0.00067	0.00067	9	0.074	-	9	0.074444444	-
40	Lower Sweeny	H		0.92271	0.92344	0.00073	0.00073	10	0.073	0.068103175	10	0.073	0.073393424
41	Middle Sherman	A		0.92335	0.92418	0.00083	0.00083	9	0.092	-	8	0.10375	-
42	Middle Sherman	B		0.91442	0.91511	0.00069	0.00069	9	0.077	-	8	0.08625	-
43	Middle Sherman	C		0.92533	0.92616	0.00083	0.00083	10	0.083	-	10	0.083	-
44	Middle Sherman	D		0.92584	0.92650	0.00066	0.00066	10	0.066	-	10	0.066	-

QA: AR 11/20/08

Spreadsheet for Determining Dry Weight of Hyalella azteca

Test Start Date:	8/8/2008	**Test End Date:**	8/18/2008
Test Number(s):	08503-131-058- (026, 028, 030, 032, 034)	**Test Material:**	Sediment
Species:	Hyalella azteca (Lot 08-042)	**Entered by:**	Pillard

Boat #	Treatment	Rep	Length	Tare wt (dry) (g)	Gross wt (dry) (g)	Dry Net wt (g)	Dry adjusted net wt (g)	Number Original Organisms	Mean wt per orig (mg)	Mean wt per treatment (orig) (mg)	Number Surviving	Mean wt per surviving (mg)	Mean wt per treatment (surv) (mg)
45	Middle Sherman	E		0.92862	0.92930	0.00068	0.00068	10	0.068	-	10	0.068	-
46	Middle Sherman	F		1.10958	1.10998	0.00040	0.00040	7	0.057	-	7	0.057142857	-
47	Middle Sherman	G		0.93065	0.93150	0.00085	0.00085	10	0.085	-	10	0.085	-
48	Middle Sherman	H		0.93243	0.93325	0.00082	0.00082	9	0.091	0.077392857	9	0.091111111	0.080031746
Blank				0.92458	0.92459	1E-05							

DAP 11/18/08
DAP AK 11/19/08

DAILY TESTING LOG | *H. azteca* | Chronic, Static Renewal | Project No. 8503-131-058 (-026, 028, 030, 032, 034)

Day	Bath CT	Range	Feeding	Initials/Date
Day -1	8/7/08, Cl⁻ of RW 8768 = 52 mg/L			
Day 0	- Homogenized sediment + added sediment to test beakers - Covered sediment with ≈ 175 ml overlying water		N/A	DAP 8/8/08
Day 1	25.6 °C	25.0 - 26.2 °C	1700 AK	AK 8/9/08
Day 2	25.6 °C	25.4 - 26.2 °C	1450 AK	AK 8/10/08
Day 3	25.4 °C	25.0 - 25.8 °C	~~0746~~ 1710 AK	AK 8/11/08
Day 4	25.4 °C	24.6 - 25.8 °C	1640 AK	AK 8/12/08
Day 5	25.2°C	24.4 - 25.8°C	1425 AK	DAP for AK 8/13/08
Day 6	25.2°C	24.4 - 25.8°C	1535 AK	DAP for AK 8/14/08
Day 7	23.6°C	22.8 - 25.4°C	1430 AK	AK 8/15/08
Day 8	23.4°C	22.6 - 25.0°C	1430 AK	AK 8/16/08
Day 9	22.6°C	21.8 - 23.6°C	1690 DH	DAP for DH 8/17/08
Day 10	22.8°C	21.4 - 24.0°C	N/A	DAP 8/18/08

OAK 8/12/08 wp

SEDIMENT/SOIL PREPARATION (Even # tests)

Artificial soil	
Constituent/source	**Amount added (g)**
White quartz Sand	1242
Silt/Clay ASP400 / Engelhard Corp.	219
Dolomite / chemical lime co.	7.5
4° α-cellulose / Sigma	77.3
Humic acid / Fluka	0.15

Notes: Container was placed into tumbler for a minimum of an hour to homogenize prior to use

Soil/sediment	FCETL#	Homogenization			
		Date	From	To	Analyst
Lower Sweeney	22015	8/7/08	1630	1636	RS
Middle Sherman	22017	8/7/08	1710	1714	RS
Lower Sherman	22019 1 of 2	8/7/08	1725	1729	RS
Lower Slate	22018 1 of 3	8/7/08	1741	1744	EMH
Lower Johnson	22016 1 of 2	8/7/08	1746	1750	RS

① RS 8/7/08 ®

APPENDIX D

Analytical Data

FCETL QA Form No.131
Revision 0
Effective 10/06

QA: AR 11/14/08

PERCENT TOTAL SOLIDS AND PERCENT TOTAL VOLATILE SOLIDS (TVS)

Project No: 08503-131-058

Analytical Balance ID: AND

TARE: Date/time: 9/5/08 1425 Analyst: DAP

DRY GROSS: Date/time: 9/8/08 1115 Analyst: DAP

ASHED GROSS: Date/time: 9/8/08 1630 Analyst: DAP

Dried in Oven # 2 from Date: 9/5/08 Time: 1530 to Date: 9/8/08 Time: 0800
Oven °C: 100

Ashed in Furnace from Date: 9/8/08 Time: 1300 to Date: 9/8/08 Time: 1425
Furnace °C: 550

Dish No.	Treatment (2)	Rep	Tare Weight of Dish (g) A	Dish + Wet Sample (g) B	Dry Gross Weight (g) (dish + dry sample) C	% Total Solids (g) [(C-A)(100)]/(B-A)	Ashed Gross Weight (dish + sample)(g) D	% Total Volatile Solids (g) [(C-D)(100)]/(C-A)
1A	22015	A	12.4276	25.3734	22.1271	74.92	21.8748	2.60
11A	22015	B	12.5302	24.7745	21.7341	75.17	21.4619	2.96
2A	22016	A	12.3628	22.8185	20.1564	74.54	19.9345	2.85
12A	22016	B	10.7979	20.9484	18.3089	74.00	18.0849	2.98
3A	22017	A	10.4476	19.6001	17.4374	76.37	17.2605	2.53
13A	22017	B	12.1450	21.4642	19.2649	76.40	19.0857	2.52
4A	22018	A	10.7727	20.2776	17.6129	71.96	17.3521	3.81
14A	22018	B	12.3598	21.4699	18.9101	71.90	18.6391	4.14
5A	22019	A	12.0064	24.2200	21.0076	73.70	20.7731	2.60
15A	22019	B	12.4941	26.2194	22.6010	73.64	22.3639	2.34
Blank			12.6770		12.6770		12.6770	

[1] Add in weight loss of blank boat, if appropriate.

(2) 22015 = Lower Sweeny
22016 = Lower Johnson
22017 = Middle Sherman
22018 = Lower State
22019 Lower Sherman

Monday, September 22, 2008

Analytical Laboratory

Dave Pillard
ENSR International
4303 W. LaPorte Ave
Fort Collins, CO 80521

RE: COEUR

Work Order: 0808169

Dear Dave Pillard:

MSE Lab Services received 5 sample(s) on 8/20/2008 for the analyses presented in the following report.

Please find enclosed analytical results for the sample(s) received at the MSE Laboratory.

If you have any questions regarding these test results, please feel free to call.

Sincerely,

Marcee Cameron

Marcee Cameron
Laboratory Director/ Chemist
406-494-7371

Enclosure

MSE Lab Services

Date: *22-Sep-08*

CLIENT:	ENSR International	**Client Sample ID:**	22015 LOWER SWEENEY
Lab Order:	0808169	**Collection Date:**	7/28/2008 10:30:00 AM
Project:	COEUR		
Lab ID:	0808169-001	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **mc/kh**
Aluminum	14000	19.6		mg/Kg-dry	1	9/8/2008
Chromium	23.6	16.3		mg/Kg-dry	1	9/8/2008
Zinc	83.2	16.3		mg/Kg-dry	1	9/8/2008
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	28.8	0.483		mg/Kg-dry	2	9/8/2008
Cadmium	0.371	0.032		mg/Kg-dry	2	9/8/2008
Copper	57.4	0.403		mg/Kg-dry	2	9/8/2008
Lead	15.4	0.064		mg/Kg-dry	2	9/8/2008
Nickel	27.3	0.322		mg/Kg-dry	2	9/8/2008
Selenium	1.07	0.644		mg/Kg-dry	2	9/8/2008
Silver	0.467	0.322		mg/Kg-dry	2	9/8/2008
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**AVS-SEM**		Analyst: **kgw**
Mercury	0.0517	0.274	J	mg/Kg-dry	1	9/4/2008
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **sh**
TOC	4.69	0.02		%-dry	1	9/12/2008
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **sh**
1" Gradation	ND	0.05		%	1	9/11/2008
2mm Gradation	ND	0.05		%	1	9/11/2008
Percent Coarse Material	ND	0.05		%	1	9/11/2008
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: **sh**
% Clay	4.0	0.1		%	1	9/16/2008
% Sand	64.0	0.1		%	1	9/16/2008
% Silt	32.0	0.1		%	1	9/16/2008
Soil Class	SANDY LOAM			%	1	9/16/2008
ACID VOLATILE SULFIDE		**AVS-SEM**				Analyst: **kgw**
Sulfide	ND	12.0	H	umoles/g	1	8/27/2008
PERCENT MOISTURE		**D2216**				Analyst: **BO**
Percent Moisture	38.6	0.05		wt%	1	9/4/2008

SW **Review**

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Lab Services

Date: *22-Sep-08*

CLIENT:	ENSR International	**Client Sample ID:**	22016 LOWER JOHNSON
Lab Order:	0808169	**Collection Date:**	7/23/2008 11:46:00 AM
Project:	COEUR		
Lab ID:	0808169-002	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **mc/kh**
Aluminum	13700	16.1		mg/Kg-dry	1	9/8/2008
Chromium	28.1	13.4		mg/Kg-dry	1	9/8/2008
Zinc	94.2	13.4		mg/Kg-dry	1	9/8/2008
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	21.9	0.396		mg/Kg-dry	2	9/8/2008
Cadmium	0.296	0.026		mg/Kg-dry	2	9/8/2008
Copper	93.3	0.330		mg/Kg-dry	2	9/8/2008
Lead	11.4	0.053		mg/Kg-dry	2	9/8/2008
Nickel	23.3	0.264		mg/Kg-dry	2	9/8/2008
Selenium	0.413	0.527	J	mg/Kg-dry	2	9/8/2008
Silver	1.24	0.264		mg/Kg-dry	2	9/8/2008
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**AVS-SEM**		Analyst: **kgw**
Mercury	0.0546	0.245	J	mg/Kg-dry	1	9/4/2008
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **sh**
TOC	0.78	0.01		%-dry	1	9/12/2008
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **sh**
1" Gradation	ND	0.05		%	1	9/11/2008
2mm Gradation	ND	0.05		%	1	9/11/2008
Percent Coarse Material	ND	0.05		%	1	9/11/2008
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: **sh**
% Clay	4.0	0.1		%	1	9/16/2008
% Sand	72.0	0.1		%	1	9/16/2008
% Silt	24.0	0.1		%	1	9/16/2008
Soil Class	SANDY LOAM			%	1	9/16/2008
ACID VOLATILE SULFIDE		**AVS-SEM**				Analyst: **kgw**
Sulfide	ND	12.0	H	umoles/g	1	8/27/2008
PERCENT MOISTURE		**D2216**				Analyst: **BO**
Percent Moisture	25.3	0.05		wt%	1	9/4/2008

SW Review

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Lab Services

Date: *22-Sep-08*

CLIENT:	ENSR International	**Client Sample ID:**	22017 MIDDLE SHERMAN
Lab Order:	0808169	**Collection Date:**	7/30/2008 9:30:00 AM
Project:	COEUR		
Lab ID:	0808169-003	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **mc/kh**
Aluminum	13300	20.4		mg/Kg-dry	1	9/8/2008
Chromium	26.9	17.0		mg/Kg-dry	1	9/8/2008
Zinc	101	17.0		mg/Kg-dry	1	9/8/2008
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	58.3	0.504		mg/Kg-dry	2	9/8/2008
Cadmium	0.401	0.034		mg/Kg-dry	2	9/8/2008
Copper	103	0.420		mg/Kg-dry	2	9/8/2008
Lead	17.1	0.067		mg/Kg-dry	2	9/8/2008
Nickel	29.9	0.336		mg/Kg-dry	2	9/8/2008
Selenium	1.02	0.672		mg/Kg-dry	2	9/8/2008
Silver	0.443	0.336		mg/Kg-dry	2	9/8/2008
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**AVS-SEM**		Analyst: **kgw**
Mercury	0.103	0.283	J	mg/Kg-dry	1	9/4/2008
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **sh**
TOC	2.82	0.02		%-dry	1	9/12/2008
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **sh**
1" Gradation	ND	0.05		%	1	9/11/2008
2mm Gradation	ND	0.05		%	1	9/11/2008
Percent Coarse Material	ND	0.05		%	1	9/11/2008
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: **sh**
% Clay	4.0	0.1		%	1	9/16/2008
% Sand	72.0	0.1		%	1	9/16/2008
% Silt	24.0	0.1		%	1	9/16/2008
Soil Class	SANDY LOAM			%	1	9/16/2008
ACID VOLATILE SULFIDE		**AVS-SEM**				Analyst: **kgw**
Sulfide	ND	12.0	H	umoles/g	1	8/27/2008
PERCENT MOISTURE		**D2216**				Analyst: **BO**
Percent Moisture	41.2	0.05		wt%	1	9/4/2008

SW Review

Qualifiers:
- H — Holding times for preparation or analysis exceeded
- Limit — Instrument Reporting Limit
- ND — Not Detected at the Method Detection Limit (MDL)
- J — Analyte detected below the Reporting Limit
- MDL — Method Detection Limit

MSE Lab Services

Date: *22-Sep-08*

CLIENT:	ENSR International	**Client Sample ID:**	22018 LOWER SLATE
Lab Order:	0808169	**Collection Date:**	7/24/2008 11:30:00 AM
Project:	COEUR		
Lab ID:	0808169-004	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **mc/kh**
Aluminum	15800	24.9		mg/Kg-dry	1	9/8/2008
Chromium	20.3	20.7	J	mg/Kg-dry	1	9/8/2008
Zinc	739	20.7		mg/Kg-dry	1	9/8/2008
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	32.6	0.622		mg/Kg-dry	2	9/8/2008
Cadmium	11.0	0.041		mg/Kg-dry	2	9/8/2008
Copper	111	0.518		mg/Kg-dry	2	9/8/2008
Lead	21.9	0.083		mg/Kg-dry	2	9/8/2008
Nickel	71.1	0.414		mg/Kg-dry	2	9/8/2008
Selenium	3.73	0.829		mg/Kg-dry	2	9/8/2008
Silver	0.807	0.414		mg/Kg-dry	2	9/8/2008
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**AVS-SEM**		Analyst: **kgw**
Mercury	0.149	0.384	J	mg/Kg-dry	1	9/4/2008
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **sh**
TOC	8.65	0.02		%-dry	1	9/12/2008
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **sh**
1" Gradation	ND	0.05		%	1	9/11/2008
2mm Gradation	ND	0.05		%	1	9/11/2008
Percent Coarse Material	ND	0.05		%	1	9/11/2008
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: **sh**
% Clay	8.0	0.1		%	1	9/16/2008
% Sand	60.0	0.1		%	1	9/16/2008
% Silt	32.0	0.1		%	1	9/16/2008
Soil Class	SANDY LOAM			%	1	9/16/2008
ACID VOLATILE SULFIDE		**AVS-SEM**				Analyst: **kgw**
Sulfide	ND	12.0	H	umoles/g	1	8/27/2008
PERCENT MOISTURE		**D2216**				Analyst: **BO**
Percent Moisture	51.8	0.05		wt%	1	9/4/2008

SW Review

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Lab Services

Date: *22-Sep-08*

CLIENT:	ENSR International	**Client Sample ID:**	22019 LOWER SHERMAN
Lab Order:	0808169	**Collection Date:**	7/30/2008 11:00:00 AM
Project:	COEUR		
Lab ID:	0808169-005	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **mc/kh**
Aluminum	16900	18.0		mg/Kg-dry	1	9/8/2008
Chromium	37.5	15.0		mg/Kg-dry	1	9/8/2008
Zinc	100	15.0		mg/Kg-dry	1	9/8/2008
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	25.6	0.448		mg/Kg-dry	2	9/8/2008
Cadmium	0.528	0.030		mg/Kg-dry	2	9/8/2008
Copper	81.5	0.373		mg/Kg-dry	2	9/8/2008
Lead	8.43	0.060		mg/Kg-dry	2	9/8/2008
Nickel	31.9	0.298		mg/Kg-dry	2	9/8/2008
Selenium	1.18	0.597		mg/Kg-dry	2	9/8/2008
Silver	0.302	0.298		mg/Kg-dry	2	9/8/2008
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**AVS-SEM**		Analyst: **kgw**
Mercury	0.0434	0.243	J	mg/Kg-dry	1	9/4/2008
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **sh**
TOC	1.92	0.01		%-dry	1	9/12/2008
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **sh**
1" Gradation	ND	0.05		%	1	9/11/2008
2mm Gradation	ND	0.05		%	1	9/11/2008
Percent Coarse Material	ND	0.05		%	1	9/11/2008
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: **sh**
% Clay	ND	0.1		%	1	9/16/2008
% Sand	64.0	0.1		%	1	9/16/2008
% Silt	36.0	0.1		%	1	9/16/2008
Soil Class	SANDY LOAM			%	1	9/16/2008
ACID VOLATILE SULFIDE		**AVS-SEM**				Analyst: **kgw**
Sulfide	ND	12.0	H	umoles/g	1	8/27/2008
PERCENT MOISTURE		**D2216**				Analyst: **BO**
Percent Moisture	33.2	0.05		wt%	1	9/4/2008

SW Review

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 22-Sep-08
Report Date: 22-Sep-08

QA/QC SUMMARY REPORT

Client: ENSR International **Work Order:** 0808169
Project: COEUR **BatchID:** 2017

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***2017-PB-UNFILTERED***			*Method:* ***SW6010B***		*Batch ID:* ***2017***		*Analysis Date:*	***9/8/2008***		
Aluminum	ND	12.0	mg/Kg							
Chromium	ND	10.0	mg/Kg							
Zinc	ND	10.0	mg/Kg							
Sample ID: ***2017-PB-FILTERED***			*Method:* ***SW6010B***		*Batch ID:* ***2017***		*Analysis Date:*	***9/8/2008***		
Aluminum	ND	12.0	mg/Kg							
Chromium	ND	10.0	mg/Kg							
Zinc	ND	10.0	mg/Kg							
Sample ID: ***2017-LCS***			*Method:* ***SW6010B***		*Batch ID:* ***2017***		*Analysis Date:*	***9/8/2008***		
Aluminum	88.2	12.0	mg/Kg	115.0	76.7	80	120			S+
Chromium	20.8	10.0	mg/Kg	27.10	76.6	80	120			S+
Zinc	43.5	10.0	mg/Kg	47.50	91.5	80	120			
Sample ID: ***0808169-002A MS***			*Method:* ***SW6010B***		*Batch ID:* ***2017***		*Analysis Date:*	***9/8/2008***		
Aluminum	13300	16.1	mg/Kg-dry	154.1	-234	75	125			NA
Chromium	53.0	13.4	mg/Kg-dry	36.30	68.7	75	125			S+
Zinc	149	13.4	mg/Kg-dry	63.63	86.9	75	125			
Sample ID: ***0808169-002A MSD***			*Method:* ***SW6010B***		*Batch ID:* ***2017***		*Analysis Date:*	***9/8/2008***		
Aluminum	13200	16.1	mg/Kg-dry	154.1	-309	75	125	0.874	20	NA
Chromium	53.1	13.4	mg/Kg-dry	36.30	68.9	75	125	0.125	20	S+
Zinc	152	13.4	mg/Kg-dry	63.63	90.9	75	125	1.71	20	
Sample ID: ***0808169-002A MST***			*Method:* ***SW6010B***		*Batch ID:* ***2017***		*Analysis Date:*	***9/8/2008***		
Aluminum	13600	16.1	mg/Kg-dry	154.1	-40.4	75	125	2.21	20	NA
Chromium	54.3	13.4	mg/Kg-dry	36.30	72.3	75	125	2.44	20	S+
Zinc	148	13.4	mg/Kg-dry	63.63	84.5	75	125	1.02	20	

Review

Qualifiers:
S Spike Recovery outside accepted recovery limits
NA Sample conc. is > 4*spike level
S+ Spike within Manufacturer's Limits

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 22-Sep-08
Report Date: 22-Sep-08

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR
Work Order: 0808169
BatchID: 2018

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: 2018-PB-UNFILTERED			*Method: SW6020*		*Batch ID: 2018*		*Analysis Date: 9/8/2008*			
Arsenic	ND	0.150	mg/Kg							
Cadmium	ND	0.010	mg/Kg							
Copper	ND	0.125	mg/Kg							
Lead	ND	0.020	mg/Kg							
Nickel	ND	0.100	mg/Kg							
Selenium	ND	0.200	mg/Kg							
Silver	ND	0.100	mg/Kg							
Sample ID: 2018-PB-FILTERED			*Method: SW6020*		*Batch ID: 2018*		*Analysis Date: 9/8/2008*			
Arsenic	ND	0.150	mg/Kg							
Cadmium	ND	0.010	mg/Kg							
Copper	ND	0.125	mg/Kg							
Lead	ND	0.020	mg/Kg							
Nickel	ND	0.100	mg/Kg							
Selenium	ND	0.200	mg/Kg							
Silver	ND	0.100	mg/Kg							
Sample ID: 2018-LCS			*Method: SW6020*		*Batch ID: 2018*		*Analysis Date: 9/8/2008*			
Arsenic	243	0.298	mg/Kg	250.9	97.0	80	120			
Cadmium	11.3	0.020	mg/Kg	10.81	105	80	120			
Copper	1520	0.248	mg/Kg	1755	86.5	80	120			
Lead	58.4	0.040	mg/Kg	56.43	104	80	120			
Nickel	17.8	0.198	mg/Kg	16.16	110	80	120			
Selenium	10.3	0.397	mg/Kg	9.917	104	80	120			
Silver	6.34	0.198	mg/Kg	5.851	108	80	120			
Sample ID: 0808169-002A MS			*Method: SW6020*		*Batch ID: 2018*		*Analysis Date: 9/8/2008*			
Arsenic	364	0.397	mg/Kg-dry	334.6	102	75	125			
Cadmium	17.0	0.026	mg/Kg-dry	14.41	116	75	125			
Copper	2340	0.331	mg/Kg-dry	2341	95.8	75	125			
Lead	94.3	0.053	mg/Kg-dry	75.24	110	75	125			
Nickel	44.3	0.264	mg/Kg-dry	21.55	97.5	75	125			
Selenium	14.5	0.529	mg/Kg-dry	13.22	106	75	125			
Silver	7.88	0.264	mg/Kg-dry	7.802	85.1	75	125			
Sample ID: 0808169-002A MSD			*Method: SW6020*		*Batch ID: 2018*		*Analysis Date: 9/8/2008*			
Arsenic	298	0.398	mg/Kg-dry	335.4	82.3	75	125	20.1	20	
Cadmium	15.0	0.026	mg/Kg-dry	14.45	102	75	125	12.3	20	
Copper	2090	0.331	mg/Kg-dry	2347	85.0	75	125	11.2	20	
Lead	84.8	0.053	mg/Kg-dry	75.44	97.3	75	125	10.5	20	
Nickel	42.4	0.265	mg/Kg-dry	21.61	88.3	75	125	4.45	20	
Selenium	13.5	0.530	mg/Kg-dry	13.26	98.8	75	125	7.00	20	
Silver	6.54	0.265	mg/Kg-dry	7.822	67.7	75	125	18.6	20	S+

Review

Qualifiers:
S Spike Recovery outside accepted recovery limits
NA Sample conc. is > 4*spike level
S+ Spike within Manufacturer's Limits

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 22-Sep-08
Report Date: 22-Sep-08

QA/QC SUMMARY REPORT

Client: ENSR International
Work Order: 0808169
Project: COEUR
BatchID: 2018

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: 0808169-002A MST			*Method: SW6020*		*Batch ID: 2018*		*Analysis Date:*		*9/8/2008*	
Arsenic	306	0.395	mg/Kg-dry	333.2	85.4	75	125	17.3	20	
Cadmium	15.6	0.026	mg/Kg-dry	14.36	107	75	125	8.47	20	
Copper	2080	0.329	mg/Kg-dry	2331	85.4	75	125	11.3	20	
Lead	86.8	0.053	mg/Kg-dry	74.95	101	75	125	8.18	20	
Nickel	42.4	0.263	mg/Kg-dry	21.47	88.8	75	125	4.45	20	
Selenium	13.3	0.527	mg/Kg-dry	13.17	97.5	75	125	8.87	20	
Silver	7.65	0.263	mg/Kg-dry	7.771	82.5	75	125	2.87	20	

SW Review

Qualifiers:
S Spike Recovery outside accepted recovery limits
NA Sample conc. is > 4*spike level
S+ Spike within Manufacturer's Limits

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labinfo@mse-ta.com

Date: 22-Sep-08
Report Date: 22-Sep-08

QA/QC SUMMARY REPORT

Client: ENSR International
Work Order: 0808169
Project: COEUR
BatchID: 2022

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***2022-PB***			*Method:* ***E245.5***		*Batch ID:* ***2022***		*Analysis Date:*	***9/4/2008***		
Mercury	ND	0.00400	mg/Kg							
Sample ID: ***LCS-2022***			*Method:* ***E245.5***		*Batch ID:* ***2022***		*Analysis Date:*	***9/4/2008***		
Mercury	4.31	0.194	mg/Kg	4.310	100	80	120			
Sample ID: ***0808169-005A-MS***			*Method:* ***E245.5***		*Batch ID:* ***2022***		*Analysis Date:*	***9/4/2008***		
Mercury	7.87	0.538	mg/Kg-dry	6.455	121	75	125			
Sample ID: ***0808169-005A-MSD***			*Method:* ***E245.5***		*Batch ID:* ***2022***		*Analysis Date:*	***9/4/2008***		
Mercury	7.84	0.483	mg/Kg-dry	6.455	121	75	125	0.390	20	

Review

Qualifiers: S Spike Recovery outside accepted recovery limits NA Sample conc. is > 4*spike level

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 22-Sep-08
Report Date: 22-Sep-08

QA/QC SUMMARY REPORT

Client: ENSR International **Work Order:** 0808169
Project: COEUR **BatchID:** R7680

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
*Sample ID: **0808169-002A-D***			*Method: **AVS-SEM***		*Batch ID: **R7680***			*Analysis Date:*	***8/27/2008***	
Sulfide	ND	12.0	umoles/g					0	20	
*Sample ID: **0808169-002A-S***			*Method: **AVS-SEM***		*Batch ID: **R7680***			*Analysis Date:*	***8/27/2008***	
Sulfide	12.0	12.0	umoles/g	8.388	99.1	75	125			
*Sample ID: **LCS R2331***			*Method: **AVS-SEM***		*Batch ID: **R7680***			*Analysis Date:*	***8/27/2008***	
Sulfide	5.0	12.0	umoles/g	4.194	119	80	120			J
*Sample ID: **PB***			*Method: **AVS-SEM***		*Batch ID: **R7680***			*Analysis Date:*	***8/27/2008***	
Sulfide	ND	12.0	umoles/g							

Review

Qualifiers: S Spike Recovery outside accepted recovery limits NA Sample conc. is > 4*spike level

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 22-Sep-08
Report Date: 22-Sep-08

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR
Work Order: 0808169
BatchID: R7694

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: 0808169-002A-D			*Method: D2216*		*Batch ID: R7694*		*Analysis Date:*		*9/4/2008*	
Percent Moisture	25.2	0.05	wt%					0.398	20	

Review

Qualifiers: S Spike Recovery outside accepted recovery limits NA Sample conc. is > 4*spike level

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 22-Sep-08
Report Date: 22-Sep-08

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR
Work Order: 0808169
BatchID: R7730

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***0808169-001A-D*** *Method:* ***OM_WALKLE*** *Batch ID:* ***R7730*** *Analysis Date:* ***9/12/2008***										
TOC	4.65	0.02	%-dry					0.872	20	
Sample ID: ***LCS Q5040*** *Method:* ***OM_WALKLE*** *Batch ID:* ***R7730*** *Analysis Date:* ***9/12/2008***										
TOC	0.36	0.01	%	0.3220	110	80	120			
Sample ID: ***A-Blk*** *Method:* ***OM_WALKLE*** *Batch ID:* ***R7730*** *Analysis Date:* ***9/12/2008***										
TOC	ND	0.01	%							

Review

Qualifiers: S Spike Recovery outside accepted recovery limits NA Sample conc. is > 4*spike level

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 22-Sep-08
Report Date: 22-Sep-08

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR
Work Order: 0808169
BatchID: R7751

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: 0808169-001A-D			*Method: MSA15-5*		*Batch ID: R7751*			*Analysis Date:*	*9/16/2008*	
% Clay	8.0	0.1	%					66.7	20	R
% Sand	60.0	0.1	%					6.45	20	
% Silt	32.0	0.1	%					0	20	
Soil Class	SANDY LOAM		%					0		

Review

Qualifiers: S Spike Recovery outside accepted recovery limits NA Sample conc. is > 4*spike level

APPENDIX 2: BENTHIC INVERTEBRATE DATA

Appendix 2: Benthic invertebrate data 2008 – Number of each genus in each sample.

				Sherman Creek Reach 1					
Class	**Order**	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Insecta	Ephemeroptera	Baetidae	Baetis	15	23	13	17	4	8
			Diphetor						
		Heptageniidae	Epeorus	0	0	0	1	0	0
			Cinygmula	0	1	0	1	0	1
			Rithrogena	3	3	0	2	5	6
		Ephemerellidae	Caudatella	3	3	1	2	0	0
			Drunella	4	4	5	7	2	4
		Leptophlebiidae	Paraleptophlebia						
	Plecoptera	Chloroperlidae	Alaskaperla						
			Haploperla	3	0	0	0	0	0
			Kathroperla						
			Plumiperla	3	1	5	8	3	4
			Neaviperla	0	0	0	1	0	0
		Capniidae	Paracapnia						
		Perlidae	Hesperoperla						
		Leuctricidae	Perlomyia	0	0	0	2	0	0
		Nemouridae	Zapada	4	3	0	3	0	1
			Nemoura						
		Perlodidae	Megarcys						
	Trichoptera	Hydropsychidae	Parapsyche						
			Arctopsyche						
		Glossosomatidae	Glossoma						
			Agapetus						
		Polycentropidae	Neureclipses						
			Paranyctiophylax						
		Rhyacophilidae	Rhyacophila	0	1	2	2	2	2
		Limnephilidae	Apatania	1	1	2	2	1	0
			Grensia	0	0	0	1	0	0
	Diptera								
	Chironomidae	Orthocladiinae	Eukiefferiella	10	26	28	25	17	42
			Tvetania	3	1	1	1	0	0
		Diamesinae	Pagasta						
		Tanytarsini	Tanytarsus						
	Nematocera	Tipulidae	Dicranota	0	0	0	0	0	1
			Tipula						
			Antocha						
		Empididae	Clinocera	0	0	0	0	0	1
	Brachycera	Ceratopogonidae	Probezzia						
	Simuliidae	Simuliidae	Prosimulium						
		Oligochaetae		1	1	1	1	0	2
Collembola			Folsomina	1	0	0	0	0	0
			Total	**51**	**68**	**58**	**76**	**34**	**72**

Appendix 2: cont.

				Sherman Creek Reach 2					
Class	**Order**	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Insecta	Ephemeroptera	Baetidae	Baetis	24	41	9	5	10	6
		Heptageniidae	Epeorus	1	1	3	0	1	1
			Cinygmula	0	0	2	1	0	0
			Rithrogena	6	5	2	0	3	0
		Ephemerellidae	Drunella	7	9	5	5	6	4
			Caudatella	4	2	2	1	0	2
		Leptophlebiidae	Paraleptophlebia	0	0	1	0	0	0
	Plecoptera	Chloroperlidae	Alaskaperla						
			Haploperla						
			Kathroperla						
			Plumiperla	7	10	4	4	5	0
		Capniidae	Paracapnia	0	0	0	1	1	0
		Leuctridae	Perlomyia	0	1	0	0	0	0
			Leuctra						
		Perlidae	Hesperoperla						
		Nemouridae	Zapada	2	6	2	1	2	1
			Nemoura						
		Perlodidae	Megarcys	0	0	1	0	0	0
	Trichoptera	Hydropsychidae	Parapsyche	0	1	1	0	0	0
			Arctopsyche						
		Glossosomatidae	Glossoma						
			Agapetus						
		Polycentropidae	Neureclipses	0	1	0	0	0	0
			Paranyctiophylax						
		Rhyacophilidae	Rhyacophila	2	6	3	0	4	0
		Limnephilidae	Apatania	1	0	0	0	2	0
			Moselyana	0	1				
			Grensia	0	0	2	0	0	0
	Diptera								
	Chironomidae	Orthocladiinae	Eukiefferiella	7	36	60	14	2	63
			Tvetania	2	5	12	1	1	8
		Diamesinae	Pagasta						
		Tanytarsini	Tanytarsus						
	Nematocera	Tipulidae	Polymera	0	0	1	0	0	0
			Tipula						
			Holorusia	0	0	0	0	1	0
		Empididae	Clinocera	0	1	0	0	0	0
			Oreogeton	0	1	0	0	0	0
		Ptychopteridae	Ptychoptera	0	1	0	0	0	0
	Brachycera	Ceratopogoniidae	Leptoconops	0	0	1	0	0	0
		Simuliidae	Prosimulium						
		Oligochaetae		4	19	3	2	0	0
			Total	**67**	**147**	**114**	**35**	**38**	**85**

Appendix 2: cont.

2008 4/20/2008 Sweeny1

				Sweeny Reach 1 Samples					
Class	**Order**	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Insecta	Ephemeroptera	Baetidae	Baetis	15	8	11	5	25	13
		Heptageniidae	Epeorus	1	1	1	1	3	1
			Cinygmula	36	10	9	8	13	15
			Rithrogena	1	1	1	1	2	1
		Ephemerellidae	Drunella	0	0	0	0	1	0
		Leptophlebiidae	Paraleptophlebia						
	Plecoptera	Chloroperlidae	Alaskaperla	0	0	0	1	0	0
			Haploperla						
			Kathroperla	0	1	1	0	1	0
			Plumiperla	5	12	11	15	9	10
			Paraperla						
		Capniidae	Paracapnia	3	2	2	0	2	2
		Leuctridae	Perlomyia	2	2	0	0	0	1
		Perlidae	Hesperoperla						
		Nemouridae	Zapada	0	0	3	1	2	1
			Nemoura						
		Perlodidae	Megarcys						
	Trichoptera	Hydropsychidae	Parapsyche						
			Arctopsyche						
		Glossosomatidae	Glossoma						
			Agapetus						
		Polycentropidae	Neureclipses						
			Paranyctiophylax						
		Rhyacophilidae	Rhyacophila						
	Diptera								
	Chironomidae	Orthocladiinae	Eukiefferiella	42	71	7	38	31	38
			Tvetania	1	0	1	4	2	2
			Corynoneura	0	0	1	1	0	0
		Podominae	Paraboreochlus						
		Tanytarsini	Tanytarsus	0	1	0	0	0	0
		Tipulidae	Dicranota						
			Hesperoconopa						
			Tipula	0	1	2	1	0	1
		Simuliidae	Prosimulium						
		Oligochaetae		0	5	0	0	0	0
			Total	**106**	**115**	**50**	**76**	**91**	**85**

Appendix 2: cont.

				Sweeny Reach 1 Samples					
Class	**Order**	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Insecta	Ephemeroptera	Baetidae	Baetis	8	23	15	24	7	31
		Heptageniidae	Epeorus	2	2	3	1	0	1
			Cinygmula	2	5	2	13	6	21
			Rithrogena	0	0	0	0	3	2
		Ephemerellidae	Attenella						
			Drunella	0	1	2	1	0	3
		Leptophlebiidae	Paraleptophlebia	0	0	0	1		
	Plecoptera	Chloroperlidae	Alaskaperla						
			Haploperla	2	0	0	1	0	1
			Kathroperla	0	0	0	2	0	0
			Plumiperla	6	17	4	28	8	5
		Capniidae	Paracapnia	0	8	0	1	1	4
			Eucanopsis	1	1	0	0	0	0
		Leuctridae	Despaxia						
			Perlomyia	1	4	0	2	1	1
		Perlidae	Hesperoperla						
		Nemouridae	Zapada	0	1	0	4	2	7
			Nemoura	0	0	0	0	0	1
		Perlodidae	Megarcys						
	Trichoptera	Hydropsychidae	Parapsyche	0	1	0	0	1	0
			Arctopsyche						
		Glossosomatidae	Glossoma						
			Agapetus						
		Polycentropidae	Neureclipses						
			Paranyctiophylax						
		Rhyacophilidae	Rhyacophila	0	0	0	0	2	0
	Diptera								
	Chironomidae	Orthocladiinae	Eukiefferiella	18	19	57	34	19	77
			Tvetania	1	0	2	6	2	6
			Corynoneura	0	0	0	1	0	0
		Podominae	Paraboreochlus	0	1	0	0	0	0
		Tanytarsini	Tanytarsus	0	0	0	2	0	1
		Tipulidae	Dicranota						
			Hesperoconopa						
			Tipula	3	4	1	2	1	0
			Antocha						
			Prionocera						
		Empididae	Chelifera	0	0	0	1	0	0
		Simuliidae	Prosimulium						
		Oligochaetae		0	1	3	3	0	1
			Total	**44**	**88**	**89**	**127**	**53**	**162**

Appendix 2: cont.

				Johnson Creek Samples					
Class	**Order**	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Insecta	Ephemeroptera	Baetidae	Baetis	55	50	134	68	90	131
			Acentrella	0	0	1	0	0	0
			Diphetor	0	0	0	1	0	0
		Heptageniidae	Epeorus	3	1	2	6	3	7
			Cinygmula	19	18	20	22	17	7
			Rithrogena	1	0	0	5	0	1
		Ephemerellidae	Attenella						
			Drunella	5	27	7	18	7	19
			Caudatella	9	0	6	8	5	28
		Leptophlebiidae	Paraleptophlebia	0	1	0	0	2	3
	Plecoptera	Chloroperlidae	Alaskaperla	2	5	0	0	0	0
			Haploperla						
			Kathroperla						
			Plumiperla	2	1	0	1	0	1
			Neaviperla						
			Paraperla	0	1	0	1	0	0
		Leuctridae	Despaxia	1	2	0	1	0	0
			Paraleuctra	0	8	0	0	0	0
		Perlidae	Hesperoperla						
		Nemouridae	Zapada	4	5	21	9	2	13
			Nemoura	0	0	1	1	0	1
			Podmosta	0	1	0	0	0	0
		Capniidae	Paracapnia	1	0	0	0	0	0
			Allocapnia	0	1	0	1	0	0
			Eucanopsis	0	0	0	1	0	0
		Perlodidae	Megarcys	1	0	0	1	0	1
	Trichoptera	Brachycentridae	Micrasema						
		Hydropsychidae	Parapsyche	0	2	3	7	3	1
			Arctopsyche	0	1	0	0	0	2
		Glossosomatidae	Glossoma	0	2	1	7	2	5
			Agapetus						
			Anangapetus						
		Polycentropidae	Neureclipses	3	0	0	0	0	1
			Paranyctiophylax	1	0	0	0	0	4
			Cyrnellus	0	1	0	0	0	0
			Polyplectropus	0	0	0	1	0	0
		Rhyacophilidae	Rhyacophila	2	6	22	11	13	69
			Himalopsyche						
		Psychomiidae	Lype						
		Phryganeidae	Yphria	0	0	0	1	0	0
	Diptera	Chironomidae							
	sub-family	Orthocladiinae	Eukiefferiella	5	20	3	14	14	24
			Tvetenia	4	2	0	5	6	17
		Diamesinae	Pagasta	2	1	0	0	0	4
		Tanytarsini	Tanytarsus	4	21	0	7	0	10
	Nematocera	Tipulidae	Dicranota						
			Tipula	0	0	0	0	1	0
			Antocha						
		Empididae	Clinocera	0	1	1	0	0	1
	Brachycera	Ceratopogonidae	Probezzia						
		Simuliidae	Prosimulium	2	1	5	4	1	11
	Collembola		Folsomina	0	1	0	0	0	0
			Total	**126**	**180**	**227**	**201**	**166**	**361**

Appendix 2: cont.

				Slate Creek Samples					
Class	**Order**	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	3	1	3
		Heptageniidae	Epeorus						
			Cinygmula	9	0	6	6	7	21
			Rithrogena						
		Ephemerellidae	Drunella	1	0	5	7	0	1
			Caudatella						
		Leptophlebiidae	Paraleptophlebia	2	1	0	2	0	3
	Plecoptera	Chloroperlidae	Alaskaperla						
			Haploperla						
			Suwallia	11	0	3	7	7	7
			Kathroperla						
			Plumiperla	0	0	1	1	0	6
			Neaviperla						
		Capniidae	Allocapnia	0	0	0	0	1	0
		Nemouridae	Nemoura	2	2	0	3	2	8
			Zapada	0	3	0	0	0	10
		Perlidae	Hesperoperla	0	0	1	0	0	0
			Hansonoperla						
			Agnetina	0	1	0	0	0	0
			Claassenia	1	1	2	2	1	3
	Trichoptera	Hydropsychidae	Parapsyche						
			Arctopsyche						
		Polycentropidae	Neureclipses	0	1	0	1	0	0
			Paranyctiophylax	0	0	0	1	0	0
		Rhyacophilidae	Rhyacophila	0	0	1	0	0	0
	Diptera								
	Chironomidae	Orthocladiinae	Eukiefferiella	0	0	0	0	1	0
			Tvetenia						
		Diamesinae	Pagastia	1	0	1	1	0	1
		Tanytarsini	Tanytarsus	4	0	1	24	5	3
			Stempellinella						
			Corynoneura						
	Nematocera	Tipulidae	Dicranota	2	0	0	0	0	0
			Tipula	1	0	0	0	1	0
	Brachycera	Ceratopogonidae	Probezzia	5	0	2	13	7	0
		Empididae	Clinocera	0	0	0	0	0	6
	Collembola		Folsomina						
Annelida	Oligochaetae			8	0	2	0	3	1
	Simuliidae	Simuliidae	Prosimulium	8	7	15	56	24	26
Bivalva	Sphaeriidae	Psidiinae	Psidium (pea clam)	32	3	1	471	1	1
			Total	**87**	**19**	**41**	**598**	**61**	**100**

APPENDIX 3A: ADFG FISH RESOURCE PERMIT
(SF2008-176d, Resident Fish Survey)

STATE OF ALASKA
DEPARTMENT OF FISH AND GAME
P.O. BOX 115525
JUNEAU, ALASKA 99811-5525

Permit #: SF2008-176

Expires: 9/30/2008

Collections Report Due: 10/30/2008

FISH RESOURCE PERMIT
(For Scientific/Educational Purposes)

This permit authorizes Liz Flory *(whose signature is required on page 2 for permit validation)*
person

of Aquatic Sciences, Inc. **at** 3031 Clinton Drive, Suite 202, Juneau, Alaska 99801
agency or organization — address

to conduct the following activities **from** July 1, 2008 **to** September 30, 2008 in accordance with AS 16.05.930:

Purpose: To estimate fish populations by species, habitat type and strata as well as measure fish condition factor as required by the Environmental Protection Agency's NPDES permit.

Location: Sherman/Sweeney/Slate/Johnson Creeks in the Berner's Bay area

Species Collected: Dolly Varden, cutthroat trout

Method of Capture: Minnow trap, backpack electrofisher

Final Disposition: ≤240 Dolly Varden and ≤60 cutthroat trout may be captured, measured and released alive at the capture site.
All mortalities must be recorded/reported with carcasses returned to the capture site

-Continued on Back-

REPORT DUE October 30, 2008. The report shall include species, numbers, dates, and locations of collection (datum/GPS coordinates in the decimal degrees format (dd.ddddd)) and disposition, and if applicable, sex, age, and breeding condition, and lengths and weights of fish. *It must also include the date/time the local biologist was contacted for final authorization to carry out collecting activities.* A completion report (abstract, background, methods, data, analysis), if not submitted with the collection report described above, must be submitted to the department by: March/2009. Data from such reports are considered public information. The report shall also include other information as may be required under the permit stipulations section.

GENERAL CONDITIONS, EXCEPTIONS AND RESTRICTIONS

1. This permit must be carried by person(s) specified during approved activities who shall show it on request to persons authorized to enforce Alaska's fish and game laws. This permit is nontransferable and will be revoked or renewal denied by the Commissioner of Fish and Game if the permittee violates any of its conditions, exceptions or restrictions. No redelegation of authority may be allowed under this permit unless specifically noted.
2. No specimens taken under authority hereof may be sold or bartered. All specimens must be deposited in a public museum or a public scientific or educational institution unless otherwise stated herein. Subpermittees shall not retain possession of live animals or other specimens.
3. The permittee shall keep records of all activities conducted under authority of this permit, available for inspection at all reasonable hours upon request of any authorized state enforcement officer.
4. Permits will not be renewed until the department has received detailed reports, as specified above.
5. UNLESS SPECIFICALLY STATED HEREIN, THIS PERMIT DOES NOT AUTHORIZE the exportation of specimens or the taking of specimens in areas otherwise closed to hunting and fishing; without appropriate licenses required by state regulations; during closed seasons; or in any manner, by any means, at any time not permitted by those regulations.

Fish Resource Permit Coordinator Division of Sport Fish	Director Division of Sport Fish	6/17/08 Date

Authorized Personnel: The following persons may perform collecting activities under terms of this permit:

Elizabeth Flory, Charmagne Gutierrez, Brian Maupin, Kate Savage

Employees and volunteers under the direct supervision of, and in the presence of, one of the authorized personnel listed above may participate in collecting activities under terms of this permit.

Permit Stipulations:

1) The local Area Management Biologist, **Brian Glynn** (465-4318; brian.glynn@alaska.gov) Juneau, must be notified **prior** to you engaging in any collecting activities. This biologist has the right to specify methods for collecting, as well as limiting the collections of any species by number, time and location.

2) All unattended sampling gear must be; 1) labeled with the permittee's name, telephone number, and permit number, 2) securely tied to substrate, 3) allowed to soak no more than twenty-four hours at a time, 4) located with GPS coordinates, and 5) accounted for/ removed at the conclusion of sampling.

3) Salmon eggs used as bait in traps must either be; sterilized commercial eggs or, if raw, be disinfected prior to use. A 10-minute soak in 1/100 Betadyne solution or some other iodophor disinfectant is adequate.

4) Gloves (cotton, etc.), boots, and collecting gear should be disinfected between streams to reduce the potential of pathogen transmission. A wash/rinse in 1/100 Betadyne solution is adequate.

5) If anadromous fish are found in permitted streams and rivers, the permit holder will work closely with ADF&G to see that information is included in the database for the *Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes*. Anadromous fish include *Oncorhynchus spp.*, Arctic char, Dolly Varden, sheefish, smelts, lamprey, whitefish, and sturgeon**.** Please direct questions to J. Johnson, 267-2337 or j.johnson@alaska.gov

6) Electroshocking is currently discouraged, but not prohibited by the department. Electroshockers **may not** be used in anadromous waters in the presence of adult salmonids, adult trout or adult char. In areas where other means of capture are not feasible, only one pass is allowed. Operators of electroshockers must have formal training.

7) **Atlantic salmon** and other **non-native invasive aquatic species** encountered should be killed. The nearest ADF&G office (**see Stipulation # 1**) must be contacted immediately with species identification or description, capture or sighting location, number captured, size, and sex. Preserve/turn in the whole specimen to the nearest ADF&G office.

8) *A copy of this permit, including any amendments, must be made available at all field collection sites and project sites for inspection upon request by a representative of the department or a law enforcement officer.*

9) Issuance of this permit does not absolve the permittee from compliance in full with any and all other applicable federal, state, or local laws, regulations, or ordinances.

10) A **report of collecting activities**, referenced to this fish resource permit number, must be submitted to the Alaska Department of Fish and Game, Division of Sport Fish HQ, P.O. Box 115525, Juneau, AK 99811-5525, Attention: Bob Piorkowski (465-6109; Robert.Piorkowski@alaska.gov), within 30 days after the expiration of this permit. This report must summarize the number of fish captured by date, by location (provide GPS coordinates and datum), and by species, and the fate of those fish. Fish length, weight, sex, and age data should be included if collected. A completion report (abstract/background/methods /data/analysis), if not submitted with the collection report described above, must be submitted to the department within six months of the expiration of the permit. Data from such reports are considered public information. A report is required whether or not collecting activities were undertaken. A report should also be sent to the Biologist(s) listed under **Stipulation #1**.

PERMIT VALIDATION requires permittee's signature agreeing to abide by permit conditions before beginning collecting activities:

____

Signature of Permittee

cc: Brian Glynn, Division of Sport Fish, Juneau
Kevin Monagle, Division of Commercial Fisheries, Juneau
Jackie Timothy, ADNR, Office of Habitat Management and Permitting, Juneau
Fish and Wildlife Protection, Juneau

APPENDIX 3B: FISH HABITAT DIMENSIONS

Appendix 3b: Dimensions of each habitat unit.

Stream Reach	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Lower Sherman	Number of Units	12	35	0	3	50
	Total Length (m)	272.0	98.9	0.0	12.5	
	Mean Length (m)	22.7	2.8	0.0	4.2	
	Mean Width (m)	4.7	2.2	0.0	4.0	
	Mean Area (m^2)	114.2	11.1	0.0	17.5	
	Total Area (m^2)	**1370.7**	**387.1**	**0.0**	**52.4**	**1810.2**
	% of Total Area	75.7	21.4	0.0	2.9	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Middle Sherman	Number of Units	13	70	0	3	86
	Total Length (m)	319.1	143.6	0.0	5.3	
	Mean Length (m)	24.5	2.1	0.0	1.8	
	Mean Width (m)	4.3	1.8	0.0	3.2	
	Mean Area (m^2)	126.0	4.8	0.0	5.3	
	Total Area (m^2)	**1637.4**	**339.2**	**0.0**	**15.9**	**1992.5**
	% of Total Area	82.2	17.0	0.0	0.8	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Upper Sherman	Number of Units	21	69	2	20	112
	Total Length (m)	178.5	144.4	16.5	92.2	431.6
	Mean Length (m)	8.5	2.1	8.3	4.6	
	Mean Width (m)	3.5	1.6	3.0	2.8	
	Mean Area (m^2)	30.5	4.2	26.5	13.1	
	Total Area (m^2)	**640.6**	**292**	**53.0**	**261.1**	**1246.3**
	% of Total Area	51.4	23.4	4.3	21.0	100.0
Stream Reach	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Lower Sweeny	Number of Units	26	48	0	7	81
	Total Length (m)	171.4	160.2	0.0	79.2	
	Mean Length (m)	6.6	3.3	0.0	11.3	
	Mean Width (m)	4.8	3.2	0.0	3.9	
	Mean Area (m^2)	35.5	13.0	0.0	0.0	
	Total Area (m^2)	**922.95**	**623.6**	**0.0**	**339.6**	**1886.1**
	% of Total Area	48.9	33.1	0.0	18.0	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Middle Sweeny	Number of Units	22	52	2	11	87
	Total Length (m)	193.2	166.1	23.1	28.9	
	Mean Length (m)	8.8	3.2	11.6	2.6	
	Mean Width (m)	3.9	2.3	3.5	2.8	
	Mean Area (m^2)	40.0	9.7	40.2	7.9	
	Total Area (m^2)	**880.2**	**506.1**	**80.3**	**87.3**	**1553.8**
	% of Total Area	56.6	32.6	5.2	5.6	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Upper Sweeny	Number of Units	16	57	4	12	89
	Total Length (m)	186.7	174.1	28.4	67.9	
	Mean Length (m)	11.7	3.1	7.1	5.7	
	Mean Width (m)	3.3	1.9	3.4	2.2	
	Mean Area (m^2)	36.9	7.2	26.0	15.2	
	Total Area (m^2)	**590.5**	**410.5**	**104.2**	**182.9**	**1288.0**
	% of Total Area	45.8	31.9	8.1	14.2	100.0

Appendix 3b cont.

Stream Reach	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Lower Johnson	Number of Units	19	33	8	4	64
	Total Length (m)	251.1	132.4	64.1	3.5	
	Mean Length (m)	13.2	4.0	8.0	0.9	
	Mean Width (m)	4.6	3.0	4.3	3.5	
	Mean Area (m^2)	69.2	14.1	31.1	3.2	
	Total Area (m^2)	**1315.4**	**464.5**	**249.1**	**13.0**	**2041.9**
	% of Total Area	64.4	22.7	12.2	0.6	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Middle Johnson	Number of Units	17	57	0	3	77
	Total Length (m)	292.0	169.6	0.0	20.7	
	Mean Length (m)	17.2	3.0	0.0	16.0	
	Mean Width (m)	4.6	2.3	0.0	17.5	
	Mean Area (m^2)	90.0	10.6	0.0	9.2	
	Total Area (m^2)	**1529.5**	**601.6**	**0.0**	**82.9**	**2213.9**
	% of Total Area	69.1	27.2	0.0	3.7	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
UpperJohnson	Number of Units	13	40	2	4	59
	Total Length (m)	220.4	157.4	17.5	6.5	
	Mean Length (m)	17.0	3.9	8.7	1.6	
	Mean Width (m)	37.5	79.0	7.0	11.0	
	Mean Area (m^2)	50.3	11.0	30.0	4.5	
	Total Area (m^2)	**653.8**	**441.6**	**60.1**	**17.9**	**1173.3**
	% of Total Area	55.7	37.6	5.1	1.5	100.0

Stream Reach	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Lower Slate	Number of Units	21	24	5	4	54
	Total Length (m)	315.4	86.2	45.6	2.4	
	Mean Length (m)	15.0	3.6	9.1	0.6	
	Mean Width (m)	3.7	2.9	4.4	3.9	
	Mean Area (m^2)	62.8	12.7	43.0	2.4	
	Total Area (m^2)	**1318.7**	**304.9**	**215.2**	**9.4**	**1848.2**
	% of Total Area	71.4	16.5	11.6	0.5	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Middle Slate	Number of Units	12	38	2	7	59
	Total Length (m)	210.1	108.5	45.7	28.3	
	Mean Length (m)	17.5	2.9	22.9	4.0	
	Mean Width (m)	39.0	66.0	5.5	17.5	
	Mean Area (m^2)	57.8	7.0	64.3	10.0	
	Total Area (m^2)	**694.2**	**267.8**	**128.5**	**70.3**	**1160.7**
	% of Total Area	59.8	23.1	11.1	6.1	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Upper Slate	Number of Units	31	57	2	1	91
	Total Length (m)	287.4	110.7	14.0	0.4	
	Mean Length (m)	9.3	1.9	7.0	0.4	
	Mean Width (m)	52.5	61.1	3.5	1.0	
	Mean Area (m^2)	15.5	2.6	12.0	0.4	
	Total Area (m^2)	**480.3**	**147.8**	**24.0**	**0.4**	**652.5**
	% of Total Area	73.6	22.7	3.7	0.1	100.0

APPENDIX 3C: RESIDENT FISH SURVEY DATA

Appendix 3c: Resident fish survey data – fish counts per habitat unit.

Lower Sherman

	Hip chain	Corrected				Snorkel		E-fisher	
Habitat Type	Distance (m)	Distance (m)	Length (m)	Width (m)	Area (m²)	Dv	Ct	Dv	Ct
Riffle	0.0	0.0	41.4	7.5	310.59		2		
SDP	1.0	1.2	1.0	1.0	1.00		0		
SDP	3.4	4.0	1.0	2.0	2.00		NS		
SDP	3.4	4.0	1.0	1.0	1.00		NS		
SDP	25.0	29.8	1.0	1.0	1.00		NS		
SDP	31.3	37.2	1.5	2.0	3.00		1		
Pool	34.8	41.4	16.8	6.5	109.06		1	1	1
Pool	48.9	58.2	5.2	4.5	23.56		NS		
Riffle	53.3	63.4	5.1	4.0	20.47		0		
Cascade	57.6	68.5	2.7	3.5	9.58		NS		
Riffle	59.9	71.3	13.4	5.6	75.30		0		
SDP	67.0	79.7	1.0	2.0	2.00		0		
Riffle	71.2	84.7	44.5	7.0	311.54	0	2	1	2
SDP	79.8	95.0	1.0	1.0	1.00		NS		
SDP	87.0	103.5	2.0	3.0	6.00		1		
SDP	95.4	113.5	1.0	1.0	1.00		0		
SDP	101.6	120.9	1.0	0.5	0.50		NS		
Riffle	108.6	129.2	4.6	5.5	25.30		0		
Pool	113.2	134.7	0.5	4.0	2.00		1		
Riffle	113.2	134.7	18.8	0.5	9.40		NS		
SDP	119.9	142.7	5.0	1.0	5.00		0		
Riffle	127.6	151.8	38.6	4.5	173.50		1		
SDP	132.0	157.1	2.0	2.0	4.00		1		
SDP	142.9	170.1	1.0	1.0	1.00		NS		
SDP	152.7	181.7	2.0	1.0	2.00	0	2	1	2
SDP	156.0	185.6	3.0	2.0	6.00	1		1	
Pool	160.0	190.4	1.0	4.0	4.00		1		1
Cascade	164.7	196.0	2.0	4.0	8.00		NS		
Riffle	166.7	198.4	18.7	4.5	84.07		NS		
SDP	169.0	201.1	3.0	3.0	9.00		1		1
SDP	177.1	210.7	2.0	2.0	4.00		0		
SDP	182.0	216.6	2.0	2.0	4.00	1	0	1	
Riffle	182.4	217.1	22.8	4.5	102.82		NS		
SDP	192.8	229.4	1.0	1.0	1.00		NS		
Pool	201.6	239.9	5.2	4.0	20.94		1		1
Riffle	206.0	245.1	32.5	4.5	146.19		0		
SDP	210.9	251.0	1.0	1.0	1.00		0		
SDP	213.7	254.3	2.0	1.0	2.00		0		
SDP	224.6	267.3	2.0	1.0	2.00		0		1
SDP	227.2	270.4	3.0	2.0	6.00		NS		
SDP	231.7	275.7	1.0	1.0	1.00		0		
Riffle	233.3	277.6	30.6	3.5	107.04		NS		
SDP	241.0	286.8	2.0	1.0	2.00		0		
SDP	252.1	300.0	2.0	2.0	4.00		0		
SDP	258.8	308.0	1.0	2.0	2.00		0		
Cascade	259.0	308.2	7.7	4.5	34.81		NS		
Pool	265.5	315.9	7.3	5.0	36.30		2		
Riffle	271.6	323.2	1.0	4.5	4.50		NS		
SDP	284.5	338.6	1.0	1.0	1.00	1			
Pool	294.6	350.6	15.4	7.5	115.70	7	1		

Appendix 3c cont.
Middle Sherman

Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel		E-fisher	
					Dv	Ct	Dv	Ct
Riffle	0.0	8.5	7.0	59.50	NS			
SDPool	2.9	2.0	3.0	6.00	1		1	
SDPool	5.1	1.0	1.0	1.00	1		1	
Pool	8.5	3.5	2.5	8.75	NS			
Sriff	8.5	3.5	1.0	3.50	NS			
Riffle	12.0	10.4	6.0	62.40	NS			
SDPool	12.0	2.0	3.0	6.00	3		2	
SDPool	12.0	1.5	1.5	2.25	NS			
SDPool	16.3	2.0	2.0	4.00	1		1	
SDPool	19.3	2.0	3.0	6.00	2			
Riffle	22.4	76.6	7.0	536.20	5		5	
SDPool	28.0	1.5	2.0	3.00	2			
SDPool	39.0	1.0	1.0	1.00	0			
SDPool	42.9	2.0	1.0	2.00	1		1	
SDPool	46.6	2.0	3.0	6.00	2			
SDPool	48.5	1.0	1.0	1.00	0			
SDPool	51.0	2.0	2.0	4.00	3		3	
SDPool	54.8	0.5	0.5	0.25	0			
SDPool	57.2	3.0	3.0	9.00	NS			
SDPool	63.2	3.0	2.0	6.00	NS			
SDPool	65.3	1.5	1.0	1.50	0			
SDPool	69.5	1.0	1.0	1.00	0			
SDPool	73.1	1.5	1.0	1.50	0			
SDPool	75.0	1.0	2.0	2.00	1		1	
SDPool	79.0	1.0	1.0	1.00	0			
SDPool	81.5	1.0	1.0	1.00	0			
SDPool	83.1	1.0	1.0	1.00	0			
SDPool	86.3	1.5	1.5	2.25	1			
SDPool	93.1	1.5	1.0	1.50	1			
SDPool	97.5	2.0	1.5	3.00	0			
SDPool	99.0	1.0	1.5	1.50	1			
Riffle	99.0	53.0	6.5	344.50	0			
SDPool	113.0	4.0	2.5	10.00	4		5	
SDPool	117.4	2.0	1.0	2.00	1		1	
SDPool	121.2	2.0	2.0	4.00	2		2	
SDPool	126.1	1.5	2.0	3.00	0			
SDPool	127.7	2.5	3.0	7.50	3			
SDPool	130.0	2.0	2.0	4.00	3			
SDPool	142.4	2.0	2.0	4.00	2			
SDPool	148.0	1.0	1.5	1.50	1			
Pool	152.0	7.9	4.0	31.60	8			
Cascade	159.9	0.5	3.0	1.50	NS			
Riffle	160.4	6.9	4.0	27.60	1		1	

Appendix 3c cont.

Middle Sherman cont.

					Snorkel		E-fisher	
Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Dv	Ct	Dv	Ct
SDPool	165.3	1.0	1.0	1.00	0			
Pool	167.3	6.5	3.5	22.75	3			
Cascade	173.8	3.2	2.5	8.00	NS			
Riffle	177.0	39.5	3.0	118.50	4			
SDPool	182.6	2.0	1.5	3.00	1			
SDPool	191.1	2.0	1.0	2.00	1			
SDPool	195.7	1.0	0.5	0.50	1			
SDPool	205.1	1.0	1.0	1.00	1			
SDPool	206.1	1.0	1.0	1.00	0			
SDPool	212.0	1.5	1.0	1.50	0			
SDPool	212.3	1.0	1.0	1.00	1			
Pool	216.5	5.4	5.0	27.00	3			
Riffle	221.9	8.7	4.5	39.15	0			
SDPool	225.1	2.0	2.0	4.00	1			
SDPool	225.3	2.0	2.0	4.00	0			
Pool	230.6	3.0	4.0	12.00	0			
Sriff	230.6	3.0	0.5	1.50	NS			
Riffle	233.6	15.0	5.0	75.00	0			
SDPool	234.0	1.5	1.0	1.50	1			
SDPool	236.4	1.0	1.0	1.00	0			
SDPool	238.4	2.0	1.5	3.00	0			
SDPool	246.5	1.0	1.0	1.00	NS			
Pool	248.6	5.1	4.0	20.40	3			
Riffle	253.7	7.5	4.5	33.75	NS			
SDPool	254.7	3.5	2.0	7.00	2			
Riffle	261.2	66.0	4.0	264.00	1			
SDPool	264.2	3.0	1.5	4.50	0			
SDPool	266.6	1.0	1.5	1.50	0			
SDPool	272.4	1.0	1.0	1.00	1			
SDPool	282.5	2.0	1.0	2.00	0			
SDPool	287.8	2.0	2.0	4.00	1			
SDPool	293.2	1.5	2.0	3.00	0			
SDPool	300.2	1.5	0.5	0.75	NS			
SDPool	303.1	3.0	2.0	6.00	1			
SDPool	316.0	1.0	1.0	1.00	0			
SDPool	318.7	1.0	1.0	1.00	0			
SDPool	322.0	2.0	2.0	4.00	1			
Cascade	327.2	1.6	4.0	6.40	NS			
Pool	328.8	1.2	3.5	4.20	0			
Riffle	330.0	20.5	3.5	71.75	0			
SDPool	335.1	0.5	1.0	0.50	1			
SDPool	338.7	1.0	2.0	2.00	0			
Pool	350.5	9.5	4.0	38.00	6			
	360.0							

Appendix 3c cont.

Upper Sherman

Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel		E-fisher	
					Dv	Ct	Dv	Ct
Riffle	0.0	7.5	5.0	37.50	0			
SDPool	0.0	3.0	3.0	9.00	2			
SDPool	4.1	0.5	0.5	0.25	1			
SDPool	4.6	1.0	1.0	1.00	0			
Cascade	7.5	0.4	3.5	1.40	NS			
Riffle	7.9	2.8	3.0	8.40	NS			
Pool	10.7	2.3	2.0	4.60	0			
Riffle	13.0	2.5	3.0	7.50	NS			
Pool	15.5	3.5	2.0	7.00	3			
Cascade	19.0	0.5	2.0	1.00	NS			
Riffle	19.5	11.6	3.0	34.80	1			
Pool	31.1	2.0	1.5	3.00	0			
Riffle	33.1	1.6	1.5	2.40	NS			
Pool	34.7	2.4	2.0	4.80	NS			
Cascade	37.1	2.0	3.0	6.00	NS			
Riffle	39.1	2.0	3.0	6.00	NS			
SDPool	40.1	0.5	0.5	0.25	1			
Riffle	41.1	14.8	4.0	59.20	0			
SDPool	45.2	1.0	0.5	0.50	0			
SDPool	51.6	1.0	0.5	0.50	0			
Pool	55.9	2.4	4.0	9.60	2			
Cascade	58.3	4.9	1.5	7.35	NS			
Pool	63.2	7.3	3.0	21.90	0			
Riffle	70.5	2.3	3.0	6.90	NS			
SDPool	70.5	1.0	1.0	1.00	1			
Pool	72.8	3.2	2.5	8.00	1			
Cascade	76.0	0.7	2.0	1.40	NS			
Riffle	76.7	11.0	3.5	38.50	0			
SDPool	76.7	1.0	1.0	1.00	1			
Pool	87.7	3.3	3.0	9.90	3			
Pool	87.7	3.3	2.5	8.25	1			
Cascade	91.0	0.4	5.0	2.00	NS			
Riffle	91.4	9.6	5.0	48.00	NS			
SDPool	92.7	2.0	1.0	2.00	0			
Cascade	101.0	4.1	3.0	12.30	NS			
SDPool	103.0	2.0	1.0	2.00	1			
Riffle	105.1	14.0	4.0	56.00	NS			
SDPool	110.7	1.0	1.0	1.00	0			
SDPool	116.7	1.0	1.0	1.00	2			
Cascade	119.1	2.5	3.0	7.50	NS			
Riffle	121.6	6.4	4.0	25.60	NS			
SDPool	121.6	1.5	1.0	1.50	1			
SDPool	124.7	1.0	1.0	1.00	1			
Pool	128.0	2.7	2.5	6.75	0			
Riffle	130.7	11.5	2.5	28.75	NS			
SDPool	135.7	2.0	2.0	4.00	1			
SDPool	139.2	2.0	1.0	2.00	0			
Pool	142.2	7.0	1.0	7.00	0			
Cascade	144.8	6.1	2.0	12.20	NS			
SDPool	149.2	1.0	1.0	1.00	0			
Glide	150.9	11.8	3.5	41.30	3		3	
Cascade	159.6	4.4	3.5	15.40	NS			
Riffle	162.7	6.3	3.0	18.90	NS			
SDPool	164.0	1.5	1.0	1.50	NS			
SDPool	166.7	1.5	1.5	2.25	1			
Cascade	169.0	12.2	4.0	48.80	NS			
SDPool	169.8	2.0	1.0	2.00	0		0	
SDPool	172.2	2.5	1.5	3.75	1			
SDPool	178.1	1.0	1.0	1.00	1		0	
Pool	181.2	3.8	2.0	7.60	2		3	
Riffle	185.0	9.9	2.5	24.75	NS			

Appendix 3c cont.

Upper Sherman cont.

					Snorkel		E-fisher	
Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Dv	Ct	Dv	Ct
SDPool	185.4	1.5	1.0	1.50	1			
SDPool	192.0	1.0	1.5	1.50	0			
SDPool	193.0	0.5	1.0	0.50	1		2	
Pool	194.9	2.8	2.0	5.60	2		3	
Riffle	197.7	16.8	3.0	50.40	0			
SDPool	197.9	1.5	1.0	1.50	0			
SDPool	201.7	1.5	1.5	2.25	0		0	
SDPool	203.4	1.0	1.0	1.00	1		1	
SDPool	208.7	2.5	2.0	5.00	2		2	
Pool	214.5	3.9	3.0	11.70	1		1	
Pool	218.4	2.6	2.5	6.50	1		1	
Cascade	221.0	7.1	3.0	21.30	NS			
SDPool	222.0	2.0	1.0	2.00	0		1	
Pool	228.1	4.9	5.5	26.95	17			
Cascade	233.0	0.7	3.5	2.45	NS			
Riffle	233.7	19.6	4.0	78.40	NS			
SDPool	235.9	1.5	1.0	1.50	0			
SDPool	240.5	0.5	0.5	0.25	0			
SDPool	242.5	1.0	1.0	1.00	0			
SDPool	244.9	0.5	1.0	0.50	1			
SDPool	250.0	1.0	0.5	0.50	0		0	
SDPool	250.4	1.0	0.5	0.50	NS			
Riffle	253.3	11.3	3.5	39.55	2		2	
SDPool	257.2	1.0	0.5	0.50	1			
SDPool	261.5	1.0	1.0	1.00	2			
Cascade	264.6	7.0	3.5	24.50	NS			
SDPool	267.4	2.0	1.0	2.00	1		2	
Riffle	271.6	6.9	5.0	34.50	1		1	
SDPool	275.4	0.5	1.0	0.50	0		1	
Glide	278.5	4.7	2.5	11.75	4		4	
Cascade	283.2	15.0	3.0	45.00	NS			
SDPool	290.0	1.0	1.0	1.00	1			
SDPool	290.1	2.0	2.0	4.00	1			
Pool	298.2	4.9	2.5	12.25	2			
Cascade	303.1	1.8	1.5	2.70	NS			
Pool	304.9	4.4	2.0	8.80	0			
Cascade	309.3	1.7	1.5	2.55	NS			
Pool	311.0	2.8	2.0	5.60	1			
Pool	313.8	4.4	2.5	11.00	2			
Cascade	318.2	4.0	2.5	10.00	NS			
Riffle	322.2	4.2	4.0	16.80	1			
SDPool	322.2	1.0	2.0	2.00	0			
Pool	326.4	3.0	4.0	12.00	4			
Cascade	329.4	7.7	2.5	19.25	NS			
SDPool	330.1	1.0	1.0	1.00	0			
SDPool	332.4	0.5	0.5	0.25	1			
Riffle	337.1	5.9	3.0	17.70	1			
Pool	343.0	5.2	2.5	13.00	2			
Pool	348.2	2.8	2.5	7.00	NS			
Cascade	351.0	9.0	2.0	18.00	NS			
SDPool	257.1	1.5	1.0	1.50	1			
	360.0							

Appendix 3c cont

Lower Sweeny

Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel		E-fisher	
					Dv	Ct	Dv	Ct
Pool	0.0	6.0	5.5	33.00		2		5
Sriff	0.0	6.0	1.5	9.00		NS		
SDPool	6.0	0.0	3.5	0.00		1		
Riffle	6.0	3.0	4.5	13.50		NS		
SDPool	9.0	3.5	3.0	10.50		1		
Riffle	9.0	3.1	4.5	13.95		NS		
Pool	12.1	8.8	6.5	57.20		3		
Riffle	20.9	6.5	5.5	35.75		0		3
SDPool	24.7	1.0	1.0	1.00		0		
SDPool	26.1	1.3	1.0	1.50		0		1
Pool	27.4	3.7	5.0	18.50		1		
Riffle	31.1	16.9	7.5	126.75		NS		
Riffle	48.0	24.7	6.0	148.20		2		
SDPool	47.8	3.0	2.0	6.00		NS		
SDPool	56.5	3.0	2.0	6.00		2		2
SDPool	62.7	3.0	2.0	6.00		2		2
SDPool	66.2	2.0	2.0	4.00		1		
Pool	72.7	5.8	4.0	23.20		4		4
Sriff	72.7	2.0	4.0	8.00		NS		
Riffle	78.5	7.4	4.0	29.60		NS		
Riffle	85.9	8.2	5.0	41.00		0		
SDPool	87.5	1.0	1.0	1.00		1		
SDPool	92.1	1.0	1.0	1.00		1		
Pool	94.1	3.4	4.0	13.60		4		
Riffle	97.5	3.9	3.0	11.70		NS		
Pool	101.4	3.7	3.5	12.95		0		
Cascade	105.1	3.7	3.0	11.10		0		
Riffle	108.8	9.2	6.0	55.20		0		
SDPool	109.6	1.0	1.0	1.00		NS		
SDPool	114.0	2.0	3.0	6.00		3		3
Riffle	118.0	4.4	4.5	19.80		1		1
Riffle	122.4	5.6	5.5	30.80		NS		
Pool	128.0	9.0	3.5	31.50		2		2
SDPool	128.0	1.0	3.0	3.00		NS		
Pool	137.0	3.6	4.0	14.40		0		
Pool	140.6	2.5	4.5	11.25		2		2
Riffle	143.1	11.2	5.0	56.00		3		3
SDPool	146.2	1.0	1.0	1.00		1		
SDPool	152.3	1.5	1.5	2.25		1		
Pool	154.3	5.8	4.0	23.20		2		
Cascade	160.1	2.2	5.5	12.10		NS		
Pool	162.3	3.7	6.0	22.20		2		
Riffle	166.0	9.5	5.5	52.25		0		
SDPool	169.3	2.0	2.0	4.00		1		
Pool	175.5	3.6	4.0	14.40		1		
Cascade	179.1	1.4	4.5	6.30		NS		
Riffle	180.5	-54.0	5.5	-297.00		0		

Appendix 3c cont

Lower Sweeny cont.

Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel Dv	Snorkel Ct	E-fisher Dv	E-fisher Ct
Cascade	126.5	62.5	4.5	281.25		NS		
Pool	189.0	6.0	5.5	33.00		3		
Riffle	195.0	2.4	4.0	9.60		NS		
Pool	197.4	1.7	3.0	5.10		NS		
Cascade	199.1	4.1	2.5	10.25		NS		
Pool	203.2	1.9	4.0	7.60		2		
Cascade	205.1	3.7	3.5	12.95		NS		
SDPool	206.6	1.5	1.0	1.50		NS		
Riffle	208.8	6.0	4.0	24.00		2		
Riffle	214.8	29.0	6.0	174.00		NS		
SDPool	223.8	2.0	1.5	3.00		4		
SDPool	229.1	3.0	1.5	4.50		2		
Pool	243.8	4.8	6.0	28.80		1		
Riffle	248.6	10.4	6.0	62.40		NS		
SDPool	250.1	2.0	2.0	4.00		NS		
Pool	259.0	3.5	6.0	21.00		2		
Riffle	262.5	2.6	5.0	13.00		NS		
Pool	265.1	3.1	4.5	13.95		3		
Pool	268.2	8.3	4.0	33.20		5		
Riffle	276.5	4.8	3.5	16.80		1		
Pool	281.3	8.7	3.5	30.45		2		
Pool	290.0	5.6	3.5	19.60		2		
Sriff	292.5	1.5	1.5	2.25		1		
Pool	295.6	5.2	4.0	20.80		3		
Riffle	300.8	16.8	5.5	92.40		NS		
SDPool	302.6	2.5	2.0	5.00		2		
SDPool	310.6	1.0	1.5	1.50		1		
Pool	317.6	2.4	4.0	9.60		NS		
Cascade	320.0	1.6	3.5	5.60		NS		
Riffle	321.6	22.5	6.0	135.00		NS		
Pool	344.1	4.8	6.5	31.20		5		
Pool	348.9	3.3	5.5	18.15		2		
Riffle	352.2	7.8	5.0	39.00		2		
SDPool	357.3	2.0	1.0	2.00		1		
	360.0							

Appendix 3c cont.

Middle Sweeny

Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel Dv	Snorkel Ct	E-fisher Dv	E-fisher Ct
Pool	0.0	4.8	3.5	16.80	0	3	0	3
Sriff	0.0	4.8	1.0	4.80	NS			
Riffle	4.8	3.3	5.0	16.50	NS			
SDPool	4.8	1.0	1.5	1.50	1		1	
SDPool	4.8	1.0	1.0	1.00	NS			
Pool	8.1	4.3	2.5	10.75	1		1	
Sriff	8.1	4.3	1.0	4.30	NS			
Pool	12.4	3.6	4.0	14.40	0	2	1	2
SDPool	13.4	3.0	2.0	6.00		1		1
Pool	16.0	12.2	6.0	73.20	1	5		
Cascade	28.2	4.8	4.5	21.60	NS			
SDPool	29.5	1.0	1.0	1.00	NS			
Riffle	33.0	1.2	6.0	7.20	0			0
SDPool	34.2	3.5	1.0	3.50		1		1
SDPool	39.7	2.0	3.0	6.00		2		
SDPool	43.1	2.5	1.5	3.75	0			
SDPool	46.5	1.5	1.0	1.50	NS			
Glide	46.5	11.0	4.0	44.00	1	4	1	4
Cascade	57.5	1.7	4.0	6.80	NS			
Pool	59.2	5.2	4.5	23.40	1	3	1	2
Sriff	59.2	5.2	1.5	7.80	NS			
SDPool	62.5	1.0	1.0	1.00	NS			
Riffle	64.4	3.2	5.5	17.60	0	0	0	0
Pool	67.6	2.5	2.5	6.25		1		2
Cascade	70.1	3.1	3.5	10.85	NS			
Riffle	73.2	29.1	5.0	145.50	1	2	1	2
SDPool	82.9	1.5	1.0	1.50	0			
SDPool	85.8	3.0	3.5	10.50	1	1	1	1
SDPool	96.7	1.0	1.0	1.00	NS			
Glide	102.3	12.1	3.0	36.30	3	1	5	1
Riffle	114.4	7.6	4.0	30.40	0			
Riffle	122.0	0.0	1.0	0.00	NS			
Pool	122.0	5.2	3.0	15.60		3		
Cascade	127.2	3.8	1.5	5.70	NS			
Pool	131.0	5.7	3.0	17.10	1			
Pool	136.7	3.2	2.0	6.40	NS			
Sriff	136.7	3.2	1.0	3.20	NS			
Pool	139.9	1.7	2.0	3.40	0			
Riffle	141.6	12.1	8.0	96.80	1	1		
SDPool	143.4	3.0	2.0	6.00	0			
SDPool	146.9	1.0	1.0	1.00	1			
Pool	153.7	8.0	4.5	36.00		1		

Appendix 3c cont.

Middle Sweeny cont.

					Snorkel		E-fisher	
Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Dv	Ct	Dv	Ct
Pool	161.7	4.0	3.0	12.00		1		
Cascade	165.7	1.0	3.0	3.00	NS			
Riffle	166.7	5.9	3.5	20.65	NS			
Pool	172.6	3.7	4.0	14.80		2		
Cascade	176.3	0.6	2.0	1.20	NS			
Pool	176.9	4.5	2.0	9.00	0			
Riffle	181.4	6.8	3.5	23.80		1		
Pool	188.2	3.4	3.5	11.90		2		
Riffle	191.6	4.6	4.5	20.70	0			
SDPool	195.0	1.5	1.0	1.50		1		
Riffle	196.2	25.9	6.0	155.40	1	5		
SDPool	201.8	2.0	2.0	4.00	1			
SDPool	204.4	1.5	1.0	1.50	0			
SDPool	209.8	2.0	2.0	4.00	NS			
Pool	222.1	4.0	4.0	16.00		2		
Pool	226.1	5.3	3.5	18.55		1		
Pool	231.4	4.6	3.5	16.10	1			
Riffle	236.0	5.3	4.5	23.85	NS			
SDPool	238.0	2.5	1.5	3.75	0			
SDPool	239.6	3.0	1.0	3.00		1		
Cascade	241.3	3.2	3.0	9.60	NS			
Pool	244.5	4.7	4.0	18.80	0			
Pool	249.2	5.7	2.5	14.25		2		
Cascade	254.9	1.6	2.5	4.00	NS			
Riffle	256.5	8.4	4.0	33.60	NS			
SDPool	259.7	3.0	1.0	3.00	1			
SDPool	263.0	1.0	2.0	2.00		1		
Cascade	264.9	6.3	3.0	18.90	NS			
SDPool	266.1	1.0	1.0	1.00	0			
SDPool	269.2	1.0	1.5	1.50	1			
Riffle	271.2	5.9	5.0	29.50	1			
Riffle	277.1	10.2	5.0	51.00	0			
SDPool	280.0	3.0	2.0	6.00		2		
Cascade	287.3	1.2	2.0	2.40	NS			
Riffle	288.5	25.9	4.5	116.55	2	3		
SDPool	291.9	1.0	1.0	1.00		1		
Pool	314.4	4.5	3.5	15.75		2		
Cascade	318.9	1.6	2.0	3.20	NS			
Riffle	320.5	13.2	3.5	46.20	0			
SDPool	320.8	1.5	1.0	1.50		1		
SDPool	323.5	1.0	1.0	1.00	1			
Pool	333.7	11.8	4.5	53.10	1	3		
Riffle	345.5	7.1	3.5	24.85	0			
SDPool	347.9	1.0	1.0	1.00	1			
Pool	352.6	1.5	1.0	1.50	1			

Appendix 3c cont.

Upper Sweeny

Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel		E-fisher	
					Dv	Ct	Dv	Ct
Riffle	0.0	7.9	4.0	31.60	1	1	2	1
SDPool	1.8	1.0	1.0	1.00	0	1	1	1
Pool	7.9	3.0	3.5	10.50	2	1	2	1
Cascade	10.9	3.5	3.0	10.50	NS			
Pool	14.4	4.0	4.0	16.00	0	1	0	1
Cascade	18.4	5.2	3.0	15.60	NS			
SDPool	21.5	1.5	1.0	1.50	NS			
Riffle	23.6	15.8	4.5	71.10	2	0	2	0
SDPool	26.4	1.0	1.0	1.00	0	0	0	0
SDPool	33.3	3.0	1.0	3.00	1	2	1	3
Pool	39.4	7.9	3.5	27.65	2	6		
Pool	47.3	4.2	1.5	6.30	3	2	4	2
Pool	51.5	3.6	2.0	7.20	2		2	1
Pool	55.1	1.6	1.5	2.40	0	0	0	0
Riffle	56.7	9.1	2.0	18.20	1	0	1	0
SDPool	58.1	1.0	0.5	0.50	0	0	1	0
SDPool	62.1	0.5	1.0	0.50	NS			
SDPool	64.0	1.0	1.0	1.00	NS			
Pool	65.8	3.3	2.0	6.60	7	0	7	0
Cascade	69.1	2.4	1.0	2.40	NS			
Riffle	71.5	8.9	2.5	22.25	NS			
Glide	80.4	8.9	3.0	26.70	1	0	1	0
Pool	89.3	4.4	2.0	8.80	4			
Riffle	93.7	9.7	1.0	9.70	NS			
Cascade	65.8	1.6	1.5	2.40	NS			
Pool	67.4	3.9	2.0	7.80	1			
Cascade	71.3	1.7	1.5	2.55	NS			
Riffle	73.0	7.4	2.5	18.50	0			
Riffle	80.4	15.4	3.0	46.20	NS			
Pool	95.8	7.6	2.0	15.20	1			
SDPool	100.2	1.5	1.5	2.25	0			
Glide	103.4	11.4	4.5	51.30	0	0	0	0
SDPool	106.2	6.0	2.0	12.00	4	3		
Pool	114.8	7.6	2.0	15.20	6	1		
Pool	122.4	3.6	2.0	7.20	0			
Pool	126.0	2.4	2.5	6.00	0			
Cascade	128.4	19.2	1.5	28.80	NS			
Pool	147.6	2.3	2.5	5.75	1			
Pool	149.9	3.6	1.5	5.40	0			
Cascade	153.5	1.4	1.5	2.10	NS			
Riffle	154.9	8.6	5.0	43.00	0			
SDPool	156.8	1.5	2.0	3.00	1			

Appendix 3c cont.

Upper Sweeny cont.

Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel Dv	Ct	E-fisher Dv	Ct
SDPool	161.3	1.0	1.0	1.00	0			
Glide	163.5	5.9	3.5	20.65	3	0	3	0
Riffle	169.4	6.8	4.5	30.60	NS			
SDPool	169.4	1.0	0.5	0.50	1			
SDPool	171.6	2.0	2.5	5.00	1	1		
Pool	176.2	3.9	3.5	13.65	4			
Cascade	180.1	2.6	3.5	9.10	NS			
Pool	182.7	2.5	2.5	6.25		1		
Cascade	185.2	2.5	2.0	5.00	NS			
Riffle	187.7	10.6	3.0	31.80	0			
SDPool	192.5	4.0	3.0	12.00	3			
SDPool	195.0	1.0	1.0	1.00	1			
SDPool	196.8	1.0	1.0	1.00	0			
Cascade	198.3	19.5	4.5	87.75	NS			
SDPool	198.9	1.0	1.0	1.00	0			
SDPool	199.3	2.0	1.5	3.00	NS			
SDPool	201.2	2.5	1.5	3.75	1			
SDPool	203.1	3.0	4.0	12.00		1		
SDPool	204.5	5.0	3.0	15.00	2			
Riffle	217.8	3.2	5.5	17.60	0			
SDPool	218.8	2.0	1.0	2.00	0			
Pool	221.0	17.8	3.0	53.40	5			
Riffle	238.8	14.9	2.0	29.80	NS			
SDPool	246.8	1.5	1.0	1.50	2			
SDPool	249.8	1.5	1.0	1.50	1			
SDPool	250.1	1.0	1.0	1.00	NS			
Pool	253.7	3.1	3.5	10.85	1	1		
Riffle	256.8	35.7	3.0	107.10	NS			
SDPool	260.0	1.0	1.0	1.00	1			
SDPool	256.2	1.0	1.0	1.00	1			
SDPool	278.4	2.0	1.0	2.00	0			
SDPool	278.6	2.0	2.0	4.00	1			
SDPool	280.6	1.0	2.0	2.00	1			
SDPool	287.6	2.0	2.0	4.00	2			
SDPool	290.5	1.0	2.0	2.00	2			
Pool	292.5	8.5	3.0	25.50	1			
Riffle	301.0	16.6	4.0	66.40	0			
SDPool	301.9	1.0	1.0	1.00	0			
SDPool	311.4	1.0	1.0	1.00	1			
Pool	317.6	5.0	2.5	12.50		2		
Cascade	322.6	5.6	2.5	14.00	NS			
Riffle	328.2	7.2	4.0	28.80	NS			
Pool	335.4	2.9	4.0	11.60	2			
Glide	338.3	2.2	2.5	5.50	NS			
Pool	340.5	7.9	3.0	23.70	2	1		
Cascade	348.4	2.7	1.0	2.70	NS			
Riffle	351.1	8.9	2.0	17.80	NS			
	360.0							

Appendix 3c cont.

Lower Johnson

Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel		Fish	
					Dv	Ct	Dv	Ct
Riffle	0.0	15.4	3.0	46.20	NS			
Sglide	0.0	15.4	3.0	46.20	NS			
SDPool	4.2	2.0	3.5	7.00	NS			
SDPool	7.2	1.5	2.0	0.00	0			
Riffle	15.4	3.7	4.0	14.80	0		0	
Pool	19.1	9.0	1.5	13.50	6		6	
SDPool	20.1	2.0	2.0	4.00	1		1	
Sglide	20.3	3.0	10.0	30.00	NS			
Sriff	27.2	1.5	2.0	3.00	NS			
Pool	28.1	4.9	4.0	19.60	NS			
SDPool	28.5	1.5	1.5	2.25	1		2	
Riffle	33.0	7.1	3.5	24.85	2		2	
Riffle	40.1	16.0	5.5	88.00	NS			
SDPool	48.1	1.5	3.0	4.50	1		1	
Pool	56.1	6.0	6.5	39.00	2		3	
Cascade	61.6	0.5	4.0	2.00	0			
Pool	62.1	3.9	5.0	19.50	1	1	1	1
Glide	66.0	11.1	4.5	49.95	1		1	
SDPool	75.5	1.0	1.0	1.00	0			
Riffle	77.1	5.9	2.0	11.80	NS			
Pool	83.0	7.0	3.5	24.50	1		1	
Pool	90.0	5.0	3.5	17.50	0			
SDPool	93.2	2.0	1.0	2.00	NS			
Riffle	95.0	18.0	1.5	27.00	0		0	
SDPool	108.8	4.2	2.0	8.40	0			
Glide	113.0	2.7	3.0	8.10	2		2	
Pool	115.7	2.9	4.5	13.05	NS			
Riffle	118.6	13.3	4.5	59.85	NS			
SDPool	123.1	1.0	1.0	1.00	NS			
Pool	131.9	1.9	5.0	9.50		3	4	
Cascade	133.8	2.0	3.5	7.00	NS			
SDPool	135.8	2.5	3.0	7.50	NS			
Riffle	135.8	5.3	4.5	23.85	NS			
SDPool	138.0	3.0	1.0	3.00	NS			
Glide	141.1	10.8	4.5	48.60	1		2	
SDPool	146.4	2.0	1.0	2.00	0			
Pool	151.9	7.5	3.5	26.25	0			

Appendix 3c cont.

Lower Johnson cont.

Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel Dv	Snorkel Ct	Fish Dv	Fish Ct
Riffle	159.4	6.2	2.5	15.50	NS			
Cascade	165.6	0.3	1.5	0.45	NS			
Glide	165.9	8.1	2.0	16.20	4		4	
Riffle	174.0	16.0	8.5	136.00	0		0	
SDPool	184.3	1.5	6.0	9.00	0			
Pool	190.0	10.9	7.0	76.30	6			
Sglide	190.0	5.0	2.0	10.00	NS			
Riffle	200.9	17.5	7.0	122.50	1		0	
SDPool	208.1	2.0	2.0	4.00	0			
Riffle	218.4	22.1	7.0	154.70	NS			
SDPool	232.7	7.0	1.5	10.50	0			
SDPool	236.7	9.0	4.0	36.00	NS			
Glide	240.5	8.0	5.0	40.00	0			
Pool	248.5	6.5	4.5	29.25	NS			
Riffle	255.0	24.5	3.5	85.75	NS			
SDPool	275.0	1.5	1.0	1.50	0			
Riffle	279.5	10.6	7.0	74.20	0			
SDPool	289.5	4.0	4.0	16.00	5			
Riffle	290.1	30.2	5.5	166.10	NS			
SDPool	304.9	1.5	1.0	1.50	0			
Pool	320.3	9.2	4.5	41.40	2			
Sriff	322.2	8.0	2.5	20.00	NS			
Cascade	329.5	0.7	5.0	3.50	NS			
Riffle	330.2	25.8	8.5	219.30	1			
SDPool	248.5	3.0	2.0	6.00	2			
SDPool	349.0	4.0	2.0	8.00	0			
Riffle	356.0	4.0	5.5	22.00	NS			
	360.0							

Appendix 3c cont.

Middle Johnson

Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel Dv	Snorkel Ct	Fished Dv	Fished Ct
Riffle	0.0	8.3	6.5	53.95	NS			
SDPool	0.0	2.0	1.5	3.00	0			
SDPool	5.9	2.0	1.0	2.00	0			
Riffle	8.3	0.0	1.5	0.00	NS			
Riffle	8.3	14.8	3.5	51.80	NS			
SDPool	18.3	1.5	1.0	1.50	0			
Riffle	23.1	3.8	6.5	24.70	0			
SDPool	26.0	1.5	1.0	1.50	0			
Riffle	26.9	0.0	1.0	0.00	NS			
Riffle	26.9	14.0	5.0	70.00	0			
SDPool	29.4	1.0	1.0	1.00	0			
SDPool	34.2	2.0	2.0	4.00	NS			
SDPool	37.4	2.5	1.5	3.75	0			
Riffle	40.9	22.8	6.5	148.20	0			
SDPool	42.5	2.0	1.0	2.00	0			
SDPool	46.6	0.0	1.5	0.00	0			
SDPool	48.2	3.0	1.5	4.50	0			
SDPool	57.5	1.5	1.0	1.50	0			
SDPool	59.0	3.0	2.0	6.00	0			
Pool	63.7	8.0	6.5	52.00	0			
Riffle	71.7	10.2	6.0	61.20	0		0	
SDPool	74.5	1.0	0.5	0.50	NS			
SDPool	76.5	1.5	1.0	1.50	0			
SDPool	79.0	1.5	1.0	1.50	0		0	
SDPool	79.1	1.0	1.0	1.00	0			
Pool	81.9	4.1	5.0	20.50	0			
Sriff	81.9	4.1	1.5	6.15	NS			
Riffle	86.0	28.8	6.0	172.80	0		0	
SDPool	87.5	3.0	1.5	4.50	0			
SDPool	90.0	1.0	1.0	1.00	NS			
SDPool	90.8	3.0	3.0	9.00	1			
SDPool	99.2	3.5	2.5	8.75	1			

Appendix 3c cont.

Middle Johnson cont.

Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel Dv	Ct	Fished Dv	Ct
SDPool	104.2	2.0	1.0	2.00	0			
SDPool	107.7	1.5	2.0	3.00	0		0	
SDPool	109.9	2.5	1.5	3.75	0			
Pool	114.8	21.2	7.0	148.40	28		28	
Cascade	136.0	3.4	5.5	18.70	NS			
Riffle	139.4	33.3	6.0	199.80	NS			
SDPool	142.2	2.0	2.0	4.00	0			
SDPool	144.8	2.0	2.0	4.00	0		0	
SDPool	152.5	1.0	1.0	1.00	0			
SDPool	159.2	1.5	1.0	1.50	0			
SDPool	164.3	2.0	1.5	3.00	0			
SDPool	169.6	3.0	2.0	6.00	0			
Pool	172.7	7.5	5.5	41.25	3		3	
Sriff	172.7	7.5	1.5	11.25	NS			
Riffle	180.2	26.7	3.0	80.10	NS			
SDPool	180.2	3.5	4.5	15.75	4		4	
SDPool	196.0	1.5	1.5	2.25	0			
SDPool	199.0	2.0	1.5	3.00	NS			
Pool	206.9	9.2	5.5	50.60	3		3	
Riffle	216.1	33.5	5.0	167.50	0		0	
SDPool	219.8	1.5	1.5	2.25	0			
SDPool	222.9	2.0	1.5	3.00	0			
SDPool	226.5	3.0	3.0	9.00	0			
SDPool	229.5	3.0	2.0	6.00	NS			
SDPool	234.1	2.0	2.5	5.00	0			
SDPool	239.5	2.5	3.0	7.50	NS			
Pool	249.6	2.9	5.5	15.95	1		2	
Riffle	252.5	49.8	5.0	249.00	0		0	
SDPool	257.2	1.5	1.0	1.50	0			
SDPool	258.9	2.0	2.0	4.00	NS			
SDPool	263.9	2.0	1.5	3.00	0			
SDPool	271.4	2.5	2.0	5.00	3		3	
SDPool	274.2	3.0	4.0	12.00	2		3	
SDPool	282.1	3.0	2.5	7.50	NS			
SDPool	293.0	2.5	2.0	5.00	0			
SDPool	299.4	1.5	2.0	3.00	2		3	
Pool	302.3	10.7	5.5	58.85	3		3	
Cascade	313.0	12.0	5.0	60.00	NS			
Riffle	325.0	15.6	6.5	101.40	NS			
SDPool	330.9	1.5	1.5	2.25	0			
SDPool	334.9	4.5	3.0	13.50	2			
SDPool	336.2	2.5	2.5	6.25	2			
Cascade	340.6	0.6	7.0	4.20	NS			
Riffle	341.2	18.8	7.0	131.60	NS			
SDPool	359.4	3.5	3.0	10.50	0			
	360.0							

Appendix 3c cont. Upper Johnson

Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel Dv	Snorkel Ct	Fished Dv	Fished Ct
Riffle	0.0	9.1	2.5	22.75	0		0	
SDPool	1.7	2.0	2.0	4.00	0			
Riffle	9.1	9.7	2.0	19.40	NS			
SDPool	14.6	1.0	1.0	1.00	NS			
Pool	18.8	3.7	2.0	7.40	0			
Pool	22.5	30.8	4.0	123.20	5		5	
Pool	53.3	4.6	2.0	9.20	0			
Riffle	57.9	6.7	2.0	13.40	0		0	
SDPool	60.7	1.5	2.0	3.00	1			
Cascade	64.6	0.6	4.0	2.40	NS			
Pool	65.2	9.0	4.0	36.00	0			
Pool	74.2	9.3	3.5	32.55	2		3	
Pool	83.5	13.8	3.0	41.40	2		3	
Glide	97.3	9.9	3.0	29.70	0		0	
SDPool	98.0	1.5	1.5	2.25	1		1	
SDPool	102.0	4.0	1.5	6.00	0			
Riffle	107.2	9.7	2.5	24.25	0		0	
SDPool	109.5	2.0	1.5	3.00	1			
SDPool	115.4	1.5	2.0	3.00	1		1	
Pool	116.9	10.5	4.0	42.00	1		1	
Pool	127.4	2.6	3.5	9.10	3		3	
Riffle	130.0	6.0	3.5	21.00	0		0	
SDPool	130.5	2.5	3.0	7.50	0			
Pool	136.0	2.0	2.5	5.00	1			
Riffle	138.0	7.0	2.5	17.50	0		0	
SDPool	142.2	1.5	1.5	2.25	0			
Riffle	145.0	16.8	3.0	50.40	0		0	
SDPool	145.0	2.5	2.0	5.00	3		3	
Pool	161.8	11.1	2.0	22.20	5		6	
Riffle	172.9	33.0	3.0	99.00	4		3	
SDPool	175.2	3.5	1.0	3.50	1			
SDPool	193.7	1.5	1.0	1.50	0			
SDPool	200.1	1.0	1.0	1.00	0			
Riffle	205.9	21.1	3.5	73.85	3		3	
SDPool	207.4	1.0	1.0	1.00	0			
SDPool	210.1	1.0	1.0	1.00	0		0	
Pool	227.0	3.1	3.5	10.85	2		3	
Riffle	230.1	17.6	3.5	61.60	0			
SDPool	232.1	1.0	1.0	1.00	0			
SDPool	235.2	1.0	1.0	1.00	1			
Cascade	247.7	2.3	2.5	5.75	NS			
Riffle	250.0	30.5	3.0	91.50	0			
SDPool	253.6	1.5	1.5	2.25	0			
SDPool	264.8	3.0	2.0	6.00	0			
SDPool	270.1	1.0	1.0	1.00	0			
SDPool	278.0	2.0	2.0	4.00	1			
Pool	280.5	2.9	3.0	8.70	0			
Cascade	283.4	2.9	3.0	8.70	NS			
Pool	286.3	6.7	3.0	20.10	2			
Cascade	293.0	0.7	1.5	1.05	NS			
Pool	293.7	3.3	2.0	6.60	NS			
Riffle	297.0	35.8	2.5	89.50	1			
SDPool	312.6	1.0	1.5	1.50	0			
SDPool	318.1	1.5	1.0	1.50	1			
Glide	332.8	7.6	4.0	30.40	0		0	
SDPool	340.4	2.0	1.0	2.00	0			
Riffle	342.6	17.4	4.0	69.60	1			
SDPool	355.0	1.0	1.0	1.00	0			
SDPool	357.6	1.0	1.0	1.00	NS			

Appendix 3c cont. Lower Slate

					Snorkel		Fished	
Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Dv	Ct	Dv	Ct
Glide	0.0	20.6	5.5	113.30	0			0
Pool	20.6	6.4	5.0	32.00		3		4
Riffle	27.0	26.2	4.5	117.90				
SDPool	34.7	0.5	0.5	0.25		2		2
Riffle	53.2	9.1	7.5	68.25	NS			
Riffle	62.3	22.0	7.0	154.00	0			
SDPool	71.2	2.0	1.5	3.00		2		2
Riffle	84.3	10.3	1.0	10.30	NS			
Glide	84.3	4.6	4.0	18.40	1		1	
Pool	88.9	5.7	3.5	19.95		1		
Riffle	94.6	29.1	6.0	174.60	NS			
SDPool	112.0	0.5	0.5	0.25		1		1
Riffle	123.7	29.0	7.5	217.50		1		1
SDPool	142.5	1.0	1.0	1.00	0			
SDPool	148.0	0.5	0.5	0.25	NS			
Pool	152.7	6.7	5.5	36.85	1	2	1	2
Riffle	159.4	23.7	4.5	106.65		1	1	
SDPool	174.1	9.0	2.0	18.00		2		
Riffle	183.1	16.8	4.5	75.60	NS			
Pool	199.9	3.3	4.5	14.85		1		1
Cascade	203.2	0.6	5.0	3.00	NS			
Riffle	203.8	19.2	5.0	96.00	NS			
SDPool	206.9	1.0	1.0	1.00		1		
SDPool	215.2	2.0	1.0	2.00		1		
Pool	223.0	2.6	4.0	10.40		2		2
Cascade	225.6	0.6	4.0	2.40	NS			
Riffle	226.2	12.9	1.5	19.35	NS			
Riffle	226.2	12.9	4.0	51.60		6		
Pool	239.1	6.9	5.0	34.50		2		2
Sriff	239.1	3.0	1.5	4.50	NS			
Riffle	246.0	11.0	3.5	38.50	NS			
Pool	246.0	5.9	2.0	11.80				
Riffle	251.9	5.1	1.5	7.65	NS			
Pool	257.0	2.0	6.5	13.00	NS			
Pool	259.0	2.7	4.0	10.80	1	2	1	2
Riffle	261.7	2.9	2.5	7.25	NS			
Glide	264.6	7.4	4.0	29.60		2		2
Riffle	272.0	4.7	3.0	14.10	NS			
Glide	276.7	7.4	3.5	25.90		3		
SDPool	284.1	2.0	1.0	2.00		1		
Riffle	284.1	31.7	1.5	47.55		2		
SDPool	299.5	1.5	1.0	1.50	0			
SDPool	305.6	2.0	3.0	6.00		2		
Riffle	315.8	20.2	1.5	30.30	NS			
Riffle	336.0	10.2	2.0	20.40	NS			
Riffle	315.8	2.8	4.5	12.60	NS			
Glide	318.6	5.6	5.0	28.00		1		2
Riffle	324.2	12.6	3.5	44.10	NS			
Pool	336.8	3.9	4.0	15.60	NS			
Cascade	340.7	0.4	3.0	1.20				
Pool	341.1	5.1	3.5	17.85		2		
Cascade	346.2	0.8	3.5	2.80	NS			
Pool	347.0	4.0	4.0	16.00	NS			
Pool	351.0	9.0	4.0	36.00		4		
	360.0							

Appendix 3c cont. Middle Slate

Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel Dv	Snorkel Ct	Fished Dv	Fished Ct
Riffle	0.0	6.7	2.0	13.40	0			
SDPool	3.5	3.2	2.0	6.40	0			
Cascade	6.7	5.0	5.0	25.00	NS			
SDPool	7.0	1.0	1.0	1.00	0			
Riffle	11.7	16.9	4.0	67.60	0		0	
SDPool	13.7	1.0	1.0	1.00	0			
SDPool	22.2	2.0	1.5	3.00	0			
Pool	28.6	4.4	2.5	11.00	0		0	
Cascade	33.0	11.4	2.0	22.80	NS			
SDPool	37.7	1.5	2.0	3.00	0			
Riffle	44.4	26.9	3.0	80.70	0		0	
SDPool	45.4	1.0	1.0	1.00	0			
SDPool	51.2	1.0	1.0	1.00	0			
SDPool	53.7	1.0	1.0	1.00	0		0	
SDPool	57.8	1.0	1.0	1.00	0			
SDPool	63.8	2.5	1.0	2.50	0			
Cascade	71.3	5.2	2.0	10.40	NS			
Pool	76.5	6.2	3.0	18.60	0		0	
Riffle	82.7	58.3	3.5	204.05	0		0	
SDPool	94.3	1.0	1.0	1.00	0			
SDPool	100.1	1.0	1.0	1.00	0			
SDPool	104.7	1.0	1.0	1.00	0		0	
SDPool	113.2	1.5	1.5	2.25	0			
SDPool	121.2	1.5	1.0	1.50	0			
SDPool	128.7	2.0	2.5	5.00	0		0	
SDPool	131.1	1.5	1.5	2.25	0			
SDPool	138.5	2.0	1.0	2.00	0			
Cascade	141.0	1.3	3.0	3.90	NS			
Pool	142.3	16.1	3.0	48.30	0		0	
Cascade	158.4	3.1	1.5	4.65	NS			
Riffle	161.5	24.9	3.5	87.15	0		0	
SDPool	165.2	1.0	1.5	1.50	0			
SDPool	166.4	0.5	0.5	0.25	0		0	
SDPool	169.3	1.0	1.0	1.00	0			
SDPool	172.6	2.0	2.0	4.00	0		0	
SDPool	183.6	1.0	1.0	1.00	0			
SDPool	186.4	2.0	1.5	3.00	0			
Riffle	197.0	8.5	4.0	34.00	0		0	
SDPool	199.8	3.0	1.5	4.50	0			
SDPool	201.9	3.0	1.0	3.00	0			
SDPool	204.0	1.0	1.0	1.00	0			
Pool	205.5	5.2	4.0	20.80	0		0	
Cascade	210.7	0.6	3.0	1.80	NS			
Pool	211.3	5.4	4.0	21.60	0			
Pool	216.7	2.7	4.0	10.80	NS			
Riffle	219.4	14.5	4.5	65.25	NS			
Pool	233.9	9.9	3.0	29.70	0			
Riffle	243.8	3.4	3.0	10.20	0		1	
SDPool	243.8	1.0	1.0	1.00	NS			
Pool	247.2	5.2	3.5	18.20	0			
Riffle	252.4	21.8	3.0	65.40	1		1	
Riffle	274.2	8.2	2.0	16.40	0		1	
Cascade	282.4	1.7	1.0	1.70	NS			
Pool	284.1	10.2	3.0	30.60	0			
Glide	294.3	17.2	2.5	43.00	1		1	
Riffle	311.5	16.0	2.0	32.00	NS			
Glide	327.5	28.5	3.0	85.50	0		0	
SDPool	355.0	1.0	1.0	1.00	0			
Riffle	356.0	4.0	4.5	18.00	NS			

Appendix 3c cont.

Upper Slate

Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel Dv	Snorkel Ct	Fished Dv	Fished Ct
Riffle	0.0	10.0	2.0	20.00	0			
SDPool	1.2	0.5	0.5	0.25	8		8	
SDPool	4.6	1.0	1.0	1.00	NS			
Riffle	10.0	8.5	2.5	21.25	NS			
Riffle	18.5	4.9	2.5	12.25	1		1	
SDPool	21.5	1.0	1.5	1.50	0		0	
SDPool	23.2	1.0	1.0	1.00	0			
Glide	23.4	8.0	1.5	12.00	2		2	
SDPool	28.5	3.0	5.0	15.00	1		1	
Riffle	31.4	13.2	1.5	19.80	0		0	
SDPool	35.1	2.5	0.5	1.25	0			
SDPool	42.7	2.0	0.5	1.00	0			
Riffle	44.6	4.7	3.0	14.10	0		0	
Pool	49.3	3.2	1.0	3.20	1		1	
Riffle	52.5	6.7	1.5	10.05	0		1	
SDPool	53.6	1.0	1.0	1.00	0		0	
Pool	59.2	2.9	2.0	5.80	0		1	
Riffle	62.1	7.5	2.0	15.00	NS			
Riffle	69.6	7.6	1.5	11.40	0		1	
SDPool	69.6	2.0	0.5	1.00	0		0	
SDPool	75.1	1.5	0.5	0.75	0			
Glide	77.2	6.0	2.0	12.00	0		0	
SDPool	80.0	3.0	0.5	1.50	0			
Riffle	83.2	18.0	1.5	27.00	0		0	
SDPool	92.3	1.5	0.1	0.08	0			
Pool	101.2	9.4	1.5	14.10	0		0	
Riffle	110.6	8.1	1.5	12.15	1		2	
SDPool	115.7	0.5	0.5	0.25	0			
Pool	118.7	3.8	1.0	3.80	0		1	
Riffle	122.5	11.5	1.5	17.25	0		1	
SDPool	127.4	1.0	0.5	0.50	0		2	
SDPool	129.6	0.5	0.5	0.25	0			
Pool	134.0	1.9	2.5	4.75	0		1	
Cascade	135.9	0.4	1.0	0.40	NS			
Riffle	136.3	3.7	1.5	5.55	0		0	
Pool	140.0	3.5	3.0	10.50	0		1	
Sriff	140.0	3.5	0.5	1.75	NS			
Riffle	143.5	23.5	1.5	35.25	1		1	
SDPool	145.2	0.5	0.5	0.25	0			
SDPool	147.0	1.0	0.5	0.50	1		1	
SDPool	151.3	1.5	0.5	0.75	0			

Appendix 3c cont.

Upper Slate cont.

Habitat Type	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel Dv	Ct	Fished Dv	Ct
SDPool	158.1	1.0	0.5	0.50	0		0	
Pool	167.0	3.8	1.5	5.70	0		1	
Riffle	170.8	5.6	1.5	8.40	0		0	
SDPool	172.9	3.0	0.5	1.50	0			
Riffle	176.4	11.1	2.0	22.20	NS			
Pool	187.5	3.3	3.0	9.90	1		2	
Riffle	190.8	9.2	2.5	23.00	0			
SDPool	190.8	1.5	1.0	1.50	0			
SDPool	197.5	1.5	0.5	0.75	0			
Pool	200.0	1.5	1.5	2.25	0		1	
Riffle	201.5	3.2	1.0	3.20	NS			
Pool	204.7	2.2	1.0	2.20	0		1	
Riffle	206.9	3.2	2.0	6.40	NS			
Pool	210.1	1.8	2.0	3.60	0			
Pool	211.9	3.8	2.0	7.60	2		3	
Riffle	215.7	6.8	1.5	10.20	NS			
Pool	222.5	3.9	1.5	5.85	1		1	
Riffle	226.4	9.4	2.0	18.80	0			
SDPool	229.1	1.0	0.5	0.50	1		1	
Pool	235.8	3.9	1.5	5.85	0			
Riffle	239.7	19.4	1.5	29.10	NS			
SDPool	249.1	1.0	0.5	0.50	0			
Pool	259.1	2.4	2.0	4.80	0			
Riffle	261.5	4.8	2.0	9.60	0			
Pool	266.3	2.3	2.0	4.60	1		1	
Riffle	268.6	3.2	1.5	4.80	NS			
Pool	271.8	3.8	1.5	5.70	0			
Riffle	275.6	6.5	2.0	13.00	NS			
SDPool	275.9	1.0	1.0	1.00	0			
Riffle	282.1	30.4	1.5	45.60	1		1	
SDPool	286.4	1.0	0.5	0.50	0			
SDPool	290.8	1.0	1.0	1.00	0			
SDPool	300.4	2.5	0.5	1.25	0			
SDPool	311.2	1.0	1.5	1.50	0			
Riffle	312.5	3.2	1.0	3.20	NS			
Riffle	315.7	2.6	1.5	3.90	0			
Pool	318.3	2.8	1.0	2.80	0			
Riffle	321.1	19.8	1.5	29.70	1			
SDPool	321.1	1.0	0.5	0.50	0			
SDPool	325.7	1.0	0.5	0.50	0			
SDPool	327.4	2.0	0.5	1.00	0			
SDPool	333.5	0.5	0.5	0.25	1			
SDPool	340.0	1.0	0.5	0.50	0			
Pool	340.9	1.5	1.5	2.25	NS			
Riffle	342.4	11.6	1.5	17.40	0			
SDPool	342.4	0.5	0.5	0.25	0			
SDPool	348.0	1.5	0.5	0.75	0			
SDPool	353.0	0.5	0.5	0.25	0			
Riffle	354.0	6.0	1.5	9.00	1			
SDPool	358.9	0.5	0.5	0.25	0			

APPENDIX 3D: FISH LENGTH & WEIGHT DATA

Appendix 3d: Total length, weight and condition factor (K) for resident fish in 2008.

Lower Sherman						Date	7/22/2008
Species	Length (mm)	Weight (g)	L power 3	$(g)/L^3$	k		k
Dolly varden	200	78.3	8000000	9.79E-06	0.979	mean	0.902
	139	21.4	2685619	7.97E-06	0.797	ST dev	0.071649
	64	2.5	262144	9.54E-06	0.954	n	5
	126	18.2	2000376	9.1E-06	0.910	95% CI	0.062803
	134	21.0	2406104	8.73E-06	0.873		
Cutthroat	132	20.3	2299968	8.83E-06	0.883	mean	0.899
	91	8.6	753571	1.14E-05	1.141	ST dev	0.128333
	108	14.0	1259712	1.11E-05	1.111	n	6
	131	19.1	2248091	8.5E-06	0.850	95% CI	0.102688
	128	18.4	2097152	8.77E-06	0.877		
	113	14.8	1442897	1.03E-05	1.026		

Middle Sherman						Date	8/5/08
Species	Length (mm)	Weight (g)	L power 3	$(g)/L^3$	k		k
Dolly Varden	143	26.1	2924207	8.93E-06	0.893	mean	0.852
	128	12.0	2097152	5.72E-06	0.572	ST dev	0.110405
	143	19.7	2924207	6.74E-06	0.674	n	20
	151	30.4	3442951	8.83E-06	0.883	95% CI	0.048387
	184	61.2	6229504	9.82E-06	0.982		
	127	15.8	2048383	7.71E-06	0.771		
	149	22.7	3307949	6.86E-06	0.686		
	130	19.9	2197000	9.06E-06	0.906		
	99	8.8	970299	9.07E-06	0.907		
	124	15.5	1906624	8.13E-06	0.813		
	124	15.0	1906624	7.87E-06	0.787		
	100	9.3	1000000	9.3E-06	0.930		
	168	44.7	4741632	9.43E-06	0.943		
	128	20.1	2097152	9.58E-06	0.958		
	144	25.5	2985984	8.54E-06	0.854		
	154	32.9	3652264	9.01E-06	0.901		
	142	24.3	2863288	8.49E-06	0.849		
	183	51.9	6128487	8.47E-06	0.847		
	72	3.8	373248	1.02E-05	1.018		
	124	16.7	1906624	8.76E-06	0.876		

Upper Sherman						Date	8/4/08
Species	Length (mm)	Weight (g)	L power 3	$(g)/L^3$	k		k
Dolly Varden	136	23.5	2515456	9.34E-06	0.934	mean	0.916
	61	1.7	226981	7.49E-06	0.749	ST dev	0.062598
	127	19.5	2048383	9.52E-06	0.952	n	25
	127	17.3	2048383	8.45E-06	0.845	95% CI	0.024539
	151	31.2	3442951	9.06E-06	0.906		
	181	55.3	5929741	9.33E-06	0.933		
	124	19.2	1906624	1.01E-05	1.007		
	116	14.1	1560896	9.03E-06	0.903		
	145	27.4	3048625	8.99E-06	0.899		
	148	30.7	3241792	9.47E-06	0.947		
	172	46.3	5088448	9.1E-06	0.910		
	150	36.6	3375000	1.08E-05	1.084		
	165	42.8	4492125	9.53E-06	0.953		
	127	18.1	2048383	8.84E-06	0.884		
	149	30.3	3307949	9.16E-06	0.916		
	154	32.3	3652264	8.84E-06	0.884		
	144	28.2	2985984	9.44E-06	0.944		
	171	46.1	5000211	9.22E-06	0.922		
	131	21.5	2248091	9.56E-06	0.956		
	124	17.2	1906624	9.02E-06	0.902		
	106	10.9	1191016	9.15E-06	0.915		
	112	12.5	1404928	8.9E-06	0.890		
	107	9.8	1225043	8E-06	0.800		
	121	16.7	1771561	9.43E-06	0.943		
	152	32.2	3511808	9.17E-06	0.917		

Appendix 3d cont.

Lower Sweeny						Date	07/13/08
Location	Length (mm)	Weight (g)	L power 3	(g)/L^3	k		k
Cutthroat	143	27.6	2924207	9.44E-06	0.944	mean	0.912
	75	4.3	421875	1.02E-05	1.019	ST dev	0.078241
	73	3.6	389017	9.25E-06	0.925	n	19
	68	3.1	314432	9.86E-06	0.986	95% CI	0.035182
	173	39.0	5177717	7.53E-06	0.753		
	125	18.8	1953125	9.63E-06	0.963		
	122	15.9	1815848	8.76E-06	0.876		
	105	11.9	1157625	1.03E-05	1.028		
	69	3.3	328509	1E-05	1.005		
	126	16.9	2000376	8.45E-06	0.845		
	139	24.2	2685619	9.01E-06	0.901		
	138	22.5	2628072	8.56E-06	0.856		
	108	10.9	1259712	8.65E-06	0.865		
	71	3.3	357911	9.22E-06	0.922		
	134	23.7	2406104	9.85E-06	0.985		
	77	3.7	456533	8.1E-06	0.810		
	73	3.7	389017	9.51E-06	0.951		
	74	3.6	405224	8.88E-06	0.888		
	124	15.2	1906624	7.97E-06	0.797		

Middle Sweeny						Date	08/19/08
Location	Length (mm)	Weight (g)	L power 3	(g)/L^3	k		k
Dolly Varden	125	16.0	1953125	8.19E-06	0.819	mean	0.834
	80	4.4	512000	8.59E-06	0.859	ST dev	0.066828
	88	6.2	681472	9.1E-06	0.910	n	12
	85	4.8	614125	7.82E-06	0.782	95% CI	0.037811
	88	5.3	681472	7.78E-06	0.778		
	76	3.6	438976	8.2E-06	0.820		
	123	13.9	1860867	7.47E-06	0.747		
	40	0.6	64000	9.38E-06	0.938		
	46	0.8	97336	8.22E-06	0.822		
	73	3.7	389017	9.51E-06	0.951		
	111	10.6	1367631	7.75E-06	0.775		
	75	3.4	421875	8.06E-06	0.806		
Cutthroat	131	21.0	2248091	9.34E-06	0.934	mean	0.875
	185	63.2	6331625	9.98E-06	0.998	ST dev	0.082166
	69	2.9	328509	8.83E-06	0.883	n	13
	123	17.2	1860867	9.24E-06	0.924	95% CI	0.044666
	127	16.6	2048383	8.1E-06	0.810		
	115	12.5	1520875	8.22E-06	0.822		
	133	20.4	2352637	8.67E-06	0.867		
	82	4.6	551368	8.34E-06	0.834		
	106	12.6	1191016	1.06E-05	1.058		
	112	10.9	1404928	7.76E-06	0.776		
	123	15.5	1860867	8.33E-06	0.833		
	139	21.9	2685619	8.15E-06	0.815		
	133	19.4	2352637	8.25E-06	0.825		

Appendix 3d cont.

Upper Sweeny						Date	8/20/2008
Species	Length (mm)	Weight (g)	L power 3	(g)/L³	k		k
Dolly Varden	132	18.1	2299968	7.87E-06	0.787	mean	0.881
	79	4.2	493039	8.52E-06	0.852	ST dev	0.132196
	79	4.4	493039	8.92E-06	0.892	n	19
	42	0.9	74088	1.21E-05	1.215	95% CI	0.059443
	71	2.9	357911	8.1E-06	0.810		
	311	264.1	30080231	8.78E-06	0.878		
	223	76.1	11089567	6.86E-06	0.686		
	102	8.1	1061208	7.63E-06	0.763		
	51	1.4	132651	1.06E-05	1.055		
	42	0.5	74088	6.75E-06	0.675		
	75	3.4	421875	8.06E-06	0.806		
	79	5.0	493039	1.01E-05	1.014		
	73	3.1	389017	7.97E-06	0.797		
	301	255.2	27270901	9.36E-06	0.936		
	293	218.4	25153757	8.68E-06	0.868		
	129	18.3	2146689	8.52E-06	0.852		
	121	18.5	1771561	1.04E-05	1.044		
	192	65.9	7077888	9.31E-06	0.931		
	223	96.9	11089567	8.74E-06	0.874		
Cutthroat	157	33.4	3869893	8.63E-06	0.863	mean	0.868
	172	43.1	5088448	8.47E-06	0.847	ST dev	0.042424
	126	18.2	2000376	9.1E-06	0.910	n	7
	112	11.9	1404928	8.47E-06	0.847	95% CI	0.031428
	122	16.5	1815848	9.09E-06	0.909		
	121	14.1	1771561	7.96E-06	0.796		
	112	12.7	1404928	9.04E-06	0.904		

Lower Johnson						Date	07/11/08
Species	Length (mm)	Weight (g)	L power 3	(g)/L³	k		k
Dolly Varden	97	7.4	912673	8.11E-06	0.811	mean	0.865
	77	4.0	456533	8.76E-06	0.876	ST dev	0.319332
	96	8.6	884736	9.72E-06	0.972	n	25
	65	2.2	274625	8.01E-06	0.801	95% CI	0.125178
	78	4.2	474552	8.85E-06	0.885		
	59	4.8	205379	2.34E-05	2.337		
	68	2.7	314432	8.59E-06	0.859		
	69	2.7	328509	8.22E-06	0.822		
	75	2.7	421875	6.4E-06	0.640		
	110	11.3	1331000	8.49E-06	0.849		
	122	12.2	1815848	6.72E-06	0.672		
	71	2.6	357911	7.26E-06	0.726		
	74	3.2	405224	7.9E-06	0.790		
	74	3.5	405224	8.64E-06	0.864		
	76	3.2	438976	7.29E-06	0.729		
	77	3.4	456533	7.45E-06	0.745		
	62	2.1	238328	8.81E-06	0.881		
	71	3.5	357911	9.78E-06	0.978		
	59	1.8	205379	8.76E-06	0.876		
	92	5.3	778688	6.81E-06	0.681		
	66	2.2	287496	7.65E-06	0.765		
	128	14.7	2097152	7.01E-06	0.701		
	120	12.2	1728000	7.06E-06	0.706		
	115	12.2	1520875	8.02E-06	0.802		
	104	9.7	1124864	8.62E-06	0.862		
Cutthroat	87	4.9	658503	7.44E-06	0.744	mean	0.744

Appendix 3d cont.

Middle Johnson						Date	08/18/08
Species	Length (mm)	Weight (g)	L power 3	$(g)/L^3$	k		k
Dolly Varden	179	44.4	5735339	7.74E-06	0.774	mean	0.849
	214	79.6	9800344	8.12E-06	0.812	ST dev	0.09632
	205	76.2	8615125	8.84E-06	0.884	n	40
	219	84.2	10503459	8.02E-06	0.802	95% CI	0.02985
	90	6.2	729000	8.5E-06	0.850		
	192	60.6	7077888	8.56E-06	0.856		
	222	91.5	10941048	8.36E-06	0.836		
	148	26.0	3241792	8.02E-06	0.802		
	182	52.0	6028568	8.63E-06	0.863		
	148	24.9	3241792	7.68E-06	0.768		
	99	7.7	970299	7.94E-06	0.794		
	96	6.8	884736	7.69E-06	0.769		
	148	30.9	3241792	9.53E-06	0.953		
	159	31.1	4019679	7.74E-06	0.774		
	178	44.0	5639752	7.8E-06	0.780		
	165	37.2	4492125	8.28E-06	0.828		
	185	49.6	6331625	7.83E-06	0.783		
	194	67.8	7301384	9.29E-06	0.929		
	205	77.2	8615125	8.96E-06	0.896		
	126	16.5	2000376	8.25E-06	0.825		
	195	77.3	7414875	1.04E-05	1.042		
	80	4.3	512000	8.4E-06	0.840		
	90	6.3	729000	8.64E-06	0.864		
	180	55.1	5832000	9.45E-06	0.945		
	144	26.9	2985984	9.01E-06	0.901		
	184	75.5	6229504	1.21E-05	1.212		
	89	5.5	704969	7.8E-06	0.780		
	172	48.0	5088448	9.43E-06	0.943		
	169	45.9	4826809	9.51E-06	0.951		
	72	3.1	373248	8.31E-06	0.831		
	174.0	43.9	5268024	8.33E-06	0.833		
	107.0	9.6	1225043	7.84E-06	0.784		
	77.0	4.2	456533	9.2E-06	0.920		
	129.0	16.8	2146689	7.83E-06	0.783		
	183.0	56.7	6128487	9.25E-06	0.925		
	177.0	47.1	5545233	8.49E-06	0.849		
	85.0	4.8	614125	7.82E-06	0.782		
	207.0	53.5	8869743	6.03E-06	0.603		
	108.0	9.7	1259712	7.7E-06	0.770		
	80.0	4.2	512000.0	8.2E-06	0.820313		

Upper Johnson						Date	09/02/08
Species	Length (mm)	Weight (g)	L power 3	$(g)/L^3$	k		k
Dolly Varden	171	41.2	5000211	8.24E-06	0.824	mean	0.918
	211	78.2	9393931	8.32E-06	0.832	ST dev	0.266246
	146	65.9	3112136	2.12E-05	2.118	n	23
	170	42.3	4913000	8.61E-06	0.861	95% CI	0.108812
	159	33.3	4019679	8.28E-06	0.828		
	202	73.4	8242408	8.91E-06	0.891		
	189	56.4	6751269	8.35E-06	0.835		
	169	40.7	4826809	8.43E-06	0.843		
	151	28.5	3442951	8.28E-06	0.828		
	168	41.1	4741632	8.67E-06	0.867		
	164	39.2	4410944	8.89E-06	0.889		
	148	26.3	3241792	8.11E-06	0.811		
	140	21.8	2744000	7.94E-06	0.794		
	82	4.8	551368	8.71E-06	0.871		
	209	77.7	9129329	8.51E-06	0.851		
	159	36.6	4019679	9.11E-06	0.911		
	154	33.5	3652264	9.17E-06	0.917		
	149	27.3	3307949	8.25E-06	0.825		
	166	37.9	4574296	8.29E-06	0.829		
	169	42.4	4826809	8.78E-06	0.878		
	177	55.2	5545233	9.95E-06	0.995		
	138	22.0	2628072	8.37E-06	0.837		
	182	59.3	6028568	9.84E-06	0.984		

Appendix 3d cont.

Lower Slate						Date	07/14/08
Species	Length (mm)	Weight (g)	L power 3	$(g)/L^3$	k		k
Cutthroat	92	6.3	778688	8.09E-06	0.809	mean	0.806
	100	8.0	1000000	0.000008	0.800	ST dev	0.073015
	123	15.1	1860867	8.11E-06	0.811	n	12
	124	15.3	1906624	8.02E-06	0.802	95% CI	0.041312
	135	20.1	2460375	8.17E-06	0.817		
	118	13.0	1643032	7.91E-06	0.791		
	123	14.1	1860867	7.58E-06	0.758		
	115	9.4	1520875	6.18E-06	0.618		
	66	2.4	287496	8.35E-06	0.835		
	79	4.5	493039	9.13E-06	0.913		
	116	14.0	1560896	8.97E-06	0.897		
	101	8.4	1030301	8.15E-06	0.815		
Dolly Varden	110	9.6	1331000	7.21E-06	0.721	mean	0.764
	87	4.8	658503	7.29E-06	0.729	ST dev	0.068106
	76	3.7	438976	8.43E-06	0.843	n	3
						95% CI	0.077069

Middle Slate						Date	08/26/08
Species	Length (mm)	Weight (g)	L power 3	$(g)/L^3$	k		k
Dolly Varden	60	1.9	216000	8.8E-06	0.880	mean	0.870
	60	1.9	216000	8.8E-06	0.880	ST dev	0.019089
	63	2.2	250047	8.8E-06	0.880	n	4
	181	49.9	5929741	8.42E-06	0.842	95% CI	0.018707

Upper Slate						Date	08/27/08
Location	Length (mm)	Weight (g)	L power 3	$(g)/L^3$	k		k
Dolly Varden	36	0.5	46656	1.07E-05	1.072	mean	0.852
	39	0.6	59319	1.01E-05	1.011	ST dev	0.168537
	32	0.3	32768	9.16E-06	0.916	n	38
	64	2.2	262144	8.39E-06	0.839	95% CI	0.053587
	123	12.6	1860867	6.77E-06	0.677		
	115	11.4	1520875	7.5E-06	0.750		
	37	0.7	50653	1.38E-05	1.382		
	34	0.3	39304	7.63E-06	0.763		
	38	0.3	54872	5.47E-06	0.547		
	78	3.5	474552	7.38E-06	0.738		
	78	3.7	474552	7.8E-06	0.780		
	39	0.4	59319	6.74E-06	0.674		
	37	0.3	50653	5.92E-06	0.592		
	72	3.4	373248	9.11E-06	0.911		
	39	0.5	59319	8.43E-06	0.843		
	73	3.4	389017	8.74E-06	0.874		
	69	2.6	328509	7.91E-06	0.791		
	64	2.4	262144	9.16E-06	0.916		
	70	2.7	343000	7.87E-06	0.787		
	32	0.4	32768	1.22E-05	1.221		
	41	0.6	68921	8.71E-06	0.871		
	64	2.2	262144	8.39E-06	0.839		
	114	12.0	1481544	8.1E-06	0.810		
	75	3.9	421875	9.24E-06	0.924		
	67	2.6	300763	8.64E-06	0.864		
	65	2.6	274625	9.47E-06	0.947		
	67	2.5	300763	8.31E-06	0.831		
	72	3.5	373248	9.38E-06	0.938		
	42	0.7	74088	9.45E-06	0.945		
	63	1.9	250047	7.6E-06	0.760		
	65	2.2	274625	8.01E-06	0.801		
	78	4.5	474552	9.48E-06	0.948		
	41	0.5	68921	7.25E-06	0.725		
	38	0.3	54872	5.47E-06	0.547		
	67	3.1	300763	1.03E-05	1.031		
	74	4.1	405224	1.01E-05	1.012		
	32	0.2	32768	6.1E-06	0.610		
	118	14.8	1643032	9.01E-06	0.901		

APPENDIX 4A: ADFG FISH RESOURCE PERMIT
(SF2008-040d; fry counts)

STATE OF ALASKA
DEPARTMENT OF FISH AND GAME

P.O. BOX 115525
JUNEAU, ALASKA 99811-5525

Permit #: SF2008-040

Expires: 6/30/2008

Collections Report Due: 7/30/2008

FISH RESOURCE PERMIT
(For Scientific/Educational Purposes)

This permit authorizes Liz Flory *(whose signature is required on page 2 for permit validation)*
person

of Coeur Alaska,Inc. (agency or organization) **at** 3031 Clinton Drive, Suite 202, Juneau, Alaska 99801 (address)

to conduct the following activities **from** April 1, 2008 **to** June 30, 2008 in accordance with AS 16.05.930:

Purpose: To estimate the number of out-migrating pink salmon fry in creeks designated by an EPA issued NPDES permit for the Kensington Mine.

Location: Sherman Creek-Lynn Canal; Slate/Johnson Creeks-Berners Bay.

Species Collected: Pink/chum/coho salmon, Dolly Varden, cutthroat trout, eulachon, and coast-range sculpin

Method of Capture: Fyke nets with adjustable wings or incline plane trap **(see Permit Stipulations #2)**

Final Disposition: All fish must be released alive back into the system they were captured.
No more than the following numbers of mostly juvenile fish may be handled;
≤250K Pink salmon *≤2K Chum salmon* *≤.5K Coho salmon* *≤50 Dolly Varden* *≤50 Cutthroat trout* *≤100 Eulachon* *≤1K sculpin*
≤7,500 Pink salmon smolts may be marked with Bismarck Brown dye and released upstream of their capture site with the goal of determining smolt trap catch efficiency.

-Continued on Back-

REPORT DUE July 30, 2008. The report shall include species, numbers, dates, and locations of collection (datum/GPS coordinates in the decimal degrees format (dd.ddddd)) and disposition, and if applicable, sex, age, and breeding condition, and lengths and weights of fish. It must also include the date/time the local biologist was contacted for final authorization to carry out collecting activities. A completion report (abstract, background, methods, data, analysis), if not submitted with the collection report described above, must be submitted to the department by: *Month/year*. Data from such reports are considered public information. The report shall also include other information as may be required under the permit stipulations section.

GENERAL CONDITIONS, EXCEPTIONS AND RESTRICTIONS

1. This permit must be carried by person(s) specified during approved activities who shall show it on request to persons authorized to enforce Alaska's fish and game laws. This permit is nontransferable and will be revoked or renewal denied by the Commissioner of Fish and Game if the permittee violates any of its conditions, exceptions or restrictions. No redelegation of authority may be allowed under this permit unless specifically noted.
2. No specimens taken under authority hereof may be sold or bartered. All specimens must be deposited in a public museum or a public scientific or educational institution unless otherwise stated herein. Subpermittees shall not retain possession of live animals or other specimens.
3. The permittee shall keep records of all activities conducted under authority of this permit, available for inspection at all reasonable hours upon request of any authorized state enforcement officer.
4. Permits will not be renewed until the department has received detailed reports, as specified above.
5. UNLESS SPECIFICALLY STATED HEREIN, THIS PERMIT DOES NOT AUTHORIZE the exportation of specimens or the taking of specimens in areas otherwise closed to hunting and fishing; without appropriate licenses required by state regulations; during closed seasons; or in any manner, by any means, at any time not permitted by those regulations.

Bob Piorkowski
Fish Resource Permit Coordinator
Division of Sport Fish

[signature]
Director
Division of Sport Fish

2/29/08
Date

Authorized Personnel: The following persons may perform collecting activities under terms of this permit:

Koren Bosworth, Chris Frank, Brian Flory, Elizabeth Flory, Chris Frank, Nicole Kohler, Johnse Ostman, Ray Pohl, John Randolph, Kate Savage, Pete Strow

Employees and volunteers under the direct supervision of, and in the presence of, one of the authorized personnel listed above may participate in collecting activities under terms of this permit.

Permit Stipulations:

1) The local Area Management Biologist, **Brian Glynn** (465-4318; brian.glynn@alaska.gov) Juneau, must be notified **prior** to you engaging in any collecting activities. This biologist has the right to specify methods for collecting, as well as limiting the collections, of any species by number, time and location.
2) The stream channel may not be blocking by capture gear. Fyke nets and inclined plane traps must be operated in such a manner as to allow cutthroat trout and Dolly Varden to migrate freely up and down stream.
3) All unattended sampling gear must be; 1) labeled with the permittee's name, telephone number, and permit number, 2) securely tied to substrate, 3) located with GPS coordinates, and 4) accounted for/removed at the conclusion of sampling.
4) If anadromous fish are found in permitted streams and rivers, the permit holder will work closely with ADF&G to see that information is included in the database for the *Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes.* Anadromous fish include *Oncorhynchus spp.*, Arctic char, Dolly Varden, sheefish, smelts, lamprey, whitefish, and sturgeon. Please direct questions to J. Johnson, 267-2337 or j.johnson@alaska.gov
5) **Atlantic salmon** and other **non-native invasive aquatic species** encountered should be killed. The nearest ADF&G office (**see Stipulation # 1**) must be contacted immediately with species identification or description, capture or sighting location, number captured, size, and sex. Preserve/turn in the whole specimen to the nearest ADF&G office.
6) *A Title 41 Permit is required from Alaska Department of Natural Resources, Office of Habitat Management and Permitting, to place structures (weir, etc.) in streams.*
7) *A copy of this permit, including any amendments, must be made available at all field collection sites and project sites for inspection upon request by a representative of the department or a law enforcement officer.*
8) Issuance of this permit does not absolve the permittee from compliance in full with any and all other applicable federal, state, or local laws, regulations, or ordinances.
9) A **report of collecting activities**, referenced to this fish resource permit number, must be submitted to the Alaska Department of Fish and Game, Division of Sport Fish HQ, P.O. Box 115525, Juneau, AK 99811-5525, Attention: Bob Piorkowski (465-6109; Robert.Piorkowski@alaska.gov), within 30 days after the expiration of this permit. This report must summarize the number of fish captured by date, by location (provide GPS coordinates and datum), and by species, and the fate of those fish. Fish length, weight, sex, and age data should be included if collected. A completion report (abstract/background/methods /data/analysis), if not submitted with the collection report described above, must be submitted to the department within six months of the expiration of the permit. Data from such reports are considered public information. A report is required whether or not collecting activities were undertaken. A report should also be sent to the Biologist(s) listed under **Stipulation #1**.

PERMIT VALIDATION requires permittee's signature agreeing to abide by permit conditions before beginning collecting activities:

____

Signature of Permittee

cc: Brian Glynn, Division of Sport Fish, Juneau
Kevin Monagle, Division of Commercial Fish, Juneau
Randy Bachman, Division of Commercial Fisheries, Haines
Jackie Timothy, ADNR, Office of Habitat Management and Permitting, Juneau
Fish and Wildlife Protection, Juneau

STATE OF ALASKA
DEPARTMENT OF FISH AND GAME-SPORT FISH
P.O. BOX 115525
JUNEAU, ALASKA 99811-5525

FISH RESOURCE PERMIT AMENDMENT #1

Permit No. SF2008-040

Permit Issued To: ***Liz Flory*** *(signature required below for permit validation)*

This amendment of Fish Resource Permit SF2008-040:

1) *under* **Authorized Personnel,** *edits the list in the following manner:*

Deletes "Chris Frank"
Adds "Brian Maupin and Charmagne Gutierrez"

All other conditions specified in Fish Resource Permit SF2008-040 remain in effect.

This amendment must be attached to the original permit.

Bob Piorkowski
Division of Sport Fish

April 25, 2008
Date

PERMIT AMENDMENT VALIDATION requires permittee's signature agreeing to abide by conditions of this permit amendment:

Signature of Permittee

cc: Brian Glynn, Division of Sport Fish, Juneau
Kevin Monagle, Division of Commercial Fish, Juneau
Randy Bachman, Division of Commercial Fisheries, Haines
Jackie Timothy, ADNR-OHMP, Juneau
Fish and Wildlife Protection, Juneau

APPENDIX 4B: ADNR FISH HABITAT PERMIT
(for fry counts)

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES
OFFICE OF HABITAT MANAGEMENT AND PERMITTING
JUNEAU AREA OFFICE

FRANK H. MURKOWSKI, GOVERNOR

400 WILLOUGHBY AVENUE, 4th FLOOR
PO BOX 111050
JUNEAU, ALASKA 99801-1050
PHONE: (907) 465-4105
FAX: (907) 465-4759

FISH HABITAT PERMITS
FH06-I-0024, FH06-I-0025, and FH06-I-0026

ISSUED: March 23, 2006
EXPIRES: December 31, 2011

Ms. Liz Flory
Coeur Alaska, Inc.
3031 Clinton Drive
Juneau, AK 99801

RE: Installation of Temporary Fish Weirs
Sherman Creek (Stream #115-31-10330)
Slate Creek (Stream #115-20-10030)
Johnson Creek (Stream #115-20-10070)
T. 35 S., R. 62 E., C.R.M. (Juneau D-4)

Dear Ms. Flory:

Pursuant to AS 41.14.870(b), the Alaska Department of Natural Resources (DNR) Office of Habitat Management and Permitting (OHMP) has reviewed your proposal to install temporary fish weirs in Sherman Creek, Slate Creek and Johnson Creek to monitor out-migrating salmon fry. Weirs will be in place from early April until fish numbers diminish in late May or early June.

Anadromous Fish Act and Coastal Consistency Requirements

Sherman Creek (Stream #115-31-10330), Slate Creek (Stream #115-20-10030), and Johnson Creek (Stream #115-20-10070) have been specified as being important for the spawning, rearing, or migration of anadromous fish pursuant to AS 41.14.870(a). Pink salmon are present in Sherman Creek; coho, pink and chum salmon are present in Slate Creek and Johnson Creek. Installation of temporary fish weirs is consistent with the Standards of the Alaska Coastal Management Program under Generally Consistent Determination GCD-6, *Temporary Fish Research and Management Facilities*, provided you conduct the project as described above and adopt the standard alternative measures. I have attached GCD 6 for your information.

In accordance with AS 41.14.870(d) and 11 AAC 110, your project is approved according to the project description, standard alternative measures, and the terms of this permit.

FH06-I-0024 authorizes placement of a weir in Sherman Creek
FH06-I-0025 authorizes placement of a weir in Slate Creek
FH06-I-0026 authorizes placement of a weir in Johnson Creek

You are responsible for the actions of contractors, agents, or other persons who perform work to accomplish the approved project. For any activity that significantly deviates from the approved plan, you shall notify OHMP and obtain written approval in the form of a permit amendment before beginning the activity. Any action that increases the project's overall scope or that negates, alters, or minimizes the intent or effectiveness of any stipulation contained in this permit will be deemed a significant deviation from the approved plan. The final determination as to the significance of any deviation and the need for a permit amendment is the responsibility of the OHMP. Therefore, it is recommended you consult OHMP immediately when a deviation from the approved plan is being considered.

This letter constitutes a permit issued under the authority of AS 41.14.870. This permit must be retained on site during construction. Please be advised that this determination applies only to activities regulated by OHMP; other divisions with ADNR also may have jurisdiction under their respective authorities. This determination does not relieve you of your responsibility to secure other permits; state, federal, or local. You are still required to comply with all other applicable laws.

In addition to the penalties provided by law, this permit may be terminated or revoked for failure to comply with its provisions or failure to comply with applicable statutes and regulations. The department reserves the right to require mitigation measures to correct disruption to fish created by the project which was a direct result of failure to comply with this permit or any applicable law.

You shall indemnify, save harmless, and defend the department, its agents, and its employees from any and all claims, actions or liabilities for injuries or damages sustained by any person or property arising directly or indirectly from permitted activities or your performance under this permit. However, this provision has no effect if, and only if, the sole proximate cause of the injury is the department's negligence.

This permit decision may be appealed in accordance with the provisions of AS 44.62.330-630.

If you have any questions, please contact Carl Schrader at (907) 465-4287 or email carl_schrader@dnr.state.ak.us.

Sincerely,

Edmund J. Fogels
Acting Deputy Commissioner

Timothy

By Jackie Timothy
Office of Habitat Management and Permitting
Department of Natural Resources

Email cc:

Al Ott, OHMP, Fairbanks
Carl Schrader, OHMP, Juneau
Joe Donohue, OPMP, Juneau
Tom Crafford, OPMP, Anchorage
Brian Glynn, ADF&G-SF, Juneau
Randy Bachman, ADF&G-CF, Haines
Mark Fink, ADF&G-SF, Anchorage

GENERALLY CONSISTENT DETERMINATION GCD-6

TEMPORARY FISH RESEARCH AND MANAGEMENT FACILITIES

The following activity is consistent with the Alaska Coastal Management Program per 11 AAC 110.730 when conducted according to the standard alternative measures listed below. This approval does not relieve the applicant from obtaining required permits and approvals from local, State, and federal individual agencies.

For activities subject to this generally consistent determination, the applicant is not automatically required to complete a CPQ. DFG may require a CPQ for project proposals where it is uncertain whether other State and federal authorizations may be required.

DESCRIPTION OF THE ACTIVITY

Seasonal construction, maintenance, operation, and removal of temporary fish weirs, counting towers, sonar arrays, holding pens, and other sampling or research facilities for the purpose of fisheries research, management, or enhancement. Camp facilities are excluded from this generally consistent determination, but may qualify for approval under generally consistent determination GCD-23.

Authority: AS 41.14.840
AS 41.14.870
AS 16.20
AS 38.05.850
5 AAC 95

Permits: Fish Habitat Permit (OHMP)
Special Area Permit (DFG)
Land Use Permit (DNR)

Region: Statewide

STANDARD ALTERNATIVE MEASURES

1. Streambanks shall not be disturbed. If streambanks are inadvertently disturbed by activities attributable to this project, they shall be immediately stabilized to prevent erosion and the resultant sedimentation of streams which could occur both during and after operations.

2. Facilities shall be operated and maintained as required by DFG and OHMP to prevent unnecessary sampling mortality and ensure that fish mortality caused by delays in migration do not occur.

APPENDIX 4C: MARK-RECAPTURE DATA FOR FRY POPULATION ESTIMATES

Appendix 4c: Daily Fry Counts and Population Estimates.

	Sherman Creek							
	Total PK Caught	Total PK Released	Total PK Recaptured					Total PK Population Estimate
	29180	**2010**	**349**					**136479**
Date	Total PK Caught	Total Released per event	Total Recaptured per day	% Recaptured per day	Total Recaptured per event	% Recaptured per event	Mean Recapture Rate	Daily Population Estimate
2-Apr								
3-Apr								
4-Apr								
5-Apr								
6-Apr								
7-Apr								
8-Apr								
9-Apr	273	100	20	20.00			0.31	881
10-Apr	479	0	11	11.00	31		0.31	1545
11-Apr	773	0	0	0.00		31.00	0.26	2973
12-Apr	408	100	11	11.00	11		0.26	1569
13-Apr	154	0	0	0.00		11.00	0.26	592
14-Apr	495	150	18	12.00			0.26	1904
15-Apr	180	0	2	1.33	20		0.26	692
16-Apr	863	0	0	0.00		13.33	0.26	3319
17-Apr	734	150	31	20.67			0.26	2823
18-Apr	209	0	1	0.67	32		0.26	804
19-Apr	416	0	0	0.00		21.33	0.35	1200
20-Apr	696	150	56	37.33			0.48	1450
21-Apr	1205	0	16	10.67	72		0.36	3347
22-Apr	2314	0	0	0.00			0.36	6428
23-Apr	2466	0	0	0.00		48.00	0.36	6850
24-Apr	1367	150	36	24.00	36		0.36	3797
25-Apr	693	0	0	0.00		24.00	0.36	1925
26-Apr	1232	150	20	13.33			0.22	5600
27-Apr	2150	0	10	6.67	30		0.22	9773
28-Apr	872	0	0	0.00			0.22	3964
29-Apr	412	0	0	0.00		20.00	0.18	2289
30-Apr	619	150	17	11.33	17		0.18	3439
1-May	703	0	0	0.00		11.33	0.18	3906
2-May	557	150	14	9.33			0.18	3094
3-May	1224	0	1	0.67	15		0.18	6800
4-May	978	0	0	0.00		10.00	0.18	5433
5-May	445	150	18	12.00			0.18	2472
6-May	432	0	1	0.67	19		0.18	2400
7-May	522	0	0	0.00		12.67	0.18	2900
8-May	635	149	23	15.44			0.18	3528
9-May	698	0	0	0.00	23		0.14	4967
10-May	846	0	0	0.00		15.44	0.12	7020
11-May	542	150	13	8.67			0.12	4497
12-May	876	0	0	0.00	13		0.12	7269
13-May	479	0	0	0.00		8.67	0.11	4508
14-May	468	150	15	10.00			0.11	4405
15-May	134	0	0	0.00			0.11	1261
16-May	18	0	0	0.00	15		0.13	138
17-May	0	0	0	0.00			0.13	0
18-May	123	0	0	0.00			0.13	946
19-May	46	0	0	0.00		10.00	0.13	354
20-May	113	106	14	13.21			0.13	869
21-May	84	0	0	0.00	14		0.13	646
22-May	141	0	0	0.00			0.13	1085
23-May	32	0	0	0.00		13.21	0.13	246
24-May	57	55	1	1.82	1		0.13	438
25-May	17	0	0	0.00		1.82	0.13	131
Totals	**29180**							**136479**

Appendix 4c cont.

Slate Creek							
Total PK Caught	Total PK Released	Total PK Recaptured					Total PK Population Estimate
14490	**1063**	**339**					**18501**
Total PK Caught	Total Released per event	Total Recaptured per day	% Recaptured per day	Total Recaptured per event	% Recaptured per event	Mean Racapture Rate	Daily Population Estimate
68	0	0	0.00			0.27	253
11	0	0	0.00			0.27	41
32	30	0	0.00	0		0.27	119
79	0	0	0.00			0.27	294
78	0	0	0.00			0.27	291
264	0	0	0.00		0.00	0.27	983
461	150	2	0.00	2		0.27	1717
35	0	0	0.00			0.27	130
7	0	0	0.00			0.27	26
19	0	0	0.00			0.27	71
195	0	0	0.00		1.33	0.27	726
181	149	40	26.85	40		0.27	674
96	0	0	0.00			0.37	263
51	0	0	0.00		26.85	0.37	140
312	150	59	39.33	59		0.37	855
649	0	0	0.00			0.41	1570
832	0	0	0.00		39.33	0.41	2013
1042	150	65	43.33	65		0.41	2521
118	0	0	0.00			0.54	217
375	0	0	0.00		43.33	0.54	690
585	150	96	64.00	98		0.65	895
732	0	2	1.33			0.65	1120
200	0	0	0.00			0.65	306
0	0	0	0.00		65.33	0.65	0
86	75	16	21.33	49		0.65	132
61	0	0	0.00		65.33	0.45	136
159	135	33	24.44	33		0.24	650
117	0	0	0.00			0.24	479
88	0	0	0.00		24.44	0.24	360
88	45	11	24.44	11		0.24	360
32	0	0	0.00			0.38	84
18	0	0	0.00		24.44	0.38	47
32	29	13	44.83	15		0.52	62
83	0	2	0.00			0.52	160
3	0	0	0.00			0.52	6
56	0	0	0.00		51.72	0.52	108
7245							**18501**

Appendix 4c cont.

	Johnson Creek							
	Total PK Caught	Total PK Released	Total PK Recaptured					Total PK Population Estimate
	136103	**2665**	**266**					**714357**
Date	Total PK Caught	Total Released per event	Total Recaptured per day	% Recaptured per day	Total Recaptured per event	% Recaptured per event	Mean Racapture Rate	Daily Population Estimate
2-Apr	248	120	0	0.00			0.23	1078
3-Apr	403	0	4	3.33	4		0.23	1752
4-Apr	1167	0	0	0.00		3.33	0.23	5074
5-Apr	1885	149	6	4.03			0.23	8196
6-Apr	1425	0	0	0.00	6		0.23	6196
7-Apr	1480	0	0	0.00		4.03	0.23	6435
8-Apr	480	150	0	0.00			0.23	2087
9-Apr	923	0	13	8.67	13		0.23	4013
10-Apr	1897	0	0	0.00			0.23	8248
11-Apr	3110	0	0	0.00		8.67	0.23	13522
12-Apr	5531	150	4	2.67	4		0.23	24048
13-Apr	3891	0	0	0.00		2.67	0.23	16917
14-Apr	1524	150	0	0.00			0.16	9525
15-Apr	1021	0	0	0.00	0		0.16	6381
16-Apr	10215	0	0	0.00			0.60	17025
17-Apr	1494	0	0	0.00		0.00	0.23	6496
18-Apr	202	150	15	10.00	34		0.23	878
19-Apr	3718	0	19	12.67		22.67	0.23	16165
20-Apr	9760	150	13	8.67			0.50	19520
21-Apr	1757	0	3	2.00	16		0.26	6758
22-Apr	1644	0	0	0.00		10.67	0.26	6323
23-Apr	1503	150	32	21.33			0.26	5781
24-Apr	4273	0	7	4.67	39		0.26	16435
25-Apr	2594	0	0	0.00		26.00	0.23	11278
26-Apr	3058	148	0	0.00			0.23	13296
27-Apr	3242	0	1	0.68	1		0.23	14096
28-Apr	4406	0	0	0.00		0.68	0.23	19157
29-Apr	3672	148	23	15.54			0.23	15965
30-Apr	6098	0	6	4.05	29		0.23	26513
1-May	3691	0	0	0.00		19.59	0.15	24607
2-May	4923	150	9	6.00			0.15	32820
3-May	2908	0	3	2.00	12		0.15	19387
4-May	3847	0	0	0.00		8.00	0.15	25647
5-May	3809	150	10	6.67			0.15	25393
6-May	3570	0	5	3.33	15		0.15	23800
7-May	2924	0	0	0.00		10.00	0.15	19493
8-May	3364	150	7	4.67			0.15	22427
9-May	3820	0	1	0.67	8		0.11	34727
10-May	3202	0	0	0.00		5.33	0.11	29109
11-May	2477	150	17	11.33			0.11	22518
12-May	2004	0	0	0.00	17		0.11	18218
13-May	1183	0	0	0.00		11.33	0.11	10755
14-May	1179	150	13	8.67			0.11	10718
15-May	1025	0	0	0.00			0.11	9318
16-May	1025	0	0	0.00	13		0.12	8542
17-May	1025	0	0	0.00			0.12	8542
18-May	1025	0	0	0.00		8.67	0.12	8542
19-May	1025	150	18	12.00			0.12	8542
20-May	871	0	0	0.00	19		0.14	6221
21-May	781	0	1	0.67		12.67	0.14	5579
22-May	842	150	22	14.67			0.14	6014
23-May	574	0	0	0.00	22		0.14	4100
24-May	1229	0	0	0.00		14.67	0.12	10242
25-May	684	150	12	8.00			0.12	5700
26-May	453	0	2	1.33			0.12	3775
27-May	11	0	0	0.00	14		0.12	92
28-May	11	0	0	0.00			0.12	92
29-May	34	0	0	0.00		9.33	0.12	283
Totals	**136103**							**714357**

APPENDIX 5: WEEKLY SALMON COUNTS

Appendix 5: Weekly salmon counts for Sherman, Sweeny, Johnson and Slate in 2008.

Sherman Creek Adult Pink Salmon Count

	7/30/2008		8/5/2008		8/11/2008		8/18/2008	
Reach	**# Live**	**# Dead**	**# Live**	**# Dead**	**# Live**	**# Dead**	**# Live**	**# Dead**
intertidal	0	0	44	3	39	0	30	6
0-50	16	0	24	0	41	2	65	0
50-100	0	0	4	0	8	1	12	0
100-150	4	0	16	1	45	0	40	2
150-200	6	0	32	0	56	0	50	1
200-250	4	0	26	0	51	0	28	2
250-300	2	0	8	0	29	1	32	4
300-350	12	0	34	0	50	0	62	0
falls pool	12	0	15	0	28	3	20	0
Total	56	0	203	4	347	7	339	15
	8/25/2008		**9/1/2008**		**9/8/2008**		**9/17/2008**	
Reach	**# Live**	**# Dead**	**# Live**	**# Dead**	**# Live**	**# Dead**	**# Live**	**# Dead**
Intertidal	30	2	5	1	1	0	Zero fish	
0-50	55	2	27	5	6	0	Very high flow	
50-100	12	1	5	0	2	1	could only hike to 50m	
100-150	40	0	44	2	0	0		
150-200	45	0	58	3	4	0		
200-250	30	0	26	1	3	0		
250-300	32	0	55	5	6	0		
300-350	36	0	26	1	2	0		
falls pool	10	0	11	1	1	0		
Total	290	5	257	19	25	1	0	0

Johnson Creek Adult Pink Salmon Count

	7/28/2008		8/5/2008		8/11/2008		8/18/2008	
	# Live	**# Dead**	**# Live**	**# Dead**	**# Live**	**# Dead**	**# Live**	**# Dead**
Lace Trib.	150	0	300	0	230	0	220	0
John Mouth	220	0	200	0	300	0	350	1
Trap Site	150	0	900	3	1000	0	800	0
Marker 4	300	0	500	0	900	0	600	2
Marker 8	340	0	1200	0	820	30	1100	6
Marker 10	200	0	600	0	1000	0	400	0
Marker 12	0	0	300	0	500	0	200	0
Powerhouse	0	0	200	0	300	0	200	1
Marker 15	0	0	20	0	170	0	20	0
Total	1360	0	4220	3	5220	30	3890	10
	8/25/2008		**9/1/2008**		**9/8/2008**		**9/17/2007**	
	# Live	**# Dead**	**# Live**	**# Dead**	**# Live**	**# Dead**	**# Live**	**# Dead**
Lace	10	0	0	0	0	0	Zero fish	
Mouth	0	0	0	0	0	0	Hiked down to Trap site	
Trap Site	200	10	10	10	5	0	Gage Underwater	
#4	300	50	30	15	15	5		
#8	200	50	15	5	10	3		
#10	100	10	5	10	0	0		
#12	50	0	10	25	0	0		
Powerhouse	20	0	0	0	0	0		
#15	0	0	0	0	0	0		
Total	880	120	70	65	30	8	0	0

Appendix 5 cont.

Sweeny Creek Adult Pink Salmon Count

	7/28/2008		8/4/2008		8/11/2008		8/19/2008	
Reach	# Live	# Dead	# Live	# Dead	# Live	# Dead	# Live	# Dead
intertidal	0	0	1	0	5	0	1	1
0-50	0	0	1	0	6	1	24	4
50-100	0	0	2	0	10	1	30	3
100-150	0	0	0	1	5	0	15	2
150-200	0	0	2	1	9	2	10	1
200-250	0	0	0	0	5	1	10	4
250-300	0	0	7	1	11	2	33	11
300-350	0	0	1	1	1	0	3	3
350-400	0	0	0	0	6	2	14	7
400-450	NC	NC	NC	NC	4	2	17	11
450-500	NC	NC	NC	NC	0	0	40	9
500-550	NC	NC	NC	NC	NC	NC	20	6
550-600	NC	NC	NC	NC	NC	NC	12	0
600-650	NC	NC	NC	NC	NC	NC	6	0
650-700	NC	NC	NC	NC	NC	NC	7	0
700-750	NC	NC	NC	NC	NC	NC	6	0
750-800	NC	NC	NC	NC	NC	NC	4	0
800-825	NC	NC	NC	NC	NC	NC	9	0
Total	0	0	14	4	62	11	261	62

	8/25/2008		9/1/2008		9/8/2008		9/17/2008	
Reach	# Live	# Dead	# Live	# Dead	# Live	# Dead	# Live	# Dead
intertidal	1	0	0	0	0		Zero fish, high flow	
0-50	3	0	3	2	1			
50-100	15	2	8	2	1			
100-150	2	0	5	2	0			
150-200	4	0	0	3	0			
200-250	3	2	0	14	0			
250-300	10	0	0	4	0			
300-350	1	0	0	2	0			
350-400	10	1	2	2	0			
400-450	23	1	1	2	1			
450-500	8	2	10	1	0			
500-550	35	3	2	1	2			
550-600	31	1	8	0	1			
600-650	9	0	0	0	2			
650-700	7	0	2	0	1			
700-750	12	0	1	0	1			
750-800	6	0	0	0	0			
800-825	5	0	5	0	0			
Total	185	5	47	35	10	0	0	0

Appendix 5 cont.

Slate Creek Adult Pink Salmon Count

	7/29/2008		8/6/2008		8/13/2008		8/21/2008	
Reach	**# Live**	**# Dead**	**# Live**	**# Dead**	**# Live**	**# Dead**	**# Live**	**# Dead**
intertidal1	0	0	66	2	65	1	NC	NC
intertidal2	6	0	165	2	300	5	100	15
0-100	24	0	120	1	230	9	210	40
100-200	10	1	108	17	140	6	230	40
200-300	32	0	10	4	150	17	110	59
300-400	4	0	32	14	80	14	80	51
400-500	6	1	22	3	85	24	95	94
500-600	0	0	50	2	120	35	80	26
600-700	4	1	0	0	3	0	75	12
700-800	0	0	NC	NC	4	0	8	2
800-900	NC	NC	NC	NC	5	0	1	0
Total	86	3	573	45	1182	111	989	339

	8/28/2008		9/3/2008		9/10/2008		9/18/2008	
Reach	**# Live**	**# Dead**	**# Live**	**# Dead**	**# Live**	**# Dead**	**# Live**	**# Dead**
intertidal1	36	19	0	0	0		Hiked up to falls	
intertidal2	39	29	2	0	1		Zero fish.	
0-100	118	29	2	0	5			
100-200	18	7	0	0	0			
200-300	14	8	1	0	0			
300-400	29	15	0	0	0			
400-500	13	6	2	0	0			
500-600	23	1	4	1	0			
600-700	5	0	0	0	0			
700-800	0	0	0	0	2			
800-900	NC	NC	0	0	0			
Total	295	114	11	1	8	0	0	0