

**Benthic Macroinvertebrate Analysis;
2004 compared to the 1996 and 1997 data.**

For: Animas River Stakeholder's Group,
Silverton, Colorado

1/27/2006

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Introduction

A common method for assessing and monitoring the impact pollution has on biological ecosystems is through investigations of the community structure of benthic macroinvertebrates. (Resh and Jackson 1993). Metals from abandoned mine lands are common pollutants in western, mountain streams (Caruso and Ward 1998, Clements et al. 2000) and it is generally recognized that Heptageniid mayflies and predatory stoneflies are the benthic insect taxa most sensitive to metal pollution (Clements et al. 2000, and Kiffney and Clements 1994).

The Animas River has been impacted by more than a century of waste from hardrock mining operations (Peter Butler, Robert Owen, and William Simon, Unpublished report to Water Quality Control Commission, Animas River Stakeholders Group, 2001). Research into how best to remediate abandoned mine lands as well as active remediation of abandoned mine-lands has been ongoing for over 15 years in the Animas River Watershed. One of the major goals of the Animas River research is to evaluate the effectiveness of remediation (Buxton and others, 1997). Part of this goal has been accomplished by assessing the benthic macroinvertebrate community structure. A study of the benthic macroinvertebrate communities was initiated in 1996. Data was collected in fall 1996, spring 1997, and fall 1997 to establish benchmark (prior to the bulk of remediation) data. Macroinvertebrate samples were obtained from 28 impaired and 12 unimpaired sites. Sampling methods were proposed to determine time of year, frequency, and location for collection of follow-up data and to qualitatively and statistically compare the benchmark to the post-remediation data. Two types of methods were proposed: (1) a single site assessment where only one sample site exists downstream from each remediation site, and (2) a multiple site assessment where a minimum of three sample sites are used for each remediation site.

Methods

In fall 2004 the macroinvertebrate sampling was repeated to gauge the effectiveness of the remediation to date. Composited samples of similar sampling effort to the 1996 and 1997 sampling were obtained from 37 sites to summarize compare the data to the benchmark data collected in 1996 and 1997 (Table 1, Table 2, Table 3). The 2004 data was graphed and differences in the community composition of the 2004 data was compared to the fall data collected in 1996 and 1997. Differences were compared to differences in the reference streams to determine the degree of natural variation as well as to differences between the 1996 and 1997 data (Figures 1-3)Figure 1. 2004 percent community composition.

In order to decrease the effects of sampling effort, the analysis focused on percent composition of the macroinvertebrate taxa as well as additions and deletions of particular taxa. Such an analysis must keep in mind that the reference tributaries are essentially saturated communities and are used as a point of reference for the impacted stations. Segments analyzed were from Eureka Gulch to Mineral Creek, Mineral Creek from the confluence with the South Fork of Mineral Creek to the confluence with the Animas, and the Animas from Mineral Creek to Hermosa Creek. Impacted sample stations were stations on the mainstem of the Animas, Eureka Gulch, and Mineral Creek. Other Tributary sample stations were sampled for reference data.

The 1996 and 1997 data are described in Anderson (in press)

Results below Hermosa Creek were not statistically analyzed due to the number of other issues affecting water quality below this point. Changes in sensitive species were noted for this segment, however.

Results

There was no overall increase in the number of taxa, percent EPT, percent Ephemeroptera, or percent Plecoptera taxa between the 2004 data and the 1996/1997 data other than in the Mineral Creek Drainage (Figures 4-8). In fact, there was a reduction in total number of taxa in some of the impacted sample sites: Up. Eureka, James Ranch and Up. Hermosa. But there were similar reductions in some of the reference tributaries - Boulder, Cunningham, Elk, Needle, and Hermosa Creeks (Figure 4).

Individual sample stations, however, showed an increase in percent EPT: Up. Kendall Creek, James Ranch and Up. Hermosa as well as Elk, Needle and Hermosa Creeks. In the impacted sample stations on the mainstem of the Animas, most of the increase was due to the addition of Plecoptera taxa, especially at A72, Up. Kendall, @ James Ranch and Up. Hermosa, as well as within Elk, Needle and Hermosa Creeks.

Increase in percent EPT at Up. Eureka and Up. Cunningham but a decrease in percent EPT at downstream sample stations on segment 3a. Although this increase in %EPT was due to a decrease in the number of non-EPT taxa.

In combination with the addition of Plecoptera taxa at A72 and Up. from Kendall, the addition of Ephemeroptera taxa at Mineral Creek Mouth and Mineral Creek Up. from S. Fork Mineral Creek Confluence when compared to the modest increase in the EPT index in the reference sample stations on the South Fork of Mineral Creek is a strong indication of improvement in Mineral Creek.

Discussion

The differences between the 1996 and 1997 data show a large amount of annual variation that makes it difficult to establish improvement due to remediation based solely on percent composition of macroinvertebrate taxa. Although there were many changes between the 2004 and the 1996/1997 data as well as differences between the 1996 and 1997 data, the presence of taxa in the 2004 data that was not in either the 1996 or 1997 data is the best indicator of improvement in the macroinvertebrate communities, especially in and below the Mineral Creek Drainage where there was an addition of taxa at 4 consecutive sample stations - at Mineral Creek Up. from S. Fork Mineral Creek Confluence, Mineral Creek Mouth, A72 and Up. from Kendall.

Repeating the 2004 sampling effort in the Mineral Creek drainage as well as at Animas sample stations immediately below Mineral Creek (A72, Up. Kendall, Up. Elk) and sample stations in the associated tributaries is recommended in order to confirm the data collected in 2004 as well as to better establish annual variation in the data. A discussion of how this data compares to changes in the water chemistry data is also recommended.

Conclusions

There is a strong indication of improvement in the benthic macroinvertebrate taxa in the Mineral Creek Drainage and some indication of improvement upstream of Boulder Creek and lower in the Animas Canyon.

2004 Data

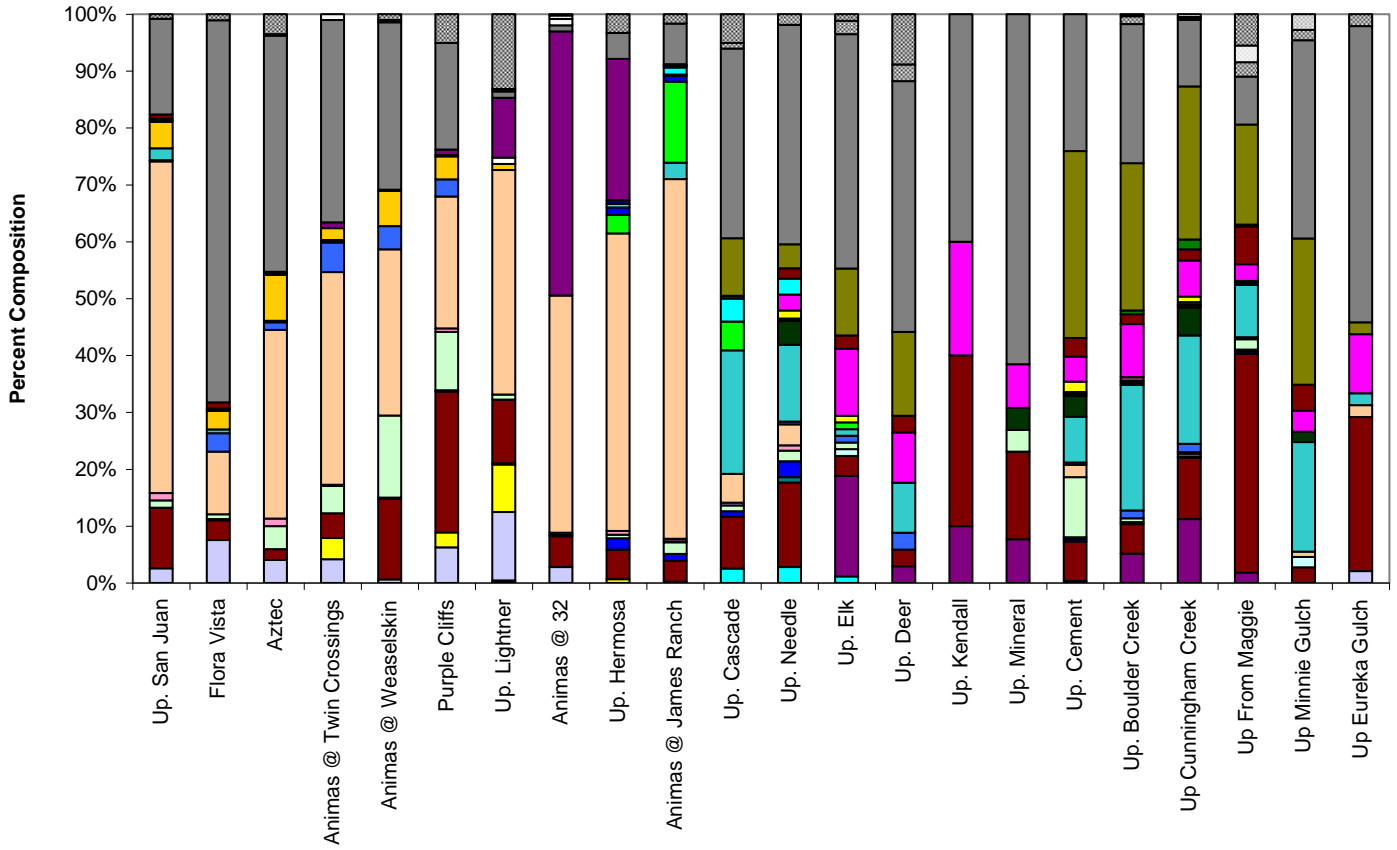


Figure 1. 2004 percent community composition.

1997 Data

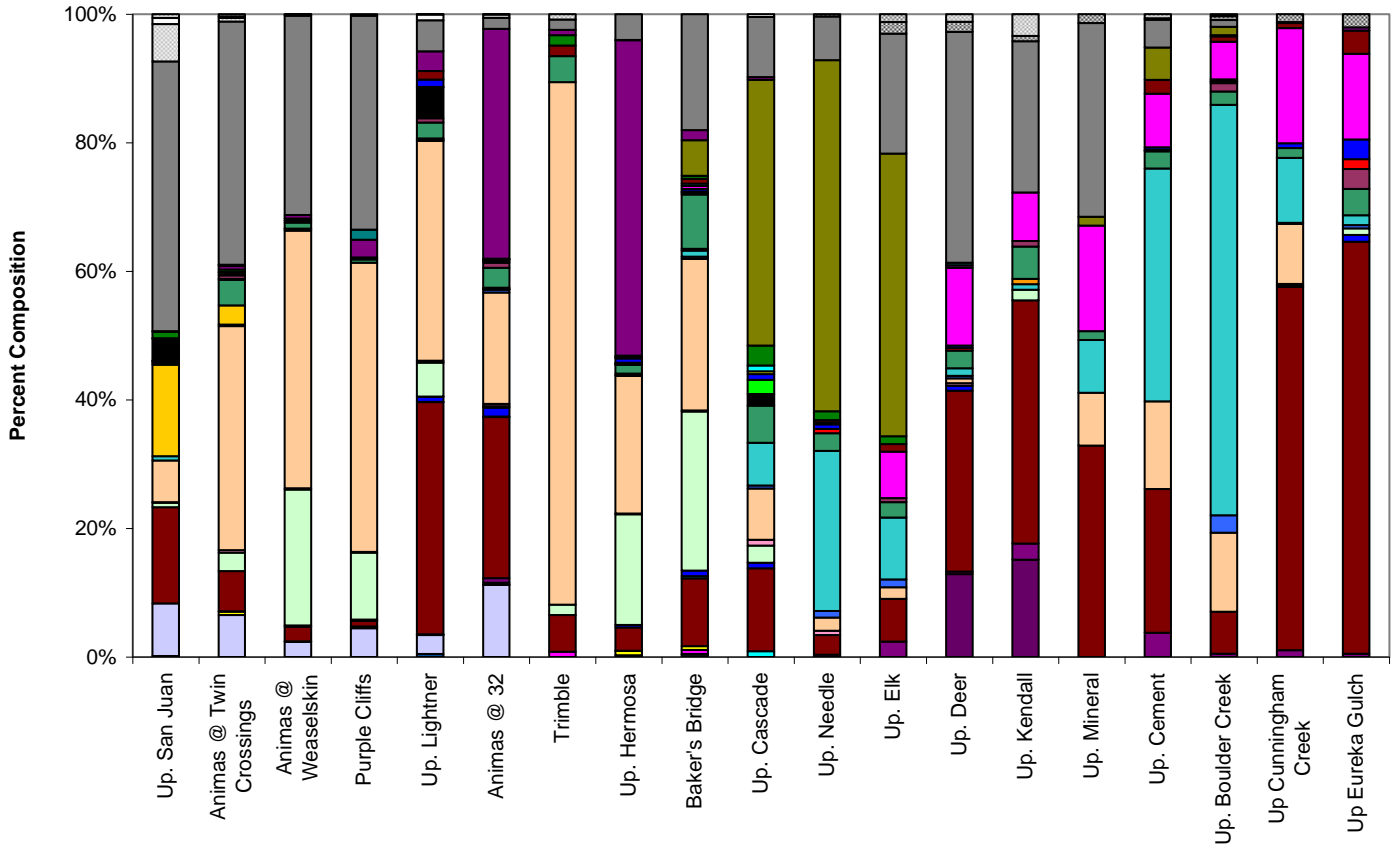


Figure 2. 1997 percent community composition

1996 Data

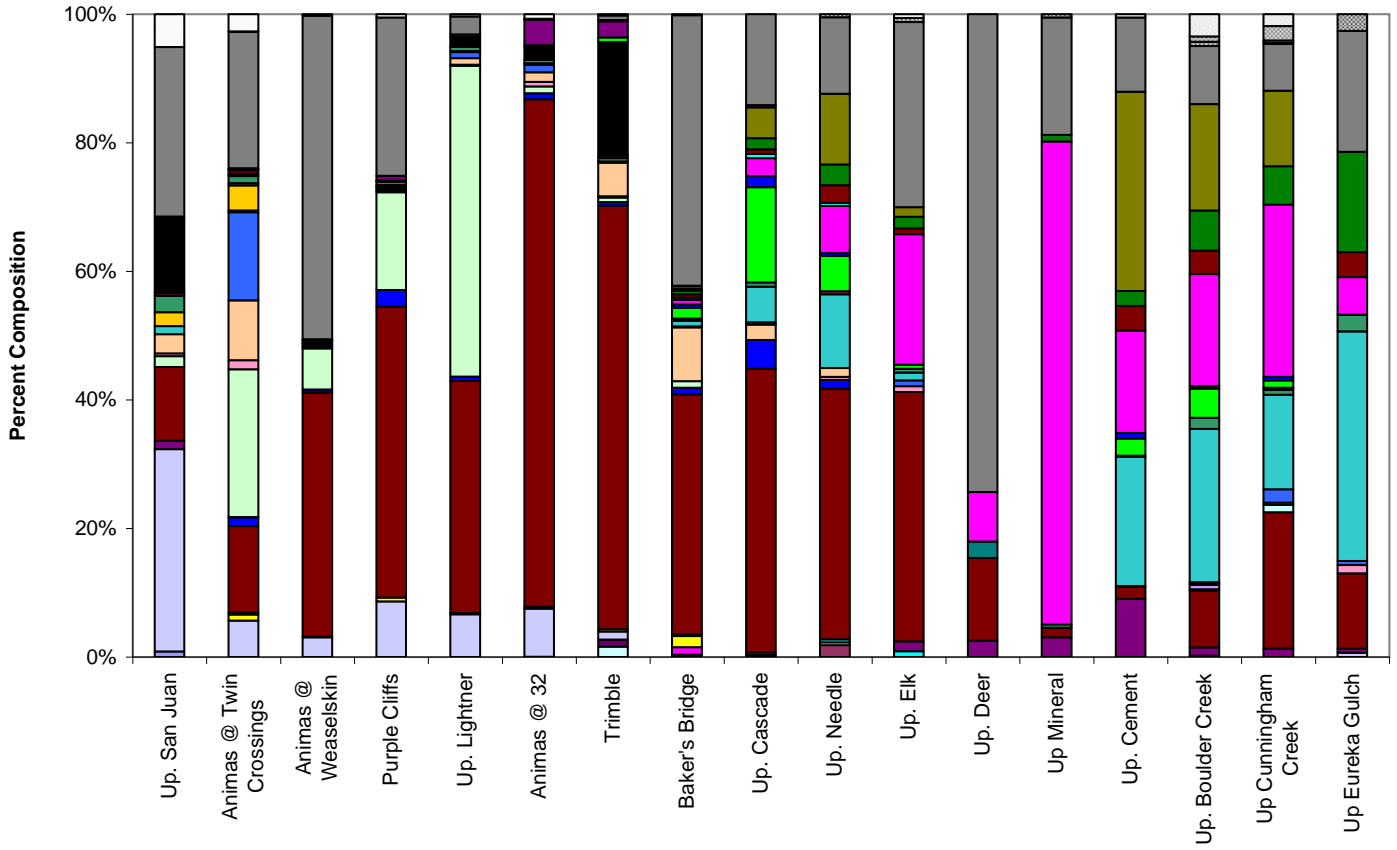


Figure 3. 1996 percent community composition.

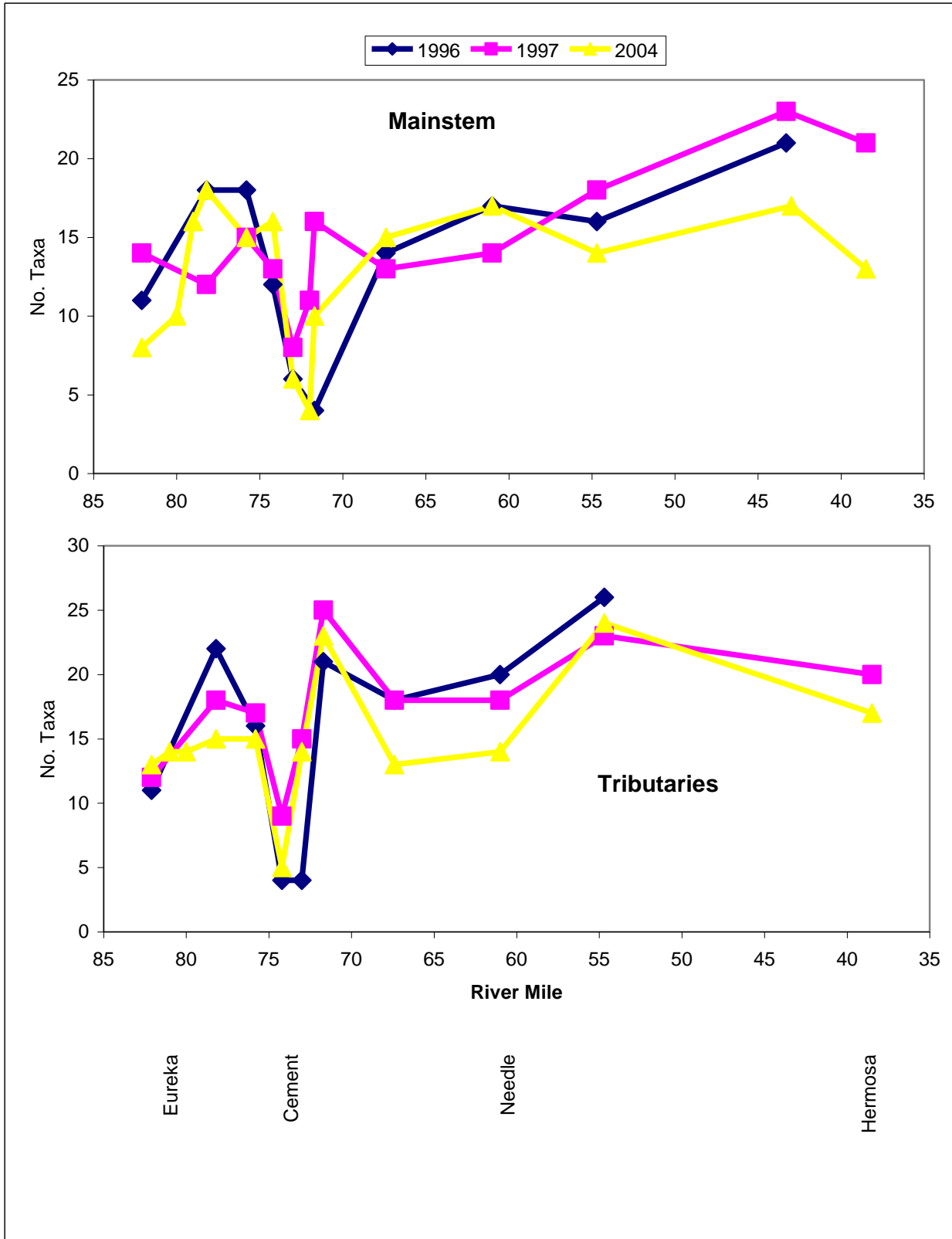


Figure 4. Number of taxa from mainstem to Hermosa Creek. Upper figure samples are from Animas upstream of each tributary and lower figure samples are from mouth of tributary. See Tables 1-2.

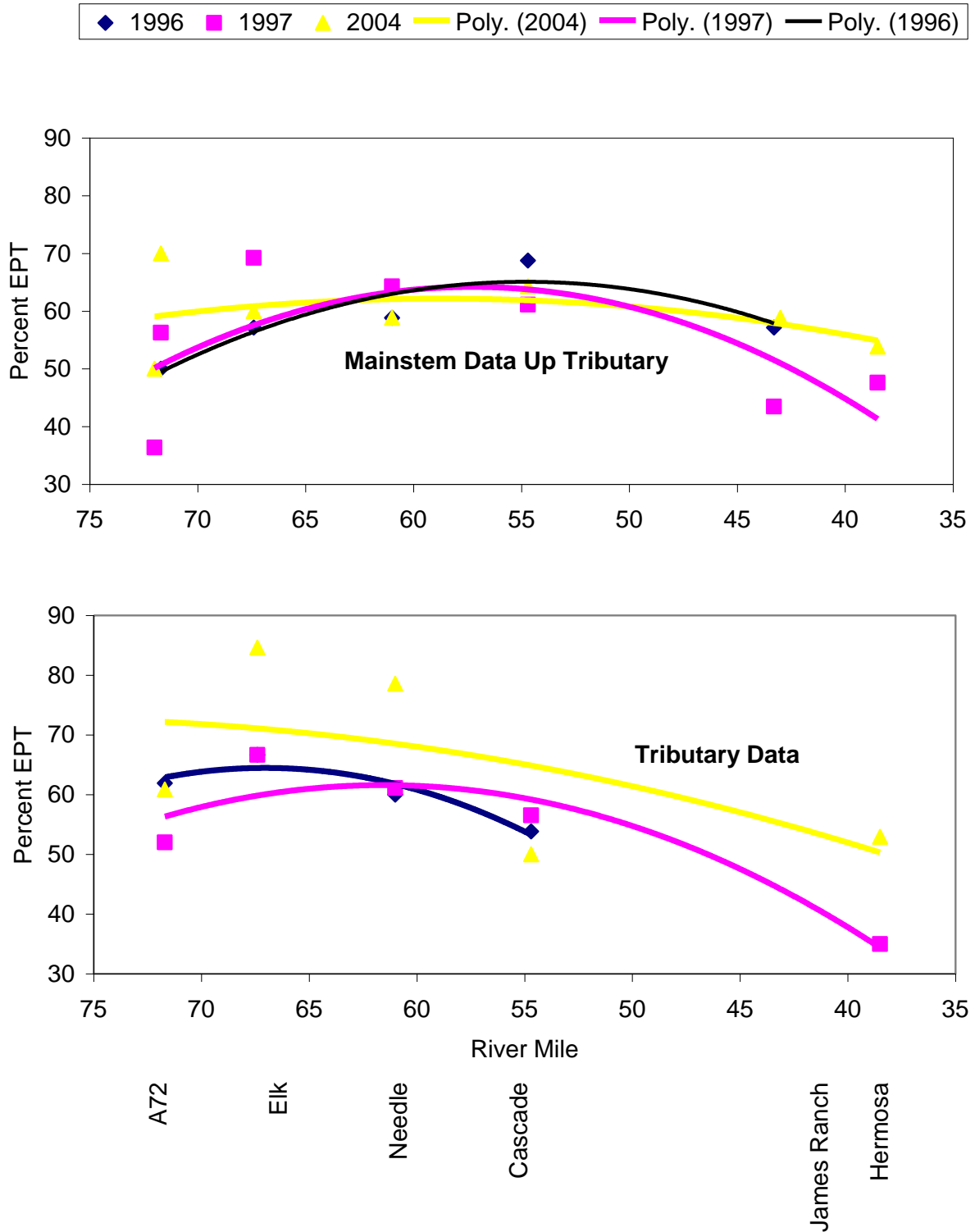


Figure 5. Percent Ephemeroptera/Plecoptera/Trichoptera. Upper figure samples are from Animas upstream of each tributary and lower figure samples are from mouth of tributary. See Tables 1-2.

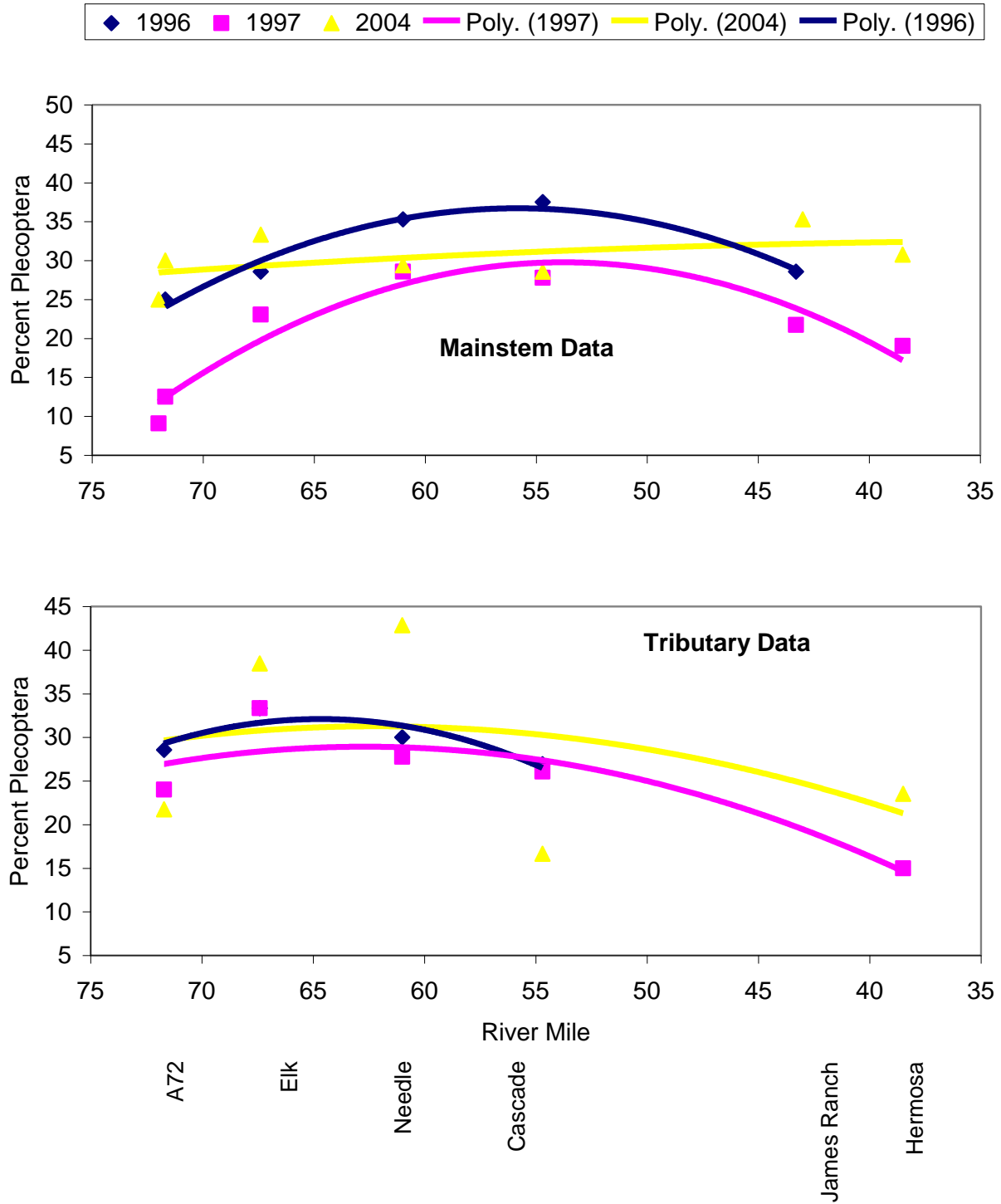


Figure 6. Percent Plecoptera Taxa. Upper figure samples are from Animas upstream of each tributary and lower figure samples are from mouth of tributary. See Tables 1-2.

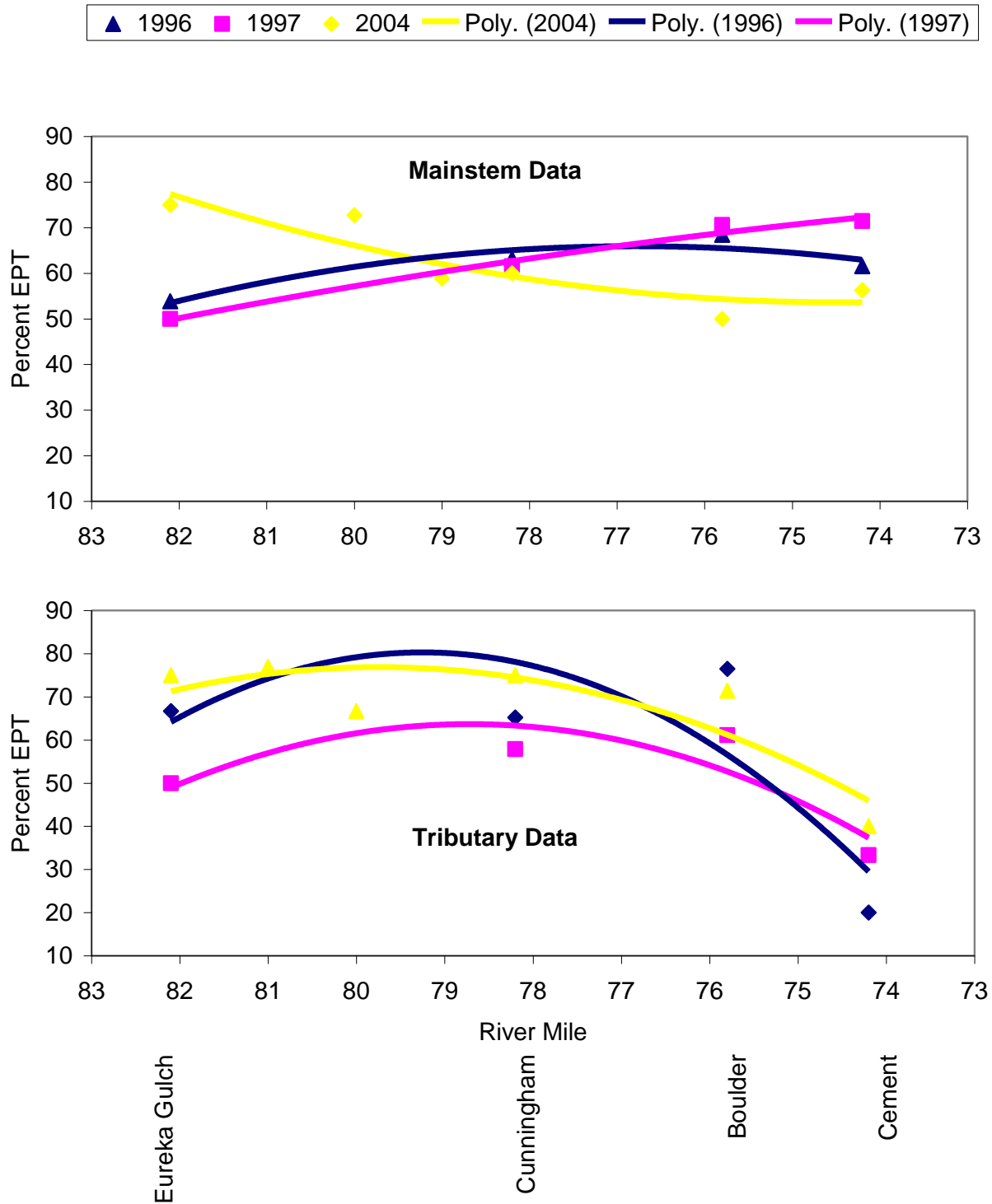


Figure 7. Segment 3a Percent Ephemeroptera/Plecoptera/Trichoptera Upper figure samples are from Animas upstream of each tributary and lower figure samples are from mouth of tributary. See Tables 1-2.

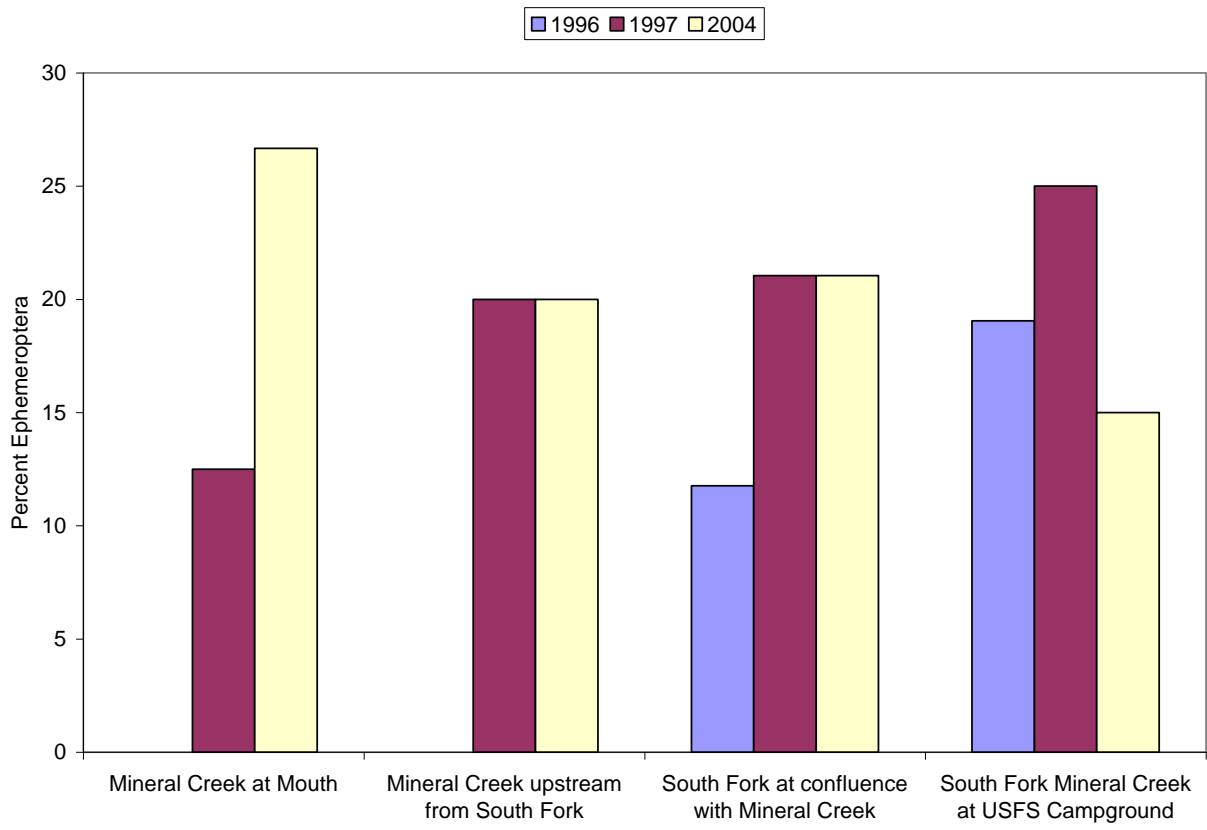


Figure 8. Percent Ephemeroptera in Mineral Creek Drainage.

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Fall 1996, cont		NS		NS								NS		NS	
Order	Family	Eureka Gulch	Minnie Mouth	Maggie Gulch Mouth	Cunningham Creek	Boulder Creek	Cement Creek at Mouth	Mineral Creek at Mouth	Deer Creek	Elk Creek	Needle Creek	Cascade Creek	Hermosa Creek	Lightner Creek	Florida River
Lepidoptera	Pyralidae														116
Nematoda	Nematoda										1	7			
Oligeata	Tubificidae				29	1			32	21	20	42			32
Oligochaeta	Oligochaeta														
Ostracoda	Ostracoda								1			1			
Plecoptera	Capniidae				21	4			2	52	6	77			
	Chloroperlidae	3			13	7			9	2	7	109			
	Leuctridae	1			6				2						
	Nemouridae	15			225	88			58	162	19	25			
	Perlidae									1	25	74			2
	Perlodidae	3			40	22			7	16	3	132			1
	Pteronarcyidae											4			
	Taeniopterygidae				366	188			48	589	2	9			
Trichoptera	Brachycentridae											1			
	Glossosomatidae														
	Helicopsychidae														1
	Hydropsychidae	3			3			3		19	8	339			2233
	Hydroptilidae														
	Lepidostomatidae								1						2
	Leptoceridae														1
	Limnephilidae				4	11		1							
	Rhyacophilidae	8			12	7			15	13	11	14			
	Uenoidae				319	2			12	1		3			
Tricladida	Planariidae				221	6				3	2				
Trombidiformes	Trombidiformes														
Grand Total		140			2756	682	29	12	468	1973	399	2180			4429
	No. Taxa	11			22	16	4	4	21	18	20	26			21
	No Plecoptera Taxa	4			6	5	0	0	6	6	6	7			2
	% Plecoptera Taxa	36.36			27.27	31.25	0.00	0.00	28.57	33.33	30.00	26.92			9.52
	No. Ephemeroptera Taxa	1			4	4	0	0	4	3	4	3			4
	% Ephemeroptera Taxa	9.091			18.182	25.000	0.000	0.000	19.048	16.667	20.000	11.538			19.048
	No. EPT Taxa	7			14	12	0	2	13	12	12	14			10
	% EPT Taxa	63.64			63.64	75.00	0.00	50.00	61.90	66.67	60.00	53.85			47.62

Fall 1997, cont			NS	NS											
Order	Family	Eureka Gulch	Minnie Mouth	Maggie Gulch Mouth	Cunningham Creek	Boulder Creek	Cement Creek at Mouth	Mineral Creek at Mouth	Deer Creek	Elk Creek	Needle Creek	Cascade Creek	Hermosa Creek	Lightner Creek	Florida River
Ostracoda	Ostracoda	2			6		1	1	62	8	2	3	1		
Plecoptera	Capniidae				10			2	14	74		4			
	Chloroperlidae				24	12		1	77	14	14	20	13	8	4
	Leuctridae								18	2					
	Nemouridae	109			71	76	2	12	250	44	8	5			
	Perlidae										2	1			2
	Perlodidae	1			88	99			28	11	6	4	13		6
	Pteronarcyidae												3	1	
Taeniopterygidae	21			18	119		2	327	677	28	77				
Trichoptera	Brachycentridae												19	2	
	Glossosomatidae							2		2					
	Helicopsychidae											1			
	Hydropsychidae					2		2	13	5	4	54	65	18	1526
	Hydroptilidae														56
	Lepidostomatidae														
	Leptoceridae													2	13
	Limnephilidae	1			1	14			5						
	Rhyacophilidae				16	33			98	5	3	17			
Uenoidae								35		1	2				
Tricladida	Planariidae														
Trombidiformes	Trombidiformes														
Grand Total		336			1730	1030	48	137	2459	1786	419	550	796	248	4065
	No. Taxa	12			18	17	9	15	25	18	18	23	20	17	18
	No Plecoptera Taxa	3			5	4	1	4	6	6	5	6	3	2	3
	% Plecoptera Taxa	25.00			27.78	23.53	11.11	26.67	24.00	33.33	27.78	26.09	15.00	11.76	16.67
	No. Ephemeroptera Taxa	2			3	3	2	1	3	3	3	3	2	3	4
	% Ephemeroptera Taxa	16.667			16.667	17.647	22.222	6.667	12.000	16.667	16.667	13.043	10.000	17.647	22.222
	No. EPT Taxa	6			10	10	3	7	13	12	11	13	7	8	10
	% EPT Taxa	50.00			55.56	58.82	33.33	46.67	52.00	66.67	61.11	56.52	35.00	47.06	55.56

Fall 2004															
Order	Family	Eureka Gulch	Minnie Mouth	Maggie Gulch Mouth	Cunningham Creek	Boulder Creek	Cement Creek at Mouth	Mineral Creek at Mouth	Deer Creek	Elk Creek	Needle Creek	Cascade Creek	Hermosa Creek	Lightner Creek	Florida River
Amphipoda	Hyalellidae														
Cladocera	Daphniidae														
Coleoptera	Dryopidae Dytiscidae Elmidae Hydrophilidae							1				2 1 20	1 17	28	98
Collembola	Collembola														
Copepoda	Copepoda														
Diptera	Athericidae Blephariceridae Ceratopognidae Chironomidae Empididae Ephydriidae Muscidae Psychodidae Simuliidae Syrphidae Tipulidae	1 1 1	5	9	5 2 1	6	6	1 5	5 46 1	6	2 3	10 9	5 8	3 63 8	7 31 1
Ephemeroptera	Ameletidae Baetidae Ephemerellidae Heptageniidae Leptophlebiidae Tricorythidae		1 66 43	2 32 100	1 97 73	1 145 128		5 5 1 2	1 10 111 94	1 48 61	42 27 170	124 27 23	250 5 13	1 1 1	150 1 5
Gastropoda	Lumbriculidae Physidae Sphaeriidae													8	
Hydracarina	Hydracarina Lebertiidae Sperchontidae							1 1				3 3			
Lepidoptera	Pyralidae						1								1
Nematoda	Nematoda														
Oligeata	Tubificidae														
Oligochaeta	Oligochaeta			2					5			8	10	23	

Fall 2004															
Order	Family	Eureka Gulch	Minnie Mouth	Maggie Gulch Mouth	Cunningham Creek	Boulder Creek	Cement Creek at Mouth	Mineral Creek at Mouth	Deer Creek	Elk Creek	Needle Creek	Cascade Creek	Hermosa Creek	Lightner Creek	Florida River
Ostracoda	Ostracoda											1		1	
Plecoptera	Capniidae		10	3	10	10			3						
	Chloroperlidae	1	1	1	6	6			3	5	4	3	1	10	
	Leuctridae							1		14	15	4			
	Nemouridae	51	23	58	18	23	1	18	87	44	9				
	Perlidae										12	1	1		
	Perlodidae	6	13	16	11	30		2	9	5	1	6	1		
	Pteronarcyidae												1		
	Taeniopterygidae	23	230	229	220	120	1	3	30	328	23				
Trichoptera	Brachycentridae											2			
	Glossosomatidae								1	1					
	Helicopsychidae														
	Hydropsychidae	2			1			1	10	1	20	119	168	125	124
	Hydroptilidae											3			
	Lepidostomatidae											10			
	Leptoceridae												3	3	
	Limnephilidae								2						
	Rhyacophilidae	6	16	9	9	17			18	9	15	36			
Uenoidae	1	30			1			1							
Tricladida	Planariidae								1						
Trombidiformes	Trombidiformes	5	1			5			5				5	13	
Grand Total		137	525	514	488	495	10	47	455	524	345	449	496	287	479
	No. Taxa	13	14	14	15	15	5	14	23	13	14	24	17	15	11
	No Plecoptera Taxa	4	5	5	5	5	2	4	5	5	6	4	4	1	0
	% Plecoptera Taxa	30.77	35.71	35.71	33.33	33.33	40.00	28.57	21.74	38.46	42.86	16.67	23.53	6.67	0.00
	No. Ephemeroptera Taxa	2	3	3	4	3	0	4	4	3	3	3	3	2	3
	% Ephemeroptera Taxa	15.385	21.429	21.429	26.667	20.000	0.000	28.571	17.391	23.077	21.429	12.500	17.647	13.333	27.273
	No. EPT Taxa	9	10	9	11	10	2	9	14	11	11	12	9	5	4
	% EPT Taxa	69.23	71.43	64.29	73.33	66.67	40.00	64.29	60.87	84.62	78.57	50.00	52.94	33.33	36.36

Table 2. No. macroinvertebrates, mainstem samples. NS = Not Sampled

Fall 1996	River Mile								NS						NS				NS	NS		
Order	Family	Up. San Juan	Animas @ Twin Crossings	Animas @ Weasel-skin	Purple Cliffs	Up. Lightner	Animas @ 32	Trimble	Up. Hermosa	Animas @ James Ranch	Up. Cascade	Up. Needle	Up. Elk	Up. Deer	Up. Kendall	Up. Mineral	Up. Cement	Up. Boulder Creek	Up Cunningham Creek	Up From Maggie	Up Minnie Gulch	Up Eureka Gulch
Amphipoda	Gammaridae Hyalellidae	2										4										
Araneida	Araneida											1										
Cladocera	Cladocera Daphniidae						1	9														
Coleoptera	Dryopidae Dytiscidae Elmidae	74	164	136	246	268	191	7		2	1							1				1
Collembola	Collembola					1	1															
Copepoda	Copepoda									7												
Diptera	Athericidae Blephariceridae Ceratopognidae Chironomidae Empididae Muscidae Psychodidae Simuliidae Staphylinidae Tanyderidae Tipulidae	3 27	26 9 390 40	7 1680 21	16 1287 74	6 1457 27	2 2012 25	2 365 3		10 2 218	1 1 128	1 3 85	3 5 128	1 1 5		6 3	54 11	6 41	7 114			1 18
Ephemeroptera	Ameletidae Baetidae Ephemerellidae Heptageniidae Leptophlebiidae Tricorythidae	7 3 5	270 397 8 113	10 8 9	4 9 3	41 39 4	38 30 4	29 1		49 1 5	7 1 16	3 3 25	3 4				120	3 1 111	2 11 79			1 55
Gastropoda	Lumbriculidae Lymnaeidae Physidae Sphaeriidae		10	2 7	1 7		2															
Hemiptera	Naucoridae																					
Hydracarina	Hydracarina Lebertiidae Sperchontidae	6	32	13	15	27	13	3		1	2		2			1		8	4			4

Fall 1996, cont	River Mile								NS						NS				NS	NS		
Order	Family	Up. San Juan	Animas @ Twin Crossings	Animas @ Weasel-skin	Purple Cliffs	Up. Lightner	Animas @ 32	Trimble	Up. Hermosa	Animas @ James Ranch	Up. Cascade	Up. Needle	Up. Elk	Up. Deer	Up. Kendall	Up. Mineral	Up. Cement	Up. Boulder Creek	Up Cunningham Creek	Up From Maggie	Up Minnie Gulch	Up Eureka Gulch
Lepidoptera	Pyrilidae			2																		
Nematoda	Nematoda	1		2	2	5	1	2				1					1		1			
Odonata	Gomphidae																					
Oligeata	Tubificidae	28	9			52	51	98		1												
Oligochaeta	Oligochaeta																					
Ostracoda	Ostracoda																					1
Plecoptera	Capniidae							4		10	43	12	2				16	21	6			
	Chloroperlidae		1			4				3	5	1					5	2	3			
	Leuctridae									4	8	16	67	3		148	95	81	144			9
	Nemouridae									2	2	1										
	Perlidae									3	2	6	3				23	17				6
	Perlodidae		16		1					3	2	6	3									
	Pteronarcyidae			3	1	1				2												
Taeniopterygidae										14	24	5				185	77	63				
Trichoptera	Brachycentridae		1	4	21	16	102	14		3	1											
	Glossosomatidae							1														
	Helicopsychidae		3																			
	Hydropsychidae	62	615	2233	700	112	1	4		246	41	26	95	29		36	69	42	39			29
	Hydroptilidae		2	1																		
	Lepidostomatidae									2												
	Leptoceridae	12	77	7	15	14	18															
	Limnephilidae																					
Rhyacophilidae								1	1		1	2			1		3	2			4	
Uenoidae																	4	12				
Tricladida	Planariidae											2					3	16	10			
Trombidiformes	Trombidiformes																					
Grand Total		235	2892	4432	2842	4033	2543	554		582	285	211	324	38		195	583	436	505			130
	No. Taxa	14	22	19	18	19	19	18		21	16	17	14	4		6	12	18	18			11
	No. EPT Taxa	5	11	8	8	9	7	7		12	11	10	8	2		3	7	12	11			6
	No. Plecoptera Taxa	0	2	1	2	2	0	1		6	6	6	4	1		1	5	5	4			2
	% EPT Taxa	36	50	42	44	47	37	39		57	69	59	57	50		50	58	67	61			55
	% Plecoptera Taxa	0	9	5	11	11	0	6		29	38	35	29	25		17	42	28	22			18

Fall 1997		River Mile																		NS	NS	
Order	Family	Up. San Juan	Animas @ Twin Crossings	Animas @ Weasel-skin	Purple Cliffs	Up. Lightner	Animas @ 32	Trimble	Up. Hermosa	Animas @ James Ranch	Up. Cascade	Up. Needle	Up. Elk	Up. Deer	Up. Kendall	Up. Mineral	Up. Cement	Up. Boulder Creek	Up Cunningham Creek	Up From Maggie	Up Minnie Gulch	Up Eureka Gulch
Amphipoda	Gammaridae Hyalellidae	4																				
Araneida	Araneida																					
Cladocera	Cladocera Daphniidae					2								33	18							
Coleoptera	Dryopidae Dytiscidae Elmidae	225	308	134	158	142	252		5	3												
Collembola	Collembola					3				1												
Copepoda	Copepoda					2	1	1		5												
Diptera	Athericidae Blephariceridae Ceratopognidae Chironomidae Empididae Muscidae Psychodidae Simuliidae Staphylinidae Tanyderidae Tipulidae		26		8		7		12	5												
											2											1
		412	294	128	31	1738	563	7	66	87	29	9	11	72	45	24	30	5	7			125
				12	6	38	31		7	7	2			2								2
						2																
		20	136	1182	368	256	5	2	314	205	6				2				2			2
						1																
		2	18	12	4	12	8		2	1	2	2		1								
Ephemeroptera	Ameletidae Baetidae Ephemerellidae Heptageniidae Leptophlebiidae Tricorythidae	178	1644	2244	1586	1645	390	100	391	195	18	6	3	2		6	108	124	61			
							10		2	3	1	3	2	1				27	1			1
		19	10						4	8	15	73	16	3	1	6	287	644	66			3
		391	142	14		2																
Gastropoda	Lumbriculidae Lymnaeidae Physidae Sphaeriidae					5	1			2					1							
					2	6	1															
						6	4															
Hemiptera	Naucoridae	8																				
Hydracarina	Hydracarina Lebertiidae Sperchontidae	6	186	54	18	119	70	5	25	70	13	8	4	7	6	1	21	21	10			8
Lepidoptera	Pyralidae		8																			
Nematoda	Nematoda	2	26	16	7	33	18		1	2			1		1		1	13				6

Fall 1997, cont		River Mile																			NS	NS
Order	Family	Up. San Juan	Animas @ Twin Crossings	Animas @ Weasel-skin	Purple Cliffs	Up. Lightner	Animas @ 32	Trimble	Up. Hermosa	Animas @ James Ranch	Up. Cascade	Up. Needle	Up. Elk	Up. Deer	Up. Kendall	Up. Mineral	Up. Cement	Up. Boulder Creek	Up Cunningham Creek	Up From Maggie	Up Minnie Gulch	Up Eureka Gulch
Odonata	Gomphidae	2																				
Oligatea	Tubificidae	94	22	18	5	233	6		2	1	4											
Oligochaeta	Oligochaeta																					
Ostracoda	Ostracoda					2	5		1	1		2		1				2				3
Plecoptera	Capniidae								2		5						1	1				
	Chloroperlidae	2	2			55			12	3	2	2		1			3	3		5		6
	Leuctridae										1											
	Nemouridae								3	4		1	12	31	9	12	66	59		117		26
	Perlidae									3	2											
	Perlodidae					63		2	2	6		1	2				17	8		5		7
	Pteronarcyidae						2															
	Taeniopterygidae									46	93	160	73			1	40	13				
Trichoptera	Brachycentridae	2	26	32	96	148	804	1	895	13	1			1								1
	Glossosomatidae		8		56				1					1								
	Helicopsychidae		2																			
	Hydropsychidae	1155	1784	1734	1174	233	39	2	73	149	21	20	31	92	28	22	34	11		1		
	Hydroptilidae	160	26																			
	Lepidostomatidae																					
	Leptoceridae	26	12	12		43	11															
	Limnephilidae						1				1											
	Rhyacophilidae										1	3	4	1	1	2	6		8			4
	Uenoidae												2									
Tricladida	Planariidae																					
Trombidiformes	Trombidiformes																					
Grand Total		2708	4682	5596	3518	4811	2245	120	1821	820	218	289	164	253	115	73	787	1003	652			195
	No. Taxa	18	20	15	14	26	22	8	21	23	18	14	13	16	11	8	13	15	12			14
	No. EPT Taxa	8	10	5	4	7	7	4	10	10	11	9	9	9	4	6	9	10	8			7
	No. Plecoptera Taxa	1	1	0	0	2	1	1	4	5	5	4	3	2	1	2	5	5	3			3
	% EPT Taxa	44	50	33	29	27	32	50	48	43	61	64	69	56	36	75	69	67	67			50
	% Plecoptera Taxa	6	5	0	0	8	5	13	19	22	28	29	23	13	9	25	38	33	25			21

Fall 2004								NS														
Order	Family	Up. San Juan	Animas @ Twin Crossings	Animas @ Weasel-skin	Purple Cliffs	Up. Lightner	Animas @ 32	Trimble	Up. Hermosa	Animas @ James Ranch	Up. Cascade	Up. Needle	Up. Elk	Up. Deer	Up. Kendall	Up. Mineral	Up. Cement	Up. Boulder Creek	Up Cunningham Creek	Up From Maggie	Up Minnie Gulch	Up Eureka Gulch
Amphipoda	Gammaridae Hyalellidae																					
Araneida	Araneida																					
Cladocera	Cladocera Daphniidae																					
Coleoptera	Dryopidae Dytiscidae Elmidae	10	20	3	31	55	13															1
Collembola	Collembola																					
Copepoda	Copepoda																					
Diptera	Athericidae Blephariceridae Ceratopognidae Chironomidae Empididae Muscidae Psychodidae Simuliidae Staphylinidae Tanyderidae Tipulidae		18		13	38			1	1	5	6	1									
		41	21	69	123	51	25		8	18	18	32	3	1	3	2	1	15	46	5		
				1	1		1		3	6	2	6					1	1	1	1	3	13
		5	23	70	51	4			1	10	2	4	1			1	29	2		5	2	
		5	1		3		2		1	1		2							2			
Ephemeroptera	Ameletidae Baetidae Ephemerellidae Heptageniidae Leptophlebiidae Tricorythidae	225	180	142	115	180	193		80	310	1	8					6		1			
		1	25	20	15						10	1	1	1			1	4	6	1	1	1
		8	1							14	43	29	1	3			22	64	78	25	21	1
		18	10	30	20	5																
Gastropoda	Lumbriculidae Lymnaeidae Physidae Sphaeriidae																					
Hemiptera	Naucoridae																					
Hydracarina	Hydracarina Lebertiidae Sperchontidae											9				1	10	1	20		2	
												1						1	1			
Lepidoptera	Pyralidae																					
Nematoda	Nematoda																	2	1			

Fall 2004, cont								NS															
Order	Family	Up. San Juan	Animas @ Twin Crossings	Animas @ Weasel-skin	Purple Cliffs	Up. Lightner	Animas @ 32	Trimble	Up. Hermosa	Animas @ James Ranch	Up. Cascade	Up. Needle	Up. Elk	Up. Deer	Up. Kendall	Up. Mineral	Up. Cement	Up. Boulder Creek	Up Cunningham Creek	Up From Maggie	Up Minnie Gulch	Up Eureka Gulch	
Odonata	Gomphidae	1																					
Oligatea	Tubificidae																						
Oligochaeta	Oligochaeta					5																	
Ostracoda	Ostracoda																1						
Plecoptera	Capniidae								5	70	10		1								1		
	Chloroperlidae								2	5							1			2	1		
	Leuctridae											3	1				5			4			
	Nemouridae									1		6	10	3	2	2	12	27		26	8	4	5
	Perlidae	1							1	6	8	6											
	Perlodidae	3								1	1	4	2	1			9	5		8	18	5	
	Pteronarcyidae				1					1													
Taeniopterygidae									1	20	9	10	5			90	75		110	48	28	1	
Trichoptera	Brachycentridae		5	1	5	48	215		38	1													
	Glossosomatidae																						
	Helicopsychidae																						
	Hydropsychidae	65	171	143	93	5	5		7	35	66	83	35	15	4	16	66	71	48	23	38	25	
	Hydroptilidae			1																			
	Lepidostomatidae																						
	Leptoceridae		5	1																			
Limnephilidae						1																	
Rhyacophilidae											2	4	2	1				4	1	7	2	1	
Uenoidae																							
Tricladida	Planariidae					1	3											1	2	8			
Trombidiformes	Trombidiformes	3		5	25	60	1		5	8	10		1	3						15			
Grand Total		386	481	486	496	456	463		153	490	198	213	85	34	10	26	274	288	401	272	106	48	
	No. Taxa	13	13	12	13	15	10		13	17	14	17	15	10	4	6	16	15	18	16	10	8	
	No. EPT Taxa	7	8	7	6	5	4		7	10	9	10	9	7	2	2	9	7	10	9	7	6	
	No. Plecoptera Taxa	2	0	0	1	0	0		4	6	4	5	5	3	1	1	5	3	5	5	3	2	
	% EPT Taxa	54	62	58	46	33	40		54	59	64	59	60	70	50	33	56	47	56	56	70	75	
	% Plecoptera Taxa	15	0	0	8	0	0		31	35	29	29	33	30	25	17	31	20	28	31	30	25	

Table 3. No macroinvertebrates, Mineral Creek drainage.

		1996				1997				2004			
		Fall				Fall				Fall			
Order	Family	Mineral Creek at Mouth	Mineral Creek upstream from South Fork	South Fork at confluence with Mineral Creek	South Fork Mineral Creek at USFS Campground	Mineral Creek at Mouth	Mineral Creek upstream from South Fork	South Fork at confluence with Mineral Creek	South Fork Mineral Creek at USFS Campground	Mineral Creek at Mouth	Mineral Creek upstream from South Fork	South Fork at confluence with Mineral Creek	South Fork Mineral Creek at USFS Campground
Cladocera	Daphniidae					5							
Coleoptera	Dytiscidae Elmidae Hydrophilidae		1							1		1	
Collembola	Collembola						1						
Diptera	Athericidae Ceratopognidae Chironomidae Empididae Simulidae Syrphidae Tipulidae	1 7	33 1	28 147 5	2 16695 106	18 79 2 3	126 1 11	10 460 17 2	42	1 5	1 28	7 7 2 5	2 17 3 1
Ephemeroptera	Ameletidae Baetidae Ephemerellidae Heptageniidae Leptophlebiidae			3 86 392 12	2 86 392 2715	2		44 30 79	108 57 202	5 5 1 2	1 1	5 10 12 9	3 19 40 221
Hydracarina	Hydracarina Lebertiidae Sperchontidae			1	50	4	3	5	2	1 1	1	3	1 1
Lepidoptera	Pyralidae						1						
Nematoda	Nematoda						1	2	1				
Oligeata	Tubificidae			1	16								
Ostracoda	Ostracoda			13	16	1		1				1	
Plecoptera	Capniidae Chloroperlidae Leuctridae			2 3	189 257	2 1		5	44			6 9	20 19

	Nemouridae		3	149	492	12	14	68	18	18	5	49	98
	Perlodidae			4	5			7	4	2		7	14
	Pteronarcyidae								16				
	Taeniopterygidae			12	1476	2		10	37	3		50	28
Trichoptera	Brachycentridae							2					
	Glossosomatidae					2		4	12				11
	Hydropsychidae	3		3	35	2				1		5	16
	Limnephilidae	1	1										
	Rhyacophilidae			13	93			3	7		1	4	18
	Uenoidae				1								
Tricladida	Planariidae			30	51								1
Grand Total		12	39	426	22680	137	159	750	552	47	40	186	533
	No. Taxa	5	6	17	21	16	10	19	16	15	10	19	20
	No. Ephemeroptera												
	Taxa	0	0	2	4	2	2	4	4	4	2	4	3
	% Ephemeroptera												
	Taxa	0.00	0.00	11.76	19.05	12.50	20.00	21.05	25.00	26.67	20.00	21.05	15.00