

State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME



STANDING STOCKS OF FISHES
IN SECTIONS OF BIG GRIZZLY CREEK
PLUMAS COUNTY, 2004

by

Charles J. Brown
Central Valley Bay-Delta Branch

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INTRODUCTION

The Department of Water Resources (DWR) initiated an instream flow program in 1976 to identify streams that would benefit from flow enhancement, to assess current instream values, and to identify actions such as habitat manipulation that could enhance these streams. The Northern District of the DWR selected Big Grizzly Creek below Lake Davis (Figure 1) as one of the streams to study under this program.

Previous sampling on Big Grizzly Creek has been conducted by Department of Fish and Game (DFG) biologists. Initial estimates of rainbow trout (*Oncorhynchus mykiss*) populations were made by the DFG in 1976 (Brown 1976). The DFG also surveyed the creek in 1981, 1986, 1988, 1991, and 1994 through 2003 to estimate standing stocks of brown trout (*Salmo trutta*) and rainbow trout in selected stations (Bumpass et al. 1989, Brown 1991a, Brown 1991b, Brown 1992, Brown 1995, Brown 1996, Brown 1997, Brown 1998, Brown 1999, Brown 2000, Brown 2001, Brown 2002, Brown 2003, and Brown, 2004).

The objective of this study is to evaluate the effects of the operation of Lake Davis on populations of trout in Big Grizzly Creek. Data for this evaluation was collected through the periodic sampling of fish at established stations in that creek. The data collected may also be used to prepare a trout rearing plan for Big Grizzly Creek necessary as a result of Lake Davis rotenone treatment to kill northern pike (*Esox lucius*) in October, 1998.

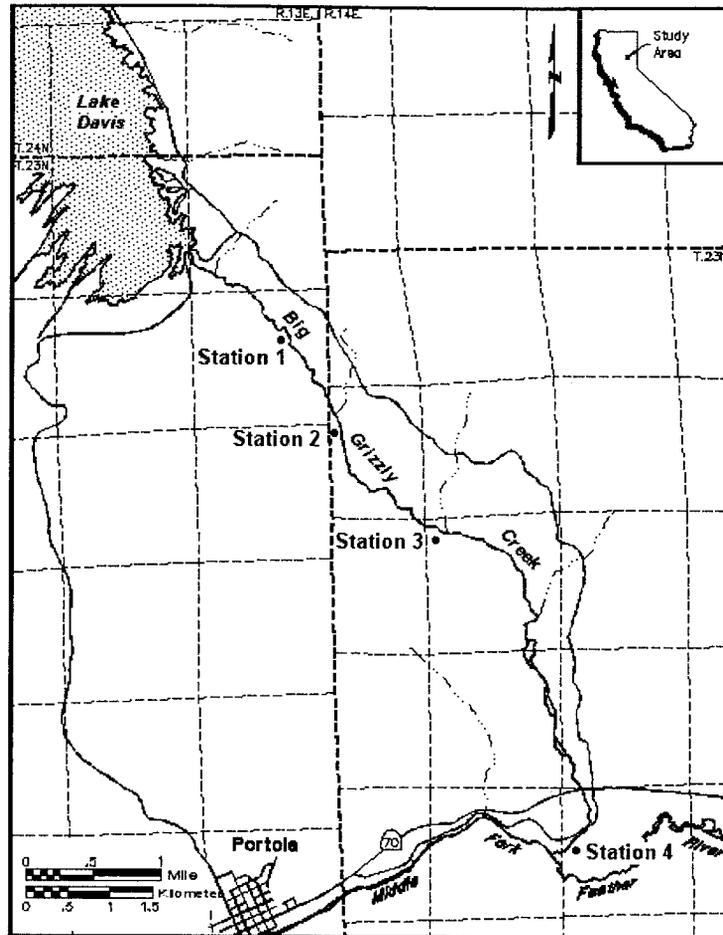


Figure 1. Map of sampling stations in Big Grizzly Creek Plumas County, 2004.

METHODS

Physical Measurements

Standing stocks of fishes were estimated at stations 1 through 4 in Big Grizzly Creek in October 2004 (Figure 1). Identified stations were intentionally selected because they were near stations sampled in previous DFG studies (Gerstung 1973), and to represent available habitat in Big Grizzly Creek. Markers were placed in trees along the stream to identify station boundaries. Stations ranged in length from 41.1 to 61 m (Appendix 1). The length and width of each station was measured with metric tape measures.

Water quality parameters collected included: pH and temperature (Oakton 35618-series portable waterproof pH/mV/temperature meter), dissolved oxygen (DO) concentration (Oakton 35641-series portable waterproof dissolved oxygen meter), turbidity (Orbeco-Hellige Model

966 portable turbidimeter), and electrical conductivity (Oakton 35608-series portable waterproof conductivity meter).

Biological Measurements

Fish were captured with a Smith Root model 12b battery-powered backpack electroshocker in stream sections blocked by seines as described by Platts et al. (1983) (Figure 2). Captured fish were removed from the net-enclosed section on each pass. Standing stock estimates were developed using the two-count method of Seber and LeCren (1967) or the multiple-pass method of Leslie and Davis (1939) with limits of confidence computed using a formula proposed by DeLury (1951).

The weights of trout were measured by displacement (Figure 3). Fork length (FL) of each fish captured was measured to the nearest millimeter. See Appendices 2 and 3 for measurements of brown and rainbow trout caught.

Age, growth rates, and condition factors (Ricker 1958) were calculated to provide baseline information that will be used to measure the effects of changes in habitat on trout populations.

Standing crops of brown trout and rainbow trout were estimated for individual stations where each species was caught. Trout have not been planted in Big Grizzly Creek since 1999 (Table 1). The distribution of all fish caught is listed according to station.

Table 1. Records of trout planted in Big Grizzly Creek by the DFG in 1999.

<u>Species of Fishes</u>	<u>Date</u>	<u>Average Length of Trout (mm)</u>	<u>Number of Trout</u>
Rainbow trout	14-Jul	230	1020
Rainbow trout	15-Jul	74	4500
Rainbow trout	15-Jul	30	5496
Rainbow trout	6-Aug	55	1000
Rainbow trout	4-Oct	180	25
Brown trout	15-Jul	54	1000
Brown trout	3-Aug	280	1001
Brown trout	4-Oct	180	25



Figure 2. Electrofishing in Big Grizzly Creek, Plumas County.



Figure 3. Measuring weights of trout by displacement.

RESULTS

Water Quality

All parameters of water quality were taken near 1200 hours on October 14, 2004 (Table 2). Temperature in Big Grizzly Creek was 14.5°C. Conductivity and turbidity were 111.5 us and 6.7 NTU. PH was 8.4 and dissolved oxygen was 8.4 mg/l. These values are well within safe limits for trout rearing (Piper et. al. 1982).

Table 2. Parameters of water quality collected in Big Grizzly Creek, Plumas County, 2004.

	<u>Station 3</u>
Temperature	14.5° C
Conductivity	111.5 us
Turbidity	6.7 NTU
pH	8.4
Dissolved Oxygen	8.4 mg/l

Distribution

Rainbow trout and brown trout were caught at all stations. Sacramento suckers (*Catostomus occidentalis*) were caught at stations 3 and 4 (Table 3).

Table 3. Distribution of fishes in Big Grizzly Creek, Plumas County, 2004.

	<u>Station Number</u>			
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
Distance below Grizzly Valley Dam (km)	2.5	3.2	4.8	9.7
Brown trout	X	X	X	X
Rainbow trout	X	X	X	X
Sacramento sucker			X	X

Standing Crop

Brown trout and rainbow trout were caught at all four stations. Weighted biomass of brown trout was 6.7 g/m² (Table 4). Catchable brown trout (trout greater than or equal to 127 mm FL) biomass averaged 5.1 g/m². Weighted biomass of rainbow trout averaged 2.5 g/m² (Table 5). Catchable rainbow trout biomass averaged 1.9 g/m². Biomass was not estimated for Sacramento suckers.

Table 4. Estimate of brown trout standing crop in Big Grizzly Creek, Plumas County, 2004.

Distance below Grizzly Valley <u>Dam (km)</u>	Population <u>Estimate</u>	95 Percent Confidence <u>Estimate</u>	<u>Biomass (g/m²)</u>	Estimate of Catchable <u>Trout</u>	Biomass of Catchable <u>Trout (g/m²)</u>
2.5	60	52-74	6.9	15	4.5
3.2	27	27-29	11.2	12	9.2
4.8	2	2-2	0.1	0	0
9.7	56	44-78	11.9	4	9.7

Table 5. Estimate of rainbow trout standing crop in Big Grizzly Creek, Plumas County, 2004.

Distance below Grizzly Valley <u>Dam (km)</u>	Population <u>Estimate</u>	95 Percent Confidence <u>Estimate</u>	<u>Biomass (g/m²)</u>	Estimate of Catchable <u>Trout</u>	Biomass of Catchable <u>Trout (g/m²)</u>
2.5	24	23-28	2.6	10	2.3
3.2	26	26-28	4.2	2	3.4
4.8	61	51-78	2.2	5	1.2
9.7	3	3-6	1.6	3	1.6

Length and Weight

Age group 0+ rainbow trout represented 67 percent of the 85 rainbow trout caught. Age 1+ comprised 26 percent, and age 2+ made up 7 percent (Figure 4). Age group 0+ brown trout made up 64 percent of the 125 brown trout caught. Age 1+ comprised 19 percent, age 2+ comprised 14 percent, and age 3+ made up 2 percent (Figure 5).

The relationship between fork length and weight (W) of rainbow trout for Big Grizzly Creek is:

$$\begin{aligned} \text{Log}_{10}W &= -4.8 + 3.0 \text{Log}_{10}FL \\ r^2 &= 0.98 \\ N &= 85 \text{ (Figure 6 and Appendix 3)} \end{aligned}$$

The same relationship for brown trout is:

$$\begin{aligned} \text{Log}_{10}W &= -4.9 + 3.0 \text{Log}_{10}FL \\ r^2 &= 0.99 \\ N &= 125 \text{ (Figure 7 and Appendix 2)} \end{aligned}$$

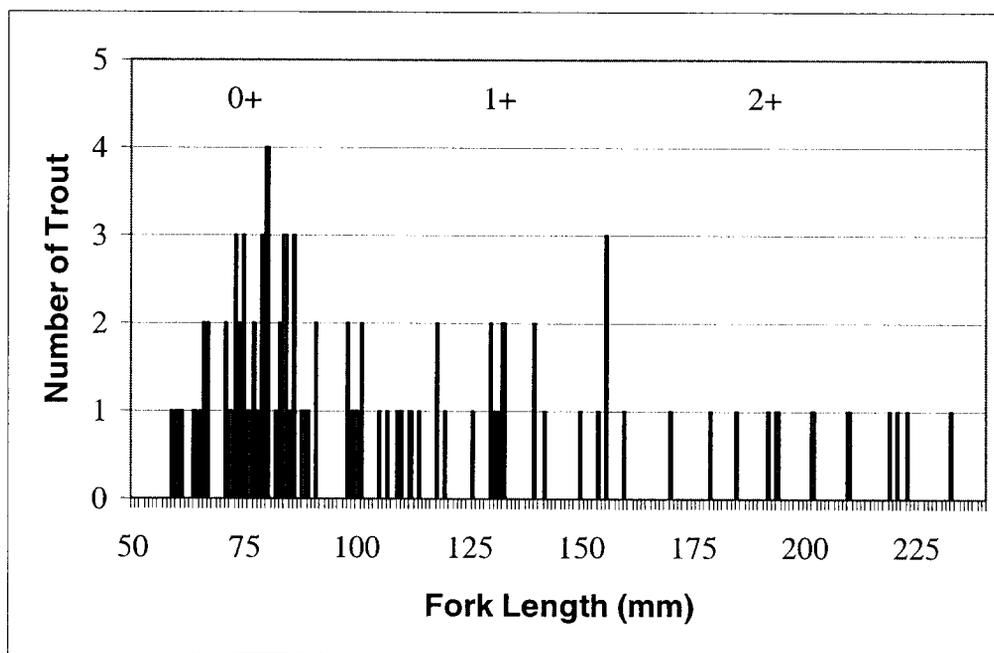


Figure 4. Length, observed frequency, and age of rainbow trout caught in Big Grizzly Creek, Plumas County, 2004.

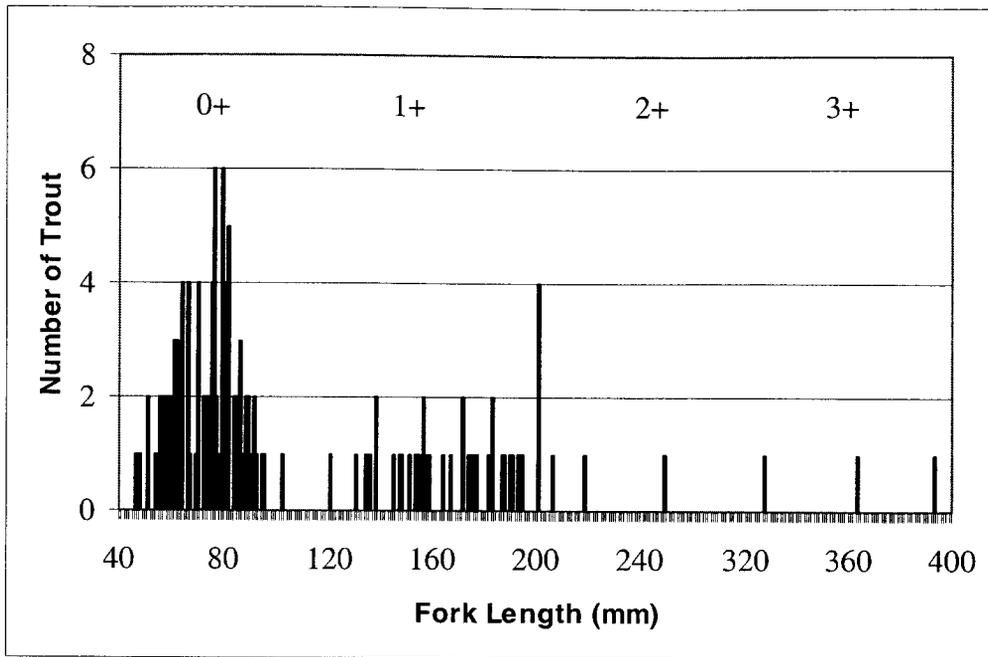


Figure 5. Length, observed frequency, and age of brown trout caught in Big Grizzly Creek, Plumas County, 2004.

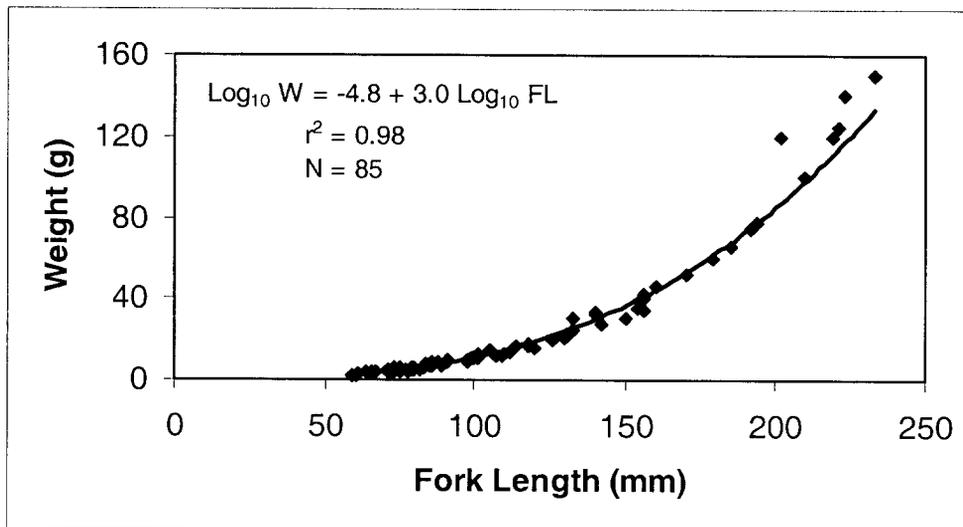


Figure 6. The relationship between length and weight of rainbow trout caught in sections of Big Grizzly Creek, Plumas County, 2004.

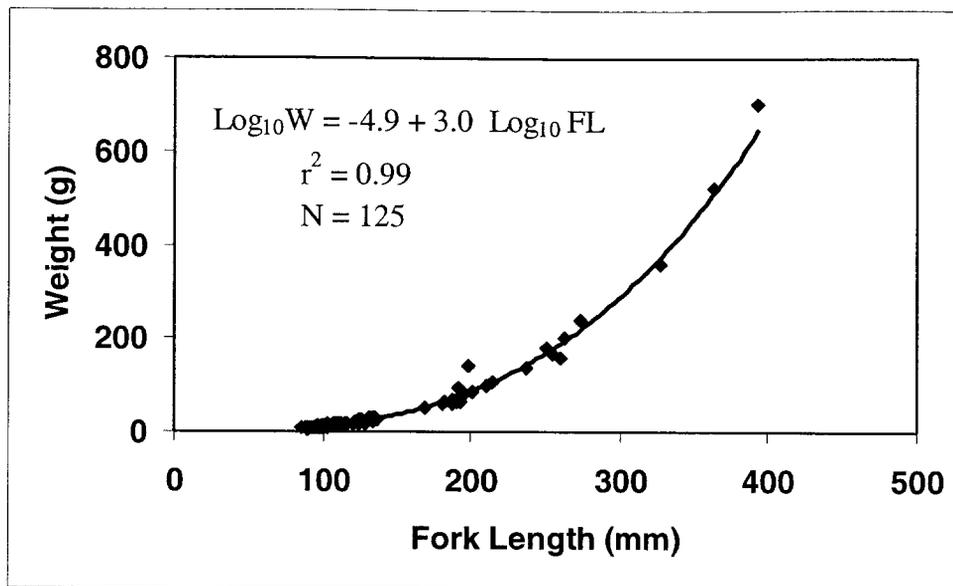


Figure 7. The relationship between length and weight of brown trout caught in sections of Big Grizzly Creek, Plumas County, 2004.

Age and Growth

The formula $FL = 10.9 + 0.2 S$ describes the relationship between the fork length and enlarged scale radius (S) of 38 rainbow trout caught in Big Grizzly Creek. The coefficient of correlation (r^2) is 0.76. The formula was $FL = 4.0 + 0.2 S$ for 43 brown trout, while the value for r^2 is 0.91.

The population instantaneous growth rate was greater than the mean individual instantaneous growth rate for age 1+ brown trout (Table 6). Population growth was also greater than mean individual growth in rainbow trout (Table 7).

Table 6 Growth rates for brown trout caught in Big Grizzly Creek, Plumas County, 2004.

Age Interval	Length Interval (mm)	Population Growth		Mean Individual Growth		
		Difference in Natural Logarithms	Instantaneous Growth Rate G_x	Length Interval (mm)	Difference in Natural Logarithms	Instantaneous Growth Rate G_x
1-2	101-198	0.794	2.382	112-219	0.671	1.605
2-3	198-253	0.245	0.735	226-274	0.193	0.771

Table 7. Growth rates for rainbow trout caught in Big Grizzly Creek, Plumas County, 2004.

Age <u>Interval</u>	Length Interval (mm)	<u>Population Growth</u>		<u>Mean Individual Growth</u>		
		Difference in Natural <u>Logarithms</u>	Instantaneous Growth Rate G_x	Length Interval (mm)	Difference in Natural <u>Logarithms</u>	Instantaneous Growth Rate G_x
1-2	80-172	0.765	2.295	105-172	0.494	1.482

Age 1+ brown trout averaged 134mm in fork length; 2+ fish averaged 220mm, and two 3+ fish were 345mm (Table 8). Age 1+ and 2+ rainbow trout averaged 149 mm and 204 mm, respectively (Table 9).

Table 8. Calculated fork length of brown trout from Big Grizzly Creek, Plumas County, 2004.

<u>Age</u>	Number of Fish	Length at Capture (mm)	Calculated Lengths at <u>Successive Annuli</u>		
			<u>1</u>	<u>2</u>	<u>3</u>
1	25	134	104		
2	15	220	116	198	
3	2	345	147	253	327
Number of back-calculations			42	17	2
Weighted means (mm)			100	204	327
Increments (mm)				104	123

Table 9. Calculated fork length of rainbow trout from Big Grizzly Creek, Plumas County, 2004.

<u>Age</u>	Number of Fish	Length at Capture (mm)	Calculated Lengths at <u>Successive Annuli</u>	
			<u>1</u>	<u>2</u>
1	31	149	80	
2	7	204	105	172
Number of back-calculations			38	3
Weighted means (mm)			85	172
Increments (mm)				87

Coefficient of Condition

The average coefficient of condition for 85 rainbow trout was 1.1284 and it was 1.0987 for 125 brown trout. Age 0+ rainbow trout had slightly higher coefficients of condition than brown trout of the same age group (Table 10).

Table 10. Condition of rainbow trout and brown trout in Big Grizzly Creek, Plumas County, 2004.

Age	Number of Fish	Coefficient of Condition	95% Confidence Interval
Brown Trout			
0+	80	1.1005	0.8741-1.3269
1+	24	1.0959	0.8961-1.2957
2+	18	1.0917	0.6950-1.4883
3+	3	1.0900	0.9693-1.2107
Combined	125	1.0987	0.8503-1.3472
Rainbow Trout			
0+	57	1.1553	0.8409-1.4698
1+	22	1.0377	0.8582-1.2172
2+	6	1.2141	1.0039-1.5210
Combined	85	1.1284	0.8390-1.4259

Streamflow

Summer streamflow in Big Grizzly Creek has generally been between 0.6 and 0.3 cms from 1974 to 2004. Higher flows occurred in 1977 and 1979 (Table 11). Streamflow data is presented in this report so that relationships between trout biomass and flow can be estimated. Haines (1982) reported that optimum flow for rainbow trout was 0.6 cms. Her recommendation was based on an instream flow study that the DWR conducted in 1981. The DWR bases flow releases from Lake Davis on lake water levels in the spring. Lake water levels were low from 1988 through 1994 so minimum releases (0.3 cms) were the rule during this period. Releases increased from 1995 through 1999, but they were dropped again in 2000 through 2004.

Table 11. Average summer streamflow in Big Grizzly Creek, 1974-2004.

<u>Year</u>	<u>Flow (cms)</u>	<u>Year</u>	<u>Flow (cms)</u>
1974	0.7	1990	0.3
1975	0.4	1991	0.3
1976	0.3	1992	0.3
1977	1.8	1993	0.3
1978	0.3	1994	0.3
1979	2.2	1995	0.6
1980	0.4	1996	0.6
1981	0.3	1997	0.6
1982	0.6	1998	0.6
1983	0.6	1999	0.6
1984	0.6	2000	0.3
1985	0.5	2001	0.3
1986	0.6	2002	0.3
1987	0.5	2003	0.3
1988	0.3	2004	0.3
1989	0.3		

Biomass of rainbow trout has averaged 2.8 g/m² and ranged from 0 to 7.3 g/m² since sampling began in 1976 (Table 12). No significant correlation between streamflow and biomass (p>0.05) has been found. Despite relative high summer flows in 1986 and 1995, rainbow trout biomass was lower than was expected. Brown trout biomass has averaged 2.8 g/m² and ranged from 0 to 6.7 g/m². Brown trout biomass is also not correlated with flow (p>0.05)

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APPENDIX 1

PERMANENT FISH POPULATION STATIONS FOR BIG GRIZZLY CREEK, PLUMAS COUNTY OCTOBER, 2004

Station 1 (Stream Gage Station) - Station 1 is located 1.8 stream km below Grizzly Valley Dam and just downstream from an abandoned USGS stream gage at an elevation of 1622 m above mean sea level (MSL). The station begins at a concrete weir near a stream gage (UTM 170 167). The stream within the station is a riffle (67%) with several split channels and small pocket pools that ends in a long, shallow pool (33%). It is 47.9 m long and has a surface area of 282.4 m² at 0.3 cms. Substrate is 75% boulders, 15% rubble, and 10% sand.

Station 2 (IFN Station) - Station 2 is 3.1 stream km below Grizzly Valley Dam. The site is located at UTM 176 156 at an elevation of 1610 m above MSL. The upper end of the station is a steep rapid (55%) followed by two deep pools (45%) separated by short rapids. The substrate is mostly rubble (60%), boulder (20%), gravel (10%), with areas of sand (10%) in the pools. The station is 41.1 m long with a surface area of 131.9 m² at 0.3 cms.

Station 3 (3-Mile Station) - Station 3 is located 5.2 km downstream from Grizzly Valley Dam at an elevation of 1549 m above MSL at UTM 189 141. The station begins in a steep rapid followed by more gradual rapids (75%) with pocket pools and two larger pools (25%) near the lower end. Substrate is boulder (65%), rubble (20%), sand (10%), and gravel (5%). The station is 42.7 m long and has a surface area of 275.2 m² at 0.3 cms.

Station 4 (6-Mile Station) - Station 4 is located 10.4 km below Grizzly Valley Dam and 0.2 km above the confluence with the Middle Fork Feather River at an elevation of 1488 m MSL. It is located at UTM 205 106. The station begins below a beaver dam in a riffle followed by several more riffle areas (67%) and shallow pools with undercut banks and overhanging grass clumps (33%). Substrate is rubble (10%), gravel (75%), bedrock (10%), and mud (5%). The station is 61 m long with a surface area of 227.1 m² at 0.56 cms.

APPENDIX 2

LENGTH AND WEIGHT OF BROWN TROUT
CAUGHT IN BIG GRIZZLY CREEK, 2004

Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)
80	5	110	13	148	35	163	46
83	11	110	14	150	34	164	46
89	7	112	16	150	36	164	44
90	7	113	17	150	36	164	41
91	9	113	17	150	36	164	28
91	9	114	19	151	38	165	52
92	8	114	16	151	38	165	48
93	7	114	16	152	37	166	47
95	9	114	15	152	34	166	55
96	10	115	20	152	34	167	48
97	9	115	14	152	48	167	48
98	82	115	16	152	40	167	48
98	11	115	16	152	39	170	51
98	11	115	15	154	34	170	56
98	10	117	18	154	47	170	56
98	11	118	19	154	47	170	50
99	12	118	15	154	40	170	50
100	11	118	19	155	34	170	55
100	11	121	22	155	34	170	54
100	11	121	19	157	37	171	56
101	12	122	20	157	40	171	50
102	12	135	25	158	47	171	52
103	11	137	28	158	42	172	56
105	11	138	25	159	38	172	58
105	12	139	28	159	38	172	44
105	11	140	28	160	41	172	44
105	12	140	30	160	50	174	54
106	12	142	30	160	39	174	54
106	13	144	34	161	42	175	55
108	14	145	38	162	56	175	58
109	14	146	34	162	46	175	58
110	14	148	36	162	50	176	64

APPENDIX 2

LENGTH AND WEIGHT OF BROWN TROUT
CAUGHT IN BIG GRIZZLY CREEK, 2004 (Continued)

Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)
177	56	196	90	221	127	271	200
178	67	197	94	222	124	273	200
178	52	198	83	222	124	274	255
180	62	200	93	223	120	279	260
180	65	200	92	224	114	281	245
180	62	200	90	224	155	282	240
180	62	200	90	224	135	283	275
180	57	201	120	225	114	284	260
181	64	202	97	225	142	284	230
181	62	202	97	226	137	285	230
182	62	203	92	226	120	286	265
182	62	203	95	227	130	304	360
182	62	204	97	228	116	309	300
185	170	205	87	229	115	311	365
185	77	205	93	234	155	311	340
185	78	205	98	236	138	325	410
186	75	205	98	236	150	329	340
186	66	207	115	242	150	330	400
186	73	208	101	246	175	342	430
186	66	208	100	247	160	484	650
186	73	209	105	248	195		
187	75	210	100	249	195		
188	78	210	100	254	190		
188	68	211	104	255	185		
190	80	216	180	255	172		
190	80	217	105	255	125		
191	77	218	121	256	190		
191	73	218	127	262	185		
191	68	219	110	266	210		
192	82	220	124	266	198		
192	87	220	107	267	200		
196	95	221	127	269	220		

APPENDIX 3

LENGTH AND WEIGHT OF RAINBOW
TROUT CAUGHT IN BIG GRIZZLY CREEK, 2004.

Fork Length (mm)	Weight (g)
208	101