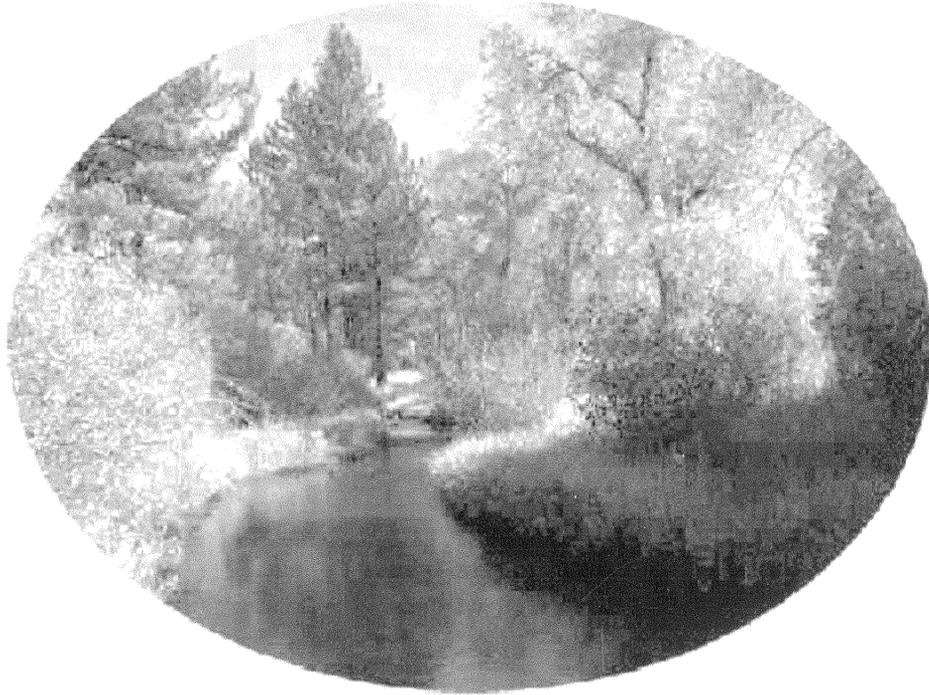


State of California  
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STANDING STOCKS OF FISHES  
IN SECTIONS OF BIG GRIZZLY CREEK  
PLUMAS COUNTY, 2003

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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, and Brown 2003).

The purpose of this study is to evaluate the effects of the operation of Lake Davis on populations of trout in Big Grizzly Creek. This evaluation was conducted 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.

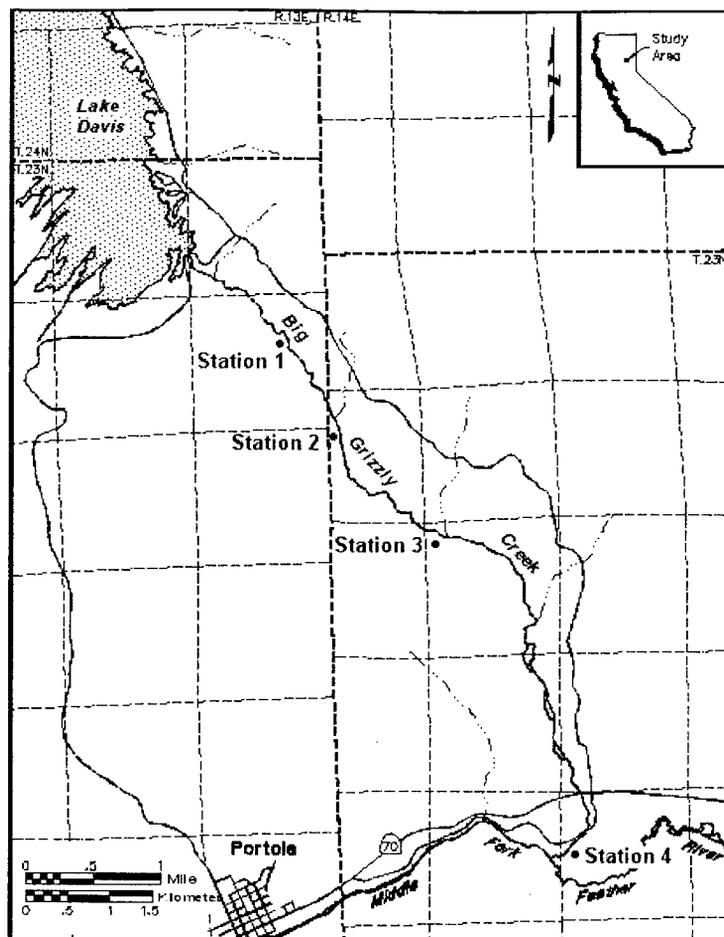


Figure 1. Map of sampling stations in Big Grizzly Creek Plumas County, 2003.

## METHODS

### Physical Measurements

Standing stocks of fishes were estimated at stations 1 through 3 in Big Grizzly Creek in October 2003 (Figure 1). Station 4 was inundated by a beaver pond. The beaver pond was too deep to electrofish. 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 47.2 to 51.1 m (Appendix 1). The length and width of each station was measured with metric tape measures.

## 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</u> <u>(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

### Distribution

Rainbow trout and brown trout were caught at all stations. Sacramento suckers (*Catostomus occidentalis*) were caught at station 3 (Table 2).

Table 2. Distribution of fishes in sections of Big Grizzly Creek, Plumas County, 2003.

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

### Standing Crop

Brown trout and rainbow trout were caught at all three stations. Biomass of brown trout was 6.1 g/m<sup>2</sup> (Table 3). Catchable brown trout (trout greater than or equal to 127 mm FL) biomass averaged 4.8 g/m<sup>2</sup>. Biomass of rainbow trout averaged 4.8 g/m<sup>2</sup> (Table 4). Catchable rainbow trout biomass averaged 4.0 g/m<sup>2</sup>. Biomass was not estimated for Sacramento suckers.

Table 3. Estimate of brown trout standing crop in Big Grizzly Creek, Plumas County, 2003.

Distance below Grizzly Valley Dam (km)	Population Estimate	95 Percent Confidence Estimate	Biomass (g/m <sup>2</sup> )	Estimate of Catchable Trout	Biomass of Catchable Trout (g/m <sup>2</sup> )
2.5	20	20-22	5.5	10	4.8
3.2	48	39-66	8.5	10	5.4
4.8	7	7-9	4.3	6	4.2

Table 4. Estimate of rainbow trout standing crop in Big Grizzly Creek, Plumas County, 2003.

Distance below Grizzly Valley Dam (km)	Population Estimate	95 Percent Confidence Estimate	Biomass (g/m <sup>2</sup> )	Estimate of Catchable Trout	Biomass of Catchable Trout (g/m <sup>2</sup> )
2.5	47	47-59	6.4	23	5.8
3.2	59	59-75	4.9	11	3.5
4.8	25	25-33	3.3	12	2.8

### Length and Weight

Age group 0+ rainbow trout represented 66 percent of the 131 rainbow trout caught. Age 1+ comprised 32 percent, and age 2+ made up 2 percent (Figure 4). Age group 0+ brown trout made up 49 percent of the 66 brown trout caught. Age 1+ comprised 24 percent, age 2+ comprised 25 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:

$$\begin{aligned} \text{Log}_{10}W &= -4.8 + 2.9 \text{Log}_{10}FL \\ r^2 &= 0.98 \\ N &= 131 \text{ (Figure 6 and Appendix 3)} \end{aligned}$$

The same relationship for brown trout is:

$$\begin{aligned} \text{Log}_{10}W &= -5.0 + 3.0 \text{Log}_{10}FL \\ r^2 &= 0.99 \\ N &= 66 \text{ (Figure 7 and Appendix 2)} \end{aligned}$$

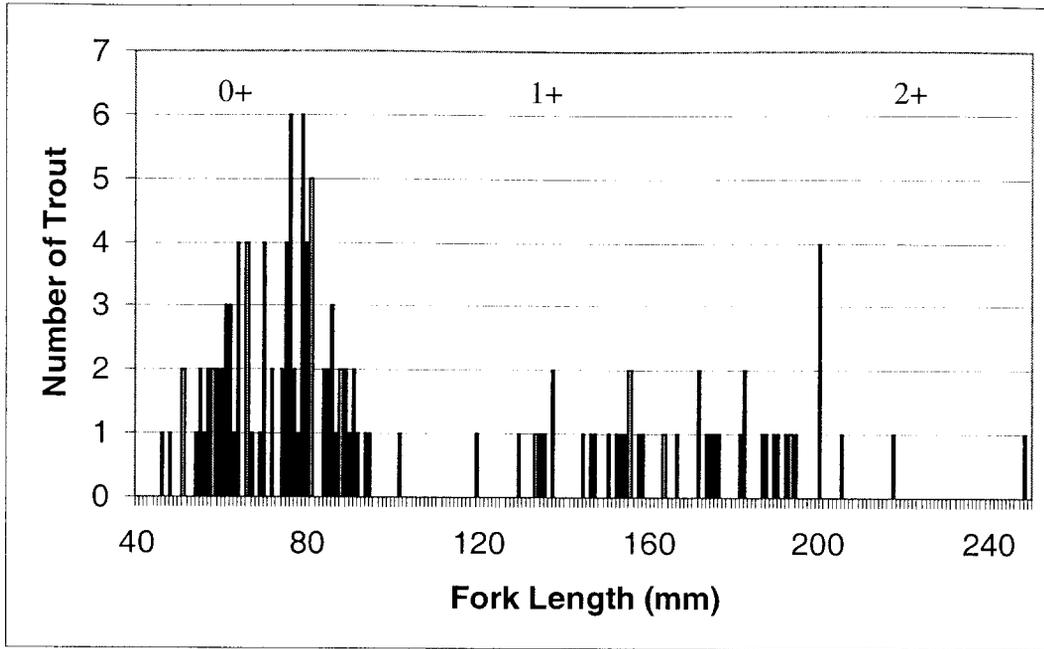


Figure 4. Length, observed frequency, and age of rainbow trout caught in Big Grizzly Creek, Plumas County, 2003.

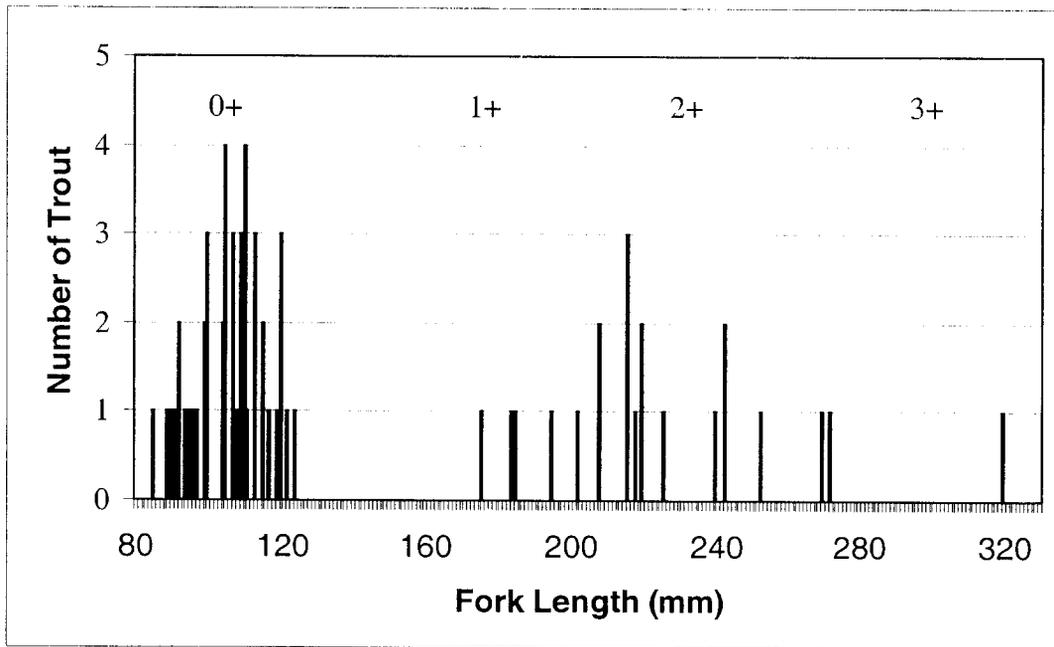


Figure 5. Length, observed frequency, and age of brown trout caught in Big Grizzly Creek, Plumas County, 2003.

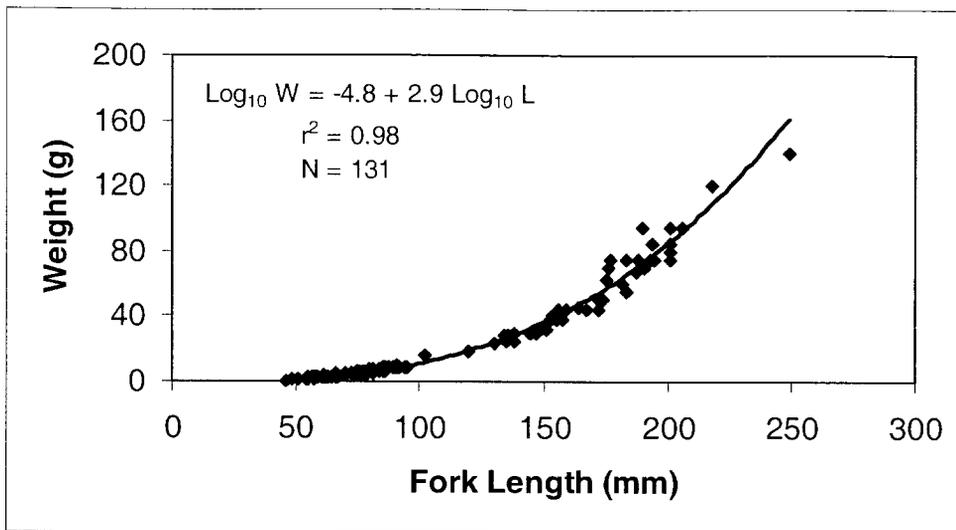


Figure 6. The relationship between length and weight of rainbow trout caught in sections of Big Grizzly Creek, Plumas County, 2003.

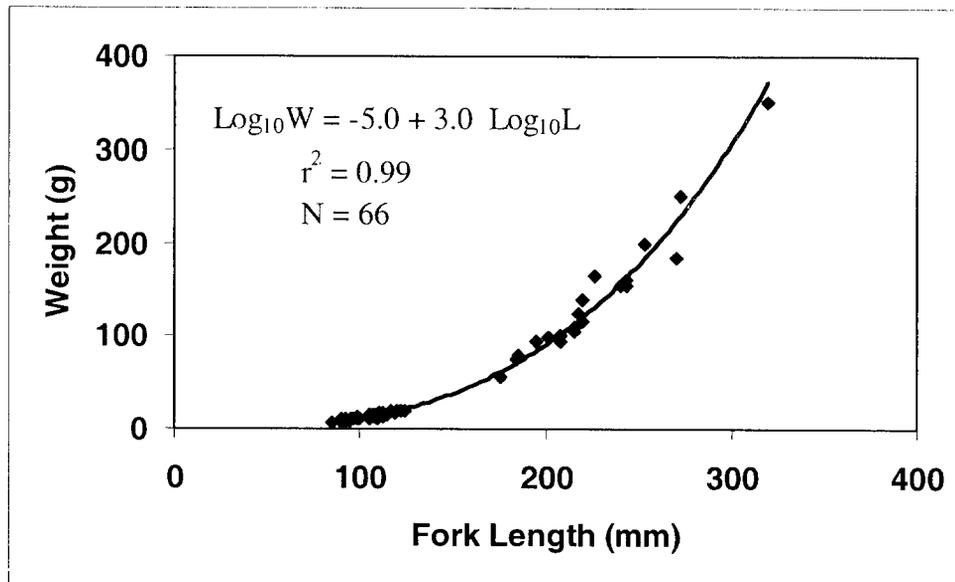


Figure 7. The relationship between length and weight of brown trout caught in sections of Big Grizzly Creek, Plumas County, 2003.

## Age and Growth

The formula  $FL = 1.0 + 0.2 S$  describes the relationship between the fork length and enlarged scale radius (S) of 25 rainbow trout caught in Big Grizzly Creek. The coefficient of correlation ( $r^2$ ) is 0.79. The formula was  $FL = -0.6 + 0.3 S$  for 63 brown trout, while the value for  $r^2$  is 0.80.

The population instantaneous growth rate was greater than the mean individual instantaneous growth rate for age 1+ brown trout (Table 5). Population growth was also greater than mean individual growth in rainbow trout (Table 6).

Table 5. Growth rates for brown trout caught in Big Grizzly Creek, Plumas County, 2003.

Age Interval	Length Interval (mm)	<u>Population Growth</u>		<u>Mean Individual Growth</u>		
		Difference in Natural <u>Logarithms</u>	Instantaneous Growth Rate <u>G<sub>x</sub></u>	Length Interval (mm)	Difference in Natural <u>Logarithms</u>	Instantaneous Growth Rate <u>G<sub>x</sub></u>
1-2	99-219	0.794	2.382	112-219	0.671	2.013
2-3	219-274	0.224	0.672	226-274	0.193	0.579

Table 6. Growth rates for rainbow trout caught in Big Grizzly Creek, Plumas County, 2003.

Age Interval	Length Interval (mm)	<u>Population Growth</u>		<u>Mean Individual Growth</u>		
		Difference in Natural <u>Logarithms</u>	Instantaneous Growth Rate <u>G<sub>x</sub></u>	Length Interval (mm)	Difference in Natural <u>Logarithms</u>	Instantaneous Growth Rate <u>G<sub>x</sub></u>
1-2	99-219	0.794	2.382	112-219	0.671	2.013

Age 1+ brown trout averaged 129 mm in fork length; 2+ fish averaged 225 mm, and one age 3+ fish was 320 mm (Table 7). Age 1+ and 2+ rainbow trout averaged 167 mm and 224 mm, respectively (Table 8).

Table 7. Calculated fork length of brown trout from Big Grizzly Creek, Plumas County, 2003.

<u>Age</u>	<u>Number of Fish</u>	<u>Length at Capture (mm)</u>	<u>Calculated Lengths at Successive Annuli</u>		
			<u>1</u>	<u>2</u>	<u>3</u>
1	16	129	99		
2	17	225	112	219	
3	1	320	100	226	274
Number of back-calculations			34	18	1
Weighted means (mm)			100	221	324
Increments (mm)			97	121	103

Table 8. Calculated fork length of rainbow trout from Big Grizzly Creek, Plumas County, 2003.

<u>Age</u>	<u>Number of Fish</u>	<u>Length at Capture (mm)</u>	<u>Calculated Lengths at Successive Annuli</u>	
			<u>1</u>	<u>2</u>
1	40	167	92	
2	3	224	99	168
Number of back-calculations			43	3
Weighted means (mm)			92	168
Increments (mm)			92	76

## Coefficient of Condition

The average coefficient of condition for 134 rainbow trout was 1.2179 and it was 1.1266 for 67 brown trout. Age 0+ rainbow trout had slightly higher coefficients of condition than brown trout of the same age group. (Table 9).

Table 9. Condition of rainbow trout and brown trout in Big Grizzly Creek, Plumas County, 2003.

<u>Age</u>	<u>Number of Fish</u>	<u>Coefficient of Condition</u>	<u>95% Confidence Interval</u>
		<u>Brown Trout</u>	
0+	81	1.0996	0.8797-1.3195
1+	43	1.1152	0.9317-1.2988
2+	83	1.1373	0.8630-1.4116
3+	12	1.1106	0.8318-1.3895
4+	1	1.0191	
Combined	220	1.1266	0.8937-1.3595
		<u>Rainbow Trout</u>	
1+	1	1.1363	
2+	3	1.1685	0.9227-1.4142
Combined		1.1604	0.9573-1.3635

## Streamflow

Summer streamflow in Big Grizzly Creek has generally been between 0.6 and 0.3 cms from 1974 to 2003. Higher flows occurred in 1977 and 1979 (Table 10). 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 were higher from 1995 through 1999, but they dropped again in 2000 through 2003.

Table 10. Average summer streamflow in Big Grizzly Creek, 1974-2003.

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<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		
1989	0.3		

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Biomass of rainbow trout has averaged  $2.9 \text{ g/m}^2$  and ranged from 0 to  $7.3 \text{ g/m}^2$  since sampling began in 1976 (Table 11). 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  $2.5 \text{ g/m}^2$  and ranged from 0 to  $6.0 \text{ g/m}^2$ . Brown trout biomass is also not correlated with flow ( $p>0.05$ )

Table 11. Biomass (g/m<sup>2</sup>) of rainbow and brown trout in Big Grizzly Creek.

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<u>Year</u>	<u>Rainbow trout</u>	<u>Brown trout</u>
1976	1.9	-
1981	1.8	0.1
1986	3.2	3.8
1988	5.6	0.4
1994	2.2	0.7
1995	1	0.5
1996	4.5	0.5
1997	7.3	2.2
1998	1.6	3.1
1999	0	6
2000	2	2.3
2001	2	2.3
2002	2.2	4.2
2003	4.8	5.8
Average	2.9	2.5

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## DISCUSSION

Sampling has not revealed the presence of northern pike in Big Grizzly Creek downstream of the dam. However, samples in riffles and shallow pools were not effective because the electrofisher is not effective in deeper pools. Therefore, because pike are often found in deeper pools, the sampling method used is unlikely to capture pike. Gill netting pools in addition to electrofishing would be required if sampling for pike was the primary objective.

This study has not established a significant relationship between flow and trout standing crop or biomass. It is likely, however, that there is a significant relationship between streamflow and trout populations in Big Grizzly Creek. Continued sampling may establish this possibility.

The year 2003 was the third year since Big Grizzly Creek was poisoned (due to the Lake Davis treatment) that all ages of trout in the stream were hatched in the gravels of the creek. Natural spawning trout maintain trout populations in the creek so additional trout planting is not necessary. All trout reflect the stream conditions of the years of their growth.

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## APPENDIX 1

### PERMANENT FISH POPULATION STATIONS FOR BIG GRIZZLY CREEK, PLUMAS COUNTY OCTOBER, 2003

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 47.2 m long and has a surface area of 231.6 m<sup>2</sup> 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 50 m long with a surface area of 167.6 m<sup>2</sup> 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 51.1 m long and has a surface area of 255.8 m<sup>2</sup> at 0.3 cms.

## APPENDIX 2

LENGTH AND WEIGHT OF BROWN TROUT  
CAUGHT IN BIG GRIZZLY CREEK, 2003

Fork Length (mm)	Weight (g)								
102	12	165	54	200	90	230	140	276	230
102	12	165	48	202	90	231	190	278	220
103	12	167	50	205	110	232	180	278	230
103	14	168	60	205	90	233	140	280	270
104	15	168	50	208	90	234	140	281	260
104	12	169	70	210	100	235	130	282	280
105	12	169	48	210	90	236	125	283	250
106	13	170	52	213	100	240	160	285	250
106	14	171	58	214	130	240	155	286	250
107	15	175	60	214	120	241	130	291	280
108	13	175	56	215	130	244	190	292	290
108	12	180	62	217	115	245	150	292	260
110	18	182	64	218	115	246	180	300	350
110	16	183	70	219	100	247	190	300	320
111	14	183	65	220	125	248	160	303	290
115	16	183	64	220	100	250	200	308	220
116	14	183	62	221	120	250	160	311	390
120	20	184	80	221	140	251	175	316	350
120	20	184	65	221	140	252	190	324	350
120	20	184	75	223	170	252	170	350	500
121	20	184	60	223	120	253	180	354	490
122	20	185	75	223	110	255	180	455	960
126	22	185	70	223	120	258	200		
130	24	186	74	223	125	258	210		
138	32	189	80	224	120	259	210		
144	32	191	75	225	110	260	210		
150	40	192	90	226	170	260	200		
159	44	193	80	226	120	260	180		
160	48	196	80	227	190	260	190		
161	50	196	90	227	140	263	200		
161	44	197	80	228	115	265	190		
162	44	198	80	230	150	273	180		
164	48	199	100	230	130	275	220		

## APPENDIX 3

LENGTH AND WEIGHT OF RAINBOW  
TROUT CAUGHT IN BIG GRIZZLY CREEK, 2003.

Fork Length (mm)	Weight (g)						
46	0.5	70	4	81	6	153	38
48	1	70	4	81	7	154	40
51	1.5	70	4	81	6	155	38
51	1.5	70	5	84	7	156	40
54	1	72	5	84	6	156	44
55	1.5	72	5	85	8	158	38
55	2	74	4	85	6	159	44
56	3	74	5	86	7	164	45
57	2	75	5	86	6	167	44
57	1.5	75	5	86	8	172	44
58	2	75	4	87	7	172	50
58	3	75	6	88	8	174	50
59	2	76	6	88	8	175	62
59	3	76	6	89	8	176	70
60	3	76	5	89	8	177	75
60	3	76	5	90	8	182	60
61	3	76	4	91	8	183	55
61	4	76	4	91	10	183	75
61	3	77	4	92	9	187	68
62	3	77	6	94	9	188	75
62	3	78	6	95	9	190	95
62	3	79	5	102	16	191	70
63	3	79	6	120	19	193	75
64	3	79	5	130	23	194	85
64	3	79	6	134	28	195	75
64	3	79	5	135	24	201	80
64	2	79	6	136	28	201	85
66	4	80	6	138	30	201	75
66	3	80	6	138	24	201	95
66	2.5	80	6	145	30	206	95
66	5	80	7	147	30	218	120
67	3	81	5	148	32	249	140
69	4	81	5	151	32		