

State of California  
The Resources Agency  
DEPARTMENT OF FISH AND GAME

STANDING STOCKS OF FISHES IN  
SECTIONS OF RED CLOVER CREEK,  
PLUMAS COUNTY, 1998

by

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INTRODUCTION

Red Clover Creek (Figure 1) is the site of a proposed and authorized dam (Abbey Bridge) that would be part of the State Water Project. It is also the site of projects designed to reduce quantities of granitic sand flowing into Indian Creek and the Feather River. Red Clover Creek is an important source of rainbow trout (Oncorhynchus mykiss) in the Indian Creek system.

An earlier study of standing stocks of fishes in Red Clover Creek established stations for long-term studies of trout populations in this watershed (Brown 1976). Stations identified and sampled in 1976 were sampled again in 1988, 1990, and 1991 (Brown 1990, Brown 1991, and Brown 1992). The biomass of trout was highest in 1988.

The purpose of this study was to gather information on tributaries to Indian Creek through periodic fish sampling at established stations in Red Clover Creek in order to increase our knowledge of the dynamics of that system. This knowledge will be used in evaluating the effects of proposed projects such as the construction of a dam on the fishery resources of this system. This report documents the results of sampling conducted in 1998.

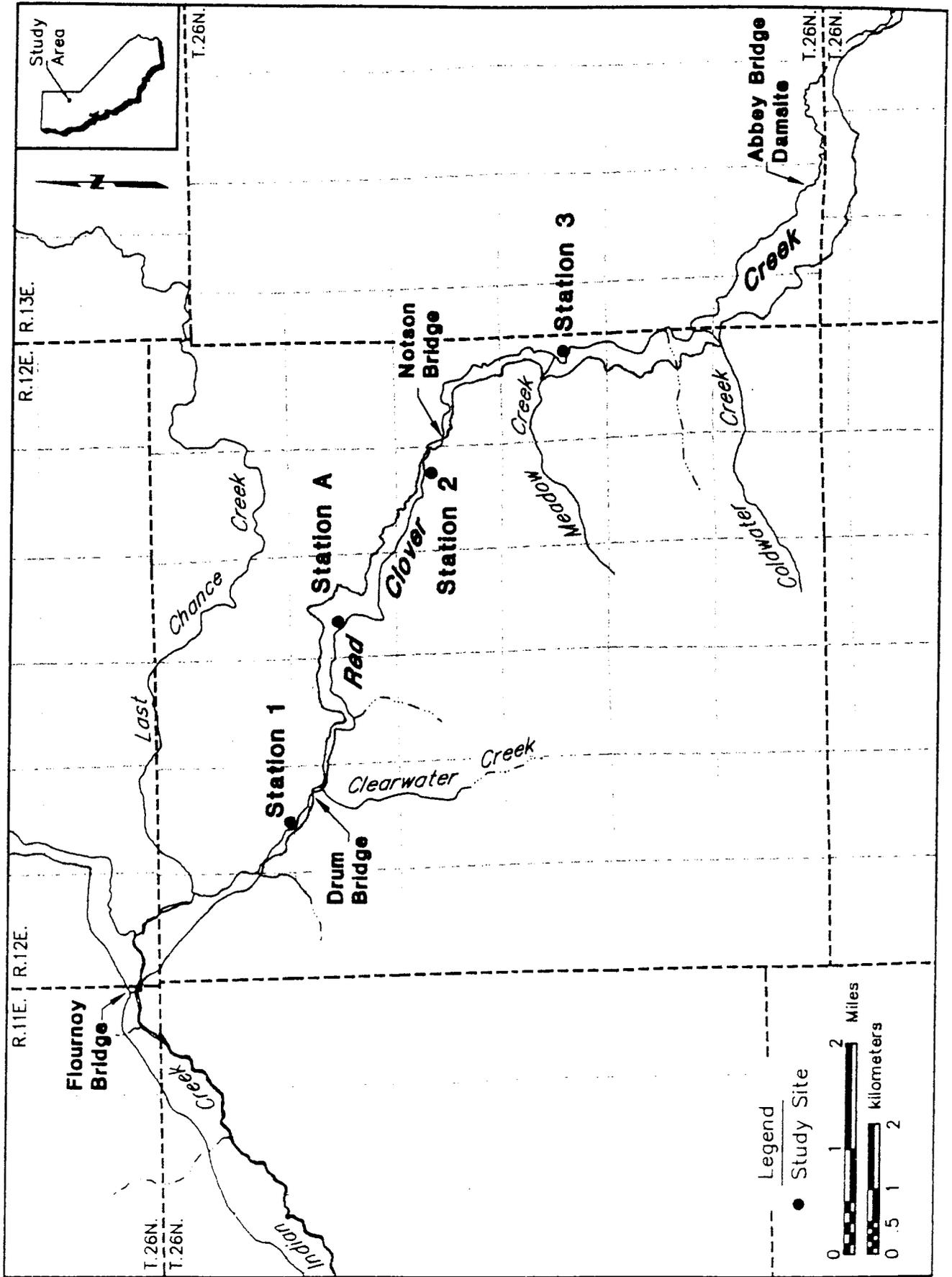


Figure 1. Stations Sampled to Estimate Standing Crop of Trout in Red Clover Creek, Plumas County, 1998.

## METHODS

Standing stocks of fishes were estimated at four stations in Red Clover Creek (Figure 1) in Plumas County. The length, average width, and average depth of each station were measured (Appendix 1). Fish were captured with a battery powered backpack electroshocker in stream sections blocked by seines. 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 weight of rainbow trout was determined to the nearest milliliter by displacement in water. Weights were measured for all trout caught, and fork length (FL) of each fish was measured to the nearest millimeter.

Scale samples were taken from trout over 100 mm in length. Scales were mounted dry between microscope slides, and their images were projected on a NCR microfiche reader at a magnification of 42X. Scale measurements for the calculation of growth were recorded to the nearest millimeter along the anterior radius of the anterior-posterior axis of the scale.

Geometric mean functional regressions were used to describe the body-scale and length-weight relationships (Ricker 1975). Estimation of true mean growth rate (G) was calculated using methods of Ricker (op. cit.).

Distribution of all fish caught is listed according to location. Standing crops of rainbow trout were calculated for individual stations where they were caught and combined for the entire creek. Age and growth, mean individual growth, and length-weight relationships were determined for rainbow trout. The coefficient of condition and 95 percent confidence intervals were also calculated by station.

## RESULTS

Rainbow trout were caught in each station. Sacramento suckers were caught in stations 1 and A, while speckled dace were also caught in station A (Table 1).

Table 1. Fishes caught in selected sections of Red Clover Creek, Plumas County, 1998.

	Station Number			
	1	A	2	3
Distance above Indian Creek (km)	2.4	5.8	9.7	13.0
Rainbow trout	X	X	X	X
Speckled dace		X		
Sacramento sucker	X	X		

Rainbow trout ranged in size from 49 to 283 mm FL (Figure 2). Rainbow trout biomass averaged 4.9 g/m<sup>2</sup> at four stations. An estimated 70 rainbow trout large enough for anglers to catch and keep (127 mm FL) were present in all the stations we sampled (Table 3).

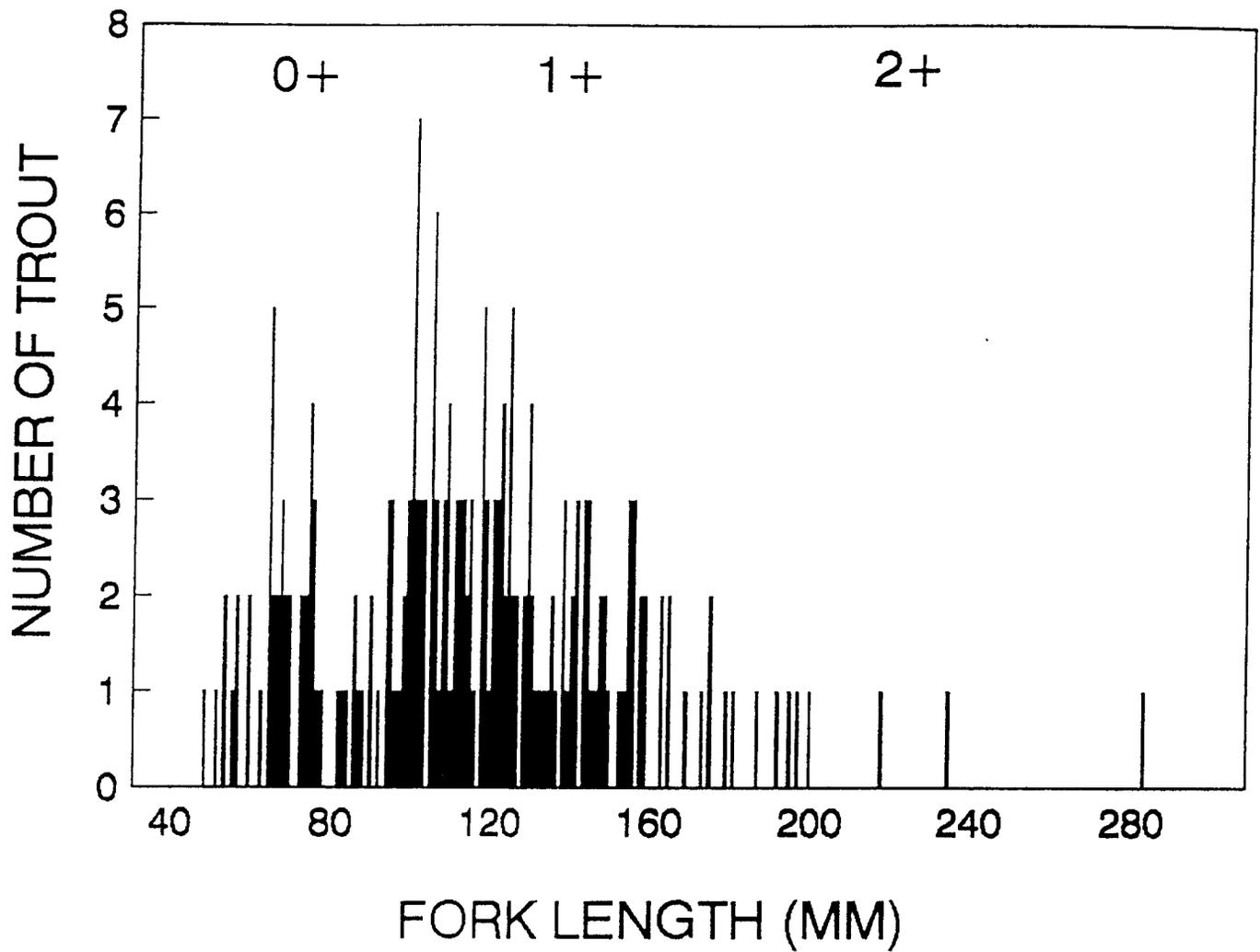


FIGURE 2. Length, observed frequency, and age of rainbow trout caught in Red Clover Creek, Plumas County, 1998.

Table 3. Estimate of rainbow trout standing crop in Red Clover Creek, Plumas County, 1998.

Distance above the mouth of Red Clover Creek (km)	Population Estimate	95% Confidence Interval	Biomass (g/m <sup>2</sup> )	Estimate of Catchable Trout (≥127 mm FL)	Biomass of Catchable Trout (g/m <sup>2</sup> )
2.4	78	72-88	7.5	24	4.0
5.8	110	90-135	4.1	23	4.1
9.7	46	43-53	6.2	22	6.2
13.0	1	1-1	1.8	1	1.8

The relationship between fork length (FL) and weight (W) of rainbow trout is:

$$\text{Log}_{10} W = -4.8 + 2.9 \text{Log}_{10} \text{FL}$$

$$r^2 = 0.98$$

N = 194 (Figure 3 and Appendix 2)

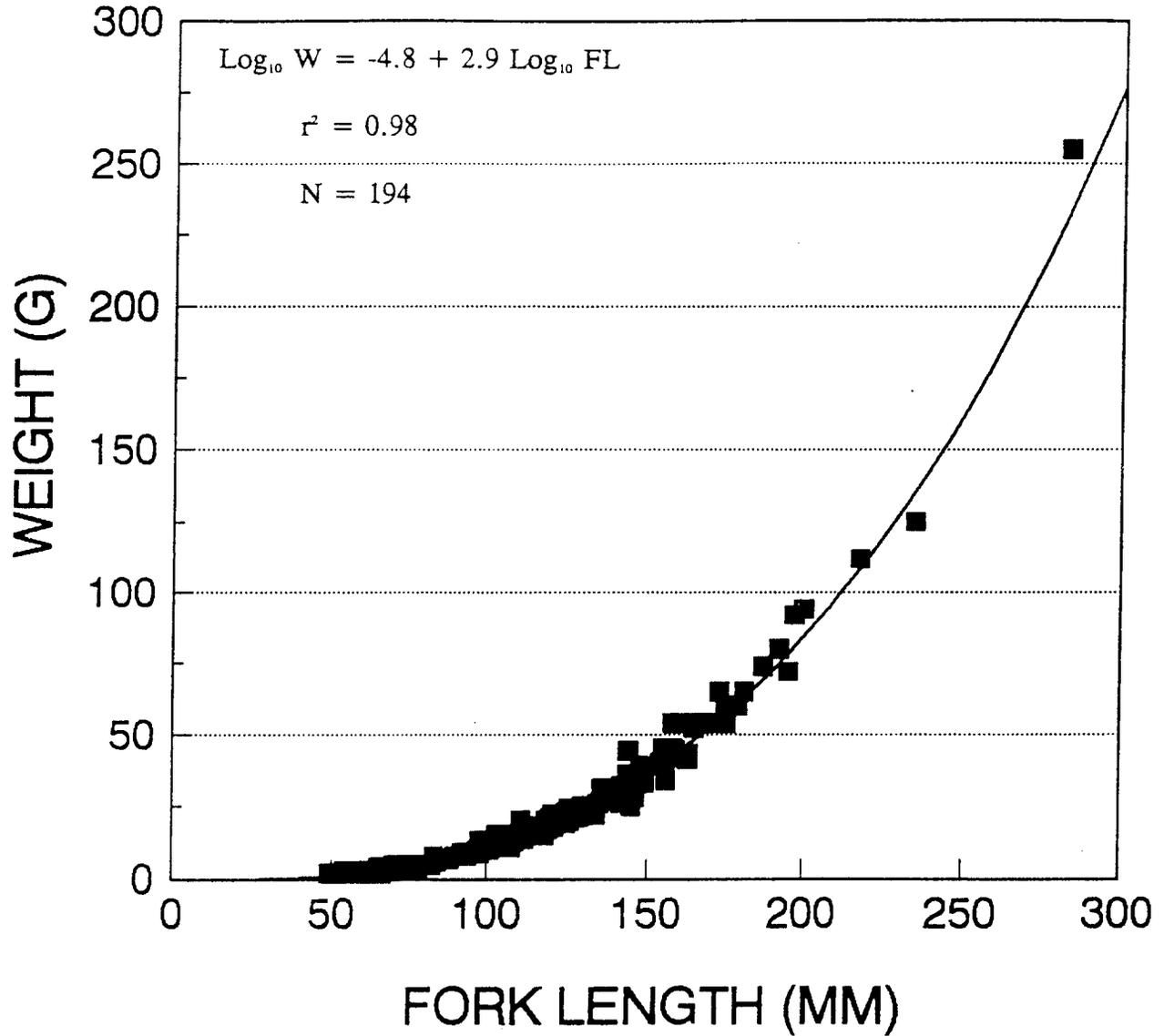


FIGURE 3. The relationship between length and weight of rainbow trout caught in sections of Red Clover Creek, Plumas County, 1998.

## Age and Growth

The formula  $FL = 58.3 + 0.9 S$  describes the relationship between the fork length and enlarged scale radius (S) of 60 rainbow trout caught in Red Clover Creek. The coefficient of correlation ( $r^2$ ) is 0.91.

Population growth was less than mean individual growth for age 1-2 rainbow trout (Table 4).

Table 4. Growth rates for rainbow trout caught in Red Clover Creek, 1998.

Age	Population Growth			Mean Individual Growth		
	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx
1-2	89-186	0.737	2.211	86-186	0.771	2.314

Age 1+ and age 2+ rainbow trout averaged 133 mm and 205 mm FL, respectively.

(Table 5).

Table 5. Calculated average fork length of rainbow trout from Red Clover Creek, 1998.

Age	Number of Fish	Length at Capture	Length at Successive Annulus	
			1	2
1	57	133	89	
2	3	205	86	186
Number of back-calculations			60	3
Weighted means (mm)			95	191
Increments (mm)				96

#### Coefficient of Condition

The average coefficient of condition for 207 rainbow trout was 1.1030 (Table 6). Age 0+ rainbow trout had slightly higher coefficients of condition than age 1+ or age 2+ rainbow trout.

Table 6. Condition of rainbow trout in Red Clover Creek, Plumas County, 1998.

Age Group	Number of Fish	Coefficient of Condition	95% Confidence Interval
0+	95	1.1231	0.7483-1.4980
1+	107	1.0849	0.8821-1.2877
2+	5	1.0950	0.9442-1.2748
Combined	207	1.1030	0.8068-1.3993

## DISCUSSION

We sampled Red Clover Creek in 1976, 1988, 1990, 1991, and 1998. Average standing crop varied between 25 and 59 rainbow trout per station (Table 7) while biomass varied between 1.0 and 5.6 g/m<sup>2</sup> (Table 8). Standing crop averaged 44 rainbow trout and biomass averaged 3.8 g/m<sup>2</sup> (Table 11). Standing crop of brown trout averaged 4 trout (Table 9) and 0.1 g/m<sup>2</sup> (Table 10). Brown trout were caught in 1976, 1988, and 1990, but not in 1991 or 1998 (Table 9).

Rainbow trout have dominated the catch each year we have sampled Red Clover Creek (Table 11). Brown trout may be scarce in our stations because high flows have been occurring in late winter and spring in recent years. High flows in early spring wash young brown trout downstream. Rainbow trout have not hatched yet, so they may survive such events (Seegrist and Gard 1972, Hansen and Waters 1974, Harvey 1987).

Speckled dace and Sacramento suckers were caught each year we sampled Red Clover Creek.

Table 7. Estimated populations of rainbow trout by station in Red Clover Creek, 1976-1998.

Station	1976	1988	1990	1991	1998
1	46	118	71	58	78
A				22	110
2		30	27	25	46
3	5	48		7	1
Average	25	58	49	28	59

Table 8. Estimated biomass (g/m<sup>2</sup>) of rainbow trout by station in Red Clover Creek, 1976-1998.

Station	1976	1988	1990	1991	1998
1	1.1	10.2	6.5	6.9	7.5
A				4.9	4.1
2		6.4	2.7	0.1	6.2
3	0.8	0.2		0.1	1.8
Average	1.0	5.6	4.6	3.0	4.9

Table 9. Estimated populations of brown trout by station in Red Clover Creek, 1976-1998.

Station	1976	1988	1990	1991	1998
1	4	5	3		
A					
2					
3	6	1			
Average	5	3	3		

Table 10. Estimated biomass (g/m<sup>2</sup>) of brown trout by station in Red Clover Creek, 1976-1998.

Station	1976	1988	1990	1991	1998
1	0.2	0.3	0.1		
A					
2					
3	0.1	0.1			
Average	0.1	0.2	0.1		

Table 11. Average standing crop and biomass for rainbow trout and brown trout in Red Clover Creek, 1976-1998.

Year	Rainbow Trout		Brown Trout	
	Population Estimate	Biomass (g/m <sup>2</sup> )	Population Estimate	Biomass (g/m <sup>2</sup> )
1976	25	1.0	5	0.1
1988	58	5.6	3	0.2
1990	49	4.6	3	0.1
1991	28	3.0		
1998	59	4.9		
Average	44	3.8	4	0.1

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## APPENDIX 1

### PERMANENT FISH POPULATION STATIONS FOR RED CLOVER CREEK, PLUMAS COUNTY.

Station 1 - Located 2.4 stream km upstream from the confluence with Indian Creek. Drive up Genesee-Beckwourth Road (26N16) 2.7 km above Flournoy Bridge to a small, dry watercourse. Hike downhill about 46 m, to Red Clover Creek, near the site of the abandoned DWR Red Clover near Genesee stream gage (SE 1/4 of SW 1/4, Section 5, T2N R12E). This station is labeled RC-3 in of DFG Region 2 files. The station is comprised primarily of large boulders and is mostly a deep run (95%), with some pool area (5%). It is 30.5 m long, with average width of 7.2 m, giving it a surface area of 218 m<sup>2</sup>.

Station A - Located 5.8 stream km upstream from the confluence with Indian Creek. Drive up Genesee-Beckwourth Road (26N16) 1.8 km above Drum Bridge to a small pullout on the stream edge of a steep canyon. Hike down a trail about 1.2 km to Red Clover Creek (SE 1/4 of NE 1/4, Section 10, T2N R12E). The station is comprised primarily of large boulders and cobbles with some sand and gravel. It is mostly riffle and run (70%), with some mid-channel pools (30%). It is 44.2 m long, with average width of 10.2 m, giving it a surface area of 451 m<sup>2</sup>.

Station 2 - Located 9.7 stream km upstream from the confluence with Indian Creek. Drive up Genesee-Beckwourth Road about 11.3 km to the campsite at the top of the canyon. Hike down to the stream adjacent to the campsite (SW 1/4, NE 1/4, Section 14, T25N, R12E). This station has many large boulders, but also has some gravel and sand bottom areas. It is mostly pool area (66%), with some run (19%) and riffle (15%). Its length is 39.9 m, with an average width of 8.1 m, giving it a surface area of 325 m<sup>2</sup>.

Station 3 - Located 13.0 stream km upstream from the confluence with Indian Creek. Drive up to the Genesee-Beckwourth Road about 16.1 km about Flournoy Bridge and turn left on a spur road. Drive 0.3 km down the spur road. The station is located just upstream of a dry tributary and downstream from a live tributary (SE 1/4, NE 1/4, Section 24, T25N, R12E). Previous studies refer to this station as "Station 4". The substrate is mostly volcanic with a small amount of sand and gravel. The station is broken up by bedrock outcroppings and is primarily pool (74%), and riffle (23%), with a small amount of run (3%). The station is 47.2 m long, with an average width of 2.9 m, giving it a surface area of 138 m<sup>2</sup>.

## APPENDIX 2

LENGTH AND WEIGHT OF RAINBOW TROUT  
CAUGHT IN RED CLOVER CREEK, 1998

Fork Length (mm)	Weight (g)						
49	2	66	2	75	4	92	9
52	2	67	4	75	3	94	8
54	2	67	3	76	4	94	9
54	3	68	3	76	5	94	9
56	2	68	4	76	4	95	9
57	3	68	4	77	5	95	9
57	2	69	4	78	3	95	9
60	3	69	4	82	5	96	9
60	2	70	5	83	8	97	10
63	2	70	4	84	6	98	9
65	4	73	4	86	7	100	11
65	3	73	4	86	7	100	12
65	3	74	5	87	7	100	12
65	4	74	4	88	7	100	11
65	3	75	5	90	8	100	11
66	3	75	4	90	8	100	13

## APPENDIX 2 (cont)

LENGTH AND WEIGHT OF RAINBOW TROUT  
CAUGHT IN RED CLOVER CREEK, 1998

Fork Length (mm)	Weight (g)						
100	12	105	13	111	20	116	17
101	10	105	13	111	14	118	18
101	11	106	14	111	16	118	18
101	12	106	13	112	15	118	16
102	12	106	14	112	16	118	17
102	12	107	15	112	14	118	15
102	11	108	14	113	18	119	17
103	12	108	12	113	15	119	20
103	11	108	11	113	16	119	18
103	15	109	15	114	15	120	21
105	13	109	14	114	15	122	20
105	12	109	13	115	17	122	20
105	11	109	15	115	16	123	19
105	12	110	15	115	16	123	20

## APPENDIX 2

LENGTH AND WEIGHT OF RAINBOW TROUT  
 CAUGHT IN RED CLOVER CREEK, 1998  
 (Continued)

Fork Length (mm)	Weight (g)						
123	20	130	25	139	29	147	36
124	21	130	23	140	27	148	38
124	22	130	23	141	29	148	33
125	20	130	25	141	30	149	35
125	23	131	24	142	32	149	33
125	19	132	22	142	26	150	39
125	21	133	23	142	30	153	39
125	20	134	22	144	36	154	40
126	20	135	26	144	44	155	42
126	24	136	30	144	27	155	45
127	21	136	31	145	25	155	39
127	24	137	31	145	33	158	54
129	23	139	29	145	33	159	44
129	21	139	30	146	28	159	42

APPENDIX 2

LENGTH AND WEIGHT OF RAINBOW TROUT  
 CAUGHT IN RED CLOVER CREEK, 1998  
 (Continued)

Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)
163	41	181	65
163	43	187	74
165	54	192	80
165	52	195	72
169	54	197	92
173	65	200	94
175	60	218	112
175	54	235	125
179	60	283	255