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The Resources Agency
DEPARTMENT OF FISH AND GAME

STANDING STOCKS OF FISHES IN SECTION
OF INDIAN CREEK, PLUMAS COUNTY, 1989

by

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INTRODUCTION

In 1976, the Department of Water Resources (DWR) initiated an instream flow program to identify streams that would benefit from flow enhancement to assess instream values streams. The Northern District of DWR selected Indian Creek below Antelope Reservoir (Figure 1) as one of the streams to study under this program. Initial flow studies by DWR indicated that flow augmentation could double trout habitat in the first 16 km of Indian Creek below the dam and increase habitat by 25 percent in lower reaches (DWR, 1979). As a result of this study, DWR and the Department of Fish and Game (DFG) decided to reoperate Antelope Reservoir to increase flow releases from 0.1 cms to 0.6 cms year-round on a trial basis. These flows would not impair recreation at Antelope Reservoir.

In 1977, sampling of salmonids was begun in Indian Creek at six different stations. Sampling continued through 1982 on a yearly basis to provide baseline data for salmonid biomasses (Brown 1978, Brown and Haines 1979, Haines and Brown 1980, Villa and Brown 1981, Villa 1982, Bumpass et. al. 1987a). Fish were not sampled in 1983, 1984, or 1985. Sampling resumed in 1986 and continued in 1987 (Bumpass et. al. 1987b, Bumpass et. al. 1989). Sampling was limited to three stations in 1989. These stations were sampled to estimate trout abundance in sections of Upper Indian Creek to compare with similar information collected in sections of Indian Creek downstream of Flournoy Bridge.

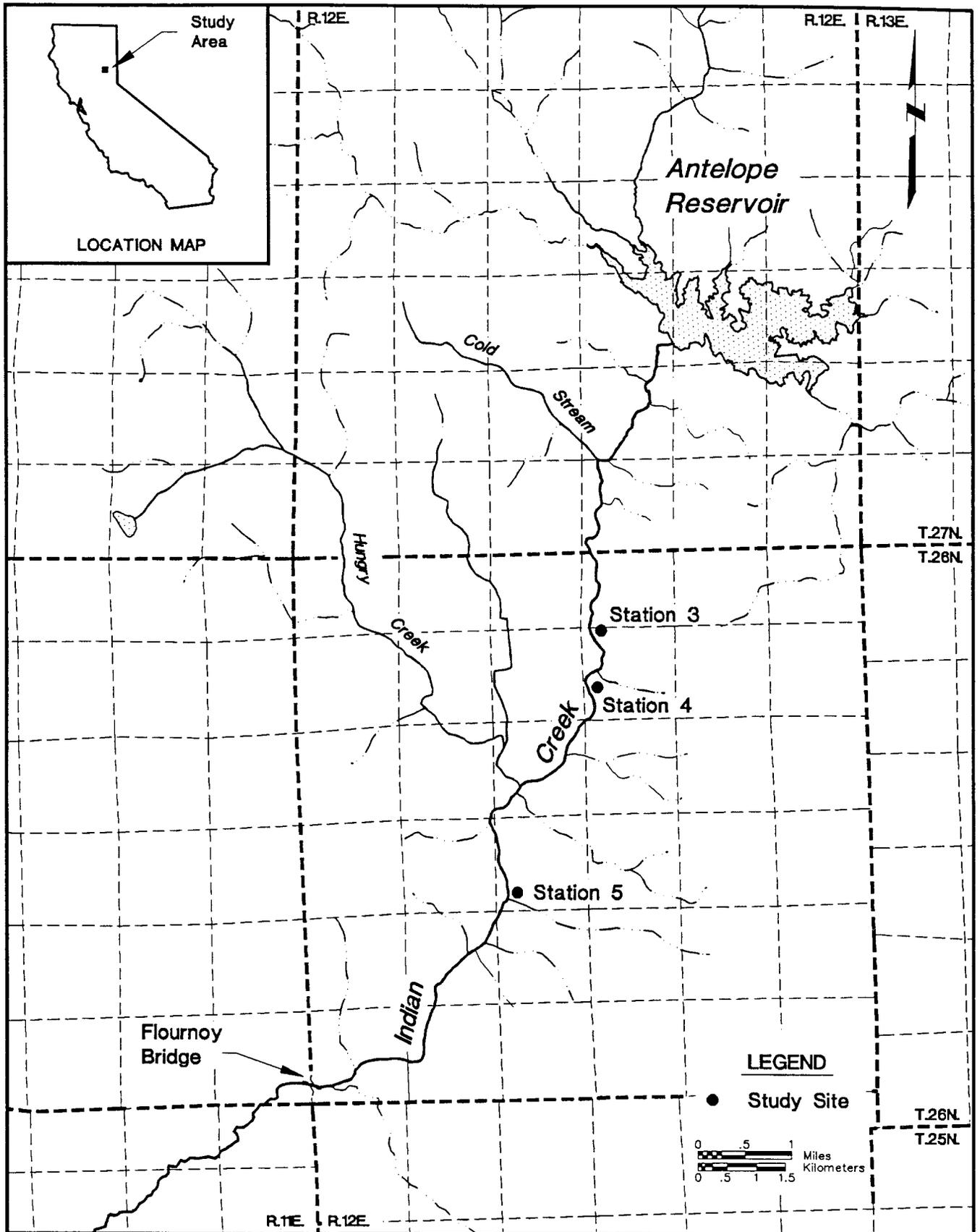


Figure 1. Stations sampled to determine biomass of fishes in Indian Creek, Plumas County, September 1989.

METHODS

Standing stocks of fishes were estimated at three stations in Indian Creek (Figure 1) in Plumas County. Stations were intentionally selected to be near stations sampled in previous DFG studies (Appendix 1). Markers had previously been placed in trees along the stream to identify station boundaries. Stations varied in length from 56.8 to 69.2 m; the length, average width, and average depth of each station were measured. 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).

Trout were also captured outside established sampling stations to help estimate age, length and weight, and condition factors when sample size was low.

The weights of brown trout (Salmo trutta) and rainbow trout (Oncorhynchus mykiss) were determined by displacement. Weights were measured for all fish caught. Fork length of (FL) each fish caught was measured to the nearest millimeter.

Scale samples were taken only from brown trout and rainbow 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 brown trout and rainbow trout were calculated for individual stations where the species of interest were caught. Age and growth were calculated for the population. Mean individual growth was calculated only for brown trout and rainbow trout. Length-weight relationships, coefficient of condition, and 95 percent confidence intervals were calculated for both brown trout and rainbow trout.

A separate report will discuss the results of 25 years of trout sampling in Indian Creek. Data presented in this report will be discussed in the 25 year summary.

RESULTS

Distribution

Brown trout were caught at stations 3 through 5. Rainbow trout were caught at stations 4 and 5 (Table 1).

TABLE 1. Distribution of Fishes in Sections of Indian Creek, Plumas County, 1989.

	Station Number		
	<u>3</u>	<u>4</u>	<u>5</u>
Distance below Antelope Dam (km)	6.1	7.3	12.0
Brown trout	X	X	X
Rainbow trout		X	X

Standing Crop

Brown trout were the most common game fish caught in Indian Creek. Biomass averaged 5.7 g/m^2 at three stations. Biomass for brown trout large enough for fishermen to catch and keep (127 mm FL and larger) averaged 5.4 g/m^2 (Table 2). Rainbow trout biomass averaged 0.9 g/m^2 , while the biomass for catchables averaged 0.6 g/m^2 (Table 3).

Age and Growth

The formula $L = 62.4 + 3.1 S$ describes the relationship between the fork length (L) and enlarged scale radius (S) of 125 brown trout caught in Indian Creek. The coefficient of correlation (r^2) is 0.52. The formula was $L = 12.4 + 0.09 S$ for 10 rainbow trout caught, while the value for r^2 is 0.13. The value of r^2 is low because few fish were caught.

Population instantaneous growth rate for 1+ brown trout was faster than for age 1+ rainbow trout. Mean individual instantaneous growth was also faster in 1+ brown trout (Table 4 and Table 5).

TABLE 2. Estimate of Brown Trout Standing Crop in Indian Creek, Plumas County, 1989.

Distance Below Antelope Dam (km)	Population Estimate	95% Confidence Interval	Biomass (g/m ²)	Estimate of Catchable Trout (>127 mm FL)	Biomass of Catchable Trout (g/m ²)
6.1	53	46-61	5.3	35	4.8
7.3	89	86-94	9.3	85	9.2
12.0	9	9-9	2.4	7	2.3

TABLE 3. Estimates of Rainbow Trout Standing Crop in Indian Creek, Plumas County, 1989

Distance Below Antelope Dam (km)	Population Estimate	95% Confidence Interval	Biomass (g/m ²)	Estimate of Catchable Trout (>127 mm FL)	Biomass of Catchable Trout (g/m ²)
7.3	1	1-1	0.4	0	0
12.0	11	11-11	1.3	7	1.1

TABLE 4. Growth Rates for Brown Trout Caught in Indian Creek, Plumas County, 1989.

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	82-207	0.817	2.288	113-207	0.830	2.324

TABLE 5. Growth Rates for Rainbow Trout Caught in Indian Creek, Plumas County, 1989.

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	83-161	0.663	1.856	100-161	0.476	1.333

Age 1+ brown trout averaged 152 mm in fork length; 2+ fish averaged 240 mm (Table 6). Age 1+ and 2+ rainbow trout measured 137 and 194 mm, respectively (Table 7).

TABLE 6. Calculated Fork Length of Brown Trout from Indian Creek, Plumas County, 1989.

Age	Number of Fish	Length at Capture (mm)	Calculated Lengths at Successive Annuli	
			1	2
1	113	152	82	-
2	12	240	113	207
Number of back-calculations			125	12
Weighted means (mm)			85	207
Increments (mm)			85	122

TABLE 7. Calculated Fork Length of Rainbow Trout from Indian Creek, Plumas County, 1989.

Age	Number of Fish	Length at Capture (mm)	Calculated Lengths at Successive Annuli	
			1	2
1	9	137	83	-
2	1	194	100	161
Number of back-calculations			10	1
Weighted means (mm)			85	161
Increments (mm)			85	76

Length and Weight

Age group 0+ brown trout represented 5 percent of the catch. Ages 1+ and 2+ fish represented 86 percent and 9 percent, respectively (Figure 2) (Appendices 2 and 3). Three 0+ rainbow trout were caught. They comprised 28 percent of the rainbow trout catch. Ages 1+ and 2+ trout made up 36 percent each (Figure 3) (Appendices 4 and 5).

The relationship between length (L) and weight (Wt) of brown trout is:

$$\text{Log}_{10}\text{Wt} = -4.5 + 2.8 \text{Log}_{10}\text{L}$$

$$r^2 = 0.93$$

$$N = 141 \text{ (Figure 4) (Appendix 3)}$$

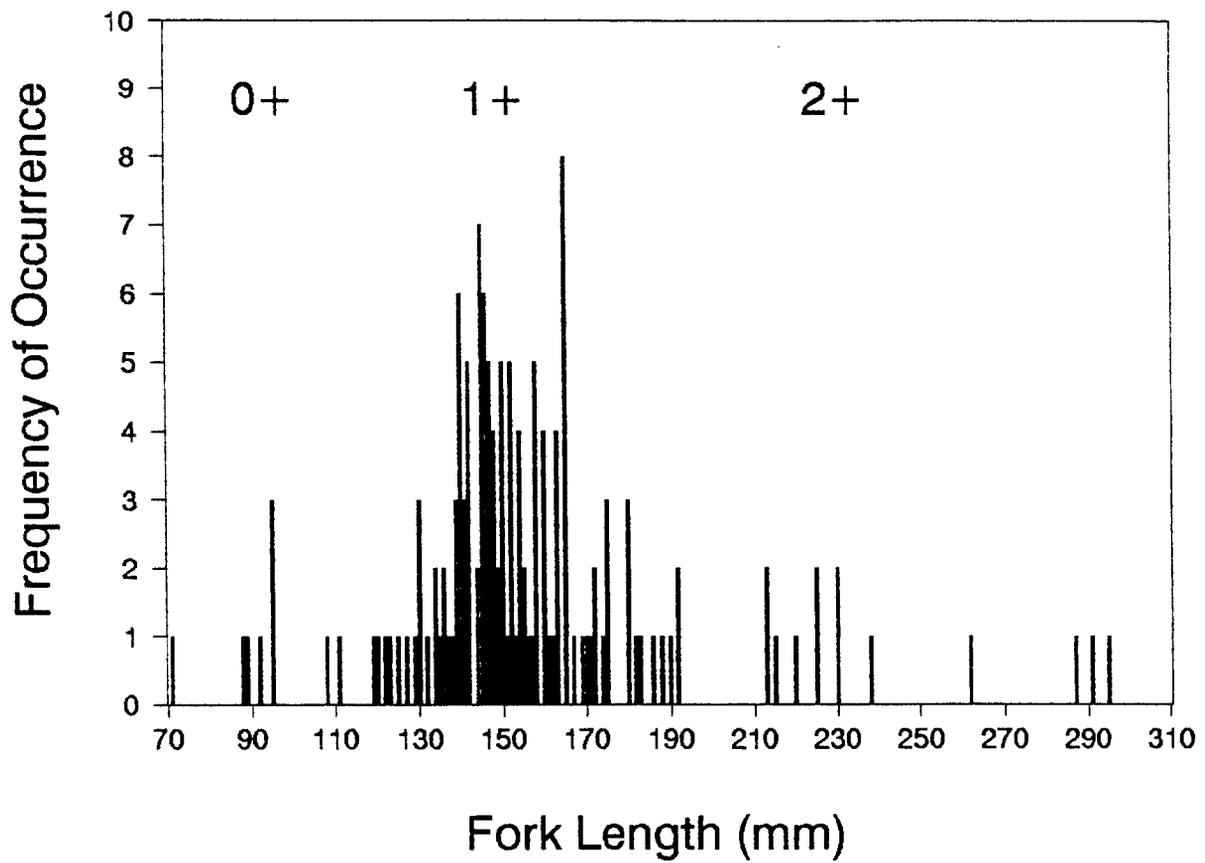


FIGURE 2. Length, observed frequency, and age of brown trout caught in Indian Creek, Plumas County, 1989.

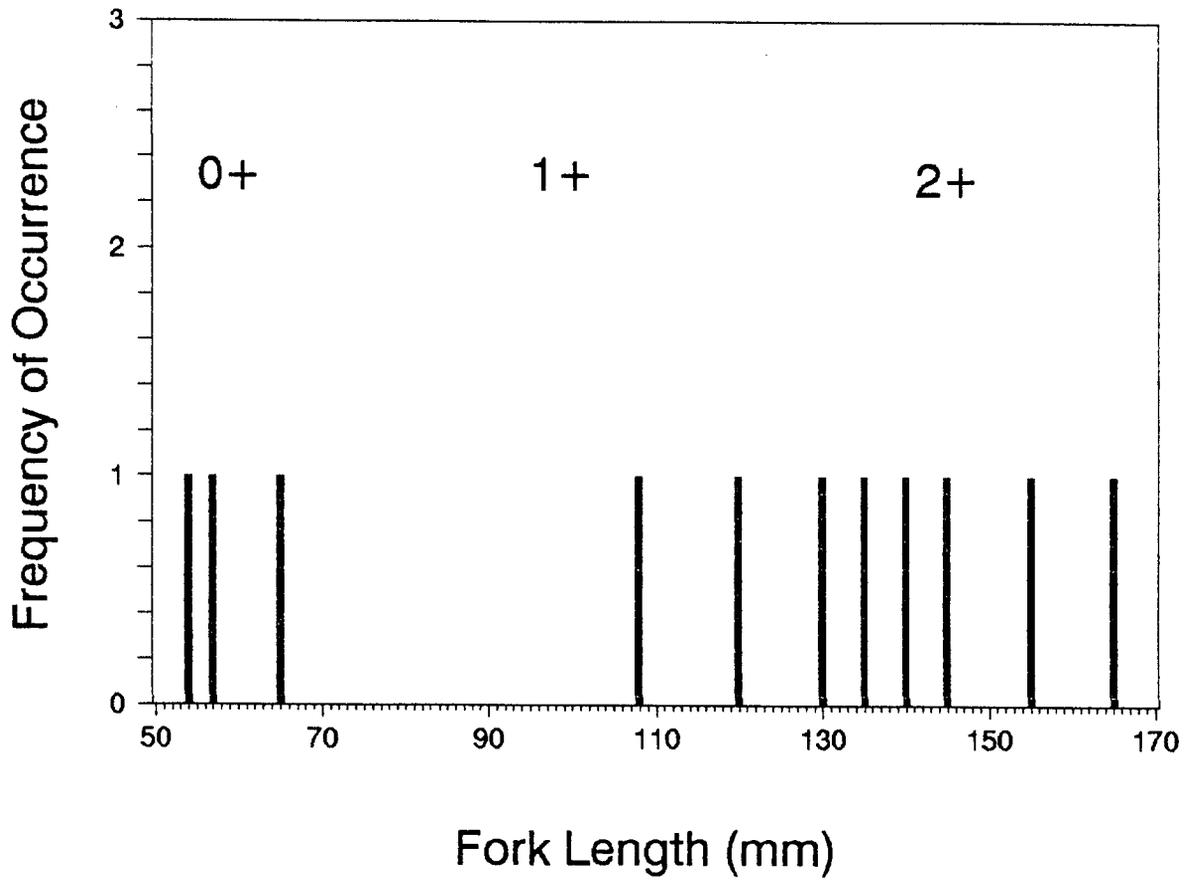


FIGURE 3. Length, observed frequency, and age of rainbow trout caught in Indian Creek, Plumas County, 1989.

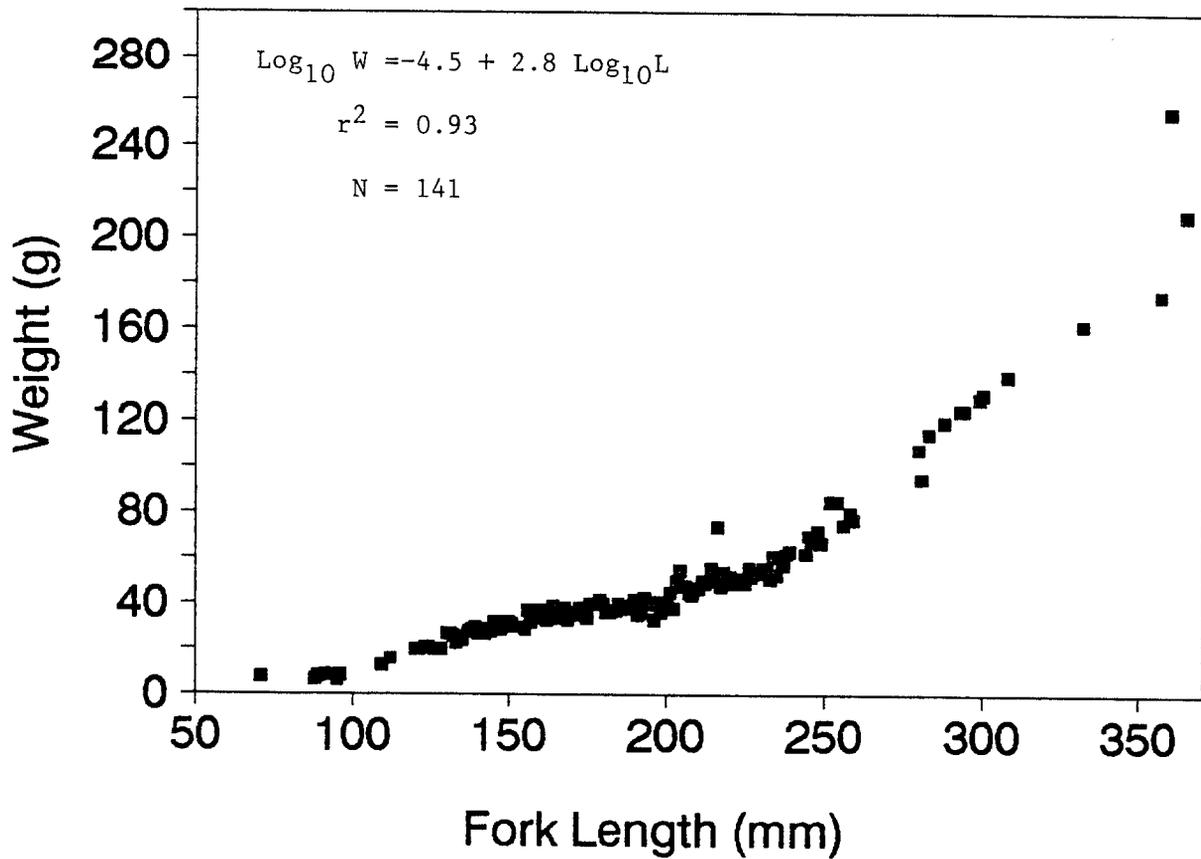


FIGURE 4. The relationship between length and weight of brown trout caught in sections of Indian Creek, Plumas County, 1989.

The same relationship for rainbow trout is:

$$\text{Log}_{10}\text{Wt} = -3.8 + 2.8 \text{Log}_{10}\text{L}$$

$$r^2 = 0.69$$

N = 12 (Figure 5) (Appendix 5)

Coefficient of Condition

We calculated the coefficient of condition and 95 percent confidence limits for a total of 141 brown trout and 12 rainbow trout (Table 8). There is no significant difference between the coefficient of condition for any age group of brown trout we tested. Age 1+ rainbow trout had a higher condition factor than age 0+ rainbow trout.

TABLE 8. Condition of Brown Trout and Rainbow Trout in Indian Creek, Plumas County, 1989.

Age Group	Number of Fish	Coefficient of Condition	95% Confidence Interval
Brown trout			
0+	10	1.1675	0.4122-1.9229
1+	119	1.1759	0.7954-1.5564
2+	12	1.031	0.7924-1.2701
Combined	141	1.1623	
Rainbow trout			
0+	3	1.0867	1.0740-1.0984
1+	9	1.9749	1.3205-2.6293
Combined	12	1.8269	

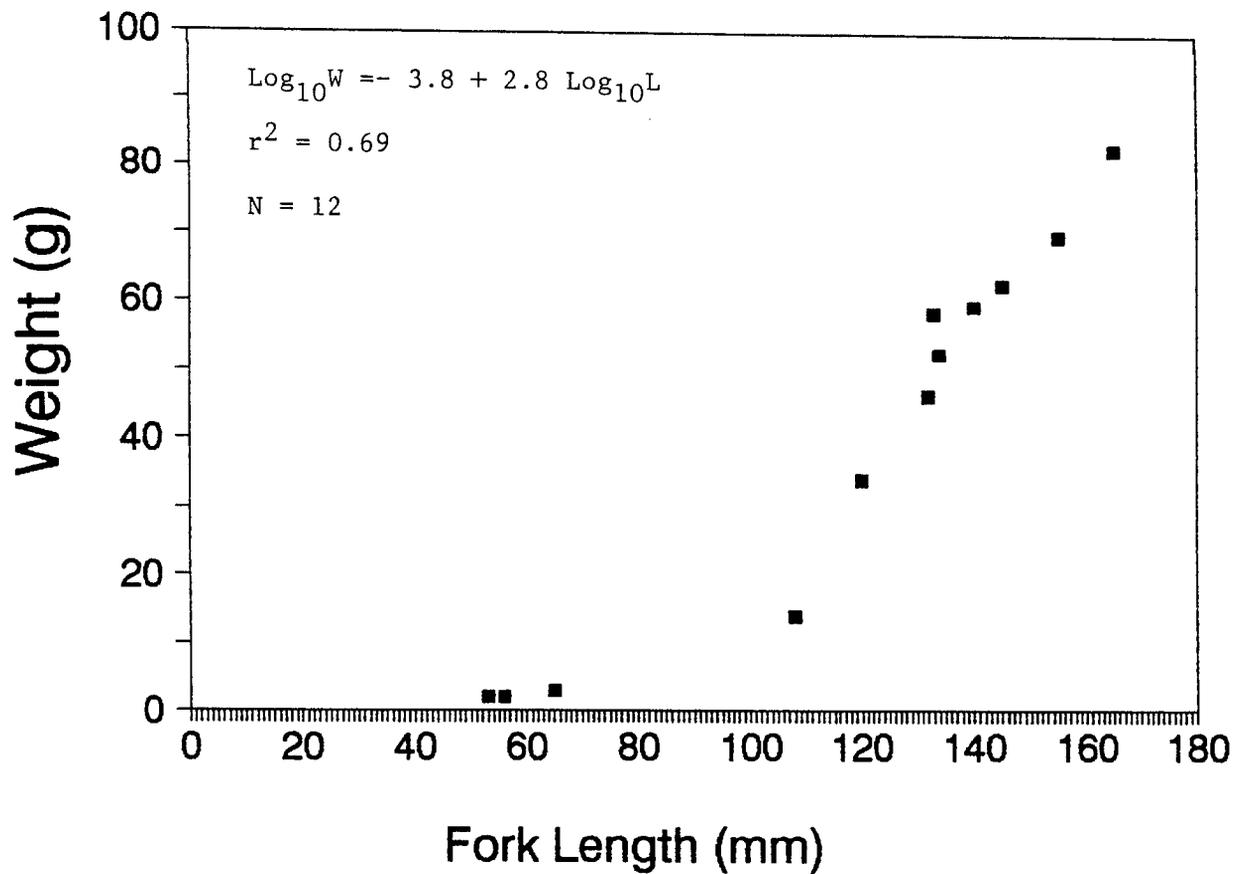


FIGURE 5. The relationship between length and weight of rainbow trout caught in sections of Indian Creek, Plumas County, 1989.

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APPENDIX 1

PERMANENT FISH POPULATION STATIONS INDIAN CREEK, PLUMAS COUNTY SAMPLED IN 1989

Indian Creek has had two periods of very high runoff (late May 1983 and mid-February 1986). High flows during these periods severely eroded streambanks in meadow sections of the creek, toppled many trees into the creek, deposited large quantities of sand and gravel, and rerouted the stream channel in many locations. Thus, although three of the six stations sampled in 1986 and 1987 are the same locations sampled in previous years, none of the stations are truly comparable to those sampled in previous years. One of the new stations (6) was picked because it appears to be similar to the station it replaced; the other two (3 and 4) are quite different from the old stations, but represent typical habitat in those portions of the creek.

Station 3 - Located about 6.1 km below Antelope Dam, 1.3 km above Babcock Crossing, and 11.9 km above Flourney Bridge (NW 1/4 of NW 1/4, Section 10, T26N, R12E). This station replaces one just downstream which has been eroded into a deep pool too hard to electrofish. The new station has two pools (22 percent) separated by runs (30 percent) and riffle areas (48 percent). There are several downed trees on the eroded left bank. Unlike the station it replaces, this station has little shade. The new station is 69.2 m long and has a surface area of 477.5 m² and a volume of 146.1 m³ at 0.56 cms.

Station 4 - Located about 7.3 km below Antelope Dam, 0.1 km above Babcock Crossing, and 10.7 km above Flourney Bridge (NW 1/4 of SW 1/4, Section 10, T26N, R12E). This new station is located about 0.1 m downstream from the previous station and about halfway between Babcock Crossing and a parking turnout 0.3 km upstream. The station contains two small pools (50 percent) separated by riffle areas (29 percent) and a run (21 percent). Like the station it replaces, it is mostly unshaded. The station is 56.8 m long and has a surface area of 453.3 m² and a volume of 84.8 m³ at 0.56 cms.

Station 5 - Located near an unimproved campground about 12.0 km below Antelope Dam and 6.0 km above Flourney bridge (NW 1/4 of SW 1/4, Section 21, T26N, R12E). Recreational gold-dredging has drastically altered the old station 5, making it unrepresentative of fish habitat in this area. In 1988, we moved the station about 200 m upstream to a more representative area. The new station is reached from the same paved access road by following a dirt road that extends upstream to a campsite near the creek. The station extends downstream from the rapid adjacent to the campsite. It contains riffle, pool and shallow run area. Riffle area is 46 percent, pool area 13 percent, and run area 41 percent. The station has a surface area of 381.5 m² and a volume of 118.3 m³ at 0.56 cms.

APPENDIX 2

LENGTH AND NUMBER OF BROWN
TROUT CAUGHT IN INDIAN CREEK, 1989

<u>Fork Length (mm)</u>	<u>Number</u>	<u>Fork Length (mm)</u>	<u>Number</u>
71	1	154	4
88	1	155	2
89	1	156	1
91	1	157	1
95	3	158	5
108	1	160	3
111	1	161	1
119	1	162	1
120	1	163	4
122	1	165	8
123	1	167	1
125	1	169	1
127	1	170	1
129	1	171	1
130	3	172	2
132	1	174	1
134	2	175	3
135	1	180	3
136	2	182	1
137	1	183	1
139	3	186	1
140	6	188	1
141	3	190	1
142	5	192	2
144	2	213	2
145	7	215	1
146	3	220	1
147	5	225	2
148	4	230	2
149	2	238	1
150	5	262	1
151	1	287	1
152	5	290	1
153	1	295	1

APPENDIX 3
 LENGTH AND WEIGHT OF BROWN TROUT
 CAUGHT IN INDIAN CREEK, 1989

<u>Fork Length (mm)</u>	<u>Weight (g)</u>	<u>Fork Length (mm)</u>	<u>Weight (g)</u>
71	8	154	33,36,39,41
88	7	155	39,45
89	8.5	156	38
91	9	157	50
95	6.5,7,9	158	44,45,48,48,55
108	13	160	47,49,50
111	16	161	50
119	20	162	56
120	20	163	48,54,54,74
122	21	165	49,49,50,51,51,52,52,56
123	21	167	54
125	20	169	56
127	20	170	56
129	27	171	51
130	23,26,27	172	53,61
132	24	174	57
134	28,29	175	57,62,63
135	30	180	62,68,70
136	27,29	182	72
137	27	183	67
139	28,30,32	186	85
140	29,30,30,31,32,32	188	85
141	29,30,30	190	75
142	32,34,35,37,37	192	77,80
144	33,36	213	95,108
145	33,34,34,34,38,38,39	215	115
146	35,35,36	220	120
147	34,35,38,40,40	225	125,125
148	36,40,40,42	230	130,132
149	36,37	238	140
150	37,38,38,39,40	262	162
151	39	287	175
152	35,36,40,42,43	290	255
153	41	295	210

APPENDIX 4
LENGTH AND NUMBER OF RAINBOW
TROUT CAUGHT IN INDIAN CREEK, 1989

<u>Fork Length (mm)</u>	<u>Number</u>
54	1
57	1
65	1
108	1
120	1
130	1
135	2
140	1
145	1
155	1
165	1

APPENDIX 5

LENGTH AND WEIGHT OF RAINBOW
TROUT CAUGHT IN INDIAN CREEK, 1989

<u>Fork Length (mm)</u>	<u>Weight (g)</u>
54	2
57	2
65	3
108	14
120	34
130	46
135	58
135	52
140	59
145	62
155	79
165	82