

State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

STANDING STOCKS OF FISHES
IN SECTIONS OF BIG GRIZZLY CREEK
PLUMAS COUNTY, 1996

by

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STANDING STOCKS OF FISHES IN SECTIONS OF BIG GRIZZLY CREEK, PLUMAS COUNTY, 1996

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 instream values, and 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, 1994, and 1995 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, and Brown 1996).

The purpose of this study is to evaluate the effects of the operation of Lake Davis on populations of trout in Big Grizzly Creek through the periodic sampling of fish at established stations in that creek. The objective of this report is to estimate the number, age, and growth of trout in previously established stations. The stations were originally established to set baseline conditions with which future changes in seasonal stream flow or other elements of habitat would be compared.

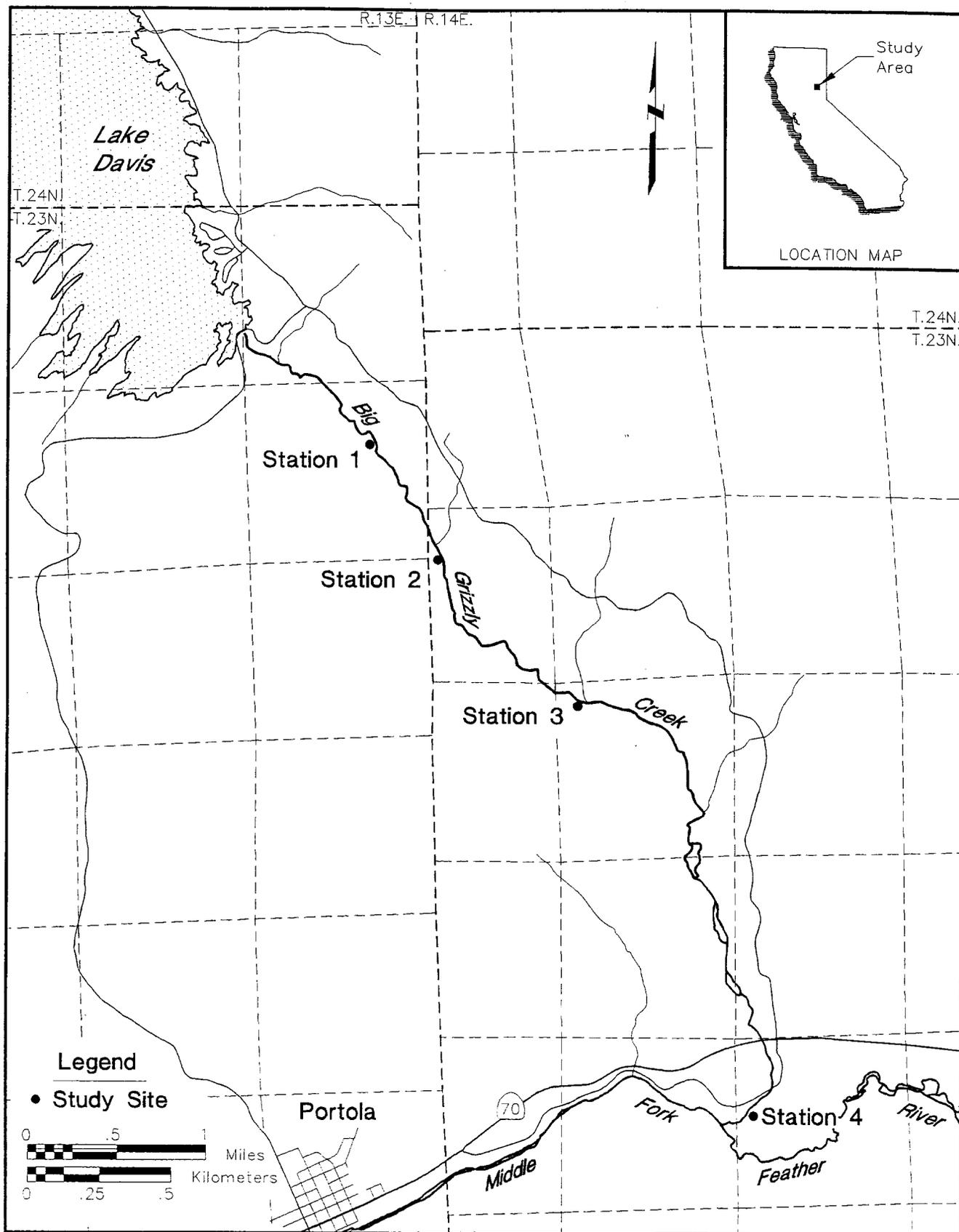


Figure 1. Stations sampled to estimate standing crop of trout in Big Grizzly Creek, 1996.

NAMES OF FISHES

The following species of fishes were caught in this study: rainbow trout, brown trout, Sacramento sucker (Catostomus occidentalis), brown bullhead (Ameiurus nebulosus), and green sunfish (Lepomis cyanellus).

METHODS

Physical Measurements

Standing stocks of fishes were estimated at four stations in Big Grizzly Creek (Figure 1). Stations were intentionally selected to be near stations sampled in previous DFG studies (Gerstung 1973). Markers had previously been placed in trees along the stream to identify station boundaries. Stations varied in length from 42.1 to 91.4 m (Appendix 1). The length and width of each station was measured with metric tape measures.

Biological Measurements

Fish were captured with a battery-powered backpack electroshocker in stream sections blocked by seines as described by Platts et al. (1983). 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. Fork length (FL) of each fish

caught was measured to the nearest millimeter.

Scale samples were taken from brown trout and rainbow trout over 100 mm in length. Scales were taken just above the lateral line between the dorsal and adipose fin (Scarnecchia 1979) and placed in a piece of paper inserted in a small coin envelope (Drummond 1966). 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. Estimation of instantaneous population growth rate was calculated (Ricker 1975) with significant values of correlation coefficients taken from a table (Steel and Torrie 1960).

$$\text{Instantaneous population growth rate} = b(\log_e l_2 - \log_e l_1)$$

b = between ages functional slope

l_1 = initial length for the last complete year of growth

l_2 = final length for the last complete year of growth

Standing crops of brown trout and rainbow trout were calculated for individual stations where each species was caught and then combined for the entire creek. Age and growth were calculated for the population (Everhart et al. 1975). Length-weight relationships were determined for both brown trout and rainbow trout (Lagler 1956). The coefficient of condition and 95 percent confidence intervals were calculated for all trout (Carlander 1969). Distribution of all fish caught is listed according to location.

RESULTS

Distribution

Rainbow trout and brown bullhead were caught in station 1. Rainbow trout and Sacramento suckers were caught in stations 2 and 3. Brown trout, rainbow trout, Sacramento suckers, and green sunfish were caught in station 4, the lowest station sampled (Table 1).

TABLE 1. Distribution of fishes in sections of Big Grizzly Creek, Plumas County, 1996.

| | Station Number | | | |
|--|----------------|-----|-----|-----|
| | 1 | 2 | 3 | 4 |
| Distance below Grizzly Valley Dam (km) | 2.5 | 3.2 | 4.8 | 9.7 |
| Brown trout | | | | X |
| Rainbow trout | X | X | X | X |
| Sacramento sucker | | X | X | X |
| Green sunfish | | | | X |
| Brown bullhead | X | | | |

Standing Crop

Rainbow trout was the most common game fish caught in Big Grizzly Creek. Biomass averaged 4.4 g/m² in four stations (Table 2). Catchable rainbow trout (trout greater than or equal to 127 mm FL) biomass averaged 4.2 g/m². We found brown trout in only one station. Biomass in that station was 3.9 g/m² (Table 3). Catchable brown trout biomass was

3.0 g/m². Biomass was not estimated for Sacramento suckers, green sunfish, or brown bullhead.

Table 2. Estimate of rainbow trout standing crop in Big Grizzly Creek, Plumas County, 1996.

| Distance Below Grizzly Valley Dam (km) | Population Estimate | 95% Confidence Interval | Biomass (g/m ²) | Estimate of Catchable Trout (\geq 127 mm FL) | Biomass of Catchable Trout (g/m ²) |
|--|---------------------|-------------------------|-----------------------------|---|--|
| 2.5 | 26 | 25-30 | 4.1 | 15 | 4.0 |
| 3.2 | 32 | 31-36 | 5.3 | 11 | 5.0 |
| 4.8 | 27 | 26-31 | 3.3 | 11 | 3.1 |
| 9.7 | 35 | 20-87 | 5.0 | 11 | 4.8 |

Table 3. Estimate of brown trout standing crop in Big Grizzly Creek, Plumas County, 1996.

| Distance Below Grizzly Valley Dam (km) | Population Estimate | 95% Confidence Interval | Biomass (g/m ²) | Estimate of Catchable Trout (\geq 127 mm FL) | Biomass of Catchable Trout (g/m ²) |
|--|---------------------|-------------------------|-----------------------------|---|--|
| 9.7 | 121 | 98-150 | 3.9 | 8 | 3.0 |

Length and Weight

Age group 0+ rainbow trout represented 61 percent of the 104 rainbow trout caught. Ages 1+ and 2+ comprised 22 percent and 16 percent respectively. Age group 3+ represented 1 percent

(Figure 2 and Appendix 2). Age group 0+ brown trout made up 94 percent of the 98 brown trout caught. Age 1+ comprised 3 percent and age 2+ also made up 3 percent (Figure 3 and Appendix 3).

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

$$\begin{aligned}\text{Log}_{10}W &= -5.0 + 3.0 \text{Log}_{10}FL \\ r^2 &= 0.99 \\ N &= 104 \text{ (Figure 4 and Appendix 4)}\end{aligned}$$

The same relationship for brown trout is:

$$\begin{aligned}\text{Log}_{10}W &= -4.8 + 2.9 \text{Log}_{10}FL \\ r^2 &= 0.98 \\ N &= 98 \text{ (Figure 5 and Appendix 5)}\end{aligned}$$

Age and Growth

The formula $FL = 54.0 + 1.0 S$ 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 0.63. The formula was $FL = 175.1 + 0.1 S$ for 6 brown trout, while the value for r^2 is 0.74.

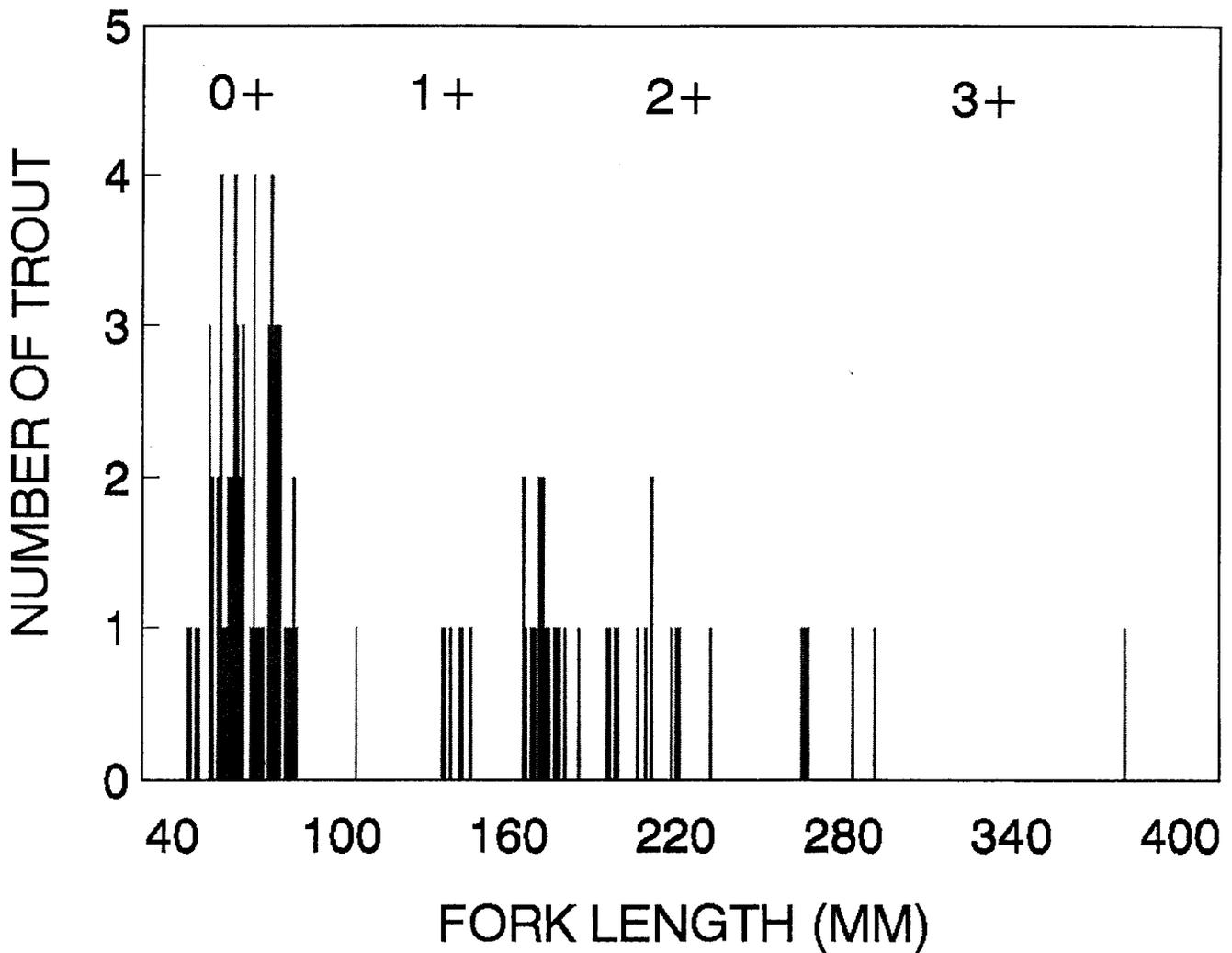


FIGURE 2. Length, observed frequency, and age of rainbow trout caught in Big Grizzly Creek, Plumas County, 1996.

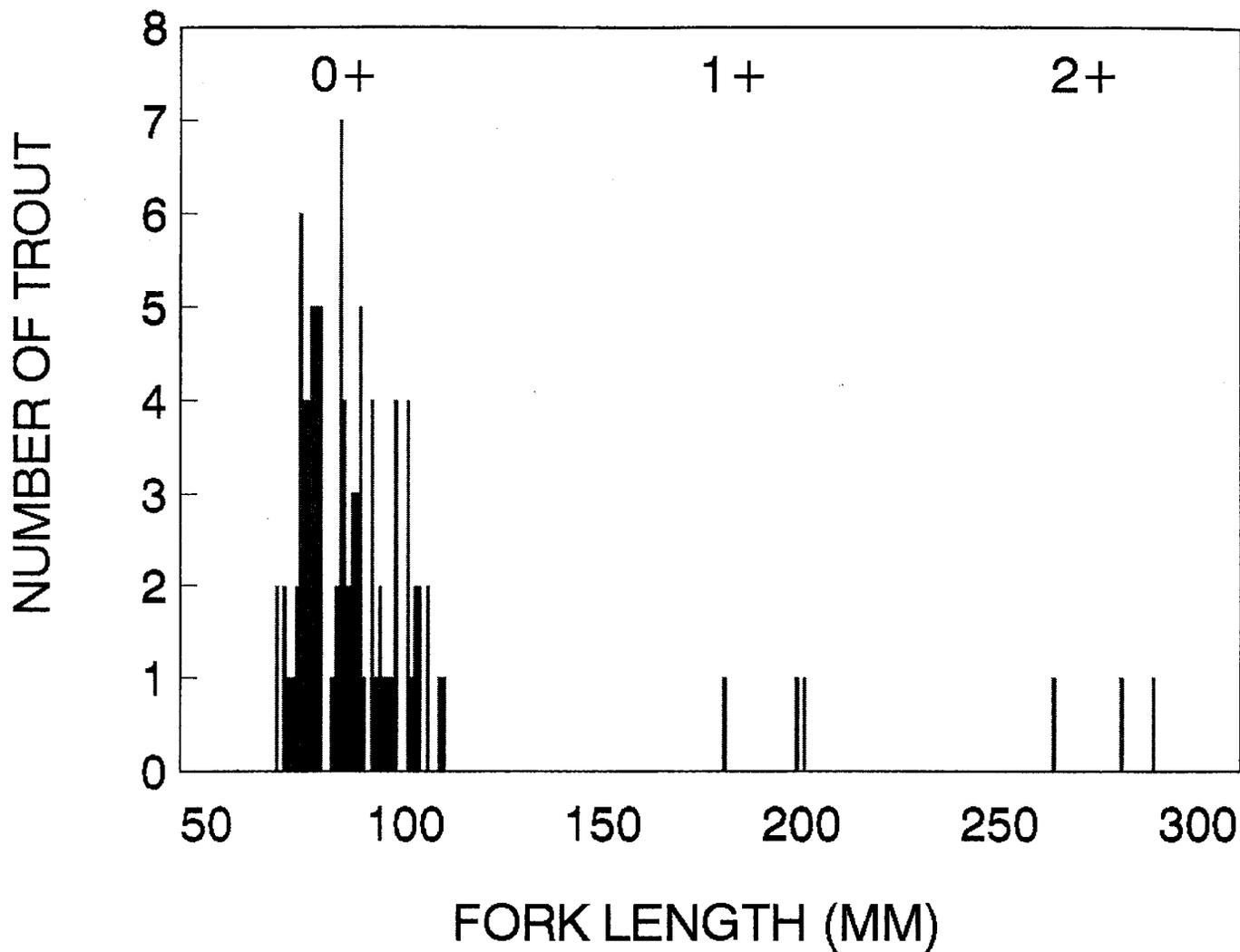


FIGURE 3. Length, observed frequency, and age of brown trout caught in Big Grizzly Creek, Plumas County, 1996.

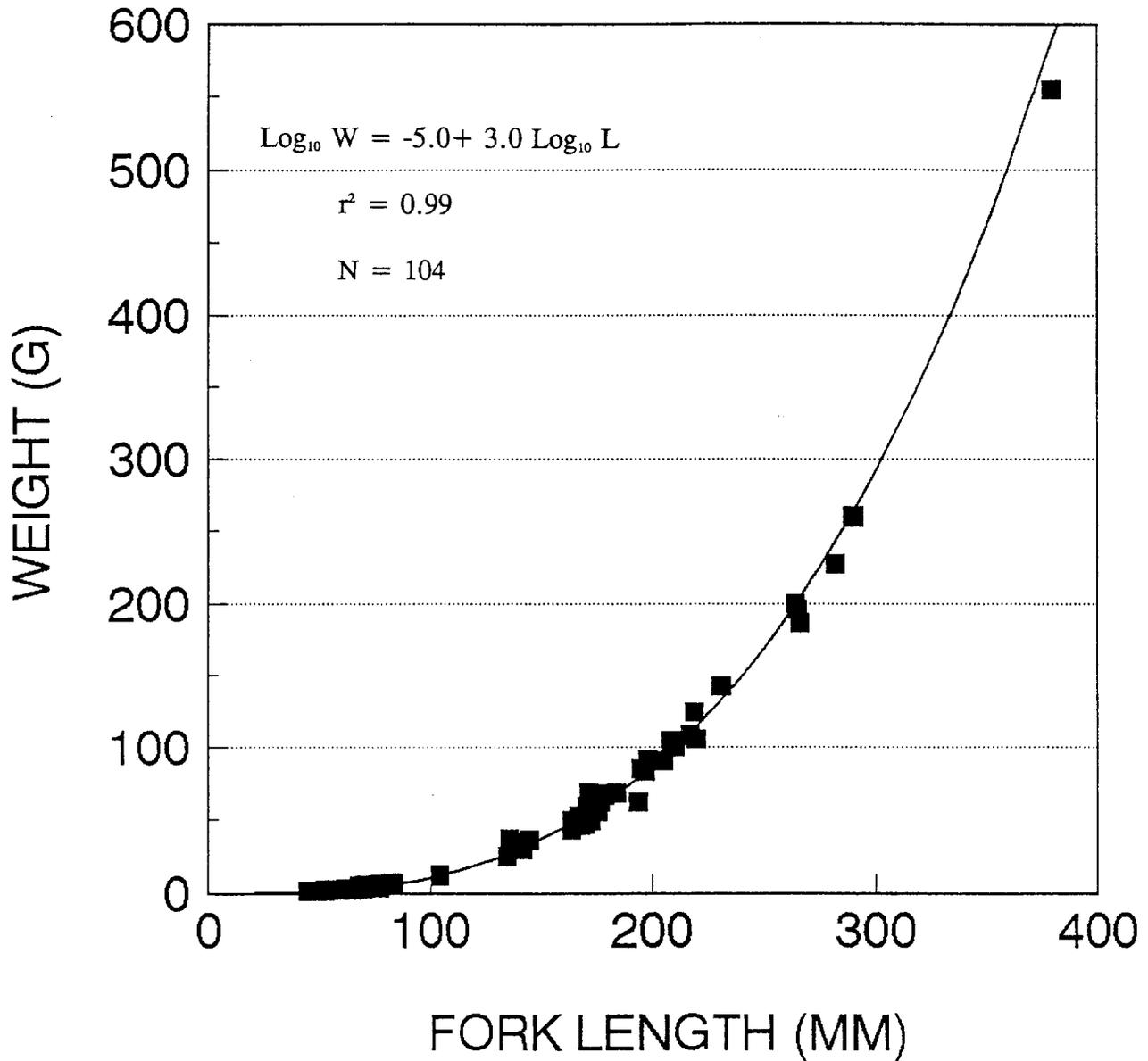


FIGURE 4. The relationship between length and weight of rainbow trout caught in sections of Big Grizzly Creek, Plumas County, 1996.

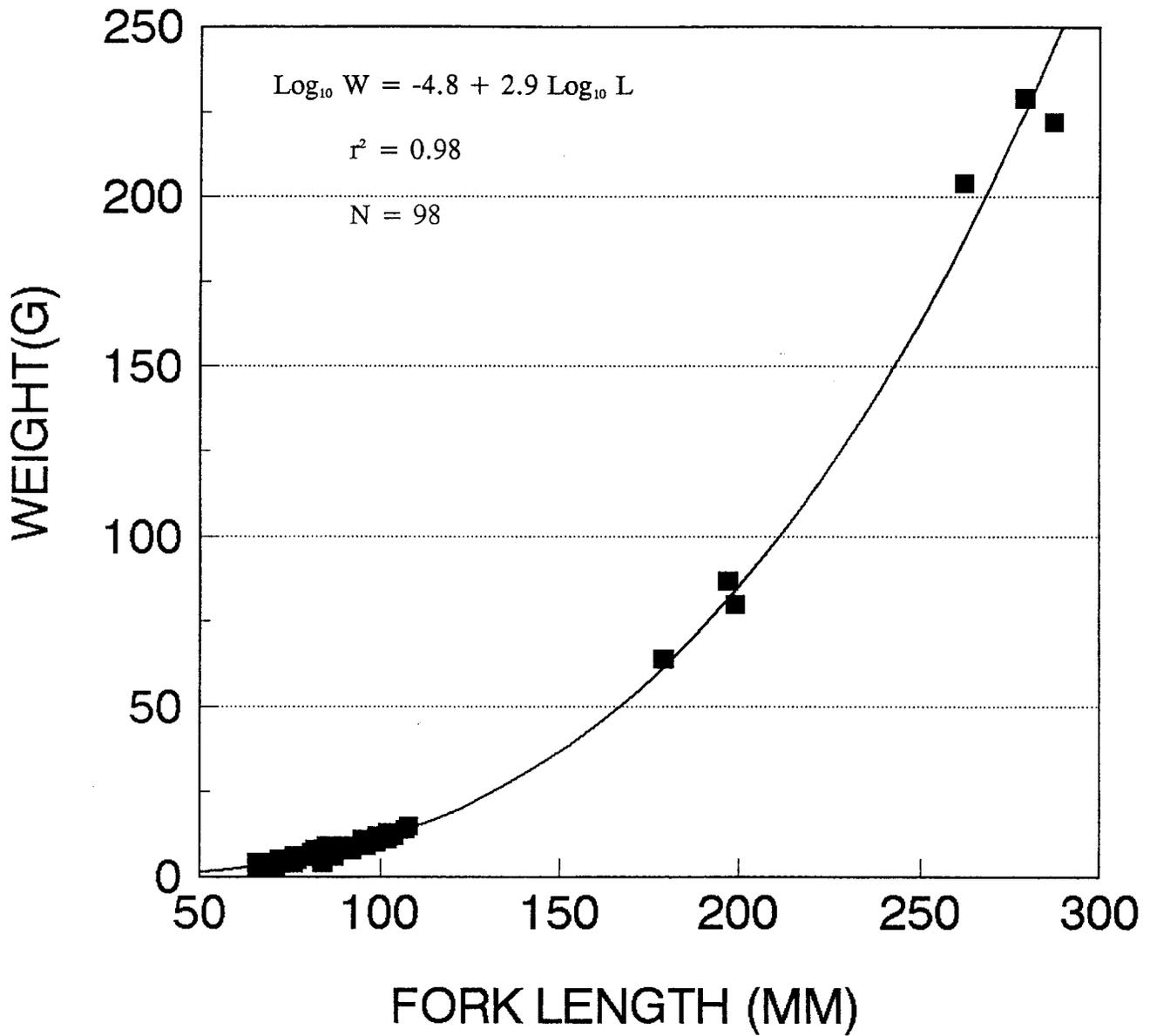


FIGURE 5. The relationship between length and weight of brown trout caught in sections of Big Grizzly Creek, Plumas County, 1996.

Population growth and mean individual growth were greater for brown trout than rainbow trout (tables 5 and 6).

Table 5. Growth rates for rainbow trout caught in Big Grizzly Creek, 1996.

| 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 | 100-193 | 0.658 | 1.973 | 103-193 | 0.628 | 1.883 |

Table 6. Growth rates for brown trout caught in Big Grizzly Creek, 1996.

| 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 | 90-192 | 0.758 | 2.273 | 100-192 | 0.652 | 1.957 |

Age 1+ rainbow trout averaged 166 mm fork length and age 2+ rainbow trout averaged 236 mm fork length (Table 7). Age 1+ and age 2+ brown trout averaged 179 mm and 256 mm, respectively (Table 8).

Table 7. Calculated fork length of rainbow trout from Big Grizzly Creek, 1996.

| Age | Number of Fish | Length at Capture | Length at Successive Annulus | |
|-----------------------------|----------------|-------------------|------------------------------|-----|
| | | | 1 | 2 |
| 1 | 24 | 166 | 100 | |
| 2 | 12 | 236 | 103 | 193 |
| Number of back-calculations | | | 36 | 12 |
| Weighted means (mm) | | | 101 | 193 |
| Increments (mm) | | | | 92 |

Table 8. Calculated fork length of brown trout from Big Grizzly Creek, 1996.

| Age | Number of Fish | Length at Capture | Length at Successive Annulus | |
|-----------------------------|----------------|-------------------|------------------------------|-----|
| | | | 1 | 2 |
| 1 | 1 | 179 | 90 | |
| 2 | 4 | 256 | 100 | 192 |
| Number of back-calculations | | | 5 | 4 |
| Weighted means (mm) | | | 98 | 192 |
| Increments (mm) | | | | 94 |

Coefficient of Condition

The average coefficient of condition for 104 rainbow trout was 1.1723 and 1.1090 for 98 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, 1996.

| <u>Age Group</u> | <u>Number of Trout</u> | <u>Coefficient of Condition</u> | <u>95% Confidence Interval</u> |
|------------------|------------------------|---------------------------------|--------------------------------|
| Rainbow trout | | | |
| 0+ | 63 | 1.1005 | 0.7763-1.4347 |
| 1+ | 23 | 1.0045 | 0.8607-1.3482 |
| 2+ | 16 | 1.0713 | 1.9084-1.2342 |
| 3+ | 2 | 1.0428 | 0.9971-1.0844 |
| | | | |
| Combined | 104 | 1.1723 | 0.8430-1.5017 |
| | | | |
| Brown trout | | | |
| 0+ | 92 | 1.1587 | 0.9173-1.4001 |
| 1+ | 1 | 1.1116 | |
| 2+ | 5 | 1.0562 | 0.9090-1.2033 |
| | | | |
| Combined | 98 | 1.1090 | 0.5938-0.6241 |

DISCUSSION

Summer streamflow in Big Grizzly Creek has generally been between 0.6 and 0.3 cms from 1974 to 1993. Higher flows occurred in 1977 and 1979 (Table 10). 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.

Table 10. Average summer streamflow in Big Grizzly Creek, 1974-1996.

| Year | Flow (cms) | Year | Flow (cms) |
|------|------------|------|------------|
| 1974 | 0.7 | 1986 | 0.6 |
| 1975 | 0.4 | 1987 | 0.5 |
| 1976 | 0.3 | 1988 | 0.3 |
| 1977 | 1.8 | 1989 | 0.3 |
| 1978 | 0.3 | 1990 | 0.3 |
| 1979 | 2.2 | 1991 | 0.3 |
| 1980 | 0.4 | 1992 | 0.3 |
| 1981 | 0.3 | 1993 | 0.3 |
| 1982 | 0.6 | 1994 | 0.3 |
| 1983 | 0.6 | 1995 | 0.6 |
| 1984 | 0.6 | 1996 | 0.6 |
| 1985 | 0.5 | | |

Biomass of rainbow trout has averaged 2.9 g/m² and ranged from 0 to 5.6 g/m² since we began sampling in 1976 (Table 11). There is no significant correlation between streamflow and biomass ($r^2 = 0.001$) because rainbow trout biomass was lower in 1986 and 1995 than we expected from the relative high summer flows that were released that year. Brown trout biomass has averaged 0.9 g/m² and ranged from 0 to 3.8 g/m². Brown trout biomass is not correlated with flow ($p > 0.05$)

Table 11. Biomass (g/m²) of rainbow and brown trout in Big Grizzly Creek.

| Year | Rainbow trout | Brown trout |
|------|---------------|-------------|
| 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 | 0.5 |
| 1996 | 4.5 | 1.0 |

Estimated numbers of catchable-size rainbow trout were slightly above average since we began sampling Big Grizzly Creek (Table 12). Catchable-size rainbow trout averaged 0.04 trout/m² and catchable-size brown trout averaged 0.01 trout/m². Relatively high numbers of rainbow trout in 1996 may have been a result of two years of favorable flow in Big Grizzly Creek (Table 10).

Table 12. Density of catchable-size rainbow and brown trout (trout/m²) in Big Grizzly Creek.

| Year | Rainbow trout | Brown trout |
|------|---------------|-------------|
| 1981 | 0.01 | 0 |
| 1986 | 0.04 | 0.08 |
| 1988 | 0.09 | 0.02 |
| 1994 | 0.02 | 0.02 |
| 1995 | 0.03 | 0.01 |
| 1996 | 0.04 | 0.01 |

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APPENDIX 1

PERMANENT FISH POPULATION STATIONS FOR BIG GRIZZLY CREEK, PLUMAS COUNTY SEPTEMBER, 1996

Station 1 (Stream Gage Station) - Station 1 is located 2.5 stream km below Grizzly Valley Dam and just downstream from an abandoned USGS stream gage at an elevation of 1622 m MSL. The station is located 21 m downstream from the concrete weir of the stream gage (UTM 170 167). The stream within the station is a steep rapid area (67%) with several split channels and small pocket pools that ends in a long, shallow pool (33%). It is 42.1 m long and has a surface area of 273.7.3 m² at 0.56 cms. Substrate is 75% boulders, 15% rubble, and 10% sand.

Station 2 (IFN Station) - Station 2 is 3.2 stream km below Grizzly Valley Dam. The site located at UTM 176 156 at an elevation of 1610 m 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 47.5 m long with a surface area of 168.1.2 m² at 0.56 cms.

Station 3 (3-Mile Station) - Station 3 is located 4.8 km downstream from Grizzly Valley Dam at an elevation of 1549 m 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 53.9 m long and has a surface area of 279.5 m² at 0.56 cms.

Station 4 (6-Mile Station) - Station 4 is located 9.7 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 in a rapid just above a large 0.7 m deep pool (33%) followed by several riffle areas (67%) and shallow pools with undercut banks and overhanging grass clumps. Substrate is rubble (10%), gravel (75%), bedrock (10%), and mud (5%). The station is 91.4 m long with a surface area of 395.8 m² at 0.56 cms.

APPENDIX 2

LENGTH AND WEIGHT OF RAINBOW TROUT
CAUGHT IN BIG GRIZZLY CREEK, 1996

| Fork Length (mm) | Weight (g) |
|------------------|------------|------------------|------------|------------------|------------|------------------|------------|
| 44 | 1 | 58 | 2 | 64 | 3 | 75 | 4 |
| 45 | 1 | 59 | 2 | 67 | 4 | 75 | 4 |
| 47 | 1 | 59 | 2 | 68 | 4 | 75 | 5 |
| 48 | 1 | 60 | 2 | 68 | 3 | 76 | 5 |
| 52 | 1 | 60 | 2 | 68 | 4 | 76 | 5 |
| 52 | 1 | 61 | 2 | 68 | 3 | 76 | 5 |
| 52 | 2 | 61 | 3 | 69 | 3 | 77 | 6 |
| 53 | 2 | 61 | 3 | 70 | 5 | 77 | 4 |
| 53 | 2 | 61 | 2 | 71 | 4 | 77 | 6 |
| 55 | 2 | 62 | 2 | 73 | 4 | 79 | 5 |
| 55 | 2 | 62 | 3 | 73 | 4 | 80 | 6 |
| 56 | 2 | 62 | 3 | 73 | 4 | 81 | 5 |
| 56 | 2 | 63 | 3 | 74 | 5 | 82 | 7 |
| 56 | 2 | 63 | 3 | 74 | 5 | 82 | 6 |
| 56 | 2 | 64 | 3 | 74 | 4 | 83 | 6 |
| 57 | 2 | 64 | 2 | 74 | 5 | 104 | 12 |

APPENDIX 2

LENGTH AND WEIGHT OF RAINBOW TROUT
 CAUGHT IN BIG GRIZZLY CREEK, 1996
 (Continued)

| Fork Length (mm) | Weight (g) | Fork Length (mm) | Weight (g) | Fork Length (mm) | Weight (g) |
|------------------|------------|------------------|------------|------------------|------------|
| 135 | 25 | 171 | 51 | 210 | 100 |
| 136 | 37 | 172 | 68 | 210 | 101 |
| 138 | 34 | 173 | 49 | 217 | 108 |
| 141 | 32 | 175 | 57 | 219 | 124 |
| 142 | 30 | 176 | 56 | 220 | 105 |
| 145 | 36 | 177 | 62 | 231 | 142 |
| 164 | 43 | 179 | 67 | 264 | 200 |
| 164 | 49 | 184 | 68 | 265 | 196 |
| 165 | 47 | 194 | 62 | 266 | 186 |
| 167 | 52 | 195 | 85 | 282 | 227 |
| 168 | 46 | 197 | 83 | 290 | 260 |
| 170 | 47 | 198 | 91 | 379 | 555 |
| 170 | 52 | 205 | 90 | | |
| 171 | 59 | 208 | 104 | | |

APPENDIX 3

LENGTH AND WEIGHT OF BROWN
TROUT CAUGHT IN BIG GRIZZLY CREEK, 1996

| Fork Length (mm) | Weight (g) | Fork Length (mm) | Weight (g) | Fork Length (mm) | Weight (g) |
|------------------|------------|------------------|------------|------------------|------------|
| 66 | 3 | 73 | 4 | 77 | 7 |
| 66 | 3 | 73 | 5 | 77 | 5 |
| 68 | 4 | 74 | 5 | 77 | 5 |
| 68 | 4 | 74 | 5 | 77 | 5 |
| 69 | 4 | 74 | 5 | 77 | 6 |
| 70 | 4 | 74 | 4 | 80 | 6 |
| 71 | 4 | 75 | 5 | 81 | 6 |
| 71 | 3 | 75 | 5 | 81 | 7 |
| 72 | 4 | 75 | 5 | 82 | 6 |
| 72 | 5 | 75 | 5 | 82 | 7 |
| 72 | 4 | 75 | 5 | 82 | 7 |
| 72 | 4 | 76 | 5 | 82 | 6 |
| 72 | 5 | 76 | 4 | 82 | 7 |
| 72 | 5 | 76 | 5 | 82 | 6 |
| 73 | 5 | 76 | 6 | 83 | 7 |
| 73 | 5 | 76 | 5 | 83 | 6 |

APPENDIX 3

LENGTH AND WEIGHT OF BROWN
TROUT CAUGHT IN BIG GRIZZLY CREEK, 1996
(Continued)

| Fork Length (mm) | Weight (g) | Fork Length (mm) | Weight (g) | Fork Length (mm) | Weight (g) |
|------------------|------------|------------------|------------|------------------|------------|
| 83 | 8 | 90 | 9 | 99 | 11 |
| 83 | 7 | 90 | 8 | 100 | 11 |
| 84 | 7 | 90 | 9 | 101 | 11 |
| 84 | 4 | 90 | 8 | 101 | 12 |
| 85 | 7 | 91 | 9 | 102 | 13 |
| 85 | 9 | 92 | 9 | 102 | 11 |
| 85 | 8 | 92 | 8 | 104 | 12 |
| 85 | 8 | 93 | 9 | 104 | 12 |
| 86 | 7 | 94 | 9 | 107 | 14 |
| 86 | 7 | 95 | 11 | 108 | 15 |
| 86 | 7 | 96 | 10 | 179 | 64 |
| 87 | 8 | 96 | 9 | 197 | 87 |
| 87 | 8 | 96 | 10 | 199 | 80 |
| 87 | 7 | 96 | 10 | 262 | 204 |
| 87 | 6 | 99 | 10 | 279 | 229 |
| 87 | 8 | 99 | 11 | 287 | 222 |
| 88 | 8 | 99 | 12 | | |