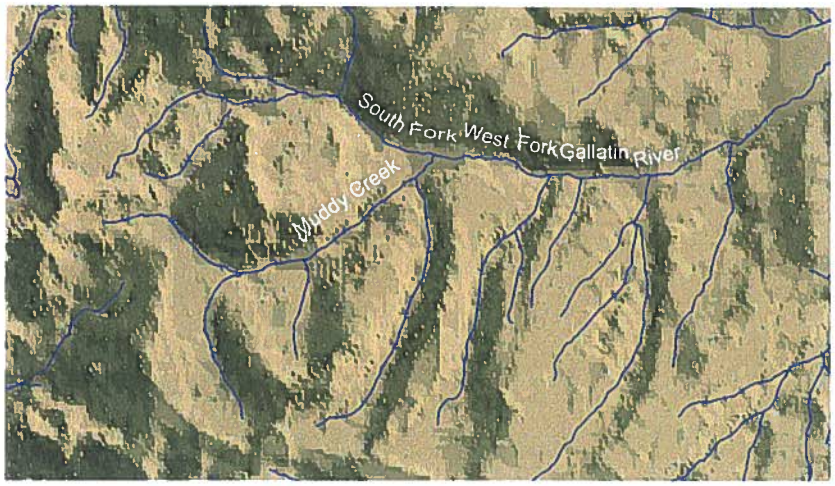
Report
SCP-19-99

ELECTROFISHING SURVEY OF THE

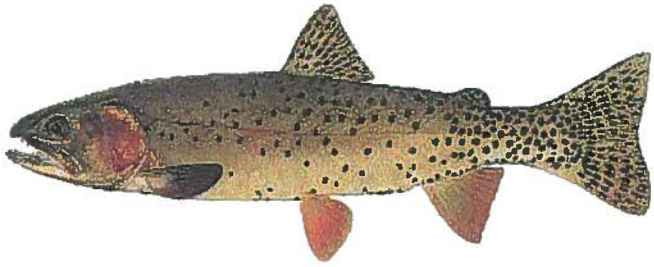
WEST FORK SOUTH FORK GALLATIN RIVER

AND MUDDY CREEK



ON THE YELLOWSTONE CLUB,

MADISON COUNTY, MONTANA



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Introduction and Methods

On October 2, 1999 fish populations on the South Fork West Fork Gallatin River and Muddy Creek on the Yellowstone Club, Madison County, Montana were surveyed to determine population levels prior to habitat enhancement of these stream reaches. Montana Department of Fish, Wildlife and Parks approved a temporary collecting permit to perform the electrofishing.

Three 500-foot reaches were sampled. The first reach was located on the South Fork West Fork Gallatin River about 250 feet below the confluence of Muddy Creek (hereafter abbreviated as Lower SFWF). This reach had plentiful riffle habitat with a few deeper pool areas and low to moderate amount of large woody debris for fish cover. The second reach was located on the South Fork West Fork Gallatin River (hereafter abbreviated as Upper SFWF) about 250 feet above the confluence of Muddy Creek. This reach had plentiful riffles, small pools and abundant large woody debris, but was only about half the size of the Lower SFWF. The third reach was located on Muddy Creek about 250 feet above the confluence of South Fork West Fork Gallatin River. This reach resembled the Lower SFWF but was only about half the size of the Lower SFWF. Block nets were placed on the upper and lower ends of each reach during the surveys to prevent fish from moving into or out of the sampled reach.

Fish were captured using a Smith-Root Model 12 backpack shocker. The shocker was set on 15 hertz pulsed DC at 500-600 volts. A two-pass removal (Zippin 1958) was performed to estimate the population size and 90 % confidence intervals in each of the three reaches. The 90 % confidence interval means that we are 90 % certain that the actual number of fish in this section of creek lies within the upper and lower bounds of the 90 % confidence interval. After capture, fish were anesthetized with a minimal dose of MS-222 (tricane methanesulfonate), measured to the nearest millimeter (mm) in total length (TL) and weighed to the nearest gram (g). Fish were held in a live car outside of

the sampled reach between passes to allow their recovery and were distributed back through the reach after sampling was completed.

Fulton-type condition factors (K) and relative weight (Wr) were calculated (Anderson and Neumann 1996). The Fulton condition factor indicates the plumpness of the fish and enables comparisons to fish in other populations. Wr compares the actual weight of the fish in a sample to the "standard" weight of a fish of the same species and the same length by dividing the actual weight by the standard weight and multiplying by 100. Thus, the Wr for each fish can be thought of as the percentage of a standard or ideal weight. I used the standard equation for cutthroat trout in streams presented in Anderson and Neumann (1996) to calculate standard weights, and Wr was calculated for only fish over the recommended minimum length of 5.1 inches (130 mm). Wr was plotted versus length of fish to detect if fish condition changed as a function of fish size.

The average total length, average weight, average Fulton condition factor (K), and average relative weight (Wr) of fish captured in the three sections were compared statistically using Analysis of Variance (ANOVA) and Tukey's Honest Significant Difference tests. This analysis allowed statistically valid comparisons of fish characteristics between the three reaches that were sampled.

Biomass density (the amount of fish flesh per unit area) was estimated by dividing the weight of fish captured by the area of stream sampled. The width of the Lower SFWF was estimated at 13 ft (4 m), the width of Upper SFWF and Muddy Creek were estimated at 6.6 ft (2 m). Because only the weight of fish actually captured was used for the biomass calculation, the estimate is conservative (i.e. we did not capture and weigh every fish present in each section).

Results

All reaches.-A total of 147 fish were captured in the three reaches sampled. All of the fish appeared to be westslope cutthroat trout (*Oncorhynchus clarki lewisi*). No mottled

sculpin (*Cottus bairdi*) or other fish species were captured in any of the sampled reaches. The length frequency histogram for all fish captured (Figure 1) suggests that perhaps four or five age classes are present.

Lower SFWF.-This reach had the most and largest fish. A total of 92 fish were captured on the two passes; 59 on Pass 1 and 33 on Pass 2. This yields a two-pass population estimate of 134 fish/500 feet, which then translates to 1415 fish/mile. The 90 % confidence interval was 36 to 232 fish/500 feet.

Trout captured in the Lower SFWF reach ranged 3.2 to 11.4 inches (80-290 mm) and, 0.1 to 0.55 lbs (3- 250 g). Average length was 8.0 inches (202 mm), and average weight was 0.19 lbs (100 g). Condition factor (K) ranged 0.44 to 1.87, and relative weight (Wr) ranged 68.1 to 130.0. The length frequency histogram (Figure 2) suggests that perhaps four or five age classes are present in this reach, including young of the year fish. Fish over 8 inches were common, and 14 fish over 10 inches were captured.

Upper SFWF.-Fewer and smaller fish were captured in Upper SFWF than in Lower SFWF. A total of 35 fish were captured on the two passes; 29 on Pass 1 and 6 on Pass 2. This yields a two-pass population estimate of 37 fish/500 feet, which then translates to 391 fish/mile. The 90 % confidence interval was 27 to 46 fish/500 feet.

Trout captured in the Upper SFWF reach ranged 3.1 to 9.8 inches (79-249 mm) and, 0.01 to 0.35 lbs (4-160 g). Average length was 6.2 inches (158 mm), and average weight was 0.11 lbs (51 g). Condition factor (K) ranged 0.65 to 1.62, and relative weight (Wr) ranged 74.5 to 107.0. The length frequency histogram (Figure 3) suggests that perhaps three or four age classes are present in this reach, including young of the year fish. Fish greater than 8 inches were rare, and only a single fish over 10 inches was captured in this reach.

Muddy Creek.-The fewest number of fish were captured in this reach. A total of 20 fish were captured on the two passes; 15 on Pass 1 and 5 on Pass 2. This yields a two-pass

population estimate of 23 fish/500 feet, which then translates to 242 fish/mile. The 90 % confidence interval was 27 to 46 fish/500 feet.

Trout captured in the Muddy Creek reach ranged 2.9 to 9.3 inches (74-236 mm) and, 0.01 to 0.28 lbs (4-125 g). Average length was 5.7 inches (144 mm), and average weight was 0.08 lbs (37 g). Condition factor (K) ranged 0.78 to 1.47, and relative weight (Wr) ranged 74.0 to 97.0. The length frequency histogram (Figure 4) suggests that perhaps three or four age classes are present in this reach, including young of the year fish. Fish greater than 8 inches were rare, and no fish over 10 inches was captured in this reach.

Analysis of variance indicated that total length and weight were significantly different between the three reaches ($P < 0.0000001$), while Fulton Condition Factors ($P = 0.75$) and Relative Weight ($P = 0.09$) were not significantly different between the three reaches. Average total length of fish in the Lower SFWF section was significantly greater than fish in the Upper SFWF ($P = 0.00043$) and fish in Muddy Creek ($P = 0.00029$). Similarly, average weight of fish in the Lower SFWF section was significantly greater in the Upper SFWF ($P = 0.00025$) and in Muddy Creek ($P = 0.00023$). Relative weight (Wr) did not decline marked with increasing fish length (Figure 5).

The biomass of fish per unit area in the Lower SFWF was 14.7 g/m^2, the biomass in Upper SFWF was 5.7 g/m^2, and the biomass in Muddy Creek was 2.4 g/m^2. The biomass for all three reaches considered together was 9.4 g/m^2.

Discussion

The native trout in this area is the westslope cutthroat trout. The westslope cutthroat trout has been petitioned for listing under the Endangered Species Act. The petition is currently under review by the U.S. Fish and Wildlife Service. Westslope cutthroat trout presently exist in only about 27 % of their original range in Montana (Liknes and Graham 1988). Genetic samples taken from Muddy Creek by the US Forest Service in 1994 indicated that the fish were essentially pure westslope cutthroat, an estimated 94% of

their genetic material was westslope cutthroat and the remaining 6% was Yellowstone cutthroat (*O. clarki bouvieri*, Montana Rivers Information System Web Page 1999). Yellowstone cutthroat are native to the Yellowstone River basin; the presence of their genes in this population indicates that Yellowstone cutthroat were stocked in this drainage at some point in time.

The trout in this area are resident fish. Resident fish live their entire life in tributary streams such as the South Fork West Fork Gallatin River or Muddy Creek. This is in contrast to adfluvial fish, which live in lakes and spawn in tributaries, or fluvial fish, which live and grow in larger rivers, but immigrate to tributaries for spawning. Resident westslope cutthroat trout rarely exceed about 12 inches in length (McIntyre and Reiman 1995). Thus, the maximum size of the fish that we observed is in agreement with the expectations for this habitat.

There are probably about five year classes of trout present in the sampled reaches (Figure 1). The approximate average length for each age class for cutthroat trout in Montana is 1 year-3 inches; 2 years-6 inches; 3 years-8 inches; 4 years-10 inches; 5 years-12 inches (Brown 1971). Therefore, fish in this area probably live to about five years old. The presence of young of the year fish indicates that spawning occurs in these reaches or young fish move to these reaches from adjacent areas.

The Lower SFWF section had the most and largest fish (Figure 1). Fish were significantly longer and heavier in the Lower SFWF than in the other two sections. However, fish condition (K and Wr) was similar in all three sections. The plumpness of a fish is related to its growth: the more food, the more plump the fish, the better the growth. This suggests that fish grow equally well in all three sections, but does not explain why the Lower SFWF had more larger fish. Also, because relative weight does not decline markedly as fish grow (Figure 5), this suggests that the food is plentiful for adult as well as juvenile fish.

The larger numbers, size and weight of trout in the Lower SFWF may be due to the larger size of the stream in general, and the larger pools in particular. The larger, deeper pools may also provide better winter habitat. Thus, perhaps some fish had moved out of the two upper sections to seek over-winter habitat in the deeper and larger pools of the Lower SFWF. Indeed, most of the trout and in particular the larger trout were captured in these pool habitats.

The biomass density in Lower SFWF (14.7 g/m^2) is about twice the average (7.71 g/m^2, standard deviation = 9.21) of 62 streams sampled in the Rocky Mountain ecoregion reported by Platts and McHenry (1988). In contrast, the biomass in the Upper SFWF (5.7 g/m^2) and Muddy Creek (2.4 g/m^2) are below this average. The biomass for the three reaches as a whole was 9.4 g/m^2. Thus, the biomass density as a whole is quite close to the average for this ecoregion, but the biomass density is much higher in the Lower SFWF than the two smaller streams located directly upstream. The "unbalanced" state of biomass density we observed suggests two possible scenarios: first, the lower SFWF supports more fish than the other two reaches year-round; or second, some fish may have moved out of the Upper SFWF and Muddy Creek into Lower SFWF to seek better over-winter habitat.

The large 90 % confidence interval for the Lower SFWF was caused by not depleting the population enough with the first pass. On Pass 1 we caught 59 fish, on Pass 2 we caught 33 fish; this is a 56% reduction. Had we caught fewer fish on the second pass, the confidence interval would have been smaller (more precise). Also, a third pass would have improved the precision of the estimate, but we did not have time to perform three passes. Despite the large confidence interval, it is clear that there were more fish in the Lower SFWF than in the other two sections.

Conclusions

1) The only fish species present in the sampling reaches were essentially pure westslope cutthroat trout.

2) There are about five age classes of trout present, including young of the year. Maximum size in these reaches is about 11.4 inches, which is a reasonable size for resident trout in tributary streams.

3) The Lower SFWF had significantly longer and heavier trout than the Upper SFWF or Muddy Creek. This may be because the larger, deeper pool habitat in this reach supports more fish year-round or because some fish moved into this reach for the winter.

4) The biomass of trout in the Lower SFWF was above average, and the biomass of trout in the Upper SFWF and Muddy Creek was below average for streams in this ecoregion. The biomass for all three reaches considered as a whole was about average.

5) Trout were in good condition, and plumpness did not decline markedly with increasing length, suggest that food supplies are adequate.

Management Recommendations

The presence of essentially pure westslope cutthroat on the Yellowstone Club is a unique and precious resource that increases value and interest for the discriminating angler and nature lover. Natural areas where anglers can fish for native, wild trout are increasingly rare. All prudent precautions should be followed to protect this population. No other trout should ever be stocked in this reach, unless they are genetically pure westslope cutthroat trout. Indeed, it is unlikely that stocking should ever be needed, particularly if a catch-and-release policy is adopted.

To monitor the effects of stream habitat enhancement, a follow-up electrofishing survey should be performed following stream work. A survey one year after enhancement would illustrate the short-term effects, while a survey three or four years after

enhancement would illustrate longer term effects. Short-term effects may include concentrating fish in improved habitat, while longer-term effects may reflect enhanced growth and survival.

An angler survey questionnaire and record book could be developed to monitor changes in angler success and fish population characteristics. This information would be a worthwhile supplement to electrofishing surveys.

Precautions should be taken to protect the riparian areas from impacts associated with development including road building, bridges, and recreational areas. Riparian vegetation should be protected to help maintain stream habitats.

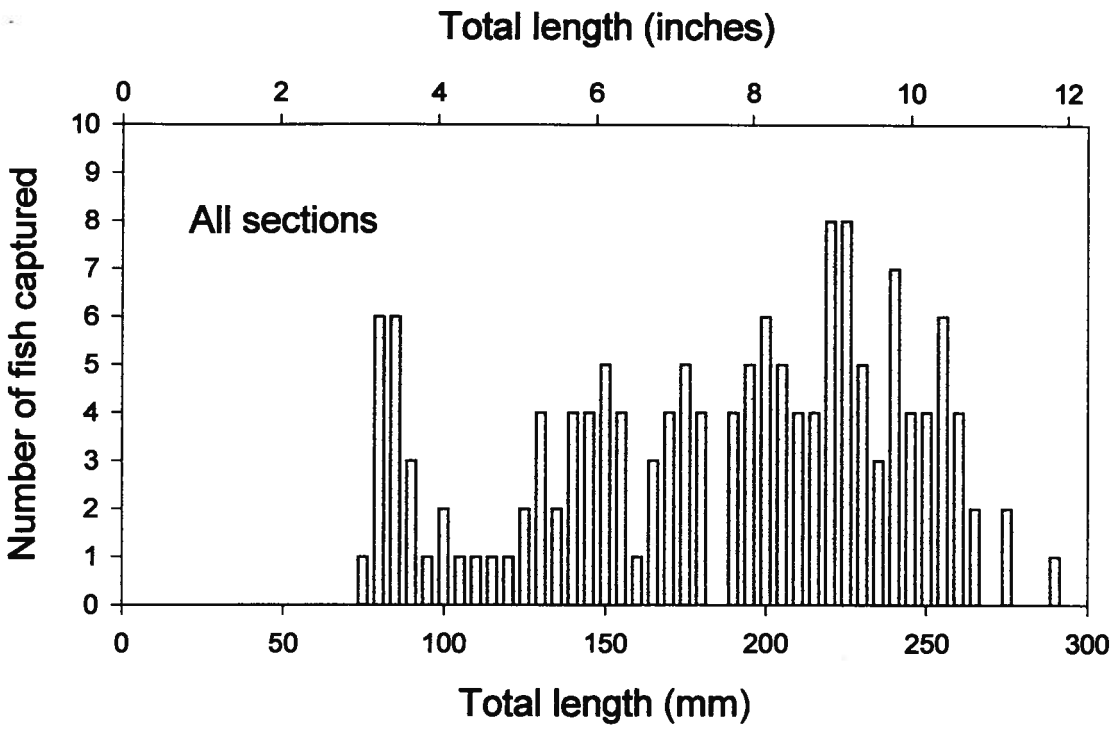

Figure 1. Distribution of sizes of fish captured in all three sections during electrofishing on the Yellowstone Club, 2 October 1999.

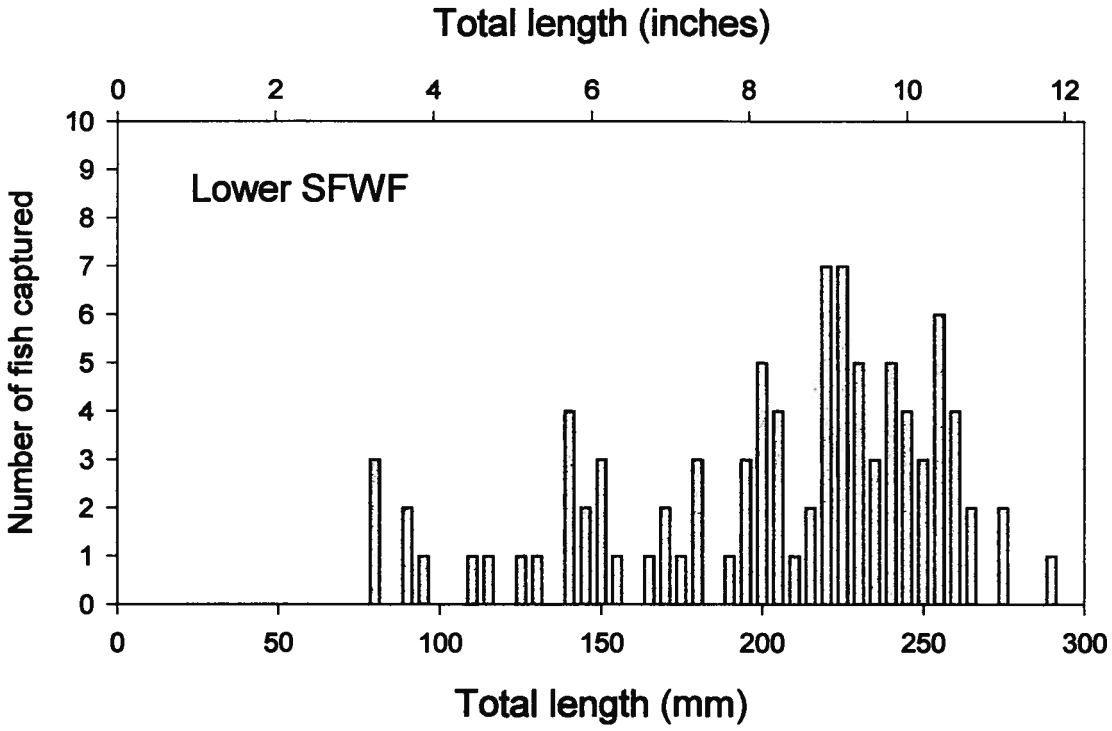

Figure 2. Distribution of sizes of fish captured in the lower SFWF section during electrofishing on the Yellowstone Club, 2 October 1999.

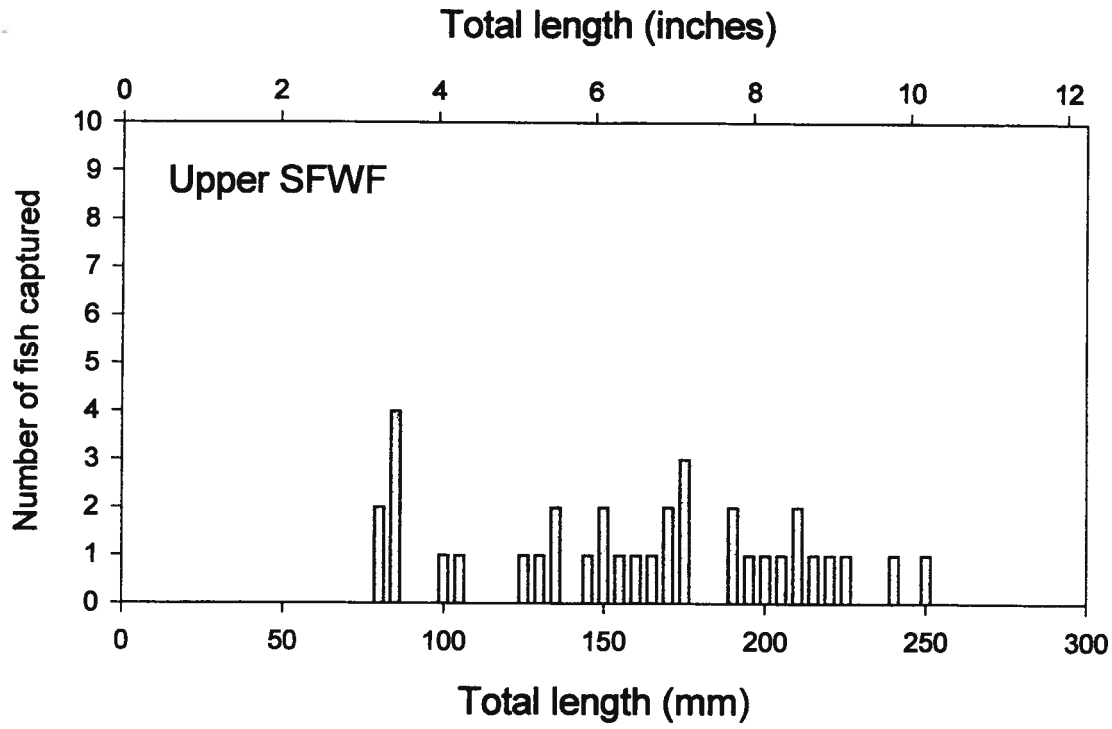

Figure 3. Distribution of sizes of fish captured in the upper SFWF during electrofishing on the Yellowstone Club, 2 October 1999.

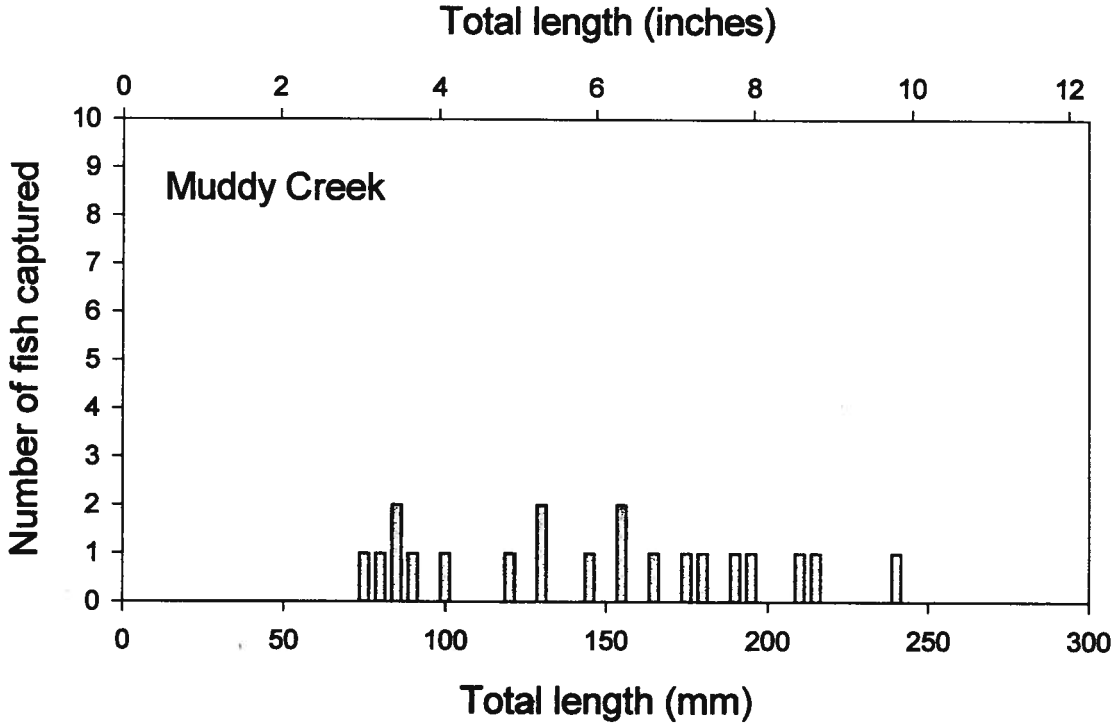

Figure 4. Distribution of sizes of fish captured in Muddy Creek during electrofishing on the Yellowstone Club, 2 October 1999.

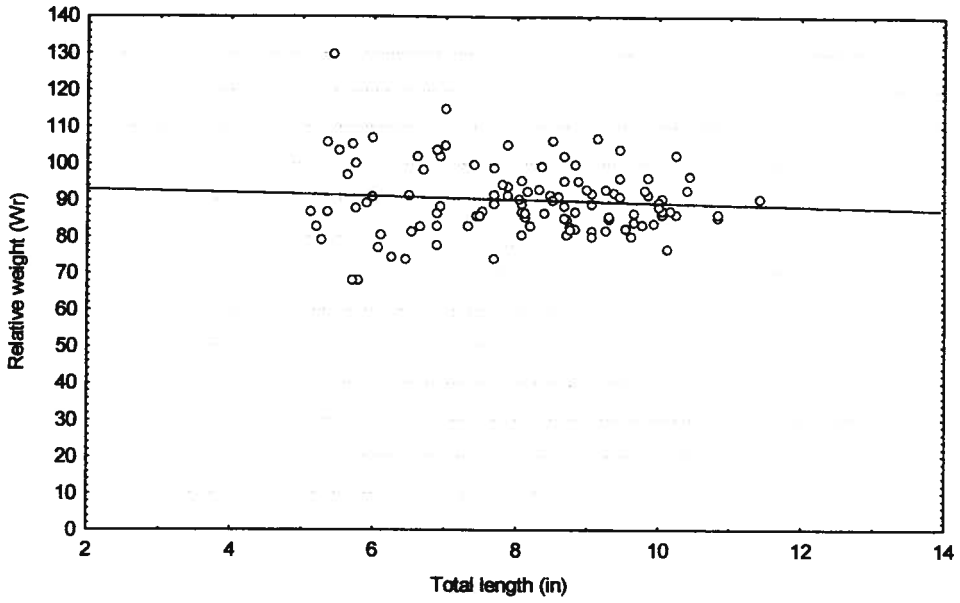

Figure 5. Relative weight (Wr) versus total length of cutthroat trout captured in the South Fork West Fork Gallatin River and Muddy Creek, Montana, 2 October 1999.

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