ELECTROFISHING SURVEY OF

SILVER SPRING CREEK

MADISON COUNTY, MONTANA

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Robert G. Bramblett
Carol L. Endicott
Fisheries/Aquatic Ecology Consulting
806 S. Tracy
Bozeman, MT 59715

Executive Summary.—Fish in Silver Spring Creek were sampled by electrofishing on two dates in April, 2000. The estimated population size for brown trout is 381 fish. We captured only one rainbow trout. There are more larger brown trout than smaller brown trout in Silver Spring Creek. About 60 % are over 12 inches and we captured brown trout greater than 22 inches. There are probably 5 year classes of brown trout in the creek; growth appears to be average or above average for Montana brown trout. Sampling in April was too early in the year to determine if successful spawning occurred in the creek. Relative fish plumpness declined as fish got larger. This may be due to lack of an adequate food supply for larger fish, possibly related to the current silty conditions in the creek. The total weight (biomass) of trout in the creek is currently about average for the Rocky Mountains. However, because trout appeared to be dense in all available habitat, and absent from long stretches of creek, habitat restoration will probably increase trout biomass in Silver Spring Creek.

Introduction and Methods

Fish populations on Silver Spring Creek were surveyed to determine population size prior to restoration of aquatic and riparian habitat on the entire stream. The electrofishing survey was conducted under the authorization of a temporary Scientific Collecting Permit issued by Montana Fish, Wildlife and Parks, and was done according to their electrofishing methods policy.

The stream was sampled from the bridge just above the confluence with the Ruby River to the bridge just below the source spring. The section we sampled was about 4000 feet in length and is virtually the entire stream.

Fish were captured using a "Leach box" shocker (H. Leach, Department of Electrical Engineering, Montana State University), powered by a portable generator. The shocker, generator, cathode and other equipment was transported by towing a 12-foot Coleman Crawdad boat. The shocker was set on smooth DC at 500-600 volts. A mobile anode was used to shock fish. The anode was thrown into and retrieved from deep pools to draw fish to netters. Two to three netters captured fish and two people pulled the boat and stood by the safety switch.

A capture-recapture (White et al. 1982) technique was performed to estimate the population size and 95 % confidence intervals (Everhart et al. 1953) for Silver Spring Creek. The 95 % confidence interval means that we are 95 % certain that the actual number of fish in this section of creek lies within the upper and lower bounds of the 95 % confidence interval. The first capture occasion (the mark run) was 9 April 2000, when fish were captured, marked and released. 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). The captured fish were marked by punching a small hole in the caudal fin. Fish were held in a live car to allow their recovery and were distributed back through the reach after sampling was completed.

The second capture occasion (the recapture run) was 23 April 2000. During the recapture run, all fish were examined for marks and measured, and unmarked fish were weighed.

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. Wr was plotted versus length of fish to detect if fish condition changed as a function of fish size.

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 average width of Silver Spring Creek was estimated at 45 ft (13.7 m). The biomass was calculated by multiplying the average weight of brown by the estimated population size trout in the creek.

Results and Discussion

Brown trout (*Salmo trutta*) were the dominant fish species; only one rainbow trout (*Oncorhynchus mykiss*) was captured. Other fish species observed were mottled sculpin (*Cottus bairdi*) and longnose dace (*Rhinichthys cataractae*). A total of 153 brown trout

were captured and marked on the mark run, 123 brown trout, of which 49 were marked, along with one rainbow trout were captured on the recapture run. The overall population estimate for Silver Spring Creek was 381 brown trout. The 95 % confidence interval of the population estimate is 313 to 449 brown trout. This translates to an estimate of 494 trout/mile. For comparison, the Ruby River in this area approximately 800 to 1200 trout/mile in this area.

Trout captured in Silver Spring Creek reach ranged 5.6 to 22.4 inches (141-570 mm) and 0.06 to 2.4 lbs (33-1190 g). Some fish weighed more than 2.4 lbs, but our scale's capacity was only 2.4 lbs. I used linear regression of lengths and weights to estimate that the 22.4 inch brown trout weighed 3.2 lbs. The overall average length was 12.9 inches (327 mm).

The distribution of lengths (length-frequency histogram) for all fish captured (Figure 1) suggests that perhaps four or five age classes are present. Age classes can be tentatively identified as peaks (modes) in the length-frequency histogram. Peaks occur at 8-9 inches, 11-12 inches, 14-15 inches, 18-19 inches, and 21-22 inches. Brown (1971) reports that approximate average lengths for brown trout in Montana are 1 year – 4 inches; 2 years – 8 inches; 3 years – 12 inches; 4 years – 14 inches; 5 years – 16 inches; 6 years – 18 inches. Comparing the peaks from our surveys to Brown's age classes suggest that Silver Spring Creek has average growth for ages 2, 3 and 4. Growth for ages 5 and 6 is either above average, or older fish (7 or 8 years old) are present in Silver Spring Creek. No young-of-the-year fish were observed, they would have either still been in the gravel

or very small during our sampling in April, or there was little reproduction of brown trout in Silver Spring Creek.

There were more brown trout greater than 10 inches in length than brown trout less than 10 inches in length in Silver Spring Creek (Figure 1). Of the individual fish we captured, 69 % were over 10 inches, 60 % were over 12 inches, 45 % were over 14 inches, and 21 % were over 16 inches. This population structure is excellent for fishing because of the prevalence of larger fish, however the lack of smaller brown trout may be of some concern. A "normal" fish population has more small fish than larger fish, because older fish suffer mortality that reduces their numbers relative to the younger fish.

The lack of smaller brown trout may be due to sampling bias. Electrofishing is more effective on larger fish than it is on smaller fish. However, we did not see many small fish escaping. I also observed that spawning habitat was generally lacking in Silver Spring Creek. Movement of trout from the Ruby River into Silver Spring Creek was only made possible three years ago when a fish barrier was removed from the downstream end of the creek (Gregory Fay, personal communication). Because the creek was only recently opened to immigration, the oldest trout produced in the creek would be three years old. The presence of older, larger fish indicates that adult fish have moved into the creek from the Ruby River.

Overall average weight of brown trout was 0.77 lbs (377 g). Condition factor (K) ranged 0.58 to 1.33, and relative weight (Wr) ranged 55 to 120. Condition factor and

relative weight are a measure of the plumpness of the fish. The plumpness of a fish is related to its growth; the more food, the more plump the fish, the better the growth. The relative weight of brown trout in Silver Spring Creek declined as a function of length, i.e. the longer fish were less plump ($P < 0.0000001$; Figure 2). This decline in plumpness may be related to food availability; larger fish need more food than smaller fish. The heavily silted gravels and cobbles in Silver Spring Creek probably limit the invertebrate production that may, in turn, limit the plumpness of larger brown trout. Larger brown trout are known to include fish in their diet (Brown 1971; Pflieger 1997). Because we observed relatively few potential prey fish (mottled sculpin, longnose dace, small trout), lack of an adequate fish prey base may also limit plumpness of large brown trout. In either case, removing silt from the stream should lead to increased food availability for brown trout.

The estimated biomass density in Silver Spring Creek (7.4 g/m^2) is about the same as 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). While current biomass levels in Silver Spring Creek are currently only about average, habitat restoration that increases trout habitat and benthic macroinvertebrate production should increase the biomass of trout. Moreover, the distribution of trout was very uneven; all of the pools and areas near undercut banks with depths that were greater than about 1.5 ft held many trout. In contrast, shallow reaches of the creek (up to 900 ft long) held few or no trout. Also, because a local reference, the Ruby River, has more biomass, Silver Spring Creek probably has potential for more biomass.

Conclusions

1) The dominant fish in Silver Spring Creek are brown trout. Rainbow trout, mottled sculpin and longnose dace were also present.

2) There are about five age classes of brown trout present; no young of the year were observed. Maximum size was about 22.4 inches.

3) The population structure of brown trout in Silver Spring Creek was biased towards larger fish.

4) Older and larger trout were relatively less plump than smaller trout. This may be due to silt and fine sediment related food limitations or lack of an adequate fish food base for large brown trout.

5) The biomass of brown trout was about average for Rocky Mountain trout streams. However, because large areas of Silver Spring Creek had no trout, habitat restoration will probably result in more biomass.

References

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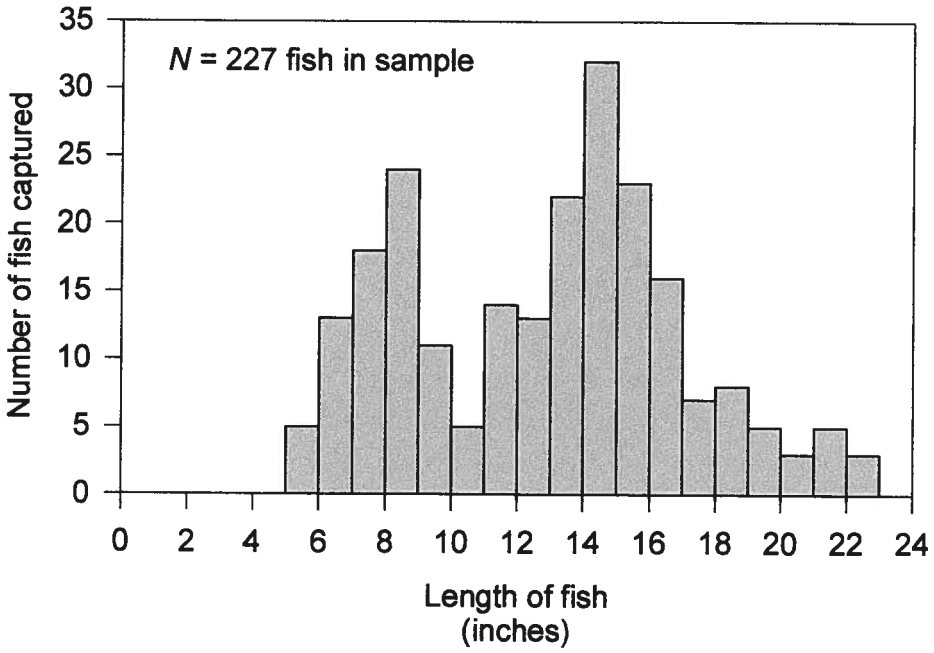

Figure 1. Distribution of lengths of fish captured during electrofishing surveys on Silver Spring Creek, Madison County, Montana, 9 and 23 April 2000.

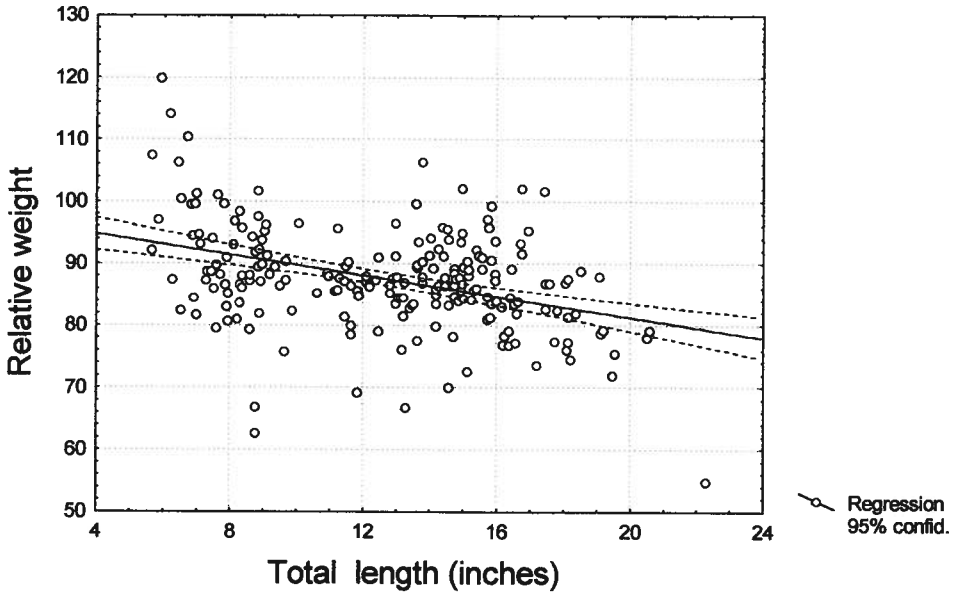

Figure 2. Relative weight as a function of length for brown trout captured in Silver Spring Creek, Madison County, Montana, 9 and 23 April 2000.