



The yield of wild and hatchery trout from Big Spring Creek, Montana
by Norman Walter Peterson

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE in Fish and Wildlife Management
Montana State University
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Abstract:

Estimates on the yield of wild and hatchery trout were made on a portion of Big Spring Creek, Montana, during the fishing seasons of 1968 and 1969. The stream was divided into two study sections (A and B) based on habitat quality, trout populations and fishing intensity. Rainbow trout represented about 80 percent of the wild trout populations within each sampling subsection (A1 and B1) during both years. An estimated 49 percent in 1968 and 55 percent in 1969 of all fishermen were interviewed. Total fishermen-hours were estimated by using "fishing intensity curves". The total fishermen-days per stream mile was 635 for 1968 and 534 for 1969. The total fisher-men-days per acre for the respective years was 128 and 104. In 1968, 11,986 game-fish (hatchery trout included) were caught during 5,077 fishermen-days for an average of 2.36 game-fish per fishermen-day.

In 1969, 7,774 game-fish were caught during 4,109 fishermen-days for an average of 1.89 game-fish per fishermen-day. The yield of wild game-fish increased 14.3 percent from 1968 to 1969 while the catch-rate of wild trout increased from 0.27 per hour to 0.36. The correlation coefficient for the relationship between late summer wild trout populations and yield was 0.97. Wild rainbow trout were not caught and kept in proportion to their relative abundance with respect to size and age. Age groups II and III contributed proportionally more to the yield than did age group I. The effects of a 50 percent reduction in stocked hatchery trout on yield, fishing pressure, percent returned, and catch-rate are discussed.

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Date May 12, 1970

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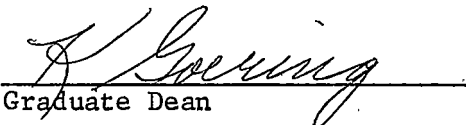
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ABSTRACT

Estimates on the yield of wild and hatchery trout were made on a portion of Big Spring Creek, Montana, during the fishing seasons of 1968 and 1969. The stream was divided into two study sections (A and B) based on habitat quality, trout populations and fishing intensity. Rainbow trout represented about 80 percent of the wild trout populations within each sampling subsection (A_1 and B_1) during both years. An estimated 49 percent in 1968 and 55 percent in 1969 of all fishermen were interviewed. Total fishermen-hours were estimated by using "fishing intensity curves". The total fishermen-days per stream mile was 635 for 1968 and 534 for 1969. The total fishermen-days per acre for the respective years was 128 and 104. In 1968, 11,986 game-fish (hatchery trout included) were caught during 5,077 fishermen-days for an average of 2.36 game-fish per fishermen-day. In 1969, 7,774 game-fish were caught during 4,109 fishermen-days for an average of 1.89 game-fish per fishermen-day. The yield of wild game-fish increased 14.3 percent from 1968 to 1969 while the catch-rate of wild trout increased from 0.27 per hour to 0.36. The correlation coefficient for the relationship between late summer wild trout populations and yield was 0.97. Wild rainbow trout were not caught and kept in proportion to their relative abundance with respect to size and age. Age groups II and III contributed proportionally more to the yield than did age group I. The effects of a 50 percent reduction in stocked hatchery trout on yield, fishing pressure, percent returned, and catch-rate are discussed.

INTRODUCTION

Estimates of total fishing effort, catch-rate and the game-fish population were made for the upper 9 miles of Big Spring Creek in Central Montana during the fishing seasons of 1968 and 1969. The data were evaluated to determine the yield of wild trout, the relationship of yield to certain characteristics of the wild fish populations, and the efficiency and effect of stocking rainbow trout.

Big Spring Creek has a history of flooding during spring runoff and five flood control dams, which will also serve as settling basins, are planned for tributaries upstream from the city of Lewistown (Marcoux, 1969). The yield may also provide a basis for evaluating the future effects of these dams.

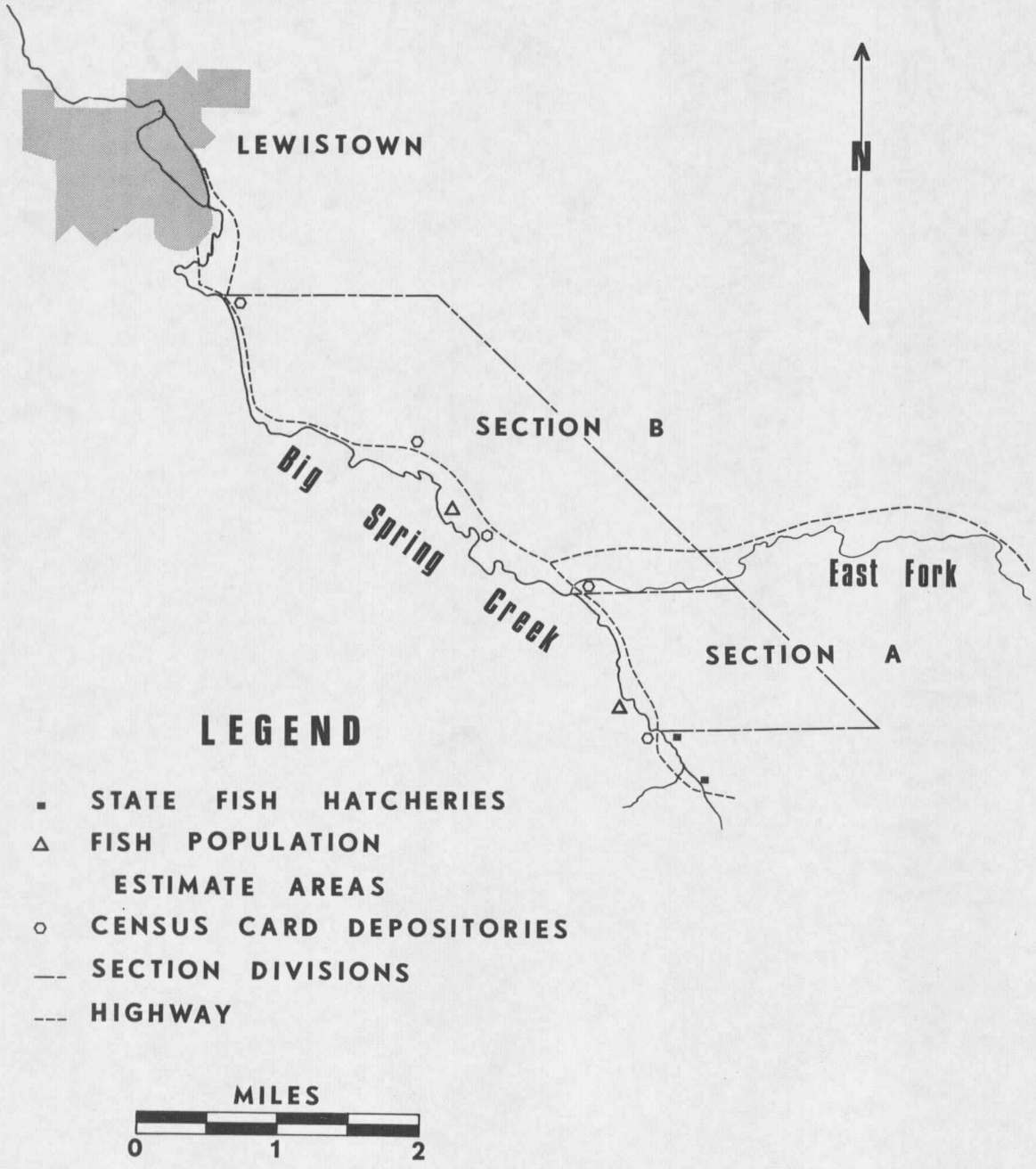


Figure 1. Study area, showing location of study sections A and B on Big Spring Creek.

DESCRIPTION OF STUDY AREA

Big Spring Creek arises from several springs 9 miles southeast of Lewistown. Located near the stream's origin are two Montana Fish and Game Department trout hatcheries. Numerous bridges (2.3 per stream mile), Montana State Fish and Game Department access areas, private access areas, and areas where the stream borders the highway provide considerable fishermen access. Seventy-two percent of the permanent homes on the floodplain are located within the lower 3.3 stream miles of the study area.

The study area was divided into two study sections. Study section A began at the highway bridge 600 feet downstream from the lower trout hatchery and continued downstream 1.9 stream miles to the confluence of the East Fork tributary (Figure 1). Section B began at the mouth of the East Fork tributary and continued 6.1 stream miles to the city limits of Lewistown. The upper 3,568 feet (subsection A₁) of section A had an average width of 36.5 feet and an average discharge of 126.6 cfs (Marcoux, 1969). A sampling section beginning about 2 miles below the mouth of the East Fork and extending 5,843 feet (subsection B₁) had an average width of 43.4 feet and an average discharge of 134.1 cfs. An area 3,704 feet long near the lower end of section B where the stream channel was altered had an average width and average discharge of 34.2 feet and 143.9 cfs, respectively.

The gradient from the upstream boundary of section A to the downstream boundary of section B was 27.5 feet per stream mile.

Turbidity measurements (in Jackson units) were made in each subsection and near the lower end of section B during 1968 and 1969 and on the East Fork tributary near its mouth in 1969 on most days when creel census was taken. Data were divided into three categories based on water clarity: clear (0-3 ppm), murky (3+7 ppm), and muddy (7+500+ ppm). Section A had the greatest number of clear water days and the station at the lower end of section B had the greatest number of murky and/or muddy days (Appendix, Table 1). The East Fork tributary had the highest percent of muddy water days in 1969. Turbidity increased more in the East Fork and section B than in section A following showers.

Rainbow trout (*Salmo gairdneri*) and brown trout (*Salmo trutta*) were the predominant wild game-fish species occurring in both stream sections. Marçoux found that these two species represented about 99 percent of the wild game-fish in 1967 and 1968 population estimates. A few brook trout (*Salvelinus fontinalis*), mountain whitefish (*Prosopium williamsoni*), and arctic grayling (*Thymallus arcticus*) were present. The latter probably resulted from an inadvertent hatchery release in 1966. Only 4 suckers per acre, including longnose sucker (*Catostomus catostomus*) and white sucker (*Catostomus commersoni*), were taken in subsection A₁, but 186 were taken in subsection B₁ and 247 in

the altered area (Marcoux, 1969). Marcoux, (1969) found that the fish population in the altered portion of section B was similar to subsection B₁. This altered area was not sampled in 1969. Hatchery rainbow trout were planted in both sections prior to and during the study.

METHODS

Beginning on opening day (May 19, 1968 and May 18, 1969) of each study year and continuing to September 15, 1968 and September 14, 1969, fishermen were censused a minimum of five days per week with the restriction that all weekends and holidays be included. The selection of the three weekdays censused was made from a table of random numbers. If a holiday fell on a weekday not normally censused, that day was also checked making a total of six census days for that week. Fishing pressure estimates for non-census weekdays were obtained from averaged data of the censused weekdays for that week. A similar partial census method was the most accurate of four studied by Best and Boles (1956).

The daily distribution of fishing intensity was determined by counting fishermen at 7, 8, and 11 a.m. and 1, 4, 6, and 8 p.m. (Mountain Daylight Time). A highway paralleled the stream at no greater distance than 0.26 mile and fishermen were readily visible from the highway on at least 90 percent of the stream. All counts were made as rapidly as possible from a vehicle. Only individuals who were actually fishing or walking to the stream with fishing rod in hand were counted.

As many fishermen as practicable were interviewed from 7 a.m. to dark to obtain length of time fished, total number in the fishing party,

the gender and residence of each individual, and the species, number, weight, and total length of fish caught.

Census cards were given to fishermen (or parties) that indicated they would continue fishing after the interview was made. Numbers on the cards corresponded to numbers on the interview forms. A high rate of card return was encouraged by requesting only party finishing time, number of trout caught and number released. Pencils and self-addressed stamped cards were provided. Cards could be returned in any one of five boxes conveniently placed along the stream or road (Figure 1).

During the study period of 1968 it seemed that a proportionately higher percent of interviews were made around certain access points as compared to the rest of the stream. Several access points also corresponded to trout planting sites so that catch data may have been biased toward hatchery fish. Other studies show that most hatchery recoveries occur within a short distance of the planting sites during the summer months (Butler and Borgeson, 1965; and Cooper, 1952). Electro-fishing data from my study showed that the majority of hatchery rainbow trout were located within 1,000 feet downstream from the planting sites. The 1,000 feet immediately downstream from planting sites were designated as access areas. If a pool and/or run was present immediately above a planting site, it was included as part of the access area. In 1969, the number of fishermen observed and the number contacted in 10 access areas were each compared to corresponding numbers for the rest of the stream.

Population estimates of wild rainbow and brown trout were made in subsections A₁ and B₁ (Figure 1). These were made during the late summers of 1968 and 1969; during March, 1968 in subsection B₁ and during March, 1969 in subsection A₁. The 1968 summer estimates for both subsections were obtained from Marcoux (1969). Estimates of wild trout were made at 2-inch size intervals, excluding fish less than 6.0 inches total length, to compensate for differential efficiency of capture. Computations were made using the Bailey Modification of the Petersen estimator (formula 3.7 of Ricker, 1958). Confidence intervals at the 95 percent level were computed using formula 6 of the Michigan Institute for Fisheries Research (1960).

Fish populations were sampled with a variable voltage, pulsed D. C. generator. Captured fish were anesthetized, measured, weighed, temporarily marked with a caudal punch or a partial caudal clip, and released near the capture site.

Hatchery rainbow trout planted in the study area totaled about 10,000 in 1968 and 5,000 in 1969. At the time of planting, the fish ranged from an average weight of 2.6 per pound early in the 1968 season to one per pound late in the 1969 season. Between five and seven plantings occurred each summer from May 14 to the last week in July. On each planting day, fish were distributed at an average of seven access points in the study area. Planting sites and dates were similar between years but the number in individual plants was reduced by 50

percent in 1969. Fish stocked in 1968 were marked by removing the adipose fin. In 1969, colored dyes of various combinations were injected intracutaneously into the left and/or right mandibles. Dyes used were chromium oxide and National Fast Blue 8GXM. Kelly (1967) reported that these dyes were externally visible in 100 percent of the fish for at least one year after marking.

An additional 1,625 rainbow trout in 1968 and 1,150 in 1969 were planted near or between the hatcheries. Those stocked in 1969 were marked to determine if they drifted into the study area.

RESULTS

Fishing intensity data were divided into weekdays and weekends-holidays. Data were further grouped into one of five strata to compare seasonal distribution patterns and to facilitate estimates. Stratum one includes opening day and the following three weeks; strata 2, 3, and 4 include consecutive four-week periods following stratum one; and stratum 5 contains the final two weeks.

Angling intensity in hours was estimated by summing the daily distributions of fishermen in each stratum and constructing "fishing intensity curves" (e.g., Figures 2, 3, and 4). Total fishing pressure for any stratum thus became the total fishermen-hours under that period's curve. Total fishermen-hours was computed as the sum of the number of fishermen under the curve at each hour. The left side of each curve was closed through extrapolation from early morning starting times recorded on interview forms. The right side was closed by extrapolation from the finishing times recorded on census cards using only data from fishermen finishing after 8 p.m.

An estimated 49 percent of all fishermen were interviewed in 1968 and 55 percent in 1969. The return on the census cards given to interviewed fishermen, in 1968, was 72 percent (21 percent by mail) and, in 1969, was 71 percent (12 percent by mail). There was little difference in the percent return between strata or between weekdays and weekends-holidays.

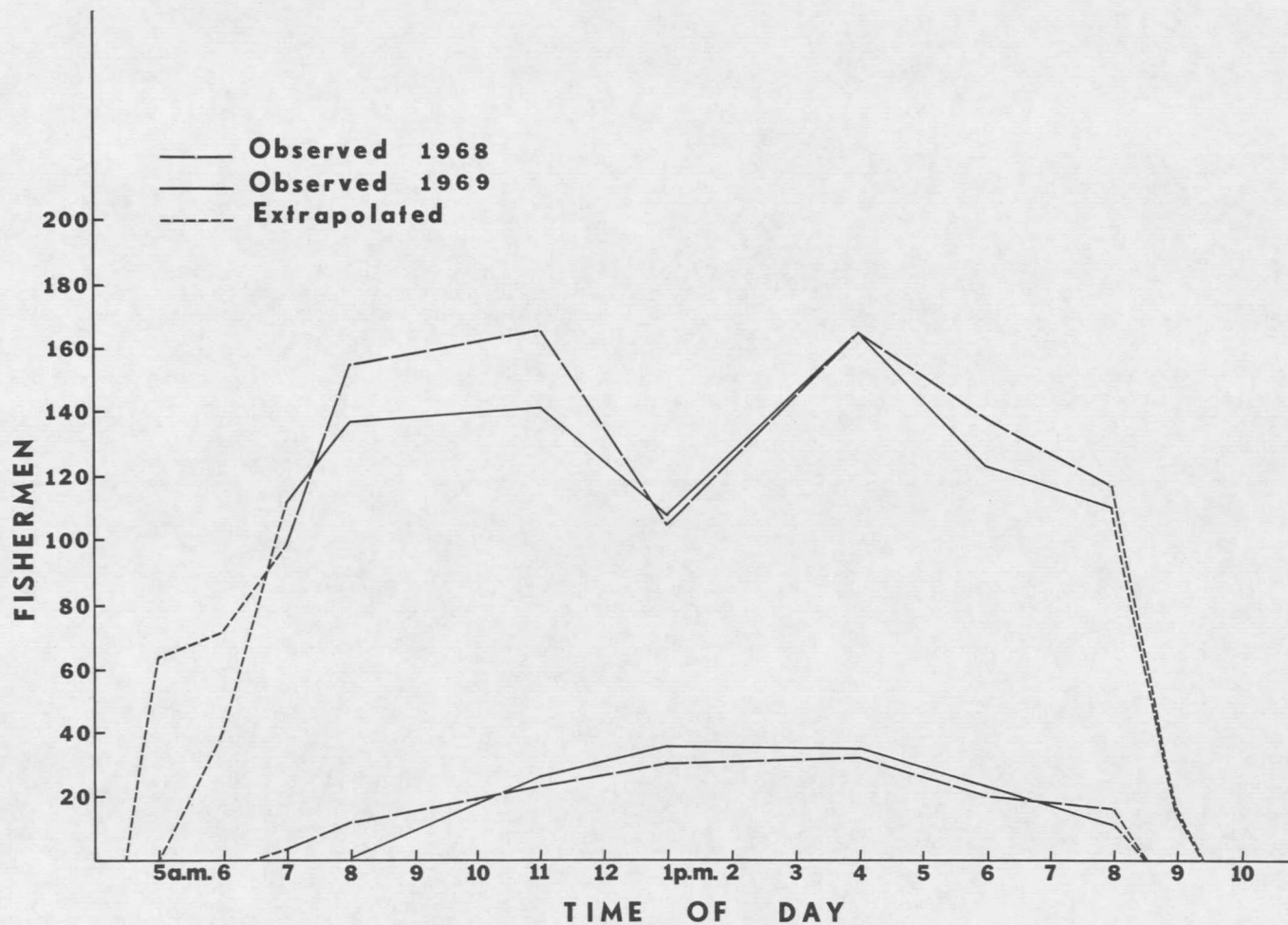


Figure 2. Fishing intensity curves for the weekends-holidays of stratum one (two larger curves) and stratum 5 (two smaller curves) for Big Spring Creek.

