



A trout population study on a small creek in Gallatin County, Montana
by George D Holton

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:

A study during two summers and the intervening winter was made of a rainbow, brook and brown trout population in four sample sections of a small spring-fed creek in the Gallatin Valley, Montana. A direct current shocker was used for sampling the population. Fish taken were fin clipped and released. Information was obtained on distribution of species in the creek, population changes through the year, movement and population stability, standing crops, age composition, survival, growth and reproduction. Of 1,016 4-inch brook trout planted in August 1950, an estimated 5 per cent were left in the 2 1/2 mile study area during the following calendar year.

Brook trout predominated in the upper part of the study area; rainbow trout, in the lower part. Rainbow trout older than age group 0 had their maximum number in the first inventory of the year due to recruitment of young fish and gradually declined in number to the last inventory of the year. The loss in total trout weight due to the reduction in number through the year was largely offset by the gain in weight of individual fish. Brook trout (upper study section) and brown trout older than young of the year showed a decided numerical increase during their spawning season. A population turnover greater than expected from normal mortality and recruitment was indicated by low recoveries of marked fish theoretically available and by the paucity of brook and rainbow trout over two years old. There was evidence of limited movement. The standing crop per acre in the combined four study sections in August 1951 was estimated to be 4,586 trout or 106 pounds. At this time 80 and 85 per cent respectively of the brook and rainbow trout numbers were in age group 0, 18 and 13 per cent were in age group I and 2 per cent of each were in age group II.

Some individual brook and rainbow trout attained legal length (7 inches) in their second summer, however, the majority did not reach this size until their second fall or the following spring. There were an estimated 5,867 young of the year per mile the first fall and 5,468 per mile the second summer. A collection of brook trout during their spawning season showed that some young of the year males were ripe and that at least 72 per cent of the fish over 6 inches long were males.

A TROUT POPULATION STUDY ON A SMALL CREEK
IN GALLATIN COUNTY, MONTANA

by

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A THESIS

Submitted to the Graduate Faculty

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partial fulfillment of the requirements

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at

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Approved

Head, Major Department

Chairman, Examining Committee

Dean, Graduate Division

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The Brook

I come from haunts of coot and hern,
I make a sudden sally,
And sparkle out among the fern,
To bicker down a valley.

.....

I wind about, and in and out,
With here a blossom sailing,
And here and there a lusty trout,
And here and there a grayling,

.....

And out again I curve and flow
To join the brimming river,
For men may come and men may go,
But I go on forever.

- Tennyson

W. B. Ewing
MADE IN U.S.A.

11/22/74 Gift - Arthur

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ABSTRACT

A study during two summers and the intervening winter was made of a rainbow, brook and brown trout population in four sample sections of a small spring-fed creek in the Gallatin Valley, Montana. A direct current shocker was used for sampling the population. Fish taken were fin clipped and released. Information was obtained on distribution of species in the creek, population changes through the year, movement and population stability, standing crops, age composition, survival, growth and reproduction. Of 1,016 4-inch brook trout planted in August 1950, an estimated 5 per cent were left in the $2\frac{1}{2}$ mile study area during the following calendar year.

Brook trout predominated in the upper part of the study area; rainbow trout, in the lower part. Rainbow trout older than age group 0 had their maximum number in the first inventory of the year due to recruitment of young fish and gradually declined in number to the last inventory of the year. The loss in total trout weight due to the reduction in number through the year was largely offset by the gain in weight of individual fish. Brook trout (upper study section) and brown trout older than young of the year showed a decided numerical increase during their spawning season. A population turnover greater than expected from normal mortality and recruitment was indicated by low recoveries of marked fish theoretically available and by the paucity of brook and rainbow trout over two years old. There was evidence of limited movement. The standing crop per acre in the combined four study sections in August 1951 was estimated to be 4,586 trout or 106 pounds. At this time 80 and 85 per cent respectively of the brook and rainbow trout numbers were in age group 0, 18 and 13 per cent were in age group I and 2 per cent of each were in age group II. Some individual brook and rainbow trout attained legal length (7 inches) in their second summer, however, the majority did not reach this size until their second fall or the following spring. There were an estimated 5,867 young of the year per mile the first fall and 5,468 per mile the second summer. A collection of brook trout during their spawning season showed that some young of the year males were ripe and that at least 72 per cent of the fish over 6 inches long were males.

INTRODUCTION

An investigation of the population and ecology of trout in Trout Creek, Gallatin Valley, Montana was made during the summers of 1950 and 1951 and the intervening winter. This stream is one of numerous small spring-fed creeks which occur in the area.

Somewhat similar studies on trout stream populations have been made by Stefanich (1952) on Prickley Pear Creek, Montana; Schuck (1945) on Crystal Creek, New York; Needham, Moffett, and Slater (1945) on Convict Creek, California and Shetter and Leonard (1943) on Hunt Creek, Michigan.

The writer wishes to acknowledge the assistance of Dr. C.J.D. Brown who directed the study and helped prepare the manuscript. Invaluable aid in setting up electric shocking equipment was given by Dr. A. R. Jordan and Mr. H.G. Helterline; identifications of aquatic plants were verified by Dr. W.E. Booth; free access to the portion of the creek studied as well as other cooperation was given by Messrs. Hugh Spain, Radford McGuire, Wilbur Spring and Ralph Herdina. Several students at Montana State College also assisted, especially Marvin Boussu and William Clothier who helped collect field data and Jack Bailey who assisted in aging the fish. The Montana Fish and Game Department allowed use of certain equipment, assisted in preparation of the scale mounts, and provided use of the state shocking crew on one occasion. The Montana State College Agricultural Experiment Station gave financial assistance.

DESCRIPTION OF CREEK

Trout Creek is $3\frac{1}{2}$ miles northeast of Belgrade, Montana at an altitude of approximately 4,450 feet. It originates in springs which are scattered

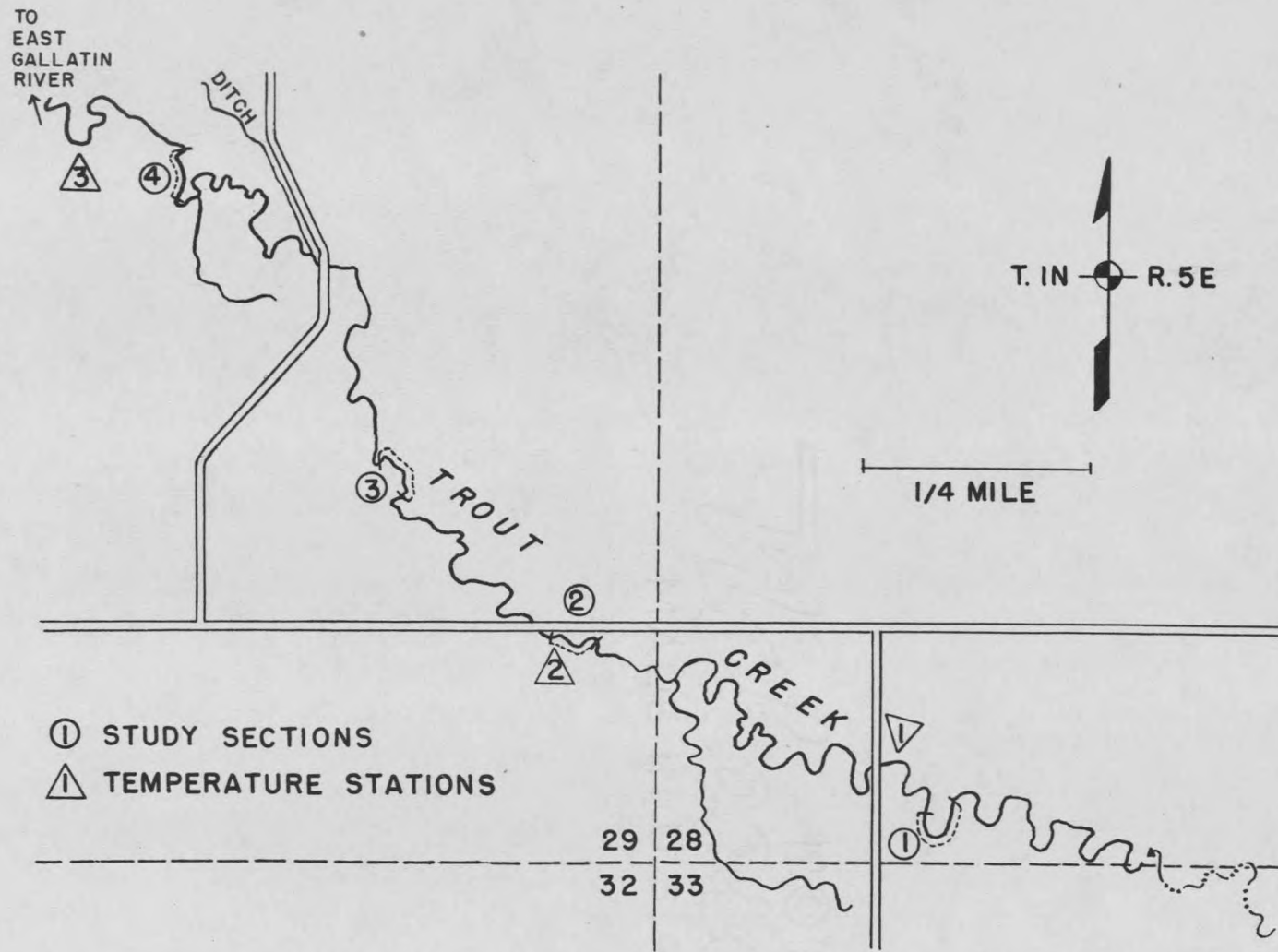


Fig. 1. Trout Creek study area.

along its entire length and meanders through a fertile agricultural area for a distance of 4 miles to where it enters the East Gallatin River. The drainage is about seven square miles.

Study Area and Sections

Observations were confined to the upper $2\frac{1}{2}$ miles of the creek. Four representative 300-foot sections were established without bias as to pools, riffles and cover. Starting with the uppermost, these study sections were designated 1, 2, 3 and 4 (Fig. 1).

Pertinent physical measurements were made in each section (Table 1). Widths and depths were determined when water levels were intermediate between March low water and September high water levels. Average widths were based on measurements made every 5 feet along the creek and in general increased progressively going downstream. Riffles within sections had an average mid-stream depth of 6.3 inches, and pools, a maximum depth of 31 inches. The bottom in riffle areas was usually composed of small gravel. In calm areas sand and silt prevailed.

Velocity and volume of flow measurements were made in fall when high water levels were being approached. Velocities were measured with a current meter half way between the surface and bottom at 12-15 equal intervals across the creek. Both velocity and volume of flow increased from the upper to the lower part of the study area. During the investigation two flash floods were caused by melting snow. One on February 9 and 10, 1951 and the other on March 26. The volume during these floods was estimated roughly to be seven times greater than in the fall. Floods of this nature were reported to be an annual occurrence. They caused

Table I - Comparison of physical characteristics of study sections.

	Section			
	1	2	3	4
Length (feet)	300	300	306	300
Average width (feet)	5.5	10.4	15.5	15.5
Area (acres)	0.038	0.072	0.109	0.107
Riffles - per cent of section length	22	50	33	40
Pools ^{1/} per cent of section length	13	44	49	39
Volume of flow (cu. ft. per sec.)	2.36	9.07	12.21	14.72
Average velocity (ft. per. sec.)	0.75 (8.2) ^{2/}	1.75 (7.7)	1.82 (5.9)	2.00 (5.5)

^{1/}At least 12 inches deep.

^{2/}Average depth (inches) of stream at place where velocity was measured.

washing of the stream banks and scouring of the bottom. The flow in section 4 was reduced approximately 20 per cent for 2-3 weeks during the summer due to an irrigation diversion.

In the upper two-fifths of the study area, (section 1 included) Trout Creek flowed through a small ravine in which willows (Salix sp.) were frequent. Section 1 had little shade from willows but was narrow enough so that overhanging sedges (Carex rostrata and C. nebraskensis) and other herbs covered a considerable portion of the creek surface (Fig. 2). The lower three-fifths of the study area (sections 2, 3 and 4 included) was more open. Much of it was bordered by low banks with occasional clumps of willows and other shrubs (Figs. 3 and 4). Sections 2 and 3 had several well shaded pools. Section 4 was completely open. There was less undercut bank in section 3 than in the others.

Aquatic plants were present in the study area from early summer until mid-winter. They were most dense in section 1 and least dense in section 4. In section 1 (Fig. 2) water cress (Nasturtium officinale) predominated. It choked the edges along most of the section and occurred as mid-stream patches which in places extended from bank to bank. There were also occasional patches of a narrow-leaved pondweed (Potamogeton sp.) with foliage three to six inches long, and a small amount of brook grass (Catabrosa aquatica). In the lower three sections water cress was common along the edges while separate patches of water speedwell (Veronica connata), brook grass and pondweed were found in mid-stream. In section 2 brook grass and water speedwell predominated and in sections 3 and 4 water speedwell was most abundant (Fig. 3). Filamentous



Fig. 2. Upper part of study area (section 1).



Fig. 3. Middle part of study area (section 3).



Fig. 4. Lower part of study area (section 4).

algae were prevalent in the creek in summer and fall.

Temperatures

Year around temperatures were secured at the upper, middle and lower portion of the study area (Fig. 1). These were taken with Taylor "Sixes" maximum-minimum thermometers and were usually recorded three or four times a month from August 1950 to October 1951. The maximum and minimum readings for each station were plotted on a graph opposite the date taken (Fig. 5).

The maximum water temperature in the hottest part of summer was 63 degrees F. and the minimum winter temperature was 32 degrees F.. This minimum occurred only for short periods, the usual December to March minimum being about 38 degrees F. The highest and the lowest temperatures recorded were at station 3 (Fig. 1) where spring water had the least moderating effect. The maximum summer temperatures at station 1 were greater than those at station 2 due to warmer water from a small tributary which entered the uppermost part of the study area.

Chemical Analyses

Limited chemical analyses using standard limnological methods were made at various points along the study area on March 1 and July 27, 1951. Chemical conditions in and below section 1 were found to be comparable on both dates and conditions at all points were well within the range tolerated by trout with the possible exception of low dissolved oxygen (24 per cent saturated) and high free CO₂ (30.0 p.p.m.) at the source on March 1. Dissolved oxygen and pH increased going downstream while free CO₂ decreased. In the study sections pH ranged from 7.5 to 8.1

