



Abundance and movement of young trout in a portion of the Madison River, Montana
by Donald Roy Sundeen

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of
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Abstract:

The species, number, and size of young trout which occupy two areas of the Madison River; the changes in species composition over the study period; the extent of movement; and the specific habitat of young trout were studied during the summer of 1966 and the summer and fall of 1967.

Brown trout and rainbow trout were found in the study areas, with brown trout being the most abundant. The ratio of rainbow trout to brown trout increased from 5.6:100 to 28.6:100 as the sampling period progressed in 1967. Young trout were generally found in water greater than 15 cm in depth where velocities were between 0.09 and 0.51 m/sec., and in or under dense overhanging shore vegetation. Most brown trout and rainbow trout were found in the upstream area, where greater amounts of aquatic vegetation and overhanging bushes existed. A total of 349 brown trout and 25 rainbow trout were marked and released during this study. A total of 132 brown trout and 10 rainbow trout were recaptured at least once. The maximum number of times that a brown trout was recaptured was 5, and that a rainbow trout was recaptured was 3. The trout in the study areas generally remained in the section or sub-section of original capture. The average straight-line distance outside of the section or sub-section in which originally captured was 11.4 m for brown trout and 6.4 m for rainbow trout.

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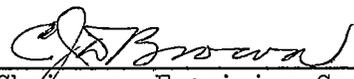
in

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ABSTRACT

The species, number, and size of young trout which occupy two areas of the Madison River; the changes in species composition over the study period; the extent of movement; and the specific habitat of young trout were studied during the summer of 1966 and the summer and fall of 1967. Brown trout and rainbow trout were found in the study areas, with brown trout being the most abundant. The ratio of rainbow trout to brown trout increased from 5.6:100 to 28.6:100 as the sampling period progressed in 1967. Young trout were generally found in water greater than 15 cm in depth where velocities were between 0.09 and 0.51 m/sec., and in or under dense overhanging shore vegetation. Most brown trout and rainbow trout were found in the upstream area, where greater amounts of aquatic vegetation and overhanging bushes existed. A total of 349 brown trout and 25 rainbow trout were marked and released during this study. A total of 132 brown trout and 10 rainbow trout were recaptured at least once. The maximum number of times that a brown trout was recaptured was 5, and that a rainbow trout was recaptured was 3. The trout in the study areas generally remained in the section or sub-section of original capture. The average straight-line distance outside of the section or sub-section in which originally captured was 11.4 m for brown trout and 6.4 m for rainbow trout.

INTRODUCTION

Studies concerning fish population biology have generally dealt with adults. Only a relatively few have been done on fish less than one year of age. Some of the more important investigations on young salmonids are: survival of young brook trout in Michigan (Shetter, 1961; Latta, 1962); growth and survival of fingerling hatchery brown trout in New York (Shuck and Kingsbury, 1945); aggressive behavior of juvenile Coho salmon as a cause for emigration in Oregon (Chapman, 1962); migration behavior of juvenile rainbow trout in outlet and inlet streams of lakes in British Columbia (Northcote, 1962); behavior of juvenile Pacific salmon (Hoar, 1954), aggressive behavior of under-yearling Kamloops trout (Stringer and Hoar, 1955) and stream aquarium behavior of juvenile brown trout (Hartman, 1963). These last three were done in British Columbia.

The objectives of my study were to determine: (1) the species, number and size of young trout which occupy two small areas of the Madison River; (2) the change in species composition over a period of time; (3) the extent of movement; and (4) the specific habitat of the young trout.

The study areas were located about 40 km upstream from the mouth of the Madison River. One area was situated 0.5 km below the mouth of Cherry Creek on the east bank and the other was 2.0 km above the mouth of Cherry Creek on the west bank. The downstream area was located on the main river, while the upstream area was located on a side channel, which was approximately 25 m wide. The study extended from 3 August to 7 October 1966 and from 12 April to 4 December 1967. Quantitative information was

collected between 6 August and 16 September 1966 in the upstream area, and between 29 August and 4 December 1967 in the upstream and downstream areas.

METHODS

Most fish were taken with the aid of a D. C. shocker and dipnet, however, some were collected with a seine or a dipnet alone. Each study area was divided into sections and sub-sections as illustrated in Figure 1. All sections were sampled at intervals of two weeks. Posts were placed at the corners of section 1A at the upstream area and at sections 2 and 3 at both areas. When water levels permitted, each of these sections was enclosed with a common seine (6.3 mm mesh) before collections were made. This procedure was followed to prevent young trout from escaping. In 1966, only the upstream area was sampled (sections 1A, 2, and 3). In 1967, sampling included sections 1, 2, 3, and 4 in both areas. Sections 2 and 3 were enclosed with a 3.2 mm mesh seine early in the season when fish were generally less than 90 mm and with a 6.3 mm mesh net later in the season when fish were somewhat larger. Two sampling passes were made along the shore, followed by two passes offshore at sections 1 and 4. The offshore portion included, as nearly as possible, a strip two meters wide beginning one meter from shore.

All trout less than 160 mm in total length were measured to the nearest millimeter. Trout larger than this were not measured, but their relative abundance was noted. Most small trout were marked (fin clip

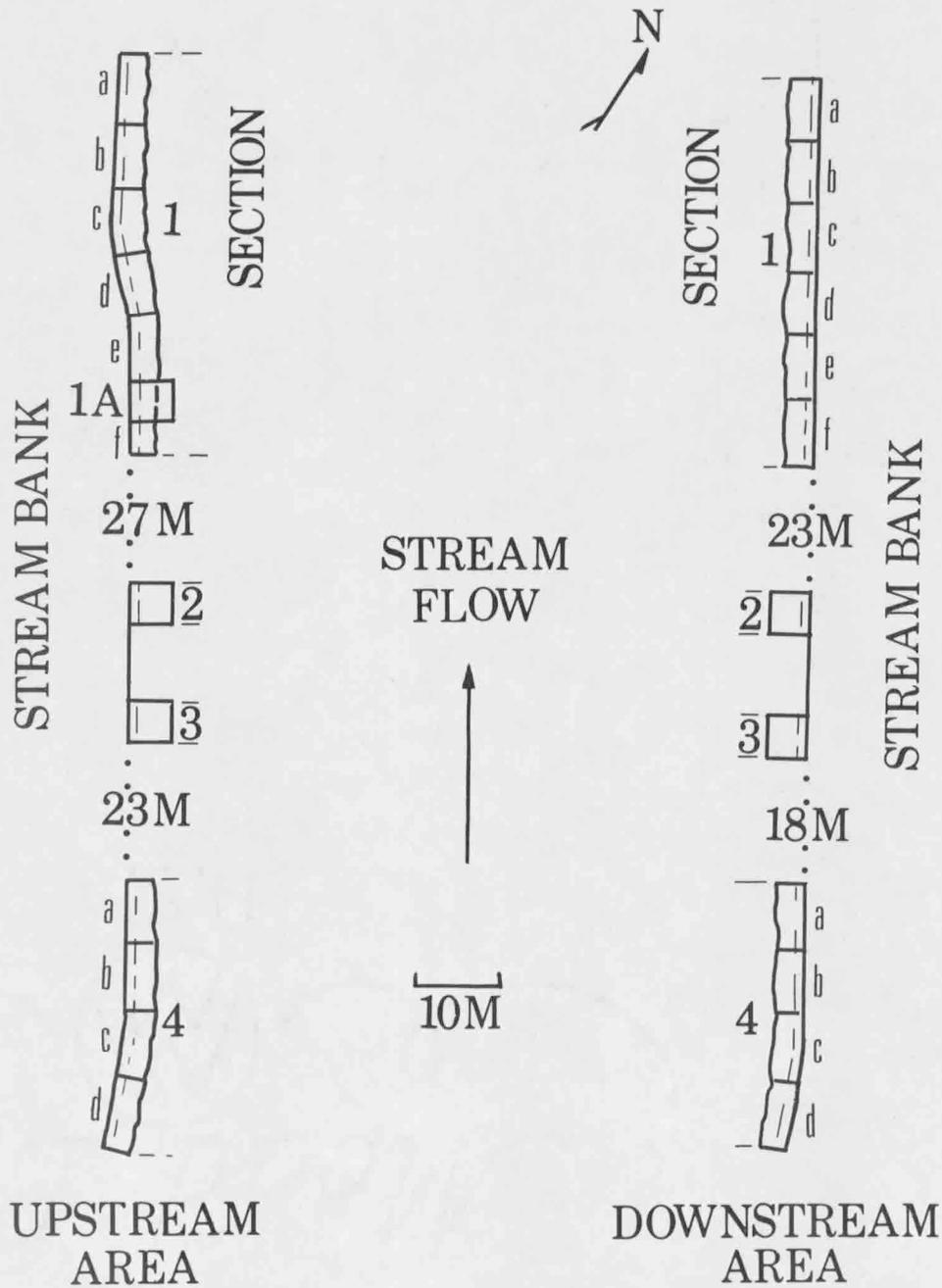


Figure 1. Map of the Study Areas on the Madison River, Montana, showing sections (arabic numerals) and sub-sections (small letters).

and/or dye injection) in order to identify recaptures and place of release. Scales were taken from approximately 60 fish for age determination. Following these procedures, fish were allowed to recuperate before being distributed at random throughout the area from which they were captured. Some sampling was done outside and within approximately 100 m of regular sections in an attempt to capture marked fish.

Numerical analyses were restricted to the young trout. The number and density of trout are given for each section.

Water levels were determined from a reference marker during each sampling period. Velocities were obtained with a current meter at irregular intervals in 18 places within the sampling areas. These measurements were taken at 30 cm intervals, extending out from the shore. The boundaries of the sections and sub-sections were generally used for the measurements. Air and water temperatures and weather conditions were recorded for each sampling period. Sampling areas were mapped and the vegetation identified. Percentages of bottom material were determined using a modification of the Daubenmire method (Daubenmire, 1959). Five categories were recognized: silt - less than 0.02 mm in diameter; sand - from 0.02 to 2.0 mm; gravel - 2.0 to 25 mm; small rubble - 25.0 to 150.0 mm; large rubble - greater than 150.0 mm. Sampling plots, in linear series, were measured at each study area. These were approximately 2 m apart and at varying distances from shore (0.3 to 3.0 m).

RESULTS

Determinations of depths, volumes, levels, bottom materials, angle of stream banks, temperatures, and vegetation were made to see if these influenced the number and distribution of young trout. The mean depth for the downstream area was 36.9 cm, with a range of 15.2 to 64.0 cm (118 measurements), while that for the upstream area was 33.2 cm, with a range of 12.2 to 79.3 cm (103 measurements). The mean volume for the downstream area was 0.57 cu.m/sec., with a range of 0.26 to 1.04 cu.m/sec. (10 measurements), while that for the upstream area was 0.51 cu.m/sec., with a range of 0.14 to 0.94 cu.m/sec. (8 measurements). Large variations in depths and volumes existed, depending upon when and where measurements were made.

Water levels were low during the first part of May, and increased to the maximum during June, 1967, due to runoff (Figure 2). A general decline followed and continued through mid-August. Water levels increased between mid-August and mid-October due to water manipulation at the dam upstream. A rapid decline began in mid-November and continued to the end of the sampling period. The bottom materials, in the order of decreasing abundance for the downstream area, were: small rubble, gravel, silt, and sand (Table 1). In the upstream area, they were: small rubble, gravel, sand, large rubble, and silt. Stream banks were approximately vertical to the water surface at both study areas. Water temperatures generally decreased, from 20.5 C on 6 August to 11.0 C on 7 October 1966 and from 19.0 C on 29 August to 2.5 C on 6 November 1967. After this date, temperatures were fairly constant through 4 December, except for a temporary

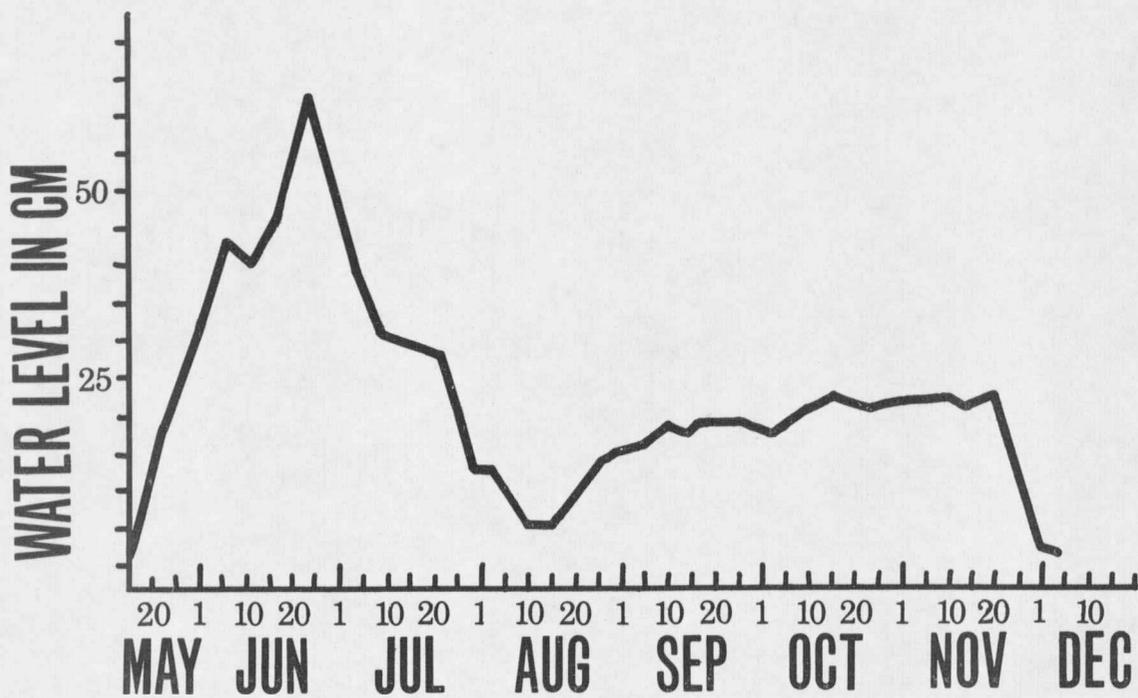


Figure 2. Water Level During the 1967 Sampling Period.

