



Responses of rainbow (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) to creation of access into a spawning tributary
by Scott Irven Snelson

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Biological Sciences
Montana State University
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Abstract:

The purpose of this study was to determine the use of Deep Creek as a spawning tributary by brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*) from the Missouri River and nearby Canyon Ferry Reservoir, after removal of a barrier across the stream. Movements of adult trout into the creek and outmigration of juveniles were monitored with traps at a concrete weir at the siphon site during 1992, 1993 and 1994. Large numbers of adult rainbow trout were captured moving upstream during spring, 719 in 1993 and 1,959 in 1994. Wild rainbow trout and two hatchery strains, DeSmet and Eagle Lake (identified by marks and dorsal fin erosion) trout were represented. Wild and hatchery strains differed in timing of spawning runs, with wild fish entering the stream and peaking in numbers before hatchery fish in both years. Hatchery fish accounted for 48.2% of the adult rainbow trout entering Deep Creek in 1993 and 76% in 1994. Of the adults tagged at the weir in 1993, 13% of the wild trout and 18.3% of the hatchery trout returned in 1994. Ages of wild adults captured in 1993, determined through scale samples, were ages 3 (6.0%), 4 (67.2%), 5 (22.4%), and 6 (3%). Growth patterns on their scales suggested that <1.5% had left their natal streams at age 0, 42.4% at age 1, 53% at age 2, and 4.5% at age 3. Few adult brown trout responded to the new access, with captures at the weir during late summer-early fall of four in 1993 and six in 1994. Length-class distribution of outmigrating juvenile rainbow trout (153 in 1993, 233 in 1994) was <23% age 0, about 62% age 1, and about 16% age 2 or greater. Length-class distribution of outmigrating juvenile brown trout (215 in 1993, 67 in 1994) was about 44% age-0 and 56% age-1. Included among the outmigrant brown trout were hatchery-origin, age-0 fish released into Deep Creek, virtually all of which moved downstream their first year. Results suggest that young rainbow produced in Deep Creek tend to remain within the stream during their first year before migrating downstream.

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APPROVAL

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Scott I. Snelson

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, citations, bibliographic style, and consistency and is ready for submission to the College of Graduate Studies.

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ABSTRACT

The purpose of this study was to determine the use of Deep Creek as a spawning tributary by brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*) from the Missouri River and nearby Canyon Ferry Reservoir, after removal of a barrier across the stream. Movements of adult trout into the creek and outmigration of juveniles were monitored with traps at a concrete weir at the siphon site during 1992, 1993 and 1994. Large numbers of adult rainbow trout were captured moving upstream during spring, 719 in 1993 and 1,959 in 1994. Wild rainbow trout and two hatchery strains, DeSmet and Eagle Lake (identified by marks and dorsal fin erosion) trout were represented. Wild and hatchery strains differed in timing of spawning runs, with wild fish entering the stream and peaking in numbers before hatchery fish in both years. Hatchery fish accounted for 48.2% of the adult rainbow trout entering Deep Creek in 1993 and 76% in 1994. Of the adults tagged at the weir in 1993, 13% of the wild trout and 18.3% of the hatchery trout returned in 1994. Ages of wild adults captured in 1993, determined through scale samples, were ages 3 (6.0%), 4 (67.2%), 5 (22.4%), and 6 (3%). Growth patterns on their scales suggested that <1.5% had left their natal streams at age 0, 42.4% at age 1, 53% at age 2, and 4.5% at age 3. Few adult brown trout responded to the new access, with captures at the weir during late summer-early fall of four in 1993 and six in 1994. Length-class distribution of outmigrating juvenile rainbow trout (153 in 1993, 233 in 1994) was < 23% age 0, about 62% age 1, and about 16% age 2 or greater. Length-class distribution of outmigrating juvenile brown trout (215 in 1993, 67 in 1994) was about 44% age-0 and 56% age-1. Included among the outmigrant brown trout were hatchery-origin, age-0 fish released into Deep Creek, virtually all of which moved downstream their first year. Results suggest that young rainbow produced in Deep Creek tend to remain within the stream during their first year before migrating downstream.

INTRODUCTION

Availability of suitable spawning habitats in tributaries is a critical factor affecting the success of wild trout populations in Montana. The important role of tributary spawning habitats in Montana has been described by Spoon (1985) for the Upper Missouri River, Sanborn (1990) for the Big Horn River, Sando (1981) for the Beaverhead River, and Byorth (1990) for the Yellowstone River. The availability of spawning habitat in tributaries to the Missouri River upstream from Canyon Ferry Reservoir is considered to be a major factor limiting the natural reproduction of brown trout, *Salmo trutta*, and rainbow trout, *Oncorhynchus mykiss*, from the reservoir and this part of the Missouri River (Montana Department of Fish, Wildlife and Parks [MFWP] 1991). Similarly, in a survey of reservoir fisheries in 11 states of the western U.S.A., Gebhards (1975) found that lack of spawning habitat was the factor most frequently mentioned as limiting to the establishment of wild trout populations.

Deep Creek is a third order stream which enters the Missouri River only about 8 km above Canyon Ferry Reservoir and thus could be a major spawning tributary for trout from the reservoir (Figure 1). However, prior to 1992, the creek had been separated from the Missouri River during a major portion of the spring and fall spawning seasons for rainbow and brown trout because it was intersected by an irrigation canal, the Montana Ditch. Deep Creek flows west from its headwaters in the Big Belt Mountains in southwestern Montana and enters the Missouri River near Townsend. The intersection of the Montana Ditch and Deep Creek is about 1 km upstream from the Missouri River.

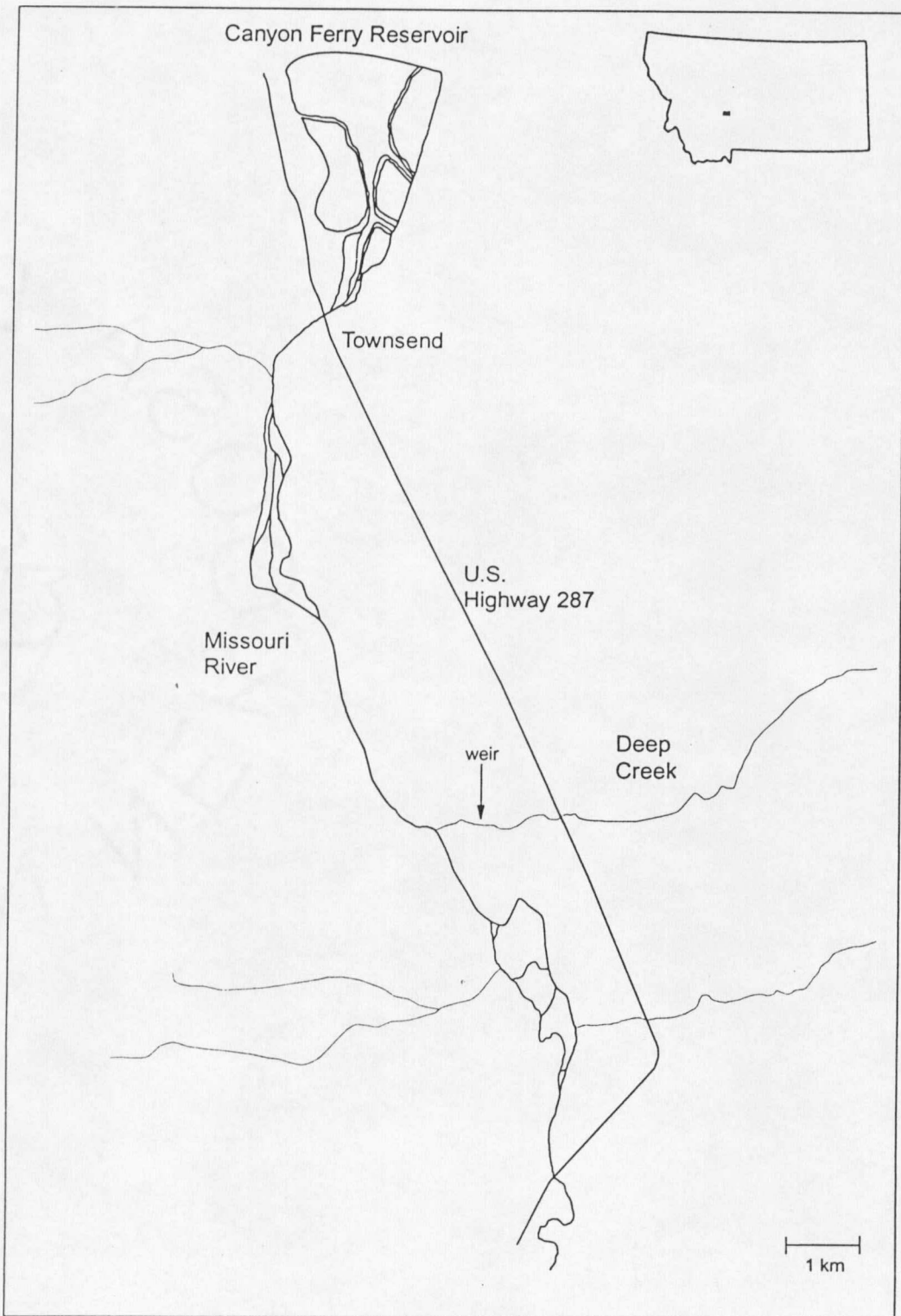


Figure 1. Location of the Deep Creek study site (Jeanes 1996).

Previously, the ditch formed a diversion completely across the creek (Figure 2). A gate in the diversion was closed during the irrigation season, typically from about mid-April to late October (Ronald Spoon, MFWP, pers. comm.), diverting creek water into the ditch and its downstream outlets. An overflow structure allowed some creek water to drop over the barrier and to flow downstream, particularly during periods of high discharge.

In the fall of 1992, a large concrete "siphon", actually a large underground conduit, was constructed to divert the Montana Ditch beneath Deep Creek (Figure 2). The siphon was constructed to allow Deep Creek to flow unimpeded to the Missouri River and thereby provide access into the creek for spawning trout. A low concrete weir was constructed about 25 m upstream from the siphon site, for monitoring fish movements. Deep Creek thus became accessible as a spawning tributary for brown and rainbow trout from Canyon Ferry Reservoir and the Missouri River. The connection with the Missouri River also provided a downstream migration corridor for young trout produced within the creek, and eliminated their diversion into the ditch.

The siphon project was undertaken as partial mitigation for the turbine retrofit of Toston Dam farther upstream on the Missouri River. It was predicted that brown trout would be the species most impacted by the Toston Dam retrofit (MFWP 1991). Brown trout are thus the intended primary beneficiaries of the Deep Creek siphon project. In addition to the siphon construction, approximately 27,000 brown trout fingerlings were stocked in Deep Creek each year by MFWP during Septembers of 1992, 1993, and 1994. These were released approximately 2 km upstream from the weir, in an effort to imprint

