MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION

JOB PROGRESS REPORT

State: Montana Title: Southwest Montana Fisheries Study

Project No.: F-9-R-34 Title: Madison River Temperature Study

Job No.: IIb

Period Covered: July 1, 1985 through June 30, 1986

ABSTRACT

Comparison of water temperature data above and below Ennis Reservoir shows the average June to August water temperatures to be 7.5°F and 4.7°F warmer at the Norris Bridge than at the Varney Bridge station for 1984 and 1985, respectively. Wild brown and rainbow trout population estimates for 1984 and 1985 shows a decrease of 31% and 18%, respectively, in numbers of three-year-old and older fish.

BACKGROUND

The Madison River is formed by the Gibbon and Firehole Rivers in Yellowstone National Park and flows in a northerly direction to join the Jefferson and Gallatin River to form the Missouri River at Three Forks. Two major reservoirs were built on the Madison River-Hebgen, which is located 1.5 miles west of Yellowstone National Park, and Ennis, which is located seven miles north of the Town of Ennis.

In 1900, the Madison Dam at Ennis was constructed to provide electrical power for southwestern Montana. Since Ennis Reservoir is located in a naturally shallow basin with a small dam, the reservoir itself is very shallow with an average depth of less than nine feet. This shallow reservoir has led to some warming of the Madison River below the dam which may endanger the "Blue Ribbon" fisheries in the last 35 miles of the river. There has been periodic fish kills in this area in the last 25 years which may have been caused by the warmer water. In 1961, a Montana Fish and Game study showed the Madison River was 10 to 15^{0} warmer below the reservoir than above (Heaton, 1962).

OBJECTIVES AND DEGREE OF ATTAINMENT

1. To determine if higher water temperatures below Ennis Reservoir are having detrimental effects on wild trout populations through changes in age structure, size composition, species composition and growth rates (data included in report).

2. To obtain wild trout population estimates to include age structure, size composition, species composition and condition factors (data for the Varney section included in report, but no estimates were made for the Norris section).

3. To gather water temperature data above and below Ennis Reservoir from April through September (data included in report).

4. To determine if a correlation exists between water temperatures and growth rates from the April through September period (data will be included in a future report).

PROCEDURES

Electrofishing gear was used to sample fish populations in two sections of the Madison River (Norris and Varney). Electrofishing was carried out while floating through the section in a fiberglass boat. Population estimates were made using the Peterson-type mark-and-recapture method. Two or more "marking" and/or "recapture" trips were ncessary where sample sizes were small and/or efficiences were low. Usually a 10-14 day period was allowed between marking and recapture trips. Scales were taken to determine age and growth rates. Actual mathematical computations were made by a computer program using methods described by Vincent (1971, 1974, 1981).

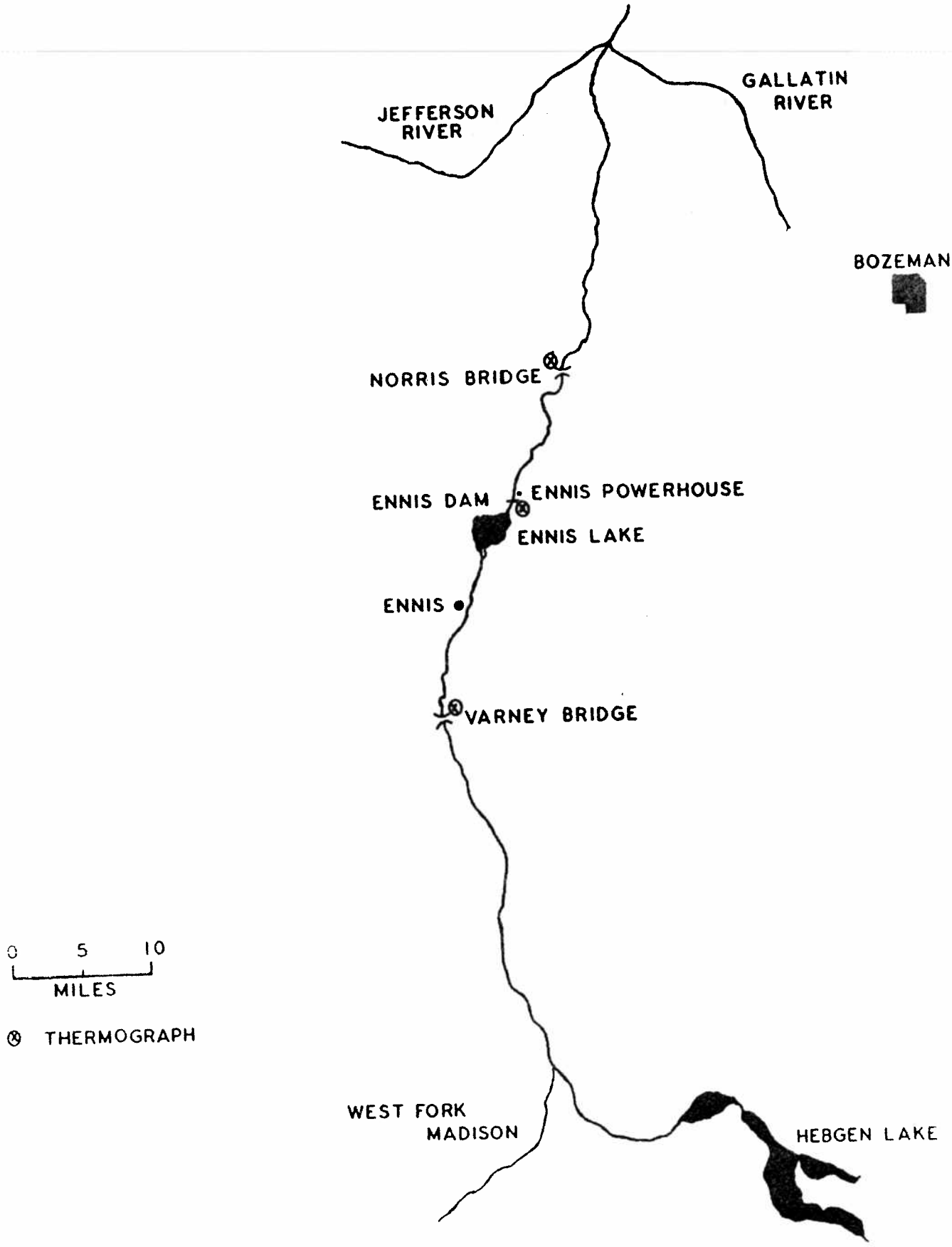

FIGURE 1. Map of Madison River

Table 2. Wild brown and rainbow trout estimates of age groups, total number and total biomass for the Varney section of the Madison River for September, 1984 and 1985. Confidence intervals at the 80% level are shown in parentheses. Section length 4 miles.

Age Group	1984		1985	
	Rainbow Trout	Brown Trout	Rainbow Trout	Brown Trout
I	2553	5504	1677	3970
II	689	1822	848	1781
III	461	905	403	805
IV	431	923	366	760
V & older	322	1031	227	412
Total No.	4456 (±960)	10185 (±1034)	3521(±740)	7738(±565)
Total Wt. (lbs)	2265(±340)	6626(±1153)	2195(±320)	5375(±539)

FINDINGS

Comparison of water temperatures at stations above and below Ennis Reservoir for the years 1984 and 1985 show that during the primary growth months for wild trout (June through August), the lower study section (Norris) averages 7.5°F and 4.7°F higher, respectively, than the upper Varney section (Table 1). Age and growth data from the Norris study section (1978-81) showed a relationship between growth rates and average monthly water temperatures for the June-August period, where cooler temperatures provided better growth rates (Vincent, 1983). Using data provided by (Brett 1956 & 1967), it was determined that water temperatures above 65°F and below 45°F inhibited salmonid growth rates. In the Norris section much of the July-August period, water temperatures exceeded 65°F. Ennis Reservoir was responsible for some of this warming primarily due to its inhibition of natural night cooling in the reservoir, thus minimum water temperatures below the reservoir in the river are much higher than above the reservoir.

Wild brown and rainbow trout age structure for the Varney section in 1983 and 1984 shows a 31% decrease in the number of three-year-old and older brown trout (Table 2). The number of three-year-old and older rainbow trout shows an 18% decrease from 1983-1984.

LITERATURE CITED

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Waters Referred to: Madison River, 12-3440-01
Ennis Reservoir