F-78-R-1
Through 5
Region 3

Gallatin River Drainage Trout Population Surveys:

July 1994 – June 1999

Project 3302

Prepared by:

Patrick A. Byorth

Montana Fish, Wildlife, and Parks
1400 S. 19th Street, Bozeman, MT 59718

June 2000

Preface and Acknowledgments

This report summarizes population censuses in the Gallatin drainage in fulfillment of Federal Aid reporting requirements. Population data reported herein are summarized as point estimates generated by a complex statistical model. Point estimates are reported to indicate trends and should not be considered statistically defensible in absence of variance and other parameters. This information is available through Montana Fish, Wildlife, and Parks if the reader requires more information.

Data was collected by Montana Fish, Wildlife, and Parks electrofishing crews including, Mark Lere, Tim Weiss, Pat Clancey, Dave Barnes, Josh Hadley, Gary Senger, and the author. Sam Hoffman, of the Hoffman Ranch, graciously provided access to the East Gallatin River.

Introduction

The Gallatin River is the easternmost of three major Missouri River headwater drainages. The East and West Gallatin rivers drain approximately 1800 miles^2 of the Bridger, Gallatin, and Madison mountains and the Horseshoe Hills (Figure 1) (Shields et al. 1999). The area is renowned for its wild trout fishing, providing over 55,000 angler days in 1997 (McFarland and Meredith 1999).

The West Gallatin River flows north through the Gallatin Canyon, a high elevation, narrow canyon that maintains cold water temperatures in the summer and creates extremely harsh conditions in the winter. The cool summer water temperatures and long winters result in slow growing trout. An average rainbow trout in the upper West Gallatin River will grow only to 8 inches in its first 3 years, reaching 12 inches only after 4 to 5 years (MFWP Files). Severe winter conditions, including hazardous anchor ice, likely regulates trout abundance in the canyon. The lower 35 river miles of the West Gallatin River is more heavily influenced by irrigation diversions and channel instability. Urban and suburban development has increased attempts to stabilize the river by channelization and riprapping. In dry years, the lower West Gallatin River becomes severely dewatered by irrigation diversions (Vincent 1978). These actions impact wild trout populations.

In recent years, angling pressure has increased substantially and the West Gallatin is no exception. Fishing pressure, measured by Fish, Wildlife, and Parks (FWP) biennial mail survey, increased steadily from 1982 (51,738angler-days) to 1993 (71,129 angler-days) (McFarland and Meredith 1999). Through the mid-1990s fishing pressure leveled off to 67,422 angler days in 1995 and 71,504 angler days in 1997. Increases in other forms of recreation including whitewater boating has also added to the perception of crowding in the upper Gallatin Canyon. Since 1980, anglers concerned about overfishing on the West Gallatin River have called for restrictive regulations to protect trout populations. In 1981, FWP responded by implementing a slot limit of 3 trout under 13 inches and 1over 22 inches. Slot limits are designed to protect intermediate-sized fish while encouraging harvest of small fish. Population censuses by standard electrofishing techniques demonstrated that the regulation failed to increase numbers or sizes of trout

Population censuses over the years have demonstrated that the harsh winter conditions and cool mid-summer water temperatures regulate trout size and density throughout the Gallatin River from Shed's Bridge upstream to the headwaters. Trout populations cycled within ranges of natural variation and thus, are quite stable. Furthermore, anglers have increasingly adopted voluntary catch-and-release, such that harvest has become more rare.

The East Gallatin River forms near Bozeman, Montana at the confluence of Sourdough Creek and Rocky Creek and within a few miles it joins Bridger Creek (Figure 1). The East Gallatin flows approximately 40 river miles through a heavily developed urban, suburban, and agricultural area before its confluence with the West Gallatin River. In the past, fish populations were heavily influenced by effluent from the Bozeman Municipal Sewage Treatment Plant. The primary treatment plant was replaced by a secondary treatment facility in 1971. (Vincent and Rehwinkle 1981). Improved water quality resulted in a substantial increase in wild trout abundance (Vincent 1978, Vincent 1979, Vincent and Rehwinkle 1981). From the confluence of the forks, the Gallatin River flows 12 miles to the headwaters of the Missouri River.

Study Sections

West Gallatin River

Three Fall population survey sections are used to monitor trout populations in the upper Gallatin River: the Porcupine Section (2.3 miles: from Porcupine Creek to the West Fork of the West Gallatin River), Jack Smith Section (2.2 miles: Jack Smith Bridge, highway 191 North of Big Sky) and the Williams Bridge Section (2.84 miles: Williams Bridge to 1 mile South of Gallatin Gateway) (Figure 1). Each of these sections has been electrofished intermittently since the 1980's. The Shed's Bridge Section had been electrofished historically, but has become impassable due to recent channel changes.

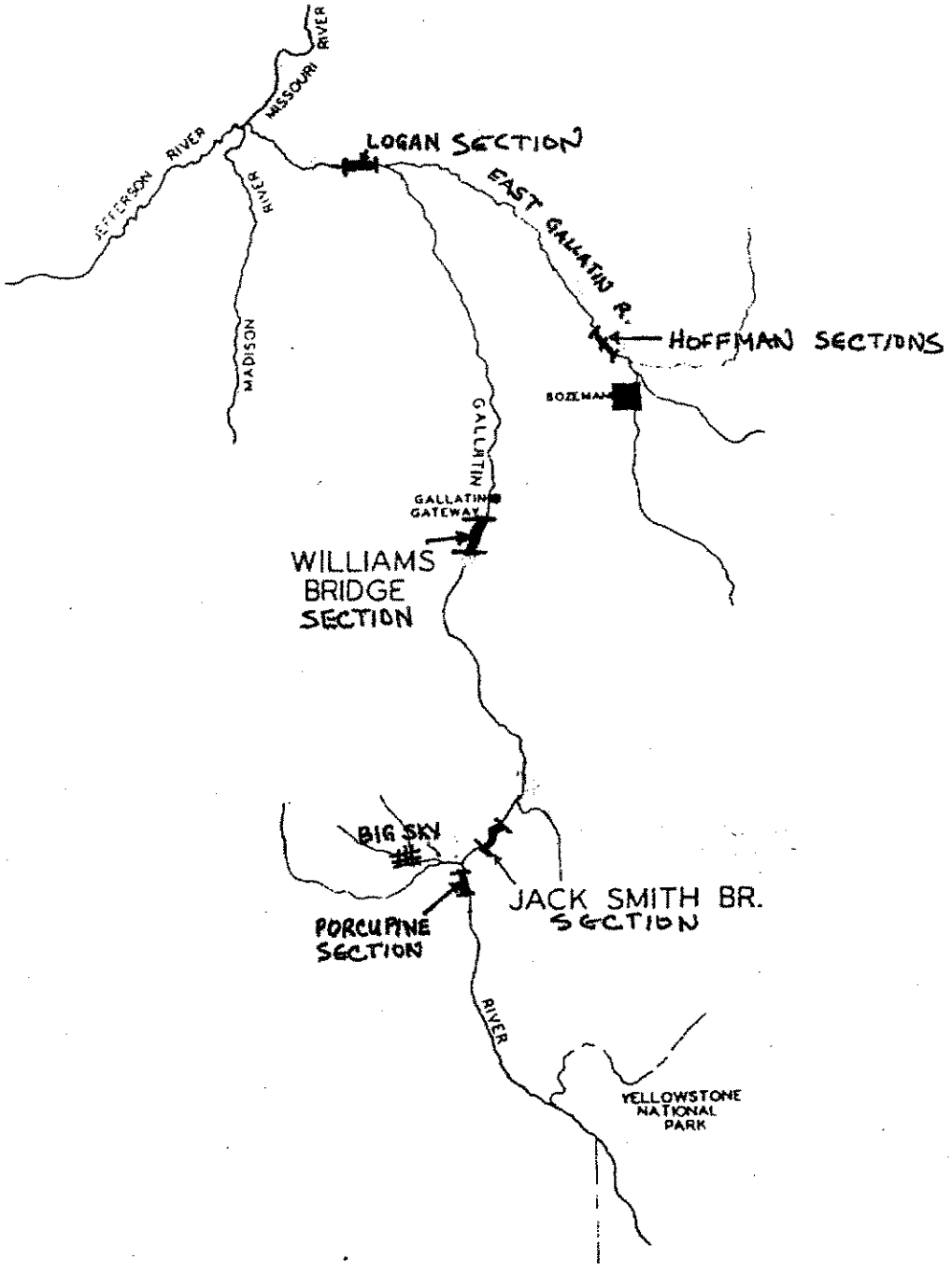

Figure 1. Map of Gallatin River drainage with study sections.

East Gallatin River

Two adjacent fall population survey sections have been sampled historically to determine the influence of the Bozeman Municipal Sewage Treatment Plant and to monitor population trends in the East Gallatin River. The Upper Hoffman section extends 0.88 miles from Springhill Road Bridge to approximately 100 yards above the sewage outfall. The Lower Hoffman Section begins at the sewage outfall and extends 1.05 miles downstream.

Gallatin River

Trout populations in the mainstem Gallatin River below the confluence of the forks are characterized by electrofishing the Logan Section. The Logan Section is 4.3 miles long beginning at Nixon Bridge and ending near the town of Logan, Montana.

Methods

Electrofishing is used to conduct Mark-Recapture experiments for trout population estimation. A drift-boat mounted, mobile positive electrode system is used to capture rainbow and brown trout. We use a driftboat equipped with a 4,500 Watt generator and Coffelt Mark XXII-M rectifying Unit. During electrofishing runs, trout are anesthetized in an MS-222 bath, measured to 0.1 inches in total length, weighed to 0.01 lbs, marked with a fin clip, and released after recovering. Recovery runs are made 10 to 14 days after marking. The ratio of marked to unmarked fish in the recovery sample is used to estimate abundance according to FWP's computerized Mark Recapture Log-likelihood model to calculate estimates. Scale samples are collected for age determination, but were not analyzed for this report.

Results

West Gallatin River

The Porcupine Section is representative of the upper reaches of the West Gallatin. Above the West Fork, the West Gallatin receives a number of tributaries that provide cool, clear water. The Taylor's Fork is the only major tributary that supplies water with high turbidity because of natural erosion in its watershed. Over the years, the trout in the Porcupine Section have maintained a stable population. This reach, like the majority of the upper West Gallatin River is dominated by rainbow trout, with relatively few brown trout. Table 1 outlines basic population characteristics in the Porcupine Section.

Rainbow trout density was the highest on record in 1998, showing no relationship between increased fishing pressure and trout density. The wide variation in total numbers over 8 inches long is indicative of high variability in mortality of young fish, which is common in systems with extensive winter icing. The high number of fish larger than 13 inches (probably over 5 years old) is contradictory to what is expected if angling exploitation is limiting the population.

The West Gallatin River undergoes a significant change between the Porcupine Section and the Jack Smith Section. A number of natural springs, the West Fork of the West Gallatin River, and groundwater carrying nutrients from development all likely contribute to changes in flows and productivity. Table 2 summarizes population estimates in the Jack Smith Section.

Table 1. Rainbow trout population summary in the Porcupine Section of the West Gallatin River, Fall 1984 – 1998. Values are number per river mile by length category.

Year	Number > 8 inches	Number > 10 inches	Number > 13 inches
1984	915	329	29
1987	1250	412	25
1995	819	386	100
1996	558	333	87
1998	1355	702	162

Table 2. Estimated population of rainbow trout in the Jack Smith section of the Gallatin River obtained during the late summer or early fall of 1981-1984, 1989, 1995-1996, and 1998. Estimates are presented as number per river mile.

Year	Number > 8 inches	Number > 10 inches	Number > 13 inches
1981	2819	1169	167
1982	2308	910	99
1983	2596	1217	108
1984	2490	1149	123
1989	3449	1413	131
1995	1460	896	181
1996	1505	936	237
1998	1464	749	167

Overall rainbow trout populations in the Jack Smith Bridge declined by nearly 50% through the late 1990's. However, the decline was primarily in younger, smaller age classes of fish (less than 10 inches, age 3 and younger). The number of fish greater than 10 inches declined moderately, but fell within expected range of variability. The number of larger, mature fish over 13 inches long has remained stable, even increasing slightly when compared to densities while the slot limit was in effect (1982-1983). Once again, such a decrease in smaller fish and younger age classes reflects a climatic or reproductive limitation. Stability in older age classes does not support a limitation by angling exploitation. An analysis by age class supports this conclusion. Table 3 outlines population estimates of rainbow trout by age class.

The density of age 4 and older rainbow trout has not changed significantly over the years in the Jack Smith Section. Older, large fish winter in deep pools and are much less likely to succumb to winter mortality due to anchor ice. Younger fish tend to winter between rocks in the stream bottom, where anchor ice forms and can trap or crush them. Because of the variations in severity of winters in Montana, the production of young fish also varies significantly. Even in good recruitment years such as 1994, with mild winter and low runoff the cohort did not carry through to age 4. In 1996 these rainbow trout numbered 1226/per mile at age 2 (an average level), but as age 4 in 1998 there were 360 per mile. This is clearly a limitation at younger life stages not subject to severe angling harvest or mortality.

Table 3. Estimated rainbow trout abundance in the Jack Smith Section of the West Gallatin River by age class, fall 1981 – 1998. Abundance estimates are in number per river mile. The estimates for 1995 –1998 are based on previously documented length-at-age ratios. The others are based on actual scale samples.

Year	Age 2	Age 3	Age 4	Age 5
1981	1784	1300	431	123
1982	2087	1017	279	80
1983	1784	1300	431	123
1984	936	1324	614	387
1989	2231	1453	763	270
1995	603	595	448	181
1996	1226	457	502	237
1998	1037	506	360	184

The Williams Bridge section is situated just below the mouth of the Gallatin Canyon. Rainbow trout are still predominant, but brown trout numbers are substantial and they grow larger. Table 4 summarizes population estimates in the Williams Bridge Section.

Table 4. Summary of Fall population estimates on rainbow and brown trout in the Williams Bridge Section of the West Gallatin River, 1977, 1990, and 1997. Estimates are in number per river mile.

Year	Rainbow Trout			Brown Trout		
	>8.0"	>10.0"	>13.0"	>8.0"	>10.0"	>13.0"
1977	673	443	146	604	483	338
1990	1316	638	131	484	435	330
1997	1125	585	218	609	510	261

Rainbow and brown trout populations in the Williams Bridge Section are apparently very stable. While water temperatures remain cool in this section, winters are somewhat less severe than in Gallatin Canyon. However, some variability is still expected in a rapid runoff river of this nature.

East Gallatin River

The East Gallatin River has much higher chemical productivity than the West Gallatin River resulting in higher density fish populations and faster growth rates (Table 5). Trout populations in the Hoffman sections of the East Gallatin tend to be quite stable, with brown trout comprising 10 to 25% of the standing crop (Table 6). While the upper and lower sections are adjacent, some differences exist. Rainbow trout densities tend to be higher in the lower Hoffman section than the upper section. However, brown trout tend to be more abundant in the upper Hoffman section than lower section. Rainbow trout densities declined temporarily in both sections in 1997, probably in response to high runoff. However, by 1998 the population rebounded to healthy levels. Brown trout densities also reflected a slight decline in 1996 and 1997, especially in the upper section. Abundance of larger brown trout reached a low point in 1997 in both sections, but appeared to rebound by 1998.

Table 5. Length-at-age (inches) estimates for rainbow and brown trout in the Hoffman sections of the East Gallatin River based on scale samples 1985 – 1987.

Species	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
Rainbow Trout	7.3	9.3	10.7	11.9	13.2	13.7
Brown trout	8.1	10.5	12.6	14.0	15.0	16.0

Gallatin River – Logan Section

Trout population censuses were reinitiated on the Logan Section in March 1999. Brown trout predominate in the Logan Section at approximately 473/mile over 6.0 inches long, 390/mile over 10.0 inches long, and 208/mile over 13.0 inches long. Rainbow trout abundance was estimated at 353/mile over 6.0 inches long, 270 over 10.0 inches long, and 107/mile over 13.0 inches. Vincent and Rehwinkel (1983) reported similar densities in Spring 1981 at 378/ mile Age 3+ (presumably 12 inches and longer). Long term monitoring will continue biannually in the Logan Section to establish a baseline and to document long term trends.

Table 6. Rainbow and brown trout population summary for the upper and lower Hoffman sections of the East Gallatin River, 1994 - 1998. Population estimates are listed as number per mile by length group.

Upper Hoffman Section (1.2 miles)						
Year (Fall)	rainbow trout per mile			brown trout per mile		
	≥ 6.0 inches	≥ 10.0 inches	≥ 13.0 inches	≥ 6.0 inches	≥106.0 inches	≥ 13.0 inches
1994	2550	600	110	847	645	271
1995	2157	450	141	1103	669	453
1996	2397	628	68	384	310	229
1997	1701	697	125	290	155	99
1998	3108	668	152	522	266	137
Lower Hoffman Section (0.88 miles)						
Year (Fall)	≥ 6.0 inches	≥10.0 inches	≥ 13.0 inches	≥ 6.0 inches	≥10.0 inches	≥ 13.0 inches
1994	2089	748	219	556	397	226
1995	3498	1108	320	501	363	225
1996	2557	1234	277	646	550	464
1997	1915	982	405	359	316	149
1998	3376	1237	329	647	355	283

Conclusions:

Trout populations in the Gallatin drainage have remained stable during the reporting period, and appear to be within natural ranges of variability. Trout populations in the West Gallatin River above Gallatin Gateway have remained fairly stable over the last twenty years, expressing variability in densities expected in a wild trout population subjected to the vagaries of weather, runoff, and other natural and human-caused disturbances. Although fishing pressure increased into the early 1990's, it appears to have stabilized through the mid-1990's. The increased fishing pressure does not appear to have impacted trout survival or densities. Older age classes - the most sought after as "keepers" and trophies - have remained stable in each section. These age classes are the most sensitive to over-exploitation and decreases in abundance. No evidence suggests that over-exploitation is occurring in the upper West Gallatin River. Furthermore, the slot limit implemented in 1981 by FWP in the canyon did not result in any significant change and was removed by the Fish and Game Commission at the request of biologists. The West Gallatin River appears to be functioning at the natural carrying capacity regulated by climate and flow conditions. However, development pressure in the Gallatin Canyon may impact fish populations in the future. Therefore, FWP will continue monitoring each section on a biennial schedule as well as maintain continued involvement in habitat and water quality protection.

Similarly, the East Gallatin River appears to have maintained stable trout populations since the sewage treatment plant was upgraded. The mainstem Gallatin River at Logan has not been consistently sampled, but continued population surveys will provide more information on population trends and stability.

Along with increased development and angling pressure, whirling disease caused by the parasite Myxobolus cerebralis is the greatest, imminent threat to rainbow trout populations in the Gallatin drainage.

Although 1998 surveys did not detect presence of whirling disease in the Hoffman section, subsequent testing has either detected presence of the parasite or cranial malformations in the East, West and mainstem Gallatin Rivers (MFWP Files). Continued disease testing and population monitoring are critical in measuring the impacts of whirling disease on trout populations in the basin.

Literature Cited

McFarland, R. C. and D. Meredith. 1999. Montana statewide angling pressure survey, 1997. Montana Fish, Wildlife, and Parks, Bozeman.

Shields, R. R. and four co-authors. 1999.Water resources data, Montana, water year 1998. Water-Data Report MT-98-1. U.S. Department of Interior, U.S. Geological Survey, Helena.

Vincent, E. R.. 1978. Southwest Montana fisheries study: inventory and survey of the waters of the Gallatin and Madison drainages. Project F-9-R-26, Job Ia. Montana Department of Fish, Wildlife, and Parks, Bozeman.

Vincent, E. R.. 1979. Southwest Montana fisheries study: inventory and survey of the waters of the Gallatin and Madison drainages. Project F-9-R-27, Job Ia. Montana Department of Fish, Wildlife, and Parks, Bozeman.

Vincent, E. R. and B. Rehwinkle. 1981. Southwest Montana fisheries study: inventory and survey of the waters of the Gallatin and Madison drainages. Project F-9-R-28, Job Ia. Montana Department of Fish, Wildlife, and Parks, Bozeman.

Vincent, E. R. and B. Rehwinkle. 1983. Southwest Montana fisheries study: inventory and survey of the waters of the Gallatin and Madison drainages. Project F-9-R-30, Job Ia. Montana Department of Fish, Wildlife, and Parks, Bozeman.