

MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION
JOB PROGRESS REPORT

STATE: <u>Montana</u>	PROJECT NO.:	<u>F-78-R5</u>
PROJECT TITLE: <u>Statewide Fisheries Investigations</u>		<u>F-78-R6</u>
JOB TITLE: <u>Northcentral Montana Coldwater Stream Ecosystems</u>		<u>F-113-R1</u>

Annual Report for 1999 and 2000
(January 1999 - December 2000)

ABSTRACT

During 1999 and 2000, fish populations in 26 streams were inventoried in the Choteau area. Westslope cutthroat trout were collected from eight streams in the Choteau area for testing of genetic purity during 2000. In 1999 and 2000, westslope cutthroat trout were transferred to the South Fork of Dupuyer Creek (2000 was the third consecutive year). Fluvial Arctic grayling were transported by pack animals into the forks of the Sun River in 2000. Population estimates of trout were determined for the North and South Forks of the Sun River in 1999 and 2000, and on three sections of the Sun River downstream from Gibson Dam in 2000. In 1999, Trout populations were estimated at 486 and 557 fish per mile, for the South Fork and North Forks of the Sun River, respectively. Rainbow and brown trout catch rates were 3.6 and 6.2 fish/h, respectively in the Tiber section of the Marias River during 2000. The rainbow trout catch rate was 55% of average, while the brown trout catch rate was about average. Big Spring Creek and 26 other streams in the Lewistown area were sampled during the two-year report period. Rainbow trout and brown trout populations (fish ≥ 10 inches) in the Carroll Trail section of Big Spring Creek were at record highs in 2000, and rainbow trout numbers (≥ 10 inches) were at a 10-years high in the Burleigh section. Baseline analyses of Big Spring Creek data (to evaluate restoration of the straightened Brewery Flats section) indicate that trout populations vary more upstream and downstream of town than between control and straightened reaches. However, average size of age-2 and older rainbow trout was smaller in the straightened reach. Westslope cutthroat trout were transferred from Richardson Creek to upper Fourmile Creek in the Smith River drainage. Other westslope cutthroat trout recovery efforts included brook trout suppression, genetic testing, and trout population surveys in several streams in the Lewistown and Great Falls areas. Population estimates were conducted on the Eagle and Deep Creek sections of the Smith River in 1999, but not in 2000 due to low-water conditions. The density of catchable-sized (≥ 8 in) rainbow trout in the Eagle Creek section has increased since 1996. Brown trout have been the most numerous trout species in the Eagle Creek section since 1997, and reached a record-high density of 918 per mile in 1999. The rainbow trout population in the Deep Creek section has been increasing since 1996, and catchable-sized brown trout reached a historic-high level of 508 per mile in 1999. During 1999 and 2000, water temperature was monitored at several sites within the Smith River, and results are presented along with water temperature data from previous years. Population estimates for rainbow trout and brown trout

were conducted on the Craig, Hardy, and Cascade sections of the Missouri River during fall of 1999 and 2000. Brown trout population estimates were also conducted on the Craig and Cascade sections of the Missouri River in the spring of 1999 and 2000. Water temperature and whirling disease infection rates were monitored in the Missouri River and tributaries.

OBJECTIVES

The purpose of this project is to implement the Fisheries Program on warmwater and coolwater ecosystems in the Missouri River drainage in northcentral Montana. Major watersheds include the Missouri, Teton, Marias, Judith, and Musselshell drainages.

The mission of the Fisheries Division of the Montana Department of Fish, Wildlife & Parks (MFWP) is to preserve and enhance aquatic species and their ecosystems to meet the public's demand for recreational opportunities while assuring stewardship of aquatic life. The Fisheries Program is divided into four major elements, with objectives and outcomes as follows:

The **Fisheries Management** element of the fisheries program has 21 objectives and the following desired outcomes:

1. A healthy aquatic resource, including native-species fisheries and sport fisheries.
2. Public satisfaction with available angling opportunities.
3. Public support for ongoing efforts to restore, maintain, and protect the state's aquatic resources.

The **Habitat** element of the fisheries program has 15 objectives and the following desired outcomes:

1. Diverse, high-quality aquatic ecosystems that support healthy fish populations and provide fishing opportunities.
2. Public participation in efforts (MFWP's as well as other state and federal agencies) to conserve and improve fish habitat through formation of watershed protection groups and partnerships for the protection and restoration of habitat.

The **Fishing Access** element of the fisheries program has 16 objectives and the following desired outcomes:

1. Provide a diversity of fishing opportunities throughout the state that might otherwise be unavailable.
2. Provide the public with a variety of incidental, non-angling recreational activities by maintaining access to Montana's waters through the fishing access site program.

The **Aquatic Education** element of the fisheries program has 11 objectives and the following desired outcomes:

1. Opportunities for the public, youth and adults, to learn about the state's aquatic ecosystems and their importance.
2. Fishing and water-safety skills for program participants.
3. Enhanced public understanding of Montana's natural and cultural resources.

4. An educated public able to make informed decisions about using and preserving Montana's aquatic resources.

PROCEDURES

Choteau Area

Fish populations were sampled with a backpack electrofishing unit and by hook and line. Rainbow trout, westslope cutthroat trout (WCT), and grayling (>8") in the North and South Forks of the Sun River were tagged with Floy T-tags. The Peterson mark-recapture method (Ricker 1975) was used to estimate the trout population after snorkel observations were made. In 2000, rainbow trout, brown trout, and mountain whitefish in the Sun River downstream from Gibson Dam were sampled with an electrofishing boat with a mobile electrode. The modified Peterson method was used to estimate trout numbers. Fish were measured to the nearest tenth of an inch and weighed to the nearest hundredth of a pound. Fin punches were obtained from cutthroat trout and sent to the University of Montana for testing genetic purity by the Pine-PCR method.

Marias River

The electrofishing system used on the Lower Marias River to sample trout and mountain whitefish was a dual-boom type mounted on a 14-foot aluminum driftboat powered with a 10-hp outboard motor. A 5000-watt AC generator supplied power for the Coffelt Model VVP-10 rectifying unit. The positive electrode arrangement consisted of two fiberglass booms with 4, 18-inch long lengths of stainless steel cable attached to each boom, extending from the end of the boom and into the water. The hull of the boat served as the negative. Output was typically 5-8 amps, 100-215 volts, and a continuous direct current wave form. Catch per unit effort (CPUE; number/h) was used as an index to fish density.

Lewistown Area

Trout populations on Big Spring Creek were surveyed using a fiberglass drift boat equipped with a mobile electrode and a Coffelt VVP-15 to rectify AC to straight DC. Power was obtained from a 240-volt generator. On the Judith River and Flatwillow Creek a plastic Crawdad® boat was substituted for the drift boat. Fish populations in small streams of the Lewistown area and young of the year (YOY) trout in Big Spring Creek were sampled with a Smith Root Model 12-A battery (12Ah 24-volt battery) powered backpack electrofishing unit. Population estimates conducted on small streams followed the methods of Leathe (1983). Streams were electrofished in an upstream direction or downstream direction with a block net at the downstream end. Big Spring Creek mark-recapture estimates were analyzed with the MFWP MR-4 program utilizing partial log-likelihood statistics (MFWP 1994). Scales were used for age analyses. Trout were collected, frozen, and sent to the Washington Animal Disease Diagnostic Laboratory for whirling disease testing.

Great Falls Area

In 1999, trout populations on the Smith River were surveyed using a fiberglass drift boat equipped with a mobile electrode and a Coffelt VVP-15 or Mark XXII-M to rectify AC to straight DC. Power was obtained from a 240-volt generator. During 2000, population estimates were not conducted on the Smith River due to low-water conditions. In 1999 and 2000, the Missouri River was electrofished at night using two aluminum jet boats. Both boats were equipped with headlights and fixed booms with stainless steel droppers suspended in front of the bow. Electricity from 240-volt portable generators was converted to pulsed or straight DC using Coffelt rectifying units. The only pulsed setting used was the Complex Pulse System (CPS). Rainbow and brown trout populations from the Smith and the Missouri rivers were estimated using the log-likelihood method which generates recapture efficiency curves for the estimate production (MFWP 1994). We analyzed mark-recapture and age data with a MFWP computer program on an IBM-PC compatible microcomputer.

Habitat Protection

Recommendations and alternatives for projects involving stream banks and channels were made through participation in the Stream Protection Act (SPA) and the Natural Streambed and Land Preservation Act (SB310).

RESULTS

Choteau Area

Westslope Cutthroat Trout (WCT) Restoration

1999

Cutthroat trout were collected in 1998 from Wrong Creek, Gates Creek, North Fork Sun River (all in the upper North Fork Sun River drainage) and the Box Canyon area of the North Fork Teton River. As reported in Tews, et al. (1999), electrophoretic analysis (horizontal starch gel) indicates that the Gates Creek sample is a hybridized population of WCT (94.3%) and rainbow trout (5.7%). The Pine-PCR method was used on all of the above streams. The following streams were all hybridized with the resulting ratios of WCT, rainbow (RBT), and Yellowstone cutthroat trout (YCT): Wrong Creek (88% WCT, 5.1% RBT, 6.9% YCT); North Fork Sun River (90.6% WCT, 5.1% RBT, 4.3% YCT); and North Fork Teton River (95.8% WCT, 0.8% RBT, 3.4% YCT). PCR results from Gates Creek showed only one PINE marker characteristic of rainbow trout. This could indicate a small amount of hybridization or it could simply be rare WCT genetic variation that is indistinguishable from that characteristic of rainbow trout (N. Kanda, Genetics Lab-University of Montana, personal communication). For the time being, this population should be managed as pure WCT.

WCT were transferred from the Middle Fork Dupuyer Creek to a previously fishless reach upstream from a barrier in the South Fork Dupuyer Creek on 21 June 1999. A total of 43 fish were transported by packhorse and released in the South Fork at the junction of Rival Creek. The transfer was conducted in the same manner as described in Tews et al. (1999).

2000

Cutthroat trout fin punches were collected from eight streams to test genetic purity. Samples were prioritized according to funding available, thus, only the North Fork Waldron Creek and North Fork Willow Creek samples were submitted for analyses. Results are pending. Samples were also taken from Green Gulch, East Fork Teton River, North Fork Teton River, Rierdon Gulch, Waldron Creek, and South Fork Waldron Creek. These samples will be submitted at a later date as funding permits. Cutthroat trout were also sampled from Cow Creek, but fin punches were not obtained.

WCT were transferred from the Middle Fork Dupuyer Creek to the South Fork Dupuyer Creek for the third consecutive year. Sixty-four WCT were moved by packhorse on 15 June 2000, and released at the mouth of Rival Creek. During the three-year program, 153 WCT were transferred from the Middle Fork to the South Fork using methods described in Tews et al. (1999).

Fluvial Arctic Grayling Introduction—Upper Sun River

1999

A total of 4,550 grayling were introduced into the South Fork of the Sun River on 28 June 1999, and an additional 6,415 grayling were introduced into the North Fork of the Sun River on four occasions during 7-13 July 1999. Average length of stocked grayling was 7.7 inches. The South Fork plant was carried out using pack stock and rubber rafts, while only pack stock were used on the North Fork. The grayling introduction is discussed in greater detail in Magee (2000).

Thirty-one grayling were caught in the North Fork of the Sun River and one was caught in the South Fork during surveys in late July/early August. Hook and line surveys were conducted on the upper South Fork of the Sun River, upstream from the mouth of Hoadley Creek on 17 August 1999; however, no grayling were caught or observed. Anglers reported catching several grayling throughout the summer and fall at various locations in the North Fork, but none were reported caught in the South Fork.

2000

Arctic grayling were stocked into the North and South Forks of the Sun River for the second consecutive year. All fish were transported by pack stock. Methodology and results are described in Magee (2001). A total of 6,668 grayling were stocked into the North Fork from 6-16 July 2000. Likewise, 4,548 grayling were stocked into the South Fork on 12 July 2000. Average length of stocked grayling was 6.9 inches.

Outfitters and individual anglers reported catching several grayling throughout the North Fork of the Sun River following stocking. Most reports were of smaller fish (age 1) although several age-2 fish were caught. A total of 31 grayling were caught on hook and line during MFWP surveys on 24-25 July 2000. These grayling varied from 6.0-9.0 inches in total length. During snorkel surveys (26 July 2000), 48 additional grayling were observed. Snorkelers observed one age-2 grayling.

Anglers reported catching several age-1 grayling in an area around Benchmark in the South Fork up until the middle of September. Only four grayling were caught during fish marking for the

annual trout population estimate in the one-mile monitoring section on the South Fork. This survey was conducted 3 to 6 days after grayling stocking. The sampled Arctic grayling varied from 8.1- to 9.0-inches long. The snorkel survey was conducted twelve days following planting and three additional grayling were observed. No age-2 grayling were caught or observed in the South Fork during 2000.

Sun River (upstream from Gibson Reservoir)

1999

Fish populations were sampled by hook and line in the forks of the Sun River from 31 July to 4 August 1999. In the South Fork, 101 rainbow and cutthroat trout were tagged and released. These fish averaged 11.7 inches (range 8.3-16.0). Average length in 1999 was comparable to the past several years. Two brook trout were also taken during sampling along with one grayling from the June introduction. Angler catch rates averaged 2.1 fish per hour, which is comparable to past surveys. A snorkel survey was conducted 2 August 1999, and the population was estimated at 486 fish per mile. This compares to an average population of 516 fish per mile for the period 1992-1997 (range 425-571). The snorkel crew observed only one grayling throughout the section.

A total of 116 rainbow and cutthroat trout were tagged and released in the North Fork. These fish varied from 8.0-14.5 inches in length (average 11.3). The average length was longer than that found in the preceding two years. Twenty-four grayling (from the July introduction) were tagged and released, but no population estimate was calculated for grayling. The sampled grayling ranged in length from 7.0-10.0 inches (average 8.9). Five brook trout were sampled. Catch rates averaged 4.5 fish per hour, which was comparable to past surveys. The population of rainbow and cutthroat trout was estimated at 557 fish per mile. This compares to an average of 602 fish per mile for the 1992-1997 period (range 508-706). The snorkel crew observed 19 grayling in the section.

Anglers reported catching four tagged trout in the South Fork, one was a fish tagged in 1997 and three were fish tagged in 1999. Fisheries crews also captured two fish that were tagged in previous years, (one from 1996 and one from 1997). In the North Fork, an angler caught a fish tagged in 1998, while fisheries crews caught two previously tagged fish (one from 1997 and one from 1998).

Scales were collected and analyzed from 88 rainbow and cutthroat trout in the South Fork and from 96 rainbow and cutthroat trout in the North Fork. Approximately 72 percent of the fish aged in the South Fork and 74 percent of those in the North Fork were age 3 and age 4 (Tables 1 and 2). These results are similar to that found in a previous survey as reported by Hill et al. (1996).

2000

Hook and line surveys were conducted in the South Fork of the Sun River from 15-18 July 2000. Anglers caught 127 rainbow and cutthroat trout and four grayling. The average size of trout caught during 2000 (12.3 inches and range of 9.4-18.0) was greater than in recent years. Catch rates averaged 3.1 fish per hour, which was higher than normal. A total of 117 rainbow and

cutthroat trout and two grayling were tagged and released. A population estimate of 498 trout per mile was determined from a snorkel survey conducted on 24 July 2000. This estimate was higher than 1999 (486 fish per mile) and was within the 1992-1999 range of 425-571 fish per mile.

Survey crews caught 154 rainbow and cutthroat trout, two brook trout, and 31 grayling on 24-25 July 2000 in the North Fork of the Sun River. The catch rate was 4.0 fish per hour. Rainbow and cutthroat trout averaged 10.9-inches long, which was less than the average of 11.3 inches in 1999. Crews tagged and released 107 rainbow and cutthroat trout and 22 grayling. A snorkel survey on 26 July 2000 observed tagged vs. untagged fish and the trout population was estimated at 432 fish per mile. This is the lowest population estimate documented since surveys were initiated in 1987.

Fishing pressure was much reduced on both forks during the latter part of the summer because of access restrictions imposed due to fire danger. Anglers caught only two tagged fish in the South Fork and none in the North Fork. In the South Fork, one fish tagged in 2000 was caught in the study section while another tagged in 1999 had moved up the North Fork approximately eight miles from the mouth. Survey crews caught five fish tagged in 1999 in the South Fork study section. In the North Fork study section, survey crews caught one fish tagged in 1996 and four fish tagged in 1999. They also caught one fish that was tagged in the South Fork section in 1997.

Sun River (downstream from Gibson Dam)

Three sections on the Sun River downstream from Gibson Dam were established during 2000 to monitor populations of rainbow and brown trout and mountain whitefish. These sections include: "287" (the 2.6-mile reach from the Floweree Diversion to the Highway 287 bridge); "Simms" (from the Lowery bridge to the bridge north of Simms; 4.6 miles); and "Sun River" (from the bridge at the town of Sun River to the Lewis Construction gravel pit; 4.8 miles). Table 1 presents the population estimates for rainbow trout, brown trout, and mountain whitefish. Table 2 exhibits average length, weight, and condition factor.

287 Section

Marking runs were conducted 3 and 5 April 2000, with recapture runs on 12 and 13 April 2000. Flows averaged approximately 100 cfs on these dates. A brown trout population of 118 fish per mile was estimated for the reach. These fish varied from 7.4 to 23.6 inches in total length. Rainbow trout were estimated at 66 fish per mile and size varied from 6.4 to 20.3 inches. Population estimates for mountain whitefish could not be calculated due to few recaptures. Other species captured include white sucker, longnose sucker, mountain sucker, longnose dace and mottled sculpin.

Simms Section

One marking run was conducted on 4 April 2000, with the recapture run occurring six days later. Flows were estimated at 125 cfs. Too few fish were captured to estimate rainbow trout density. However, brown trout and mountain whitefish were estimated at 45 and 111, fish per mile, respectively. Total length varied from 7.2 to 20.3 inches for rainbow trout, 6.2 to 21.5 inches for

brown trout, and 7.5 to 18.3 inches for mountain whitefish. Longnose dace, mountain sucker, longnose sucker and white sucker were also taken during the surveys.

Sun River Section

Brown trout and mountain whitefish estimates were made in this section with fish marked on 6 April 2000 and recaptured on 11 April 2000. Flows were not available for this portion of the river, but were similar to those found in the Simms section. Only 22 rainbow trout were captured and they ranged from 9.1-15.4 inches. Mountain whitefish ranged in size from 6.0 to 16.7 inches and their numbers were estimated at 780 fish per mile. Brown trout were estimated at 68 fish per mile ranging from 5.1 to 20.9 inches in total length. Miscellaneous species taken during the surveys include burbot, white sucker, longnose sucker, mountain sucker, longnose dace, common carp, and mottled sculpin.

Table 1. Population estimates of rainbow trout, brown trout, and mountain whitefish from three sections of the Sun River during 2000.

Species	River section	Date marked	Number marked	Number captured	Number recaptured	Number per mile	Biomass/mile (lbs.)
Rainbow	287	04/05/00	39	29	6	66	59
	Simms	04/04/00	15	5	1	*	*
	Sun River	04/06/00	7	15	0	*	*
Brown	287	04/05/00	89	71	20	118	147
	Simms	04/04/00	49	41	9	45	56
	Sun River	04/06/00	36	43	4	68	63
Whitefish	287	04/05/00	53	32	2	*	*
	Simms	04/04/00	110	68	14	111	83
	Sun River	04/06/00	200	409	21	780	449

* Data not suitable for estimating population.

Table 2. Average size and condition factor of rainbow trout, brown trout, and mountain whitefish from three sections of the Sun River during 2000.

Species	River section	Number sampled	Average length	Average weight	Condition factor
Rainbow	287	62	12.2	0.87	33.7
	Simms	19	13.0	1.01	34.8
	Sun River	22	11.2	0.52	34.2
Brown	287	140	14.8	1.24	34.1
	Simms	90	14.8	1.24	33.5
	Sun River	75	13.1	0.93	34.0
Whitefish	287	83	11.1	0.63	33.6
	Simms	164	12.7	0.75	32.8
	Sun River	588	11.3	0.58	36.1

Miscellaneous Streams

Deep Creek/South Fork Deep Creek

In 2000, data were collected from several locations on Deep Creek to document species composition and relative abundance prior to habitat improvements undertaken by the landowner (Table 3).

Table 3. Surveys of various streams in the Choteau area during 2000 by electrofishing by stream, date, location, and species [rainbow trout (RBT), Westslope cutthroat trout (WCT), eastern brook trout (EBT), mountain white fish (MWF), rainbow and WCT hybrids (HYB), white sucker (WSU), longnose sucker (LNSU), mountain sucker (MTSU), and brown trout (LL)].

Stream	Date	Location	Species	n	Length range (avg.)	Weight range (avg.)
Deep Creek						
	11 May 00	23N 8W 26	RBT	10	3.2-15.5 (10.5)	
			WCT	1	(10.0)	
			EBT	3	3.0-8.5 (5.7)	
			MWF	12	3.0-12.5 (9.1)	
South Fork Deep Creek						
	11 May 00	23N 8W 21	RBT	8	5.0- 8.0 (6.0)	
			EBT	2	8.5- 9.0 (8.8)	
			MWF	18	7.0-16.0 (10.6)	
		23N 8W 19	WCT	5	4.7-13.6 (9.9)	
		(Upstream from small falls)	HYB	2	14.6-16.9 (15.8)	
		23N 8W 19	RBT	2	6.0 (6.0)	
		(Downstream from small falls)	EBT	2	7.0-10.0 (8.5)	
			MWF	7	7.0-12.0 (9.5)	
		23N 9W 24	No	fish		
		(Upstream from barrier)				
Dupuyer Creek						
	10 May 00	28N 7W 10	RBT	9	4.0- 9.1 (6.5)	0.03-0.33 (0.14)
		(Jack Haynes)	EBT	4	4.2-12.8 (7.6)	0.04-0.93 (0.34)
			WSU	2	8.0-14.0 (11.0)	0.28-1.32 (0.80)
			LNSU	1	(5.2)	(0.08)
			MTSU	2	3.8- 5.0 (4.4)	0.03-0.05 (0.04)

Table 3. Continued.

Stream	Date	Location	Species	n	Length range (avg.)	Weight range (avg.)
		28N 7W 2 (Pondera Colony)	RBT	15	3.0- 8.8 (6.0)	0.01-0.25 (0.12)
			EBT	1	(5.3)	(0.06)
			MWF	6	4.3- 7.0 (6.1)	0.04-0.11 (0.08)
			WSU	4	5.8- 8.8 (7.1)	0.07-0.24 (0.15)
			MTSU	1	(4.2)	(0.04)
Elk Creek*						
	24 April 00	19N 7W SW 32 (Upper section)	RBT	21	2.4-14.8 (5.1)	0.02-1.12
			EBT	19	2.9- 8.9 (5.5)	0.02-0.22
			LL	3	2.8-15.8 (11.2)	0.03-1.10
		19N 7W SW 32 (Mid. Section)	RBT	14	2.4-13.0 (5.7)	0.02-0.60
			EBT	14	3.6- 9.5 (6.4)	0.03-0.32
			LL	10	3.2- 7.0 (3.8)	0.03-0.15
		19N 7W NE 32 (Lower section)	RBT	3	3.1- 6.0 (4.9)	0.03-0.10
			EBT	16	3.2- 8.8 (5.5)	0.03-0.27
			LL	3	3.0- 7.3 (4.5)	0.02-0.15

* no average weight since small fish (≥ 3 in) were not weighed.

Electrofishing surveys were conducted upstream and downstream from a fish barrier (waterfall) on the South Fork of Deep Creek. Downstream from the barrier, fin punch samples of cutthroat trout were taken and preserved for later analyses of genetic purity by Pine-PCR methods. No fish were observed upstream from the barrier. Surveys have not been conducted in this area for many years, thus these data were used to update district files.

Dupuyer Creek

Two sections of Dupuyer Creek downstream from the town of Dupuyer were electrofished on 10 May 2000. Both sections were sampled to gather information for updating district files (Table 3). In addition, the lower section (on Pondera Colony) was sampled to obtain species composition and relative abundance data prior to a Future Fisheries project commencing.

Elk Creek

Future Fisheries projects have been completed and/or proposed on Elk Creek southwest of Augusta. Three reaches were electrofished on 24 April 2000, (Table 3). Rainbow and brook trout dominated the upper section (project completed in 1999). The middle section (proposed project) had nearly equal numbers of rainbow, brook, and brown trout. The lower section (non-project) was dominated by brook trout.

Habitat Protection

In 1999, 27 SB310 applications and 3 SPA applications were reviewed in the Choteau area. In 2000, 24 SB310 applications were reviewed and processed in six counties in the Choteau area, and six SPA applications were permitted in the area.

Lower Marias River

Tiber Dam Tailwater

The Tiber Dam tailwater study area extends over a 21-mile reach of the Lower Marias River from the dam to Circle Bridge at Highway 223. Tiber Reservoir is a water storage reservoir with no hydroelectric power generation. Flows in the river downstream are completely controlled by discharges from the dam.

A trout fishery exists in the 21-mile reach of the Lower Marias River immediately downstream from Tiber Dam and is maintained by coldwater releases from the dam. Prior to 1985, the coldwater fishery existed far below its potential because of inadequate instream flows and periodic surface warmwater releases from the dam (Gardner and Berg 1983). MFWP has recommended a minimum instream flow of 500 cfs be maintained in the river downstream from Tiber Dam for the trout fishery. A 4-mile survey section was established from Sanford Park (immediately downstream from Tiber Dam) to 0.25 miles past Pugsley Bridge to monitor fish population trends.

The trout fishery had improved substantially from 1985 to 1988 probably in response to improved flow and temperature conditions (Gardner 1988). Field studies in 1987 showed marked improvements in trout numbers, sizes, and reproductive success. However, results from the 1988-96 surveys indicated that trout populations stabilized then declined, and did not continue to improve as anticipated.

A total of 35 rainbow trout, 58 brown trout, and 105 mountain whitefish were sampled in the study section while conducting our biannual population trend surveys (Table 4). Because of the abundant mountain whitefish population in the area, only a representative sub-sample of the whitefish shocked were netted and measured for size comparisons. Comparisons of the 2000 size statistics with the long-standing averages show that average total length was 3.8 inches greater for rainbow trout, 2.4 inches greater for brown trout, and 0.5 inches greater for mountain whitefish. However, trout abundance measured in 2000 indicated that rainbow trout numbers were only 55% of average, while brown trout numbers were about average.

Figures 1 and 2 are rainbow and brown trout length-frequency distributions for 1998 and 2000. These distributions show a decline of fish in the 6- to 11-inch group (comprised of mostly age-1 fish) for the 2000 sample. Comparison of catch rate compositions (Table 4) best summarizes the magnitude of this decline. Rainbow trout <11 inches represented only 8% of the total average catch rate in 2000, compared to 39% in the 1998 sample. Similarly for brown trout, fish <11 inches comprised 5% of the total average catch rate in 2000, compared to 20% for the 1998 sample. Size structure of the mountain whitefish population changed from one poorly represented by fish <11 inches in 1998 (14%) to one where fish <11 inches represented 27% of

the 2000 sample (Figure 3). Mountain whitefish average total length correspondingly decreased from 15.1 inches in 1998 to 13.7 inches in 2000 (Table 4).

Table 4. Size statistics and catch rates for game fish sampled in the Marias River, Tiber Section, 1987-2000.

Species	Statistic	Year		1987-96	
		2000	1998	Average	Range
Rainbow trout	Number sampled	35	63	88.6	37-124
	Average total length	17.0	17.0	13.2	11.0-17.0
	CPUE ¹ <11"	0.3	3.8	2.4	0.2-3.8
	CPUE ¹ ≥11"	3.3	6.0	4.1	2.3-6.6
	Effort (h)	9.8	8.0	14.4	8.0-16.0
Brown trout	Number sampled	58	79	94.8	57-118
	Average Total length	18.4	17.1	15.9	13.9-18.4
	CPUE <11"	0.3	2.0	1.3	0.2-2.9
	CPUE ≥11"	5.9	7.9	5.3	3.1-7.9
	Effort (h)	9.8	8.0	14.4	8.0-16.0
Mountain whitefish	Number ² sampled	105	100	101.5	98-105
	Average total length	13.7	15.1	13.2	15.1-12.1
Burbot	Number sampled	19	--	--	--
	Average Total length	16.5	--	--	--
	CPUE (all)	1.9	--	--	--
	Effort (h)	9.8	--	--	--

¹ Catch per unit effort expressed as number of fish per hour.

² Only a sub-sample of fish were netted for average size composition.

The long-standing average total length value for mountain whitefish is 13.2 inches, which indicates that the size structure depicted in 2000 is more typical of the Marias River mountain whitefish population.

The catch rate for burbot in the Tiber Section averaged 1.9 fish/h (Table 4). However, Gardner and Berg (1983) previously reported a burbot catch rate of 1.2 fish/h. Burbot catch rates in the middle Missouri River ranged between 0.1 and 0.9 fish /h for the 1999 and 2000 surveys (Gardner 2001).

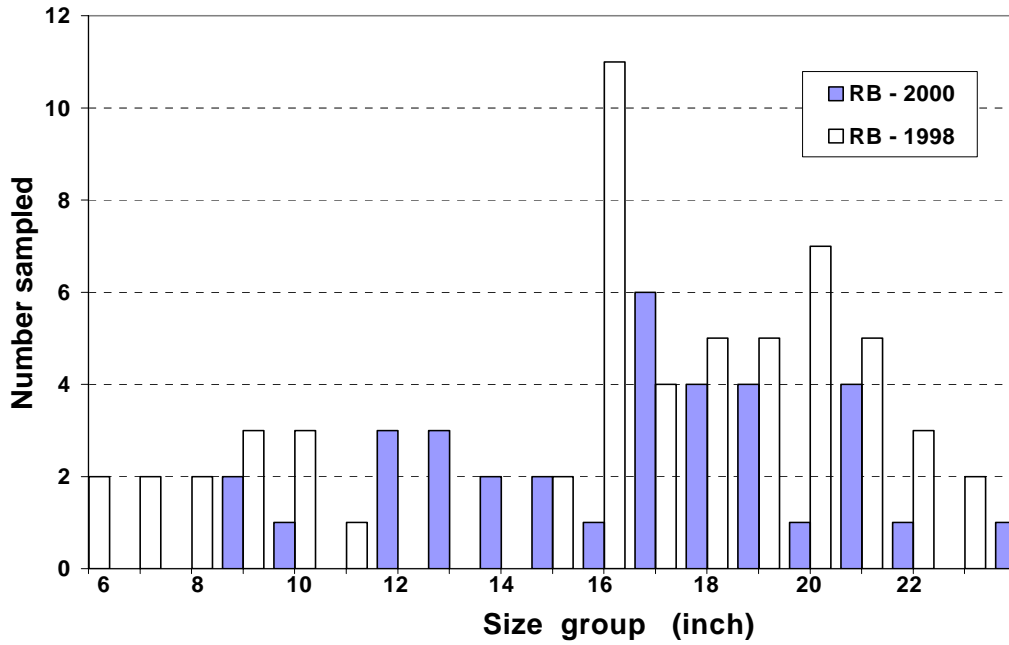


Figure 1. Length frequencies of rainbow trout sampled in the Tiber Section of the Marias River, Montana, 1998 and 2000.

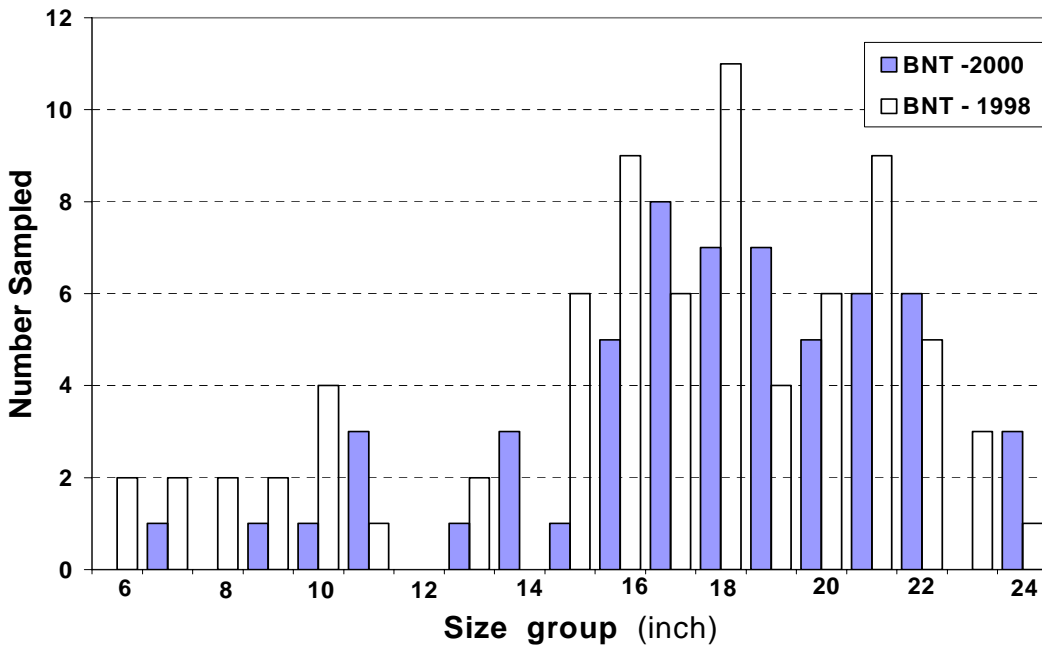


Figure 2. Length frequencies of brown trout sampled in the Tiber Section of the Marias River, Montana, 1998 and 2000.

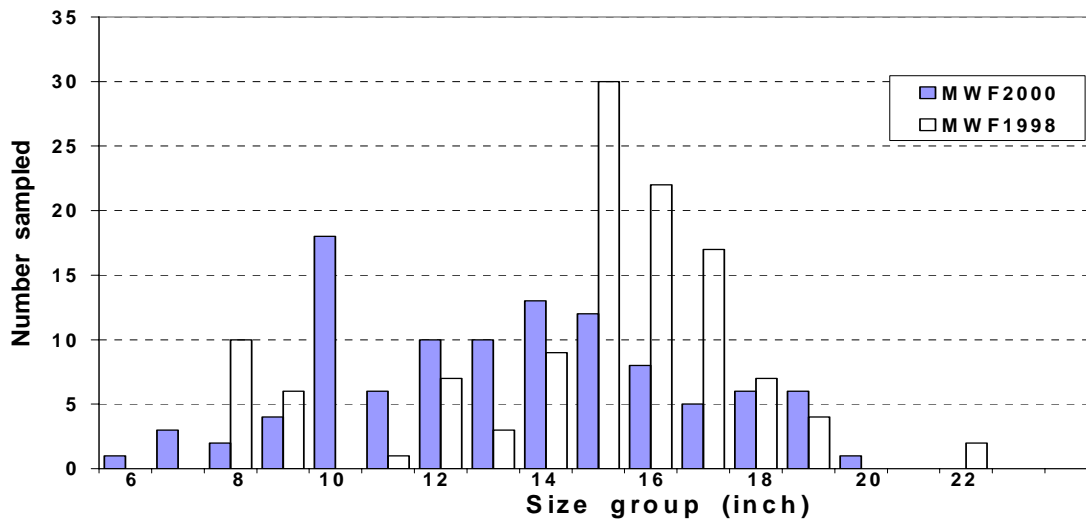


Figure 3. Length frequencies of mountain whitefish sampled in the Tiber Section of the Marias River, Montana, 1998 and 2000.

Beginning in 1998, an experimental 5-year trout stocking program was initiated in the upper 10.5 miles of the Marias River, downstream from Tiber Dam. The program involves stocking 20,000 rainbow trout (Eagle Lake strain) and 20,000 fingerling (3- to 5-inches long) brown trout each year. All stocked fish will be adipose fin clipped to allow for evaluation of the stocking program.

Mavrakis and Yule (1998) evaluated Wyoming's stocking program for the coldwater sections of the North Platte River, a river of similar size to that of the Marias. The authors recommended rainbow fingerling stocking rates of 2,500-10,000/mile and reported good success when Eagle Lake rainbow trout were stocked at these densities. The targeted stocking rate for rainbow and brown trout (combined) in the 10.5-mile reach of the Marias River is 3,810 trout/mile. This stocking rate is within the range set by Mavrakis and Yule (1998) for the North Platte River. We implemented the stocking plan in 1997 (one year before the plan was scheduled to begin) due to the low numbers of trout sampled in the section during the 1996 survey and the availability of surplus hatchery fish. Subsequent stocking efforts are reported in Table 5. A total of 11,165 brown trout were stocked in 1997. The following year in 1998, electrofishing surveys sampled 16 yearling brown trout of which only three had a clipped adipose fin (hatchery fish). A total of 25,095 brown trout and 20,064 rainbow trout were stocked in 1999. Eight age-1 brown trout and five age-1 rainbow trout were sampled in the 2000 electrofishing survey. None of the rainbow trout, and only two of the age-1 brown trout were adipose clipped, indicating that only the hatchery brown trout were contributing directly to the trout population.

Table 5. Number of hatchery trout stocked in the 10.5-mile reach of the Marias River immediately downstream of Tiber Dam, 1997-2000.

Year	Quantity	
	Brown trout	Rainbow trout
1997	11,165	
1998	23,050	19,080
1999	25,095	20,064
2000 ¹	41,650	39,928

1. Surplus hatchery trout were available so stocking quota was doubled.

Lewistown Area

Big Spring Creek

Three sections on Big Spring Creek have been sampled for several years to evaluate fish populations and the effects of the Brewery Flats stream restoration project. These sites include the Burleigh (5,860 ft) and Brewery Flats (3,704 ft) sections upstream from Lewistown, and the Carroll Trail section (4,394 ft; previously Tresch section) downstream from Lewistown. Mark-recapture population estimates on the Carroll Trail and Burleigh sections have been conducted on a regular basis since the late 1960's; however, population estimates were rarely conducted on the Brewery Flats section until 1995. The Carroll Trail and Burleigh sections have a more natural meander pattern and are considered control sections for the Brewery Flats project. The Brewery Flats section consisted primarily of a straight, rock lined channel with high velocities. Mark recapture estimates were completed on three sections of Big Spring Creek in August 1999 and 2000 (Table 6). Age summaries are in Appendices A and B. In 2000, the Carroll Trail section was reduced from 4,394 ft to 3,740 ft due to time constraints.

In September 2000, 2,500 ft of the Brewery Flats section was re-routed into a restored channel over a three-day period. The channel was restored from a straight 2,500-foot rock lined ditch to a 3,900-foot channel with riffle, pool, and floodplain characteristics. The project has increased channel length by over 50%, slowed water velocities, and created deep pools, thus, we anticipated that total trout numbers and biomass would increase. The channel was straightened in 1907 to make space for a railroad-switching yard. In addition, the channel was located in an industrial area for decades. Construction of the new channel began in 1998, but was halted a month later when gravel predicted by preliminary surveys was not found. In 1999, 5,000 cubic yards of gravel was hauled into the site to add 1.5 ft of gravel to the new streambed. The added gravel increased channel stability and provided additional spawning habitat in Big Spring Creek. Natural gravel was found when the mud channel was excavated to accommodate the additional gravel fill. Therefore, the gravel fill was placed on a natural gravel bed. To further increase channel stability, 3,000 willow cuttings were planted, erosion control fabric was installed along the stream banks, and native vegetation was seeded more than one year prior to re-routing Big Spring Creek into the new channel.

Table 6. Mark recapture statistics from population estimates conducted on Big Springs Creek during 1999 and 2000. Standard deviations are in parentheses.

Section	Date Marked	# marked	# captured	# recaptured	Pooled (P)	#/mile 6-10 inches	#/mile ≥ 10 inches	#/mile > 6 inches	Biomass/mile (lbs.)
Rainbow trout 1999									
Burleigh	8/24	186	107	33	0.02*	206 (36)	350 (30)	557 (47)	303 (33)
Brewery Flats	8/26	183	167	46	0.62	705 (61)	340 (22)	1045 (65)	345 (33)
Carroll Trail	8/25	530	580	156	0.04*	791 (64)	1,858 (62)	2,649 (89)	1,674 (92)
Rainbow trout 2000									
Burleigh	8/14	171	169	37	0.15	173 (46)	622 (53)	796 (70)	559 (55)
Brewery Flats	8/15	362	341	140	0.47	709 (45)	756 (23)	1,464 (50)	618 (28)
Carroll Trail	8/16	777	723	271	0.09	720 (44)	2,453 (51)	3,173 (68)	2,659 (108)
Brown trout 1999									
Burleigh	8/24	61	45	23	0.22	0	104 (11)	104 (11)	144 (19)
Brewery Flats	8/26	46	48	17	0.33	23 (7)	167 (18)	190 (20)	184 (38)
Carroll Trail	8/25	126	172	35	0.35	154 (30)	589 (42)	743 (51)	576 (56)
Brown trout 2000									
Burleigh	8/14	37	37	10	0.27 not pooled	3 (3)	104 (25)	107 (25)	172 (49)
Brewery Flats	8/15	104	63	29	0.11	34 (8)	283 (24)	317 (25)	322 (36)
Carroll Trail	8/16	210	234	72	0.41	205 (24)	778 (33)	983 (41)	799 (47)

*Pooled P < 0.05 indicates unacceptable fit to model.

Figures 4-6 graphically compare data of the straightened Brewery Flats section with the Burleigh and Carroll Trail sections. Numbers of small (6-10 inch) rainbow trout are typically lowest in the Burleigh section (Figure 4). Estimates of larger trout (≥ 10 inches) per mile from the Brewery Flats and Burleigh sections are usually similar with overlapping 95% confidence intervals

(Figures 5 and 6). Estimates are consistently higher for both brown trout and rainbow trout in the Carrol Trail section. For example, from 1995-2000, Carroll Trail section point estimates for rainbow trout (≥ 10 inches) fluctuated from 874-2,453 per mile. Population estimates from 1995-2000 for rainbow trout were 207-622 per mile in the Burleigh section and 218 – 756 per mile at the Brewery Flats section. Record-high numbers of rainbow trout and brown trout (≥ 10 inches) were estimated in the Carroll Trail section in 2000 (Figures 7 and 8). Rainbow trout numbers in the Burleigh section were the highest in 10 years (Figure 7), and brown trout numbers were similar or slightly lower than estimates from the past several years (Figure 8). The Carroll Trail section supported 3,231 trout (≥ 10 inches) per mile for a total of 3,222 pounds per mile in 2000. This compares with point estimates of 726 (703 pounds) and 1,039 (756 pounds) per mile for the Burleigh and Brewery Flats section, respectively.

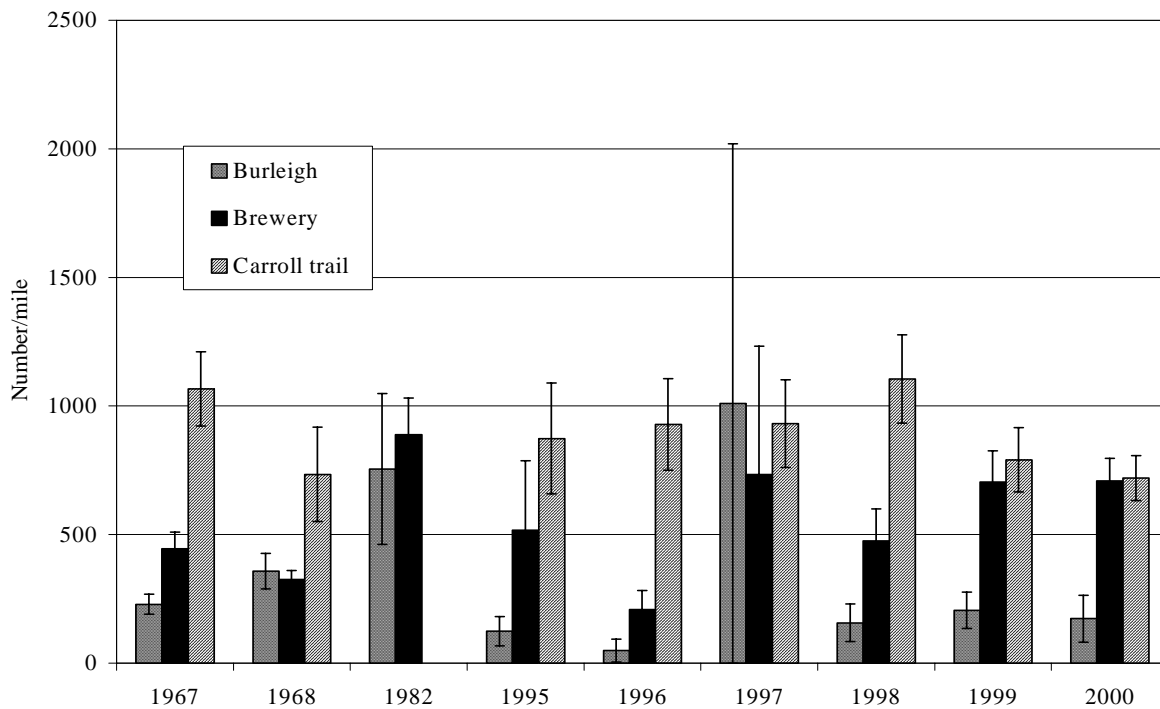


Figure 4. Density estimates (number/mile) of rainbow trout 6-10 inches total length. Error bars represent 95% confidence interval.

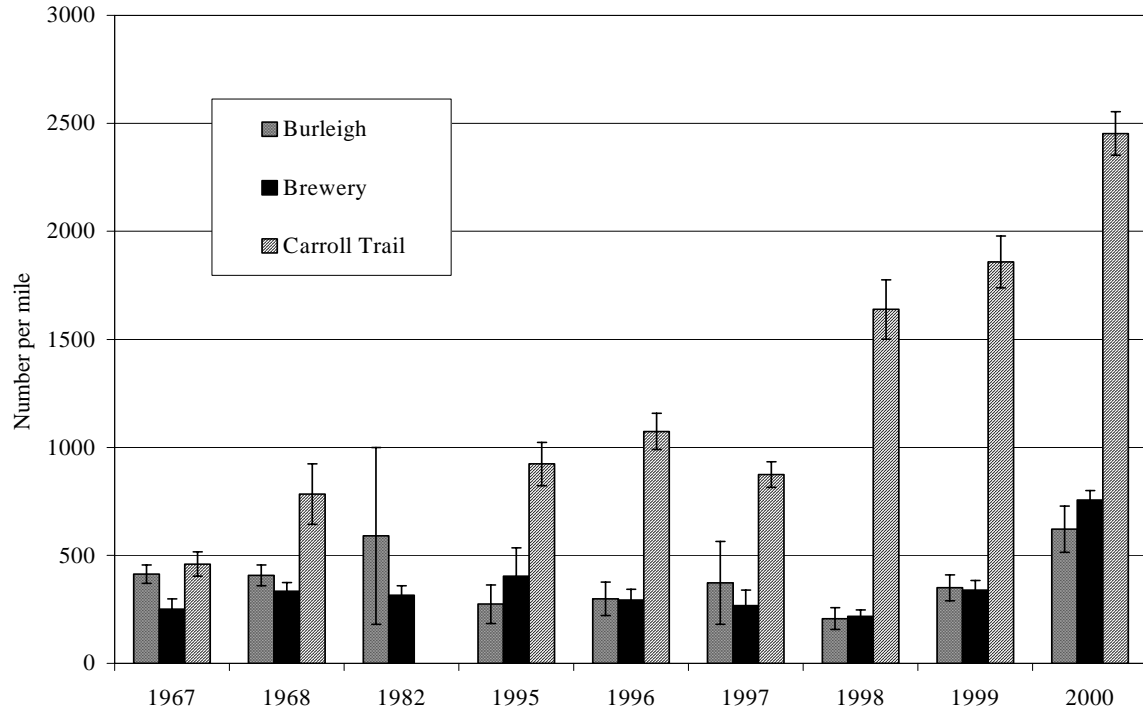


Figure 5. Density estimates (number/mile) of rainbow trout ≥ 10 inches. Error bars represent 95% confidence interval.

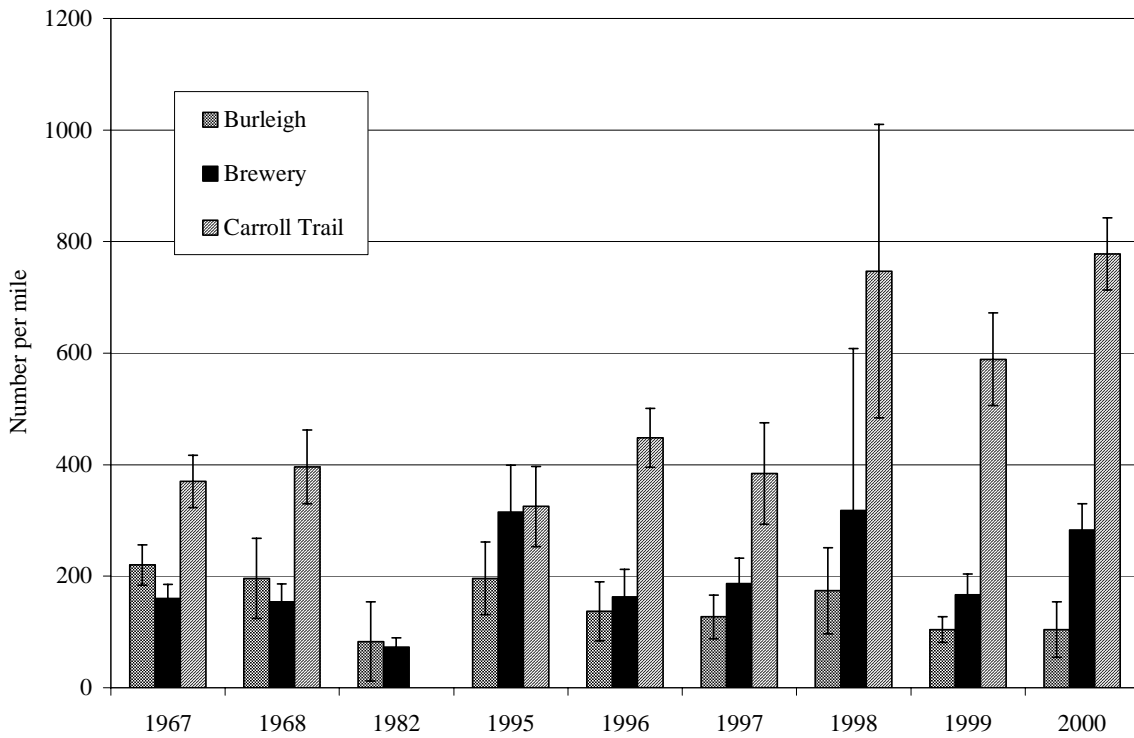


Figure 6. Density estimates (number/mile) of brown trout ≥ 10 inches. Error bars represent 95% confidence intervals.

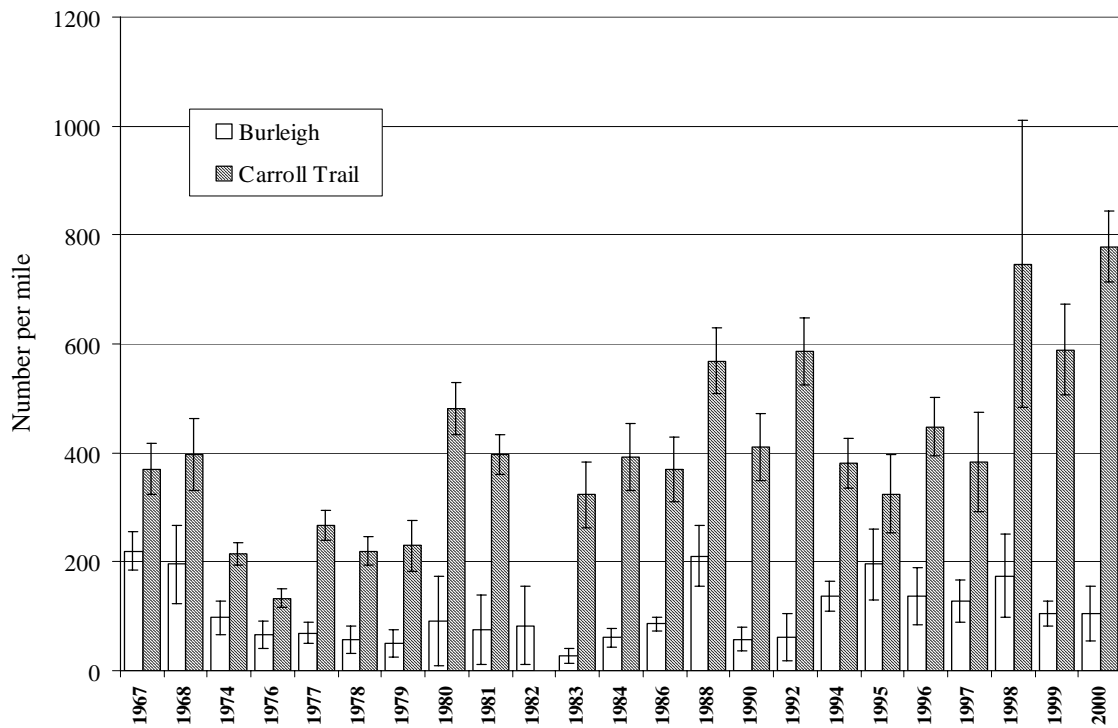


Figure 7. Density estimates (number/mile) of rainbow trout ≥ 10 inches from two sections of Big Spring Cr. Error bars represent 95% confidence intervals.

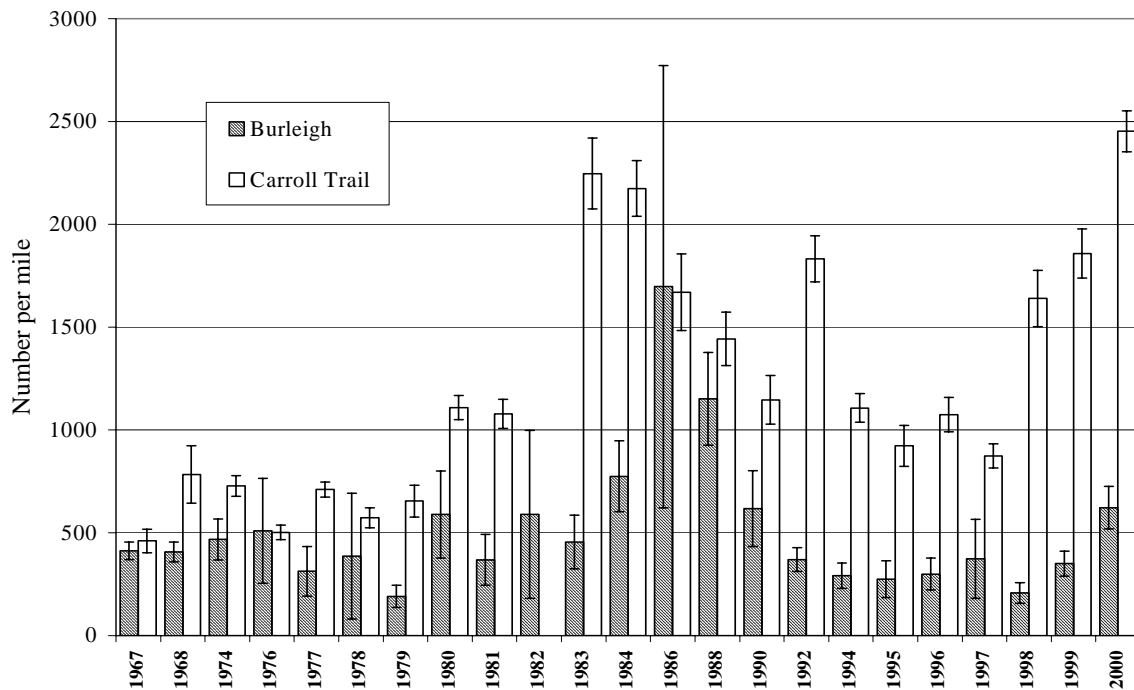


Figure 8. Density estimates (number/mile) of brown trout ≥ 10 inches from two sections of Big Spring Cr. Error bars represent 95% confidence intervals.

Size statistics differ between control and straightened reaches (Table 7). When annual average size of sampled rainbow trout larger than 10 inches is compared, the Brewery Flats trout are more than one inch shorter than those in either the Carroll Trail section (downstream) or the Burleigh section (upstream). Average length of rainbow trout at age was also at least 0.5 inches less in the Brewery Flats section for age-2 and older fish (Table 8). Trends were different for brown trout (Table 7). Average length for Brewery Flats brown trout was midway between those captured in the Carroll Trail and those captured in the Burleigh section. Relative weight of the Carroll Trail rainbow trout appears to be higher than the populations upstream from town (Table 7). In summary, these baseline data indicate that trout numbers vary more upstream and downstream from town than between control and straightened sections. However, average size of age-2 or older rainbow trout appears to be smaller in the straightened Brewery Flats reach.

Young of the year (YOY) trout were sampled by one-pass electrofishing at several locations in Big Spring Creek in 2000 (Table 9). Rainbow trout, brown trout, small trout not easily identifiable to species, and mottled sculpins were sampled in all reaches. Lake chub and YOY white suckers were sampled in the Carroll Trail section. Longnose dace were captured in the Burleigh and Brewery Flat sections. Carroll Trail and the Upper Hatchery had the highest CPUE of trout. The Brewery Flat section had the lowest catch rate. The high catch of YOY trout downstream from the upper hatchery is interesting, since high levels of dissolved nitrogen exist in this reach. Mortality of brown trout eggs in this area is low despite nitrogen super-saturation levels as high as 132% (M. Kornick, MFWP, personal communication).

Table 7. Comparison of 1995-2000 mean length, mean weight, and mean relative weight among electrofishing sections on Big Spring Creek for trout ≥ 10 inches.

Species	Section	n	Total length (inches)		Weight (lbs.)		Relative weight	
			Mean	SD	Mean	SD	Mean	SD
Brown trout	Brew	520	14.2	0.09	1.07	0.06	94.06	4.00
	Burleigh	468	15.5	0.27	1.37	0.11	92.50	3.50
	Carroll Trail	1,163	13.7	0.36	0.97	0.06	94.25	4.27
Rainbow trout	Brew	908	11.9	0.12	0.62	0.04	91.83	4.02
	Burleigh	942	13.1	0.18	0.79	0.06	88.81	3.88
	Carroll Trail	3,315	13.1	0.37	0.89	0.10	97.73	3.32

Table 8. Average length at age of sampled trout on three sections of Big Spring Creek from 1995-2000.

Species	Age	Section	n	Average total length (inches)
Brown trout	0	Brewery Flats	35	4.5
		Burleigh	14	5.4
		Carroll Trail	47	4.2
	1	Brewery Flats	44	9.4
		Burleigh	34	8.4
		Carroll Trail	173	9.5
	2	Brewery Flats	92	12.1
		Burleigh	40	12.2
		Carroll Trail	170	11.7
	3	Brewery Flats	118	14.2
		Burleigh	88	14.8
		Carroll Trail	114	13.9
4	Brewery Flats	70	15.5	
	Burleigh	132	16.3	
	Carroll Trail	59	16.0	
Rainbow trout	0	Brewery Flats	76	4.9
		Burleigh	74	4.4
		Carroll Trail	68	4.7
	1	Brewery Flats	376	8.0
		Burleigh	212	8.2
		Carroll Trail	465	8.1
	2	Brewery Flats	198	10.6
		Burleigh	185	11.4
		Carroll Trail	246	11.1
	3	Brewery Flats	164	12.4
		Burleigh	148	13.1
		Carroll Trail	204	13.2
4	Brewery Flats	43	13.6	
	Burleigh	73	14.5	
	Carroll Trail	148	15.2	

Table 9. Summary statistics of YOY trout captured on Big Spring Creek in June 2000.

Location	Date	Section length (ft)	Number of captured trout	# per 1,000 ft	Total length (inches)		
					Min	Max	Avg.
Brewery	6/5/00	717	18	25	1.2	2.9	2.0
Burleigh	6/1/00	940	33	35	1.0	5.7	2.2
Carroll Trail	6/2/00	847	98	115	1.1	4.3	2.0
Hatchery (all)	6/12/00	1,751	113	64	0.9	6.7	2.6
(Upper only)	6/12/00	628	66	105	1.0	5.5	2.2

Improvements to hatchery water quality in 1999 probably resulted in only a slight improvement of water quality upstream of Lehman spring (J. Boyce, MFWP Hatchery Manager, personal communication). Therefore it appears that despite nitrogen super-saturation, many trout are recruiting to Big Spring Creek from the area immediately downstream of the upper hatchery. To maximize recruitment, Big Spring Hatchery personnel should continue water management in the upper creek that benefits wild trout.

In 2000, whirling disease tests were conducted on 60 fingerling (2.8- to 5.5-inches long) trout from the Carroll Trail and Brewery Flat sections of Big Spring Creek. The 46 rainbow trout and 14 brown trout tested negative by histology.

Other Streams

About 26 other streams were sampled during the study period. Statistics of sampled fish are listed in Appendix C. Highlights are discussed below.

Judith River

Electrofishing between Hobson and the Ross Fork during turbid conditions in June 2000, captured several mountain whitefish and three brown trout (Appendix C). A thermograph recorded daily temperature from late June through September. Daily high water temperatures were in the high 70's to low 80's throughout July. Low temperatures were typically in the middle 60's. The Judith was apparently dry near this reach, hence it is likely little if any flow was present through much of the summer.

South Fork Judith River

The rainbow trout population estimate of 58 per 1,000 ft (Table 10) was similar to 1987 and 1994 estimates, but was less than the 80 per 1,000 ft observed in 1997. Mountain whitefish numbers were about twice the 22-26 per 1,000 ft found in previous years (MFWP 1989, Tews et al. 1995, and Tews et al. 1999).

Table 10. Depletion removal population estimates for fish [westslope cutthroat trout (WCT), brook trout (BRK), rainbow trout (RBT), brown trout (LL), and catostomus spp. (Suckers)] ≥ 4 inches from small northcentral Montana streams.

Stream (legal)	Date	Species	#/1,000 ft (95% CI)	Mean total length (in)	Probability of capture
Dry Wolf Cr. (T14N R9E S13)	11 July 94 ¹	WCT	11 (11-16)	7.2	0.70
		BRK	10 (10-15)	8.1	0.52
		RBT	17 (17-27)	12.4	0.36
	13 Oct 98 ²	WCT	51 (51-3)	8.1	0.93
		BRK	45	6.4	1.0
	26 July 99	WCT	45 (45-47)	7.1	0.82
		BKT	47 (47-47)	7.4	0.92
	28 Sept 00	WCT	110 (110-112)	6.9	0.92
BRK		114 (110-124)	6.7	0.79	
East Fork Spring Cr. (T15N R19E S28/33)	20 Aug 99	RBT	58 (58-60)	6.6	0.90
		MWF	45 (45-48)	6.9	0.88
	13 July 99	RBT & LL	11 (11-13)	12.2	0.90
		Suckers	28 (26-33)	12.4	0.86
Deep Cr., S. Fk. (Smith) (T14N R5E S21)	19 July 00	WCT	260 (245-278)	7.5	0.76
Deep Cr., N. Fk. (Smith) (T15N R5E S19)	18 July 00	WCT	242 (242-248)	7.4	0.91

¹ Data from Tews et al. (1995)

² data in Tews et al. (1999) estimated all fish (including those 3-4 inches).

Tributaries to Big Spring Creek

Burnette Creek was sampled for the first time in 2000. Brown trout appear to use it as a rearing stream (Appendix C). A diverse fish community was found including brook stickleback, which probably came from Carter Ponds in the headwaters of this stream.

Survey results for three sections on Castle Creek indicated a more diverse community than found in 1996, when only one white sucker was captured (Appendix C; Hill et al. 1997). Rainbow trout and mottled sculpin were found in all three sections. Brook trout were found in the two most upstream reaches. White suckers were not found upstream from a culvert on the Miller Ranch.

Estimates of trout in East Fork Spring Creek decreased from 20 per 1,000 ft in September 1996 to 11 per 1,000 ft in July 1999 (Table 10; Hill et. al 1997). This decline was due to fewer brown

trout. Numbers of rainbow trout increased. It is likely that the September brown trout estimates were inflated by spawning fish. Sucker numbers declined from about 66 per 1,000 ft in 1996 to about 22 per 1,000 ft in 1999. Several other species were also captured, including a yellow perch that likely came from East Fork Reservoir (Appendix C). Numbers of trout captured were similar to catch in August 1990, however, average total length increased over 8 inches for brown trout and 1.6 inches for rainbow trout (Appendix C; Hill et al. 1997).

Brook trout were the most common species sampled on Wolverine Creek (Appendix C). Rainbow trout, brown trout, longnose dace, and white sucker were also sampled. White suckers were the most common species found in Little Casino Creek, and brook trout were the only game fish sampled (Appendix C).

Beaver Creek

In 1997, the Fergus County Conservation District and the Natural Resource and Conservation Service (NRCS) restored a channel in a 1,200-foot section of Beaver Creek that had been channelized in the 1950's. Prior to restoration the site was characterized by multiple channel gullies and a G4 (Rosgen) channel type. Restoration efforts changed the channel back to the historic riffle pool C4 (Rosgen) channel, and increased channel length from about 1,200 ft to 1,800 ft (T. Hawn, NRCS, personal communication). In 1996 and 1999, data were collected on "control" and "restoration" sections to evaluate fisheries benefits of the stream restoration. During the evaluation, the control section was moved downstream because beaver dams flooded the control reach between 1996 and 1999. Few brook trout were captured on the reclaimed reach in 1998 (Tews et al. 1999). This was likely due to poor sampling efficiency during high-flow conditions.

Catch per unit effort data indicate that numbers of brook trout have increased substantially since the project was implemented (Appendix C). The 600-foot increase in stream length has also increased fish habitat by 50% in the straightened reach. In 1996, there were 46-47 brook trout (≥ 4 inches) per 1,000 ft in the straightened reach and 94 (+/- 13) in the control reach (Hill et al. 1997). High capture rates during the second pass meant accurate population estimates could not be completed in 1999. However, the number of brook trout sampled (≥ 4 inches) during the 1999 electrofishing was much higher than the total population estimates for 1996. There were 71 per 1,000 ft captured in the restored section and 105 per 1,000 ft captured in the control section in 1999. Brook trout reproduction success may have benefited from stream restoration. In 1996, the smallest brook trout captured in either section was 5.1 inches (Hill et al. 1997). In both 1998 and 1999, brook trout less than 4 inches were captured. In 1999, 64 brook trout less than 4-inches long were captured in the control reach. It is likely that sediment from gully washing in the project area has been reduced due to channel restoration, resulting in benefits for trout reproduction downstream of the project area.

Cottonwood Creek (Tributary to Spring Creek)

A stream-rehabilitation project is planned on the Floyd Maxwell ranch on Cottonwood Creek. Brook trout numbers were much lower on the proposed treatment reach than on a control reach just upstream (B. Shepard, MFWP Fisheries Biologist, personal communication). The treatment reach had 76 (72-81) brook trout per 1,000 ft, while the control reach held 132 (113-146) per 1000 ft. Size ranged from YOY to 13.4 inches in the treatment section and from YOY to 12.7

inches in the control section. Other species captured included white suckers, longnose dace, and mottled sculpins.

Warm Springs Creek

This stream was sampled twice by angling in 2000. Anglers fished the Schweitzer section for 4.5 hours on 10 March 2000. During that time 19 rainbow trout, all without adipose clips were captured. A rainbow trout tagged in the same reach on 6 May 1997 at 9.6 inches was 11.2-inches long when recaptured in 2000 and was probably at least age 5. In early summer 2000, anglers fished the state owned section of Warm Springs Creek for 10 hours. Fifteen rainbow trout 10- to 12-inches long with clipped adipose fins and about 20 smallmouth bass 8- to 17-inches long were captured. Adipose clipped rainbow trout are stocked annually at the state section and do not appear to move much. The Schweitzer section is located about two miles downstream from the state section.

Musselshell River, N. Fk.

Tributaries of the North Fork Musselshell including, Basin Creek, Lion Creek, and Whitetail Creek were sampled. Brook trout was the only species found in these streams (Appendix C).

Musselshell River, S. Fk.

The stream was electrofished in the vicinity of the Martinsdale diversion in October to evaluate a proposed fish passage notch over the diversion. Brown trout redds were observed both upstream and downstream of the diversion. Brown trout were the most common species sampled (Appendix C). The South Fork Musselshell was dry immediately downstream from the diversion where dewatering is common during drought. Dewatering occurred in both 1999 and 2000 on the South Fork of the Musselshell.

Flatwillow Creek

Several sections of Flatwillow Creek and its tributaries were sampled during 1999 and 2000 (Appendix C). In the South Fork at the BLM camp, numbers of brook trout declined from 1997, but average size increased from 3.9 to 5.4 inches (Tews et al. 1999). Much higher densities of brook trout were found about 1.5 miles upstream. The headwater reaches of the North Fork, just downstream from the confluence of Half Moon Creek (a westslope cutthroat trout stream), contained only brook trout. Only mottled sculpin were sampled in an area about five miles downstream, near the mouth of Holt Creek. In 1999, main Flatwillow Creek was sampled about three miles downstream of the Lucky Fork section, which had been surveyed in 1998. Fish distribution was similar in both sections, except that mountain suckers were found during the 1999 survey of the lower section (Tews et al. 1999).

Westslope Cutthroat Trout (WCT) Recovery

During the report period, several WCT recovery activities were completed in conjunction with United States Forest Service--Lewis and Clark National Forest personnel (USFS). Beyond what is reported here, USFS crews performed additional survey and brook trout removal. MFWP personnel prepared environmental assessments (EAs) for brook trout removal on Big Coulee Creek, Oti Park Creek, North Fork Highwood Creek, Placer Creek, Chamberlain Creek, Cottonwood Creek (Arrow Creek drainage), and Little Belt Creek. USFS personnel removed brook trout on several of these streams during the report period to protect native WCT

populations. Tissue samples were tested for genetic purity from several streams and collected from several others for testing (data available from Lewistown Area Office, MFWP). WCT in the North Fork Highwood Creek were tested by PINEs DNA analysis and found to be 82% westslope cutthroat and 18% rainbow trout (J. K. Wenburg, University of Montana, personal communication). Disease testing was undertaken on Deep Creek, Carpenter Creek, and Cottonwood Creek (Smith drainage) as part of the evaluation for possible transfer of trout to other streams. Barrier sites were evaluated on several streams. The USFS plans to install a barrier on Cottonwood Creek (Arrow) in 2001. A report that summarizes status and restoration activities in northcentral Montana was completed (Tews et al. 2000).

Smith River drainage

Deep Creek

The North and South Forks of Deep Creek were surveyed in July 2000. Genetics data from the 1980's indicates that WCT in the North Fork (n=60) are pure and the South Fork (n=14) WCT are slightly hybridized (Tews et al. 2000). These streams flow underground before reaching the Smith River. During sampling, the forks were dry at their junction. Both forks were surveyed for barriers, genetics, and population distribution. Disease samples were taken from the North Fork to evaluate use as a donor population. Westslope cutthroat averaged about 7-inches long in both forks (Appendix C) and both had dense (over 240 WCT per 1,000 ft) populations (Table 10).

Waterfalls fragment habitat in the North Fork of the Smith River by blocking fish movement. A waterfall located about 1.5 miles from the forks is likely a barrier at all flows. Mottled sculpin and WCT were found downstream from this waterfall. Total population size for the North Fork was estimated at over 2,500 fish, and it is likely that the entire North Fork drainage (including tributaries) contains over 3,000 fish. This number is based on a depletion estimate of 242 fish per 1,000 ft (Table 10) in about two miles of habitat. Len Walsh (a USFS biologist) transferred WCT to an additional mile of headwater habitat in the late 1980's, which likely contains about 500 additional fish. Bruce Creek, a North Fork tributary also has WCT (Appendix C). WCT were the only species found in the South Fork. It has about 1.5 miles of good habitat for a total of about 2,040 fish. Both forks contain cutthroat populations close to the 2,500 individuals recommended by Hilderbrand and Kershner (2000) for viable populations. There are only about six populations in northcentral Montana that contain as many fish (Tews et al. 2000). The South Fork contains an additional 1.5 miles of fishless habitat upstream from a 15-foot high waterfall. This reach will be evaluated for transfer of cutthroat from one of the forks.

Fourmile Creek

A total of 50 WCT from Richardson Creek were transferred in May and June 2000 to a fishless reach upstream from a waterfall on Fourmile Creek. The fish were 2-8 inches total length. An environmental assessment, disease sampling, insect and amphibian surveys, and brook trout removal in the donor stream were completed during this project. Additional fish will be moved in 2001.

Lake Creek

Allozyme analysis of 10 fish indicated that they were genetically comprised of 72% westslope cutthroat, 14% Yellowstone cutthroat and 5% rainbow trout (Leary 2000).

Wosley Creek

Wosley Creek was sampled to determine its potential as a WCT recovery stream. Brook trout were the only fish species sampled. Chemical eradication of brook trout may be difficult on this stream due to the high number of springs present.

Belt Creek drainage

Gold Run Creek

Fifteen trout were tested and appear to be pure WCT (R. Leary, University of Montana, personal communication). Even in October 2000, during major drought, there appears to be fishless habitat that would support cutthroat trout on this stream. An environmental assessment was written to transfer WCT upstream of some cascades, which would increase habitat length from about 0.25 to 1.0 miles. Transfers are planned to start in 2001.

Judith drainage

Dry Wolf Creek

Population estimates were conducted on a standard section in 1999 and 2000 (Table 10). Numbers of brook trout and WCT increased after stocking of rainbow trout was discontinued in 1994 (Table 10). Estimates of brook trout and cutthroat in 2000 were more than twice what was previously observed. Electrofishing in the campground indicated more brook trout than WCT in both spring and fall. The USFS has developed plans to remove gabions and create a limited floodplain on Dry Wolf Creek upstream from the campground. Work is being done in conjunction with the USFS Stewardship program and should be completed within two years.

East Fork Spring Creek

Genetically pure WCT (n=25) were found in this stream (R. Leary, University of Montana, personal communication). WCT were the only fish sampled and their average length was 7.7 inches (Appendix C).

South Fork Judith River

The headwaters of the South Fork Judith River are being evaluated as a WCT recovery area. Fish surveys were conducted on the Judith and tributaries upstream of Bluff Mountain Creek in 2000. Combination depletion/one pass estimates were conducted on several sites indicated between 41-174 WCT (>3 inches total length) per 1,000 ft in the Upper South Fork (B. Shepard, MFWP fish biologist, personal communication). Barrier sites were evaluated between Russian Creek and Bluff Mountain Creek. No existing barriers were found but possible construction sites exist upstream and downstream from Cross Creek, downstream from Smith Creek and downstream from Bluff Mountain Creek.

In the headwaters and tributaries (approximately from the mouth of Cross Creek upstream) WCT are the primary species. These fish were genetically tested in 1984 and were 98% WCT, with a small percentage of rainbow trout and Yellowstone cutthroat trout genes present. Limited sampling indicates 100% pure WCT may survive in the headwater tributaries. Genetics samples were taken in 2000 to determine the extent of pure WCT in the South Fork Judith.

Habitat Protection

In the Lewistown area, 61 SB310 applications and 19 SPA applications were processed during the two-year report period.

Two fishing access sites were obtained on Big Spring Creek. The “Lazy KB” site includes 1,000 feet of Big Springs Creek on 15 acres, located at the edge of Lewistown, MT. The “Reed & Bowles” site contains 3,700 feet of Big Springs Creek on 50 acres, located three miles downstream from Lewistown, MT. Environmental assessments were written for each acquisition, and purchases were completed in late March 2001

Great Falls Area

Smith River

Fish populations

The Smith River has been managed as a wild-trout fishery since 1974 when all trout stocking was discontinued. Two electrofishing sections have been monitored on a long-term basis on the Smith River. The Eagle Creek Section is a 2.04-mile reach that starts downstream from the mouth of Eagle Creek, located about 1.5 miles downstream from Camp Baker. Provisional population estimates from the Eagle Creek section of the Smith River (Figure 9A) show that rainbow trout ≥ 8 inches (catchable fish) were the most numerous trout species from 1969 to 1990. After peaking in 1987, catchable rainbow trout numbers declined to a historic low in 1996. Since 1996, catchable rainbow trout numbers have steadily increased. Catchable brown trout numbers in the Eagle Creek section remained low until the late 1980's, then increased to a peak in 1993, and became the most numerous trout species until 1997 (Figure 9A). Since 1997, both rainbow trout and brown trout have increased in number, but neither species appears to be influencing (e.g., through interspecific competition or predation). In fall 1999, the population of brown trout ≥ 8 inches was estimated at a historic-high level of 918 per mile in the Eagle Creek section; rainbow trout numbers ≥ 8 inches increased dramatically to 886 per mile from historic-low levels in the mid-1990's. In this upper section, the long-term historical means are 619 and 276 per mile for catchable rainbow and brown trout, respectively.

The Deep Creek section of the Smith River is a 2.52-mile reach located downstream from the mouth of Deep Creek. This section is the furthest downstream section in the drainage that has been monitored on a long-term basis. Trout densities have historically been lower in this section than in the upstream Eagle Creek section. Although provisional population estimates from the Deep Creek section of the Smith River show that the catchable size (≥ 8 inches) rainbow trout

population has fluctuated since monitoring was initiated, the only observable trends are three cycles of slight population building from 1989-91, 1993-95, and 1996-99 (Figure 9B). Catchable size brown trout have been the most numerous trout in the section since the early 1990's. Similar to the upper section, fall 1999 catchable size brown trout estimates were at a historic-high level of 508 per mile in the Deep Creek section. In addition, density estimates of catchable size rainbow trout increased from low levels in 1995-96. The long-term historical means are 181 and 241 fish per mile for catchable rainbow and brown trout, respectively.

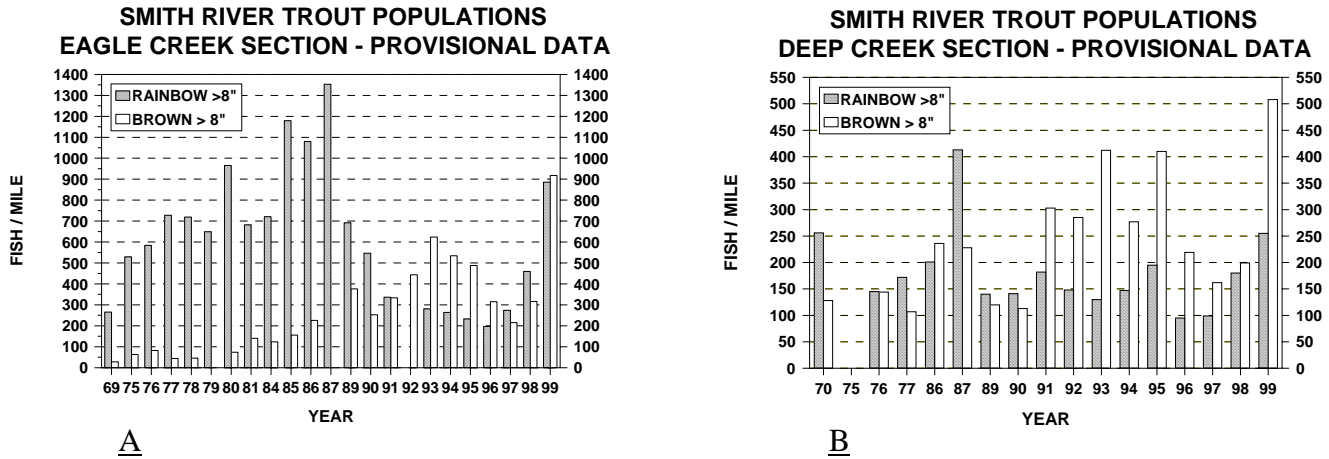


Figure 9. Provisional population estimates of rainbow and brown trout in the Eagle Creek (A) and Deep Creek (B) sections of the Smith River, Montana.

Other game species present in the main Smith River drainage include brook trout, cutthroat trout, mountain whitefish, and burbot. Non-game species include stonecat, white, longnose, and mountain suckers, longnose dace, and mottled sculpins.

Water Temperature

Water temperature monitoring stations have been established throughout the Smith River drainage. Mean monthly water temperatures at all sites were highest in July or August of each year (typically exceeding 62 °F at most sites; Table 11). From 1996 through 1999, mean monthly water temperatures exceeded 64 °F at the mainstem station near Camp Baker (Table 11). In 1999, mean monthly water temperatures exceeded 64 °F at the site near Black Canyon, and in 1998 and 1999 at the site near Eden Bridge (Table 11). Mean monthly water temperatures exceeded 66 °F at two sites: Camp Baker in 1996; and near Eden Bridge in 1998 and 1999. The highest maximum water temperatures (varying from 67.2-80.0 °F) were recorded at most sites in July or August. The highest temperature recorded (80.3 °F) was measured at the Smith River near Eden Bridge in both 1998 and 1999 (Table 12). Maximum water temperatures exceed 70 °F at only two sites in June 1999 (stations near Black Canyon and Eden Bridge; Table 12).

Mean and maximum water temperatures on the mainstem of the Smith River, increased in a downstream direction in August 1999. Mean monthly and maximum temperatures during July

1999 were substantially lower than in July 1995-1998 at the site near Camp Baker (Tables 11 and 12). Overall, water temperatures on the Smith River near Camp Baker in 1999 were substantially lower throughout most of the spring and early summer when compared to 1995-1998 (Figure 10). However, August 1999 water temperature data shows a similar or slightly higher temperature regime than in previous years.

Table 11. Mean monthly water temperatures (°F) from six sites in the Smith River drainage, Montana, 1995-1999.

Location	Year	Month								
		Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.
North Fork Smith River	1999	-	-	-	-	-	63.1*	50.9	43.2	40.6
Smith River near Newlan Creek	1999	-	-	-	-	-	62.5*	50.2	42.4	39.7*
Smith River near Camp Baker	1995	-	-	-	56.4*	62.3	63.0	54.6*	-	-
	1996	-	-	-	-	67.6*	61.8	55.1*	-	-
	1997	-	-	-	-	66.0*	62.7	57.0*	-	-
	1998	40.6*	46.5	54.3	53.4	65.8	63.6	58.6*	-	-
	1999	-	46.9*	49.4	53.6	59.8	64.3	53.1*	-	-
Sheep Creek	1999	-	-	-	54.2*	58.8	61.5	49.1*	-	-
Smith River near Black Canyon	1995	-	-	-	56.8*	61.2	60.0	53.6	43.4*	-
	1999	-	45.7*	50.0	57.7	62.6	64.6*	-	-	-
Smith River near Eden Bridge	1998	42.7*	47.9	55.6	56.3	67.5	67.3	61.4	46.5*	-
	1999	-	48.3*	53.5	60.9	65.5	68.4*	-	-	-

* - Water temperature data obtained for only part of the month.

Missouri River

Fish Populations

In the spring of 1999 and 2000, population estimates were conducted for brown trout in the Cascade and Craig sections. Population estimates were conducted for brown trout and rainbow trout in the Cascade, Hardy, and Craig sections in the fall of 1999 and 2000. Results from these estimates will be presented in the 2001 report along with estimates from 1996-1998.

Table 12. Maximum daily water temperatures measured each month from six sites in the Smith River drainage, Montana, 1995-1999.

Location	Year	Month								
		Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.
North Fork Smith River	1999	-	-	-	-	-	74.5*	61.0	51.5	47.3*
Smith River near Newlan Creek	1999	-	-	-	-	-	74.4*	63.8	53.0	47.7*
Smith River near Camp Baker	1995	-	-	-	68.4*	73.8	75.1	68.2*	-	-
	1996	-	-	-	-	76.6*	71.4	68.4	-	-
	1997	-	-	-	-	73.5*	73.5	66.4*	-	-
	1998	47.7*	59.2	63.4	63.7	74.3	74.3	66.9*	-	-
	1999	-	55.5*	56.9	60.0	67.2	74.6	63.7*	-	-
Sheep Creek	1999	-	-	-	65.5*	70.8	71.4	60.4*	-	-
Smith River near Black Canyon	1995	-	-	-	67.9*	71.4	76.9	67.3	49.7*	-
	1999	-	55.3*	64.0	74.3	74.6	75.6*	-	-	-
Smith River near Eden Bridge	1998	53.2*	61.4	66.3	69.5	80.3	77.8	75.3	59.1	-
	1999	-	60.3	68.4	72.8	80.3	79.2*	-	-	-

* - Water temperature data obtained for only part of the month.

Water Temperature

Water temperature was monitored at various sites throughout the Missouri River and major tributaries in 1999 and 2000. These data will be presented along with data from previous years in the 2001 report.

Whirling Disease Monitoring

Whirling disease monitoring was conducted in the mainstem Missouri River and tributaries in 1999 and 2000. Information from these and previous years will be presented in the 2001 report.

Habitat Protection

From 1 July 1998 to 30 June 1999, 86 SB310 and 39 SPA applications were processed in the Great Falls area. From 1 July 1999 to 30 June 2000, 70 SB310 and 24 SPA applications were processed in the Great Falls area. From 1 July 2000 to 30 June 2001, 50 SB310 and 12 SPA applications were processed.

DISCUSSION AND RECOMMENDATIONS

Genetic testing of cutthroat trout should be continued to detect additional pure WCT populations. Where possible, investigations should be coordinated with the USFS. The South Fork of Dupuyer Creek should be sampled to determine survival and reproduction of introduced WCT. We should continue to provide assistance to the grayling introduction team, and continue to monitor survival, reproduction, and movement of stocked grayling. The forks of the Sun River should continue to be monitored for changes in fish population density and to determine success of grayling introduction. As flows permit, surveys on the Sun River downstream from Gibson Dam should again be conducted to evaluate the influence of flow regimes and watershed improvements on trout populations. Follow-up surveys should be made of the habitat-improvement project on Deep Creek. Additional investigations are needed upstream from the falls on the South Fork of Deep Creek to determine presence or absence of fish. If fishless, consideration should be given to introduction of WCT.

We recommend continuing the experimental trout-stocking program for the Marias River downstream from Tiber Dam using both brown and rainbow trout fingerlings for two additional years (through 2002). The intended results are to increase brown trout numbers and maintain a two-species fishery. Trout population trends will be monitored on a biannual basis (next survey 2002). Special attention will be directed at evaluating the success of brown and rainbow trout fingerling stocking, and the extent of natural reproduction in Tiber Section. We will continue to develop management recommendations (such as changes in Tiber Dam operations or habitat improvements) to address limiting factors and enhance the trout population.

We hypothesize that environmental factors and habitat conditions regulate the trout population density and dynamics in the Smith River. In previous winters, ice jams and flooding have caused substantial bedload transport of gravel, filled in pools, and scoured brown trout redds. These factors probably caused substantial reductions in trout reproduction. Likewise, drought conditions with warm summer water temperatures cause additional stresses. High water temperatures combined with lower dissolved oxygen levels and other infectious agents can cumulatively affect fish health.

ACKNOWLEDGEMENTS

The authors acknowledge the following individuals for assistance in collecting, assembling, and analyzing field data and other information for this project: Kelly Smith, Jill Shoemaker, Paul Hamlin, Randy Rodencal, Brian Haugen, Rick Dykstra, Jim Magee, Craig Jourdonnais, Greg Gibbons, George Anderson, Steve Dalbey, Aaron Swallow, Rob Clark, Dave Yerk, Brad Shepard, Dave Stearns, Randy Rodencal, Chip Kearns, Jack and Leanne Haynes, Pondera Colony, John Krause, Sue McNeal, Tom Salansky, and Bob Peebles. USFS personnel Mike Enk, Stan VanSickle, Kris Whittaker, and Jay Frederick did much of the WCT recovery work.

REFERENCES CITED

- Gardner, W.M. and R. K. Berg. 1983. Instream flow requirements for the Marias River fishery downstream of Tiber Dam. Montana Department of Fish, Wildlife & Parks, Helena.
- _____, W. M. 1988. Northcentral Montana Fisheries Study, Middle Missouri River Basin – instream flow studies. Montana Department of Fish, Wildlife & Parks, Helena. Fed. Aid to Fish and Wildlife Rest. Proj. F-38-R-3, Study No. II, Job B.
- _____, W. M. 2001. Middle Missouri River Fisheries Evaluations. Mont. Dept. Fish Wildlife and Parks, Helena. Fed. Aid to Fish and Wildlife Rest. Proj. F-78-R-6&7.
- Hilderbrand, R. H. and J. L. Kershner. 2000. Conserving inland cutthroat trout in small streams. How much stream is enough? North American Journal of Fisheries Management 20:513–520.
- Hill, W. J., A. E. Tews, and G. A. Liknes. 1997. Statewide Fisheries Investigations. Northcentral Montana Coldwater Streams. Project F-78-R-3. Job Progress Report. Montana Department of Fish, Wildlife and Parks, Fisheries Division, Helena.
- Leathe, S. A. 1983. A cost-effective electrofishing technique to determine fish population size in small headwater streams in Montana, *in* Handbook for the Assessment of Small Hydroelectric Developments. Montana Department of Fish Wildlife and Parks, Helena.
- Magee, J. 2000. Statewide fluvial Arctic grayling recovery program. Montana Department of Fish, Wildlife and Parks, Fisheries Division, Job Progress Report, Helena.
- Mavrakis, P. H. and Dan L. Yule. 1998. North Platte comprehensive fisheries study: Creel survey and stocking evaluation, 1995-1996. Wyoming Game and Fish Dept, Technical Report, Cheyenne.
- Montana Department of Fish, Wildlife and Parks. 1989. Application for reservations of water in the Missouri River Basin above Fort Peck Dam. Montana Fish, Wildlife and Parks, Helena.
- Montana Department of Fish, Wildlife and Parks. 1994. MarkRecapture Version 4.0. A software package for fishery population estimates. Montana Department of Fish, Wildlife and Parks, Helena.
- Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Fisheries Research Board of Canada Bulletin 191.
- Tews, A. E., M. Enk, S. Leathe, W. Hill, S. Dalbey, and G. Liknes. 2000. Westslope cutthroat trout in northcentral Montana, status and restoration strategies. Montana Fish, Wildlife

and Parks and United States Forest Service--Lewis and Clark National Forest, Technical report, Great Falls, Montana.

Tews, A. E., W. M. Gardner, G. A. Liknes, and W. J. Hill. 1995. Statewide Fisheries Investigations. Survey and Inventory of Coldwater Streams. Northcentral Montana Coldwater Streams. F-78-R-1. Montana Department of Fish, Wildlife and Parks, Fisheries Division, Job Progress Report, Helena.

Tews, A. E., W.M. Gardner, W. J. Hill, G. A Liknes and E. A. Zollweg. 1999. Statewide Fisheries Investigations. Northcentral Montana Coldwater Streams. Project F-78-R-5. Montana Department of Fish, Wildlife and Parks, Fisheries Division, Job Progress Report, Helena.

Prepared by: Anne E. Tews, William J. Hill, Willam M. Gardner, George A. Liknes and Travis B. Horton

Date:

Principal Fish Species Involved: rainbow trout, westslope cutthroat trout, brown trout, eastern brook trout, mountain whitefish, kokanee salmon, Arctic grayling, mottled sculpin, smallmouth bass, longnose sucker, white sucker, mountain sucker, brook stickleback, and longnose dace.

Code Numbers of Waters Referred to in this Report:

14-1000	Cow Creek
14-1320	Deep Creek
14-1640	Dupuyer Creek
14-1840	E. Fk. Teton River
14-2240	Green Gulch
14-3480	M. Fk. Dupuyer Creek
14-4000	N. Fk. Teton River
14-	N. Fk. Waldron Creek
14-4040	N. Fk. Willow Creek
14-4600	Rierdon Gulch
14-4680	Rival Creek
14-5460	S. Fk. Deep Creek
14-5480	S. Fk. Dupuyer Creek
14-	S. Fk. Waldron Creek
14-6360	Waldron Creek
16-0760	Cottonwood Creek (Highwoods)

16-0800	Castle Creek
16-0900	Cottonwood Creek
16-1280	Dry Wolf Creek
16-1445	E. Fk. Spring Creek
16-1800	Judith River, Section 1
16-3520	South Fork Judith
16-3920	Warm Springs Creek
16-4220	Wolverine Creek
17-2816	Fourmile Creek
17-3015	Gold Run Creek
17-4016	Lake Creek
17-5200	Newlan Creek
17-5820	N. Fk. Deep Creek
17-6944	S. Fk. Deep Creek
17-8585	Wolsey Creek
18-0180	Basin Creek
18-1200	Collar Gulch
18-2640	Flatwillow Creek
18-3420	Lion Creek
18-4560	N. Fk. Flatwillow Creek
18-5610	S. Fk. Flatwillow Creek
18-5640	S. Fk. McDonald Creek
18-6780	Whitetail Creek
20-2000	Elk Creek
20-2350	Gates Creek
20-4400	N. Fk. Sun River
20-5600	S. Fk. Sun River
20-6100	Sun River
20-6750	Wrong Creek

Appendix A. Population estimates for rainbow trout at age and average total length for three sections of Big Spring Creek 1999 – 2000.

Section and Year		Age			
		I	II	III	IV +
Brewery 1999	Number (SD)	624 (56)	101(16)	167 (20)	53 (14)
	Inches	8.3	10.7	12.3	13.0
Brewery 2000	Number (SD)	786 (52)	365(38)	192 (26)	83 (17)
	Inches	8.4	11.1	12.5	13.3
Burleigh 1999	Number (SD)	184 (36)	86(16)	146 (21)	125 (24)
	Inches	8.4	10.7	12.7	14.2
Burleigh 2000	Number (SD)	193 (43)	167(36)	265 (45)	149 (27)
	Inches	8.2	12.2	13.4	14.8
Carroll Trail 1999	Number (SD)	772 (66)	363(53)	935(86)	568 (72)
	Inches	8.0	10.9	12.8	14.2
Carroll Trail 2000	Number (SD)	837(50)	756(74)	913(100)	667 (81)
	Inches	8.6	12.2	13.8	15.0

Appendix B. Population estimates for brown trout at age and average total length for three sections of Big Spring Creek 1999 – 2000.

Section and Year		Age			
		I	II	III	IV +
Brewery 1999	Number (SD)	26 (8)	29(7)	42 (7)	92 (16)
	Inches	9.2	11.1	13.6	15.5
Brewery 2000	Number (SD)	49 (10)	61(10)	82 (15)	126 (19)
	Inches	9.8	11.6	14.3	15.6
Burleigh 1999	Number (SD)	2 (0.1)	1 (0.1)	27 (6)	69 (12)
	Inches	9.4	12.6	14.8	16.2
Burleigh 2000	Number (SD)	6 (3)	2 (2)	16 (6)	86 (25)
	Inches	9.1	13.4	15.2	16.8
Carroll Trail 1999	Number (SD)	168 (30)	89(19)	311 (45)	176 (42)
	Inches	9.5	11.0	13.4	15.2
Carroll Trail 2000	Number (SD)	262 (26)	360(29)	180 (32)	181 (30)
	Inches	10.4	12.3	14.2	15.8

Appendix C. Statistics of fish captured during stream surveys 1999 – 2000.

Water Date (length)	Legal (location)	Species	n	Total length (inches)			Weight (lbs)		
				Min	Max	Avg	Min	Max	Avg
Basin Cr. 26 June 00 (230 ft)	T11N R10E Sec 34 (Near Bear Park)	No Fish							
Basin Cr. 26 June 00 (368 ft)	T10N R10E Sec 11	Brook trout	19	3.3	9.9	6.9			
Beaver Cr. 21 July 99 (750 ft)	T14N R17E Sec 26 (Gardner)	Brook trout	14	2.0	11.5	5.3	0.04	0.59	0.16
		Longnose dace	1						
		Longnose sucker	2	3.5	4.2	3.9			
		Longnose sucker	28	8.7	14.0	11.2	0.26	1.05	0.58
		Mottled sculpin	33	2.3	4.0	3.0			
		Mountain sucker	5	6.4	7.5	7.0	0.09	0.17	0.13
		White sucker	27	7.2	12.7	10.3	0.16	0.85	0.48
Beaver Cr. 5 Aug 99 (1,100 ft)	T14N R17E Sec 36 (Reglie, restored reach)	Brook trout	83	3.0	12.5	7.3	0.06	0.83	0.19
		Lake chub	9	2.3	5.4	4.4			
		Longnose dace	12	2.3	4.5	3.1			
		Longnose sucker	86	3.2	14.8	9.7	0.08	1.2	0.47
		Mottled sculpin	24	2.5	4.7	3.6			
		Mountain sucker	38	3.7	6.2	4.7	0.03	0.08	0.06
		Rainbow trout	1	10.5	10.5	10.5	0.44	0.44	0.44
		White sucker	40	5.0	13.5	9.9	0.08	0.93	0.51
Bruce Cr. 20 July 00 (420 ft)	T15N R5E Sec 20 (trib. of N. Fk. Deep)	Westslope cutthroat trout	39	2.6	9.2	6.6			
Burnette Cr. 6 June 00 (480 ft)	T16N R18E Sec 32 (just above mouth)	Brown trout	20	2.1	9.7	3.9	0.04	0.35	0.11
		Mottled sculpin	1	4.2	4.2	4.2			
		Northern redbelly dace	2	1.6	2.0	1.8			
		Stickleback	31	1.5	2.3	1.8			
		Trout	1	2.1	2.1	2.1			
		White sucker	35	1.8	8.8	4.1	0.04	0.28	0.15

Appendix C. continued.

Water Date (length)	Legal (location)	Species	n	Total length (inches)			Weight (lbs)		
				Min	Max	Avg	Min	Max	Avg
Castle Cr. 17 June 99 (260 ft)	T14N R19E Sec 7 (Miller above culvert)	Fathead minnow	1	2.4	2.4	2.4			
		Mottled sculpin	77	2.1	4.5	2.9			
		Rainbow trout	2	7.6	12.6	10.1	0.16	0.88	0.52
		White sucker	72	3.0	14.0	6.2	0.03	1.09	0.48
Castle Cr. 17 June 99 (600 ft)	T14N R19E Sec 7 (Miller below culvert)	Brook trout	3	8.5	9.2	8.7	0.3	0.44	0.35
		Mottled sculpin	1	2.6	2.6	2.6			
		Rainbow trout	1	9.7	9.7	9.7	0.45	0.45	0.45
Castle Cr. 17 June 99 (744 ft)	T14N R19E Sec 5/6 (Sereday's below culvert)	Brook trout	4	6.9	8.3	7.6	0.13	0.24	0.19
		Longnose dace	3	1.8	2.5	2.1			
		Longnose sucker	24	5.0	9.9	7.6	0.12	0.42	0.20
		Mottled sculpin	17	2.2	4.1	3.0			
		Rainbow trout	2	6.5	8.2	7.3	0.13	0.24	0.19
		White sucker	53	2.9	14.1	7.3	0.14	0.98	0.52
Collar Gulch 16 July 99 (1,000 ft)	T17N R20E Sec 29/32	Westslope cutthroat trout	32	3.0	8.7	6.1			
Deep Cr., N. Fk. 15 July 00- 20 July 00 (~1,600 ft)	T15N R5E Sec 19,20,21 (reaches on entire stream shocked)	Westslope cutthroat trout	217	1.4	10.2	6.8			
		Mottled sculpin (present below lowest falls)							

Appendix C. Continued.

Water Date (length)	Legal (location)	Species	n	Total length (inches)			Weight (lbs)		
				Min	Max	Avg	Min	Max	Avg
Dry Wolf Cr. 26 July 99 (492 ft)	T14N R9E Sec13 (estimate section)	Brook trout	25	2.2	9.6	6.0			
		Westslope cutthroat trout	28	2.6	12.0	7.8			
Dry Wolf Cr. 18 May 00	T14N R9E Sec13 (in campground)	Brook trout	18	3.1	8.7	6.7	0.07	0.25	0.16
		Westslope cutthroat trout	6	3.1	9.8	7.0	0.07	0.36	0.20
Dry Wolf Cr. 28 Sept 00 (800 ft)	T14N R9E Sec13 (shocking section and campground)	Brook trout	86	2.0	9.5	6.2			
		Westslope cutthroat trout	92	2.4	11.0	6.2			
East Fork Spring Cr. 13 July 99 (790 ft)	T15N R19E Sec 28/33 (Below dam. Comes Ranch, estimate section)	Brown trout	3	15.4	16.9	16.2	1.35	1.78	1.52
		Longnose dace	1	3.2	3.2	3.2			
		Longnose sucker	8	6.5	15.8	12.8	0.1	1.37	0.88
		Mottled sculpin	8	2.7	4.3	3.5			
		Rainbow trout	6	5.7	14.4	10.2	0.07	1.08	0.62
		White sucker	13	4.3	16.1	12.1	0.08	3.9	1.25
East Fork Spring Cr. 27 July 99 (spot shock)	T12N R19E Sec4 (1.5 miles above USFS boundary)	Westslope cutthroat trout	53	7.4	2.8	11.4			
Flatwillow Cr. 15 June 99 (2,600 ft)	T12N R23E Sec 16 (Cemetery section)	Brown trout	21	5.4	17.8	11.1	0.05	2	0.70
		Longnose dace	9	2.2	5.0	3.6	0.02	0.04	0.03
		Longnose sucker	12	5.1	13.6	9.9	0.03	1.08	0.43
		Mottled sculpin	1	3.4	3.4	3.4			
		Mountain sucker	14	4.4	6.4	5.0	0.02	0.08	0.05
Flatwillow N. Fk. 8 Apr 99 (600 ft.)	T13N R20E Sec 36 (near Holt Creek)	White sucker	18	3.9	14.6	8.5	0.02	1.4	0.39
			5						
		Mottled sculpin (subsample)	11	1.4	4.3	3.4			

Appendix C. Continued.

Water Date (length)	Legal (location)	Species	n	Total length (inches)			Weight (lbs)		
				Min	Max	Avg	Min	Max	Avg
Flatwillow N. Fk. 14 Oct 99 (1,800 ft)	T15N R20E Sec 5 (Half Moon Ranch)	Brook trout	92	3.4	9.1	5.0			
Flatwillow Cr., S. Fk. 29 June 00 (600 ft)	T12N R21E Sec 10 (BLM below camp)	Brook trout	1	5.4	5.4	5.4			
		Longnose dace	6	2.1	3.5	3.0			
		Mottled sculpin	28	2.2	4.2	2.9			
		Minnow	1	4.3	4.3	4.3			
		White sucker	30	1.8	6.4	4.5			
Flatwillow Cr., S. Fk. 29 June 00 (635 ft)	T12N R21E Sec 10 (BLM above camp)	Brook trout	11	1.8	9.7	5.2			
		Longnose dace	3	3.5	3.6	3.6			
		Mottled sculpin	25	2.1	3.9	2.9			
		White sucker	3	4.8	6.6	5.6			
Flatwillow Cr., S. Fk. 29 June 00 (580 ft)	T12N R21E Sec 9 (above closed road)	Brook trout	54	2.0	8.8	5.4			
		Mottled sculpin	11	2.2	4.8	3.0			
Judith River 22 June 00	T15N R15E Sec 25	Brown trout	3	5.9	14.7	10.7	0.07	1.17	0.61
		Longnose dace	30	1.2	3.3	2.4			
		Longnose sucker	7	2.0	11.7	5.5	0.16	0.55	0.33
		Mottled sculpin	5	2.1	4.3	3.2			
		Mountain sucker	29	1.7	4.7	3.3			
		Mountain whitefish	22	4.6	12.9	7.6	0.05	0.70	0.26
		White sucker	18	3.2	15.3	9.0	0.07	1.63	0.53
Judith R., S. Fk. 20 Aug 99 (770 ft)	T12N R11E Sec 23 (estimate section)	Brook trout	2	6.1	7.4	6.8	0.06	0.15	0.11
		Mottled sculpin	46	2.0	4.8	3.3			
		Mountain whitefish	40	2.5	11.2	6.3	0.02	0.44	0.13
		Rainbow trout	44	1.9	11.8	6.4	0.01	0.48	0.11
		RB*CT	1	6.2	6.2	6.2	0.04	0.04	0.04
		Westslope cutthroat trout	2	6.6	8.3	7.5	0.08	0.17	0.13
Lake Cr. 7 June 00 spot shock	T11N R8E S24	Westslope cutthroat trout	52	2.0	9.2	4.4			

Appendix C. Continued.

Water Date (length)	Legal (location)	Species	n	Total length (inches)			Weight (lbs)		
				Min	Max	Avg	Min	Max	Avg
Lion Cr. 23 June 00 (483 ft)	T11N R9E Sec 34	Brook trout	34	1.3	7.2	3.5			
Lion Cr. 23 June 00 (961 ft)	T11N R9E Sec 34	Brook trout	21	1.3	8.5	3.9			
Lion Cr. 26 June 00 (292 ft)	T11N R9E Sec 14 (headwaters)	No Fish							
Little Casino Cr. 17 May 00 (60 ft)	T15N R18E Sec15 (below upper dam)	Brook trout	3	2.5	8.5	6.2			
		Fathead minnow	16	1.3	2.9	2.3			
		Longnose dace	1	2.2	2.2	2.2			
		Mottled sculpin	2	3.7	3.9	3.8			
		White sucker	70	2.4	8.5	5.2			
Little Casino Cr. 17 May 00 (170 ft)	T15N R18E Sec15 (stream above upper dam)	Brook trout	4	6.8	10.7	8.4			
		Longnose dace	1	2.8	2.8	2.8			
		Mottled sculpin	2	3.7	3.7	3.7			
		White sucker	37	5.3	12.2	8.1			
McDonald Cr., S. Fk. 23 June 99 (1,000 ft)	T14N R22E Sec 7	Longnose dace	8	1.7	2.6	2.2			
		Longnose sucker	3	8.8	11.4	10.3	0.28	0.55	0.42
		Mottled sculpin	1	3.1	3.1	3.1			
		Lake chub	6	2.5	3.7	3.2			
		Mountain sucker	31	2.4	4.5	3.8			
		White sucker	41	2.9	15.2	6.0	0.08	1.85	0.47
Musselshell S. Fk. 17 Oct 00 (900 ft)	T8N R11E Sec 10/11 (just above Martinsdale diversion)	Brown trout	21	7.1	20.2	14.4	0.15	2.00	1.11
		Rainbow trout	1	7.8	7.8	7.8	0.20	0.20	0.20
		White sucker	P*						
		Longnose sucker	P*						
		Longnose dace	P*						
Mottled sculpin	P*								
Newlan Cr. 20 May 99 (180 ft)	T10N R6E Sec 14	Brook trout	22	3.9	7.8	5.9			

Appendix C. Continued.

Water Date (length)	Legal (location)	Species	n	Total length (inches)			Weight (lbs)		
				Min	Max	Avg	Min	Max	Avg
Newlan Cr. 10 May 00 (180 ft)	T10N R6E Sec 14	Brook trout	35	4.1	8.8	6.4			
		White sucker	1	9.8	9.8	9.8			
		Warm Springs Cr.	Rainbow trout	19	8.5	14.0	11.1		
Whitetail Cr. 26 June 00 (480 ft)	T11N R10E Sec 32	Brook trout	35	2.8	7.5	5.3			
Wolsey Cr. 18 Oct 00 (spot shock)	T12NR7E S12/14	Brook trout	46	1.5	7.1	3.6			
Wolverine Cr. 12 July 00 (620 ft)	T16N R18E Sec 31 (Stillson Ranch)	Brook trout	23	3.0	11.1	6.1			
		Brown trout	3	2.7	6.9	4.4			
		Longnose dace	4	2.8	4.1	3.2			
		Rainbow trout	1	5.7	5.7	5.7			
		White sucker	4	3.6	10.0	6.6			

*P = present