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

STATE: Montana PROJECT NO.: F-78-R-3
PROJECT TITLE: Statewide Fisheries Investigations
JOB TITLE: Northcentral Montana coldwater Streams
PERIOD COVERED: July 1, 1996 through June 30 ,1997

ABSTRACT

Cutthroat trout were collected from seven streams along the Rocky Mountain Front for determination of genetic purity. A population of 301 cutthroat trout per mile was estimated for the South Fork of Dupuyer Creek. Trout populations were estimated at 671 and 706 fish per mile in the South Fork and North Forks of the Sun River, respectively. Catch rates were 4.6 and 4.1 fish per hour for the North Fork and South Fork, respectively. The Tiber Dam tailwater trout fishery was evaluated for population improvements that have been anticipated since the Bureau of Reclamation began maintaining minimum instream flows in 1985. The rainbow trout standing crop was estimated at only 12 fish/mile, an 88% decline from the 1994 estimate. The brown trout standing crop was estimated at 22 fish/mile, slightly higher than the 1994 estimate. It appears the previous stocking of rainbow trout fingerlings provided minimal improvements in trout numbers. The Burleigh section of Big Spring Creek continued to have low rainbow trout numbers; they were similar to those seen in 1995. Small rainbow trout numbers declined in the Brewery Flats section. Brown trout declined in both sections but were at higher levels than seen in the 1980's. Point estimates of rainbow and brown trout increased in the Tresch Section. Low rainbow trout numbers in the Burleigh section appear to be due to small numbers of young fish. A summer creel census completed on 6.5 miles of Upper Big Spring Creek found a total of 178 angler days per mile. Trout catch averaged 1.08 fish per hour. Five percent of the trout were harvested. Brook trout were the dominate game fish sampled in Beaver Creek and Casino Creek. Trout populations have improved dramatically since 1990 on a fenced section of East Fork Spring Creek. We obtained population and biomass estimates on the Smith and Missouri rivers; results will be presented in the next report. Approximately 205 projects were reviewed under the Natural Streambed and Land Preservation Act while another 32 projects were reviewed under the Stream Preservation Act.

OBJECTIVES

1. To identify and monitor the characteristics and trends of fish populations, angler harvest and preferences, and habitat conditions in northcentral Montana coldwater stream ecosystems.

2. Use survey and inventory information to identify management problems and opportunities, then develop and implement management actions to maintain fish populations at levels consistent with habitat conditions or other limiting factors.

3. Review projects proposed by state, federal, and local agencies and private parties which have the potential to affect fisheries resources and aquatic habitats. Provide technical advice or decisions to reduce or mitigate resource damage.

4. Provide landowners and other private parties with technical advice and information to sustain and enhance fisheries resources and aquatic habitat.

5. Enhance public understanding and awareness of fishery and aquatic habitat resources and issues in northcentral Montana through oral and written communication.

6. Maintain and enhance public access to fishery resources in northcentral Montana.

7. To enhance trout populations and trout fishing opportunity in Marias River immediately downstream from Tiber Dam.

PROCEDURES

Choteau Area

Fish populations at the confluence of the forks of the Sun River at the upper end of Gibson Reservoir were sampled using an aluminum jet boat with fixed booms. All rainbow and cutthroat trout over eight inches were tagged with Floy tags to assist in monitoring harvest and movement. The forks of the Sun River within the Bob Marshall Wilderness were sampled by hook and line. Rainbow and cutthroat trout over eight inches were also tagged with Floy T-tags to aid in harvest, movement, and population estimation. The Petersen mark-recapture method (Ricker 1975) was used to estimate the population in which snorkelers visually observed tagged and untagged trout. Other streams were sampled with a backpack shocker. A two-pass method was used to estimate cutthroat trout numbers in the South Fork Dupuyer Creek. Measurements of all fish sampled include total length to the nearest tenth of an inch and weight to the nearest hundredth of a pound. Several streams were surveyed in cooperation with personnel from the Lewis & Clark National Forest. Cutthroat trout were collected for electrophoretic analysis at the University of Montana under the direction of Dr. Robb Leary.

Marias River

The electroshocking system used to capture trout and whitefish was adapted from the system described by Novotny and Priegal (1974). The electroshocking apparatus was a

boom-type and mounted on a 14-foot aluminum McKenzie style driftboat powered by a 10 hp outboard motor. Power was supplied by a 4000-watt AC generator. The alternating current was delivered to a Coffelt Model VVP-10 rectifying unit which changes the alternating current to continuous direct current. The positive electrode consisted of two circular hoops with twelve 16-inch stainless steel droppers fastened on each hoop. These electrodes were supported by fiberglass booms and were positioned about six feet in front of the boat. The hull of the boat served as the negative. The unit was typically operated at 2-5 amps, 100-215 volts and continuous direct current.

The Petersen mark/recapture technique was used to estimate the trout populations in the Marias River. The following formula, Chapman's modification, was used (Ricker 1975):

$$N = \frac{(M+1)(C+1)}{(R+1)}$$

Where:
N = population estimate
M = number of marked fish
C = number of fish in the recapture sample
R = number of marked fish in the recapture sample

Lewistown Area

Trout populations on Big Spring Creek were surveyed using a fiberglass drift boat equipped with a mobile electrode and Coeffelt VVP-15 to rectify AC to straight DC. Power was obtained from a 240 volt generator. Big Spring Creek mark-recapture estimates were analyzed with the MDFWP MR-4 program utilizing log-likelihood statistics (MDFWP 1994). Rainbow trout were collected, frozen and sent to the Washington Animal Disease Diagnostic Laboratory for testing for whirling disease. Fish populations in small streams in the Lewistown area were sampled with a Smith Root Model 12-A battery powered backpack electrofishing unit on the H-3 setting, using a 12Ah, 24 volt battery.

A fishing pressure estimate for Upper Big Spring Creek was obtained from total angler counts completed on two weekend days and four weekdays per month from May 1-September 30, 1996. The percentage of weekend to weekday counts was assumed to be representative of the total number of weekdays and weekend days per month. This census was done on a 6.5 mile section located from the bridge below the MFWP Hatchery downstream to the Ash Street bridge. Counts of all anglers were completed from the highway that runs adjacent to the creek. Most of the stream easily accessible to the public could be viewed from the road, but only about 50% of the total creek could be seen. Only people actively fishing were counted. The time of the first count on each census day was randomly selected on a half-hour basis from 6:00 AM to 4:00 PM (less during shorter daylight hours). Two counts were made on each count day at a 4 hour interval. Times and

dates of counts for each two week interval were randomly selected without replacement. Counts were considered instantaneous since a count on each section required less than 30 minutes to complete (Neuhold and Lu 1957). Pressure and harvest estimates were derived using the MFWP creel census program (McFarland and Roche 1987). Catch rates, catch composition, fishing techniques, and angler and trip characteristics were determined from direct angler interviews. These interviews were completed throughout the census area during daylight hours. Interviewing was done between census counts and on days when counts were not completed. Fish statistics were not collected during the creel census, due to low harvest levels.

Great Falls Area

Trout populations on the Smith River were surveyed using a fiberglass drift boat equipped with a mobile electrode and a Coeffelt VVP-15 or Mark XXII-M to rectify AC to straight DC. Power was obtained from a 240 volt generator. 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 estimate production (MDFWP 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 Natural Streambed and Land Preservation Act (SB310).

RESULTS

Choteau Area

Westslope Cutthroat Trout

Cutthroat trout were sampled in a number of streams along the Rocky Mountain Front and specimens were collected for genetic testing from the following waters: Middle and South Forks of Dupuyer Creek, Limestone Creek, North Fork Little Badger Creek, East Fork Teton River, Gates Creek, and Moudess Creek. Electrophoretic analysis determined that

the sample from the Middle Fork of Dupuyer Creek contains pure westslope cutthroat trout. This population is protected from invasion by other species by a man-made barrier and is on private land. All other streams sampled in 1996 are pending analysis as is the South Fork of Birch Creek, which was sampled in 1995.

Miscellaneous Streams

Several streams were inventoried to determine species composition and update files (Table 1). A population estimate of 301 cutthroat trout per mile was calculated for the South Fork Dupuyer Creek. These fish are presumed to be pure westslope (see preceding paragraph) and are protected from invasion of other species by a natural barrier.

Table 1. Streams surveyed in the Choteau area during 1996.

Date	Stream	Location	Species[1]	Number	Length range	Weight range
7-18-96	Deep Ck.	23N-5W-20	Rb	2	5.2-16.6	0.05- 1.48
			LL	9	4.9-10.4	0.04-0.53
			MW	3	8.0-11.5	0.20-0.70
			Wsu	11	2.9-12.4	0.02-0.88
			LnSu	2	6.6-7.0	0.12-0.14
			MtSu	108	2.0-5.4	0.01-0.05
			LND	22	2.8-3.6	
			Carp	1		
6-26-96	Middle Fork Dupuyer Creek	27N-9W-26	CT	41	4.4-10.5	0.03-0.46
9-25-96	South Fork Dupuyer Creek	27N-9W-35	CT	56	3.3-11.0	
7-16-96	Teton River	25N-7W-36	Rb	71	3.8-10.4	0.04-0.47
			LL	4	4.4-18.5	0.05-2.48
			MW	1	7.8	0.19
7-16-96	Teton River	25N-6W-31	Eb	79	3.2-10.0	0.02-0.52
			LL	4	4.6-9.7	0.04-0.40
			MW	1	8.7	0.26
6-25-96	Teton River	25N-6W-34	Rb	11	4.0-15.6	0.02-1.38
			Eb	36	3.6-11.0	0.02-0.55
			LL	32	3.4-21.8	0.01-3.74

1 - Species abbreviations: Rb=rainbow trout; CT=cutthroat trout; LL=brown trout; Eb=brook trout; MW=mountain whitefish; WSu=white sucker; LnSu=longnose sucker; MtSu=mountain sucker; LND=longnose dace.

Sun River

For the third consecutive year, rainbow and cutthroat trout were captured by electrofishing at the head of Gibson Reservoir where the North and South Fork Sun River converge. The fish captured ranged in length from 8.2 to 24.1 inches (mean=12.6) and in weight from 0.18 to 6.10 pounds (mean=0.67). A total of 292 trout were tagged to monitor harvest and movement. During 1996, anglers reported catching 13 of these tagged fish, but only kept 3 for a harvest of 1.0 percent. Fairly high spring flows were experienced and possibly influenced fish to ascend the forks as 5 tag returns were reported from the North Fork and 7 tag returns from the South Fork. The remaining tag return was reported from Gibson Reservoir. Anglers also reported catching and releasing one tagged fish in Gibson Reservoir from the 1994 tagging year, along with 9 tagged fish from 1995, of which 4 were released. Of these 9 fish, 4 were caught in Gibson, 2 in the North Fork and 3 in the South Fork. The cumulative harvest is 4.3 percent for fish tagged in 1994 and 3.8 percent for fish tagged in 1995.

Trout population trends were also monitored in the forks upstream of the confluence at stations established in 1989. A total of 125 fish were tagged in the North Fork while 122 trout were tagged in the South Fork. Mean length of fish in the North Fork was 11.1 inches (range 8.0-17.5) and in the South Fork the mean length was 11.6 inches (range 8.2-15.5). This is a slight decrease from the previous year (Figure 1). Figure 1 also shows that the population increased in both forks. The North Fork had the larger population at 706 fish/mile followed by the South Fork at 671 fish/mile. Catch rates continue to remain high on the North Fork at 4.6 fish/ hour. The South Fork was nearly as high at 4.1 fish/hour, which is considerably higher than that found in earlier years (Tews et al. 1995).

During 1996, trout anglers fishing the North Fork reported catching one fish tagged in 1993, four fish tagged in 1995 (three of which were kept), and two fish tagged in 1996. Fisheries crews also released or retagged one fish tagged in 1994, two fish tagged in 1995 and two fish tagged in 1996. In the South Fork, anglers kept one fish and released two others that were tagged in 1996, as well as releasing one fish tagged in 1995. Fisheries crews also released or retagged one fish tagged in 1993, 6 fish tagged in 1995 and three fish tagged in 1996. Examination of Table 2 shows that the greatest cumulative harvest is 5.3 percent in the North Fork and 6.1 percent in the South Fork, both occurring for 1990 tagged fish. Overall, cumulative harvest in both forks is approximately 3 percent for all fish tagged since 1990.

Little movement of fish tagged in either of the forks was observed. Of 72 tag returns reported from fish tagged in the North Fork since 1990, 83 percent were recaptured in the North Fork and 13 percent were recaptured in Gibson Reservoir (Table 3). Of fish tagged in the South Fork, 85 percent of tag returns came from the South Fork while 10 percent came from the confluence (Table 4).

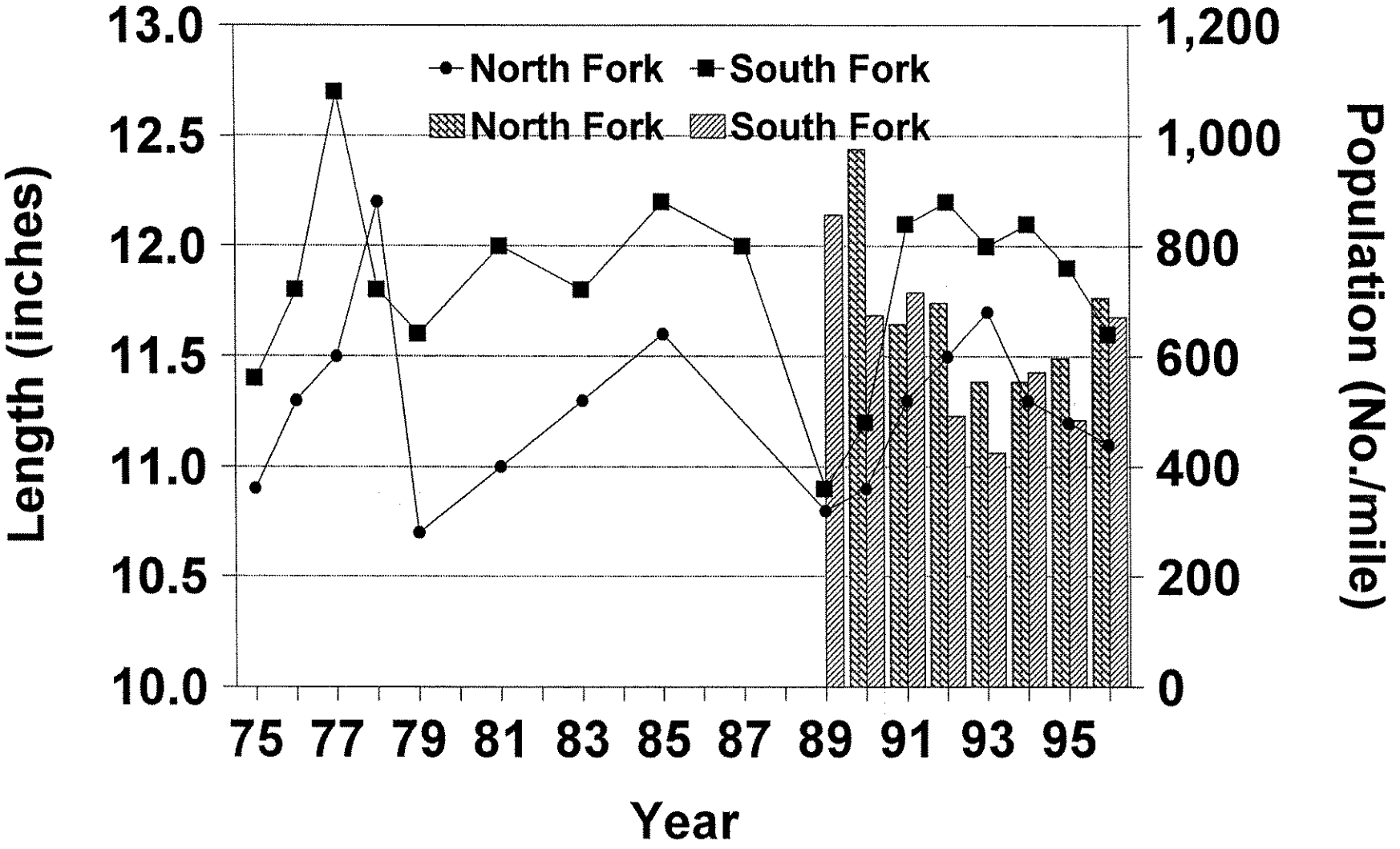

Figure 1. Population estimates and average lengths of trout in the forks of the Sun River. (Line = lengths; bars = population estimate)

Table 2. Exploitation of rainbow and cutthroat trout from the North and South Forks of the Sun River (based on voluntary angler tag returns, 1990-1996).

Stream	Year tagged	Number tagged[1]	Number harvested	Cumulative harvest (%)	No. fish released	Others released[2]
North Fk	1990	113	6	5.3	6	3
	1991	124	6	4.8	6	1
	1992	97	2	2.1	0	2
	1993	101	4	4.0	11	4
	1994	108	1	0.9	1	3
	1995	105	5	4.8	3	4
	1996	124	0	0.0	2	2
	Totals	772	24	3.1	29	19
South Fk	1990	82	5	6.1	0	6
	1991	102	4	3.9	1	8
	1992	96	5	5.2	8	2
	1993	64	1	1.6	5	4
	1994	90	2	2.2	0	5
	1995	115	0	0.0	3	9
	1996	122	1	0.8	2	3
	Totals	671	18	2.7	19	37

1-Number adjusted to compensate for fish released after tags pulled by anglers or fish re-tagged by FWP.
2-Includes fish with tags pulled or re-tagged.

Table 3. Movement of trout tagged in the North Fork Sun River[1], 1990-1996.

Year tagged	Cumulative recaptures by area				
	Confluence	Gibson Res.	Below Gibson	No.Fork	So.Fork
1990	-	1	-	14	-
1991	2	2	-	9	-
1992	-	-	1	3	-
1993	-	1	-	18	-
1994	-	1	-	4	-
1995	-	4	-	8	-
1996	-	-	-	4	-
Totals	2	9	1	60	-

1 - The North Fork Sun River study section includes an area from the vicinity of Freezeout Creek upstream to slightly above Glenn Creek.

Table 4. Movement of trout tagged in the South Fork Sun River[1], 1989-1996.

Year tagged	Cumulative recaptures by area			
	Confluence	Gibson Res.	N. Fork	S. Fork
1989	-	-	-	5
1990	3	-	1	7
1991	2	1	-	10
1992	1	-	-	14
1993	1	-	-	9
1994	1	1	-	5
1995	-	1	-	11
1996	-	-	-	6
Totals	8	3	1	67

1-The South Fork study section begins near Bear Creek and extends upstream to slightly below Windfall Creek.

Scales from rainbow and cutthroat trout were collected and analyzed from the confluence of the forks at the head of Gibson Reservoir and from both forks within the study sections. Approximately 70 percent of the fish sampled at the confluence in late May were three to five years old (Table 5). The largest was 19 inches long and six years old. In the forks, approximately 71 percent of the fish in the North Fork and 81 percent of the fish in the South Fork were three and four years old (Tables 6 and 7). The oldest fish aged in both forks was six years old.

Marias River - Tiber Dam Tailwater

Description of Study Area

The study area for the Tiber Dam tailwater study is a 21 mile reach of the Marias River extending from the dam near Chester to the Circle Bridge at Highway 223. Tiber Reservoir is a water storage reservoir and the dam has no hydroelectric power generation. Flows in the river downstream are completely controlled by discharges from the dam.

A trout fishery in the 21 mile reach of Marias River immediately below Tiber Dam is maintained by coldwater release. 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). Montana Fish Wildlife and Parks has recommended a minimum instream flow of 500 cfs be maintained in the river below Tiber Dam for the trout fishery.

Table 5. Age composition of rainbow and cutthroat trout at the confluence of North and South Forks of Sun River during May, 1996.

Length group (inches)	No. fish per length group	Number of fish/age group					
		1	2	3	4	5	6
3	1	1					
4	1	1					
5	1	1					
6	1	-	1				
7	2	-	2				
8	6	-	5	1			
9	6	-	2	4			
10	11	-	3	5	3		
11	10	-	-	3	6	1	
12	10	-	-	-	10		
13	9	-	-	3	6		
14	9	-	-	1	3	5	
15	3	-	-	-	-	1	2
16	3	-	-	-	-	1	2
17	2	-	-	-	-	1	1
18	1	-	-	-	-	1	
19	1	-	-	-	-	-	1
Totals	77	3	13	17	28	10	6

Table 6. Age composition of rainbow and cutthroat trout, North Fork Sun River, 1996.

Length group (inches)	No. fish per length group	No. fish per age group				
		2	3	4	5	6
6	2	2				
7	3	3				
8	5	5				
9	14	10	4			
10	23	3	15	5		
11	37		27	10		
12	23	3	16	4		
13	8	3	4	1		
14	0					
15	0					
16	2				1	1
Totals	117	23	49	34	9	2

Table 7. Age composition of rainbow and cutthroat trout, South Fork Sun River, 1996.

Length group (inches)	No. fish per length group	No. fish per age group				
		2	3	4	5	6
6	2	2				
7	1	1				
8	2	2				
9	10	3	7			
10	11	1	7	3		
11	30		13	17		
12	38		15	18	5	
13	12		1	6	3	2
14	1				1	
Totals	107	9	43	44	9	2

The trout fishery had improved substantially from 1985 to 1988, most likely in response to better flow and temperature conditions (Gardner 1988). Field studies in 1987 showed marked improvements in trout numbers, sizes and reproductive success. However, results from the 1989-96 surveys indicated that the trout populations had stabilized and later declined, and did not continue to improve as anticipated.

A number of mountain whitefish, brown and rainbow trout were sampled while conducting the population estimates (Table 8). Comparisons of these size statistics show that sizes for all three species of salmonids measured in 1996 were considerably larger than the previous year sampled and the 5-year average. The larger average sizes for 1996 is attributed to the lack of young fish in the sample, probably resulting from poor survival of the young-of-year and yearling fish. Trout standing crop estimate statistics for 1996 show that rainbow trout 11 inches and greater have declined 37% from that reported for 1994 (Table 9). Also, very few yearling rainbow trout were sampled in 1996 compared with the 1994 estimate of 336 for the 4-mile section. Adult brown trout numbers increased 38% from that reported in 1994; however, numbers of yearling browns, like the rainbows, appeared to be considerably less than that sampled in 1994. A total of 6 yearling brown trout were sampled in 1996 compared with 33 in 1994 for a similar effort.

Both rainbow and brown trout numbers are considered to be at less than the potential for this stream. Several chronic environmental factors have limited trout numbers in the section over the years. During 1991 warm water was inadvertently released from Tiber during July and August. This elevated downriver water temperatures above 70 degrees for

Table 8. Comparison of size statistics for mountain whitefish and trout sampled in the Marias River below Tiber Dam during 1988-96.

Year	Number	Avg. Length (inches)	Avg. Weight (pounds)
		Mountain whitefish	
5-yr Avg[1]	621	13.3	1.01
1994	101	12.1	0.81
1996	105	13.6	1.34
		Rainbow trout	
5-yr Avg[1]	447	11.8	0.86
1994	110	11.0	0.69
1996	37	16.1	2.13
		Brown trout	
5-yr Avg[1]	499	16.2	1.58
1994	84	13.9	1.38
1996	57	17.1	2.45

1 - includes the years 1988, 1990-93

Table 9. Standing Crop estimate statistics of trout populations in a 4 mile reach of the Marias River below Tiber Dam during 1987- 1996.

Size Group	1996	1994	5 Year[1] Average	Maximum	Minimum
			Rainbow trout		
(6.0 - 10.9)	--	336	100	336	10
(11.0 - 20.6)	48	76	108	225	48
			Brown trout		
(6.0 - 10.9)	--	--[2]	31	55	3
(11.0 - 32.0)	88	64	137	195	64

1 - the years 1987, 1990-93
2 - no estimate could be made due to the absence of marked fish in the recapture sample, but based on the number sampled, it is believed there was more than 100.

a two month period which probably stressed the trout population here. Low flows in the section were experienced in 1992 and 1993. During these years water releases were less than the minimum instream flow of 500 cfs 67% and 25% of the time, respectively. Cover habitat appears to be limiting especially for juvenile trout. This probably makes young trout especially vulnerable to predation. Northern pike are present in the section and pike numbers soared from only 1 in the 1994 sample to 23 in 1996 for a similar sample effort.

Over the past seven years fisheries management for the Tiber Dam tailwaters has been directed at improving rainbow trout numbers with limited success. A total of 47,785 fingerling and advanced fingerling rainbow trout have been stocked in this section since 1990. In spite of this effort rainbow trout numbers continue to decline. Better results may be accomplished by managing for brown trout. Brown trout numbers have not declined as drastically as the rainbows and the brown trout appear to have a more even age distribution without year-class failures as depicted in length-frequency histogram (Figure 2).

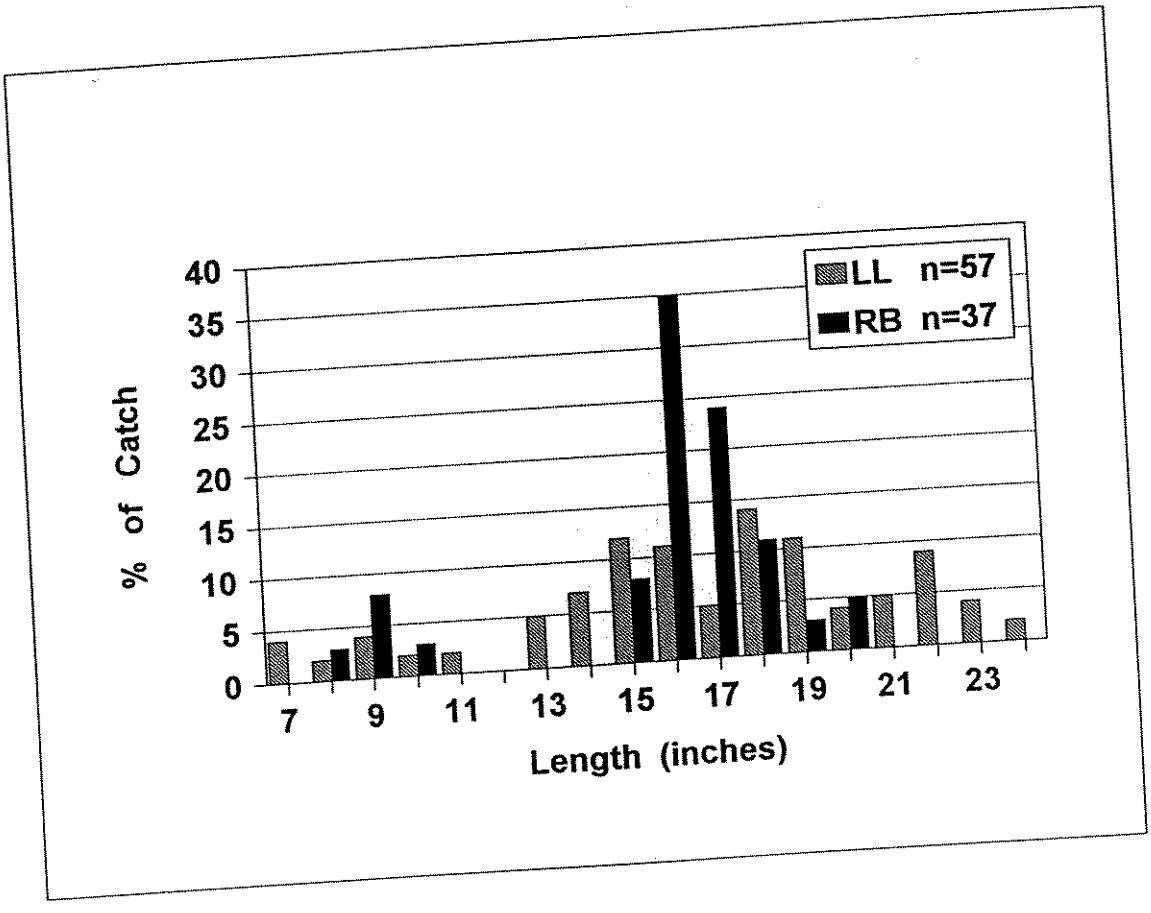

Figure 2. Length Frequencies of brown and rainbow trout sampled in the Tiber Section of the Marias River, 1996. (LL = brown trout; RB = rainbow trout).

Lewistown Area

Big Spring Creek

Mark recapture estimates were completed on three sections of Big Spring Creek during August 1996. As seen since 1992, low rainbow numbers in the Burleigh section appear to be caused by a lack of small fish (Appendix Table 1; Liknes et al. 1996). Both the Brewery Flats section and the Tresch section had higher numbers of rainbow less than 10 inches long than were found in the Burleigh section. Trout numbers and biomass continue to be highest in the Tresch Section. The Tresch section contained about 5 times more rainbow biomass and twice as much brown trout biomass as seen in the other 2 sections (Appendix Table 1). Point estimates increased for both rainbow and brown trout on the Tresch section but confidence intervals overlapped with those seen in 1995 (Figure 3). Rainbow trout numbers in the Brewery Flats section were the lowest recorded during 5 years of data collected (Figure 3). Declines were smallest for rainbow 10 inches and longer. Brown trout numbers were also lower than seen in 1995.

Population at age for 1996 and 1995 is tabulated in Appendix Table 2. The population decline of rainbow trout in the Burleigh section continues to be attributed to low numbers of Age 1 and 2 fish (Appendix Table 2), a change which has occurred since 1990 (Liknes et al. 1996). Rainbow trout populations in both the Brewery Flats section and the Tresch section appear to have more young fish. In recent years, Age 1 brown trout have been infrequent in the Brewery Flats and Burleigh sections and more common in the Tresch Section (Appendix Table 2; Liknes et al. 1996).

Two northern pike were captured during electrofishing on the Burleigh section. Though an occasional northern has been captured by anglers, this is the first time this species has been sampled during electrofishing of Big Spring Creek. At least two other northern pike were reported by anglers within 2 miles of the Burleigh shocking section. Northern pike could be coming from East Fork Reservoir (upstream) or from Fort Peck Reservoir(downstream).

Rainbow trout were tested for whirling disease during 1995 and 1996 in Big Spring Creek. All fish tested negative. Eighty-seven rainbow tested negative in 1995. In 1996, 69 rainbow tested negative.

Water chemistry samples were taken from Big Spring Creek on October 7, 1996 and March 20, 1997 (Appendix Table 3). During October sampling, orthophosphate levels were extremely low above town in the Burleigh section and were about 10 times higher near the Tresch section. In October, ammonia levels were higher above town than below the sewage treatment plant. Nitrates were highest in the Tresch section. Most nutrient levels changed dramatically in March. With the exception of nitrate/nitrite, nutrient levels were higher during the March sampling, with phosphorus levels increasing more than 10 fold in the Burleigh section. Total Kjeldahl nitrogen (TKN) also increased several fold near Old Carrol trail and at the Burleigh section. At the MFWP hatchery TKN levels were below

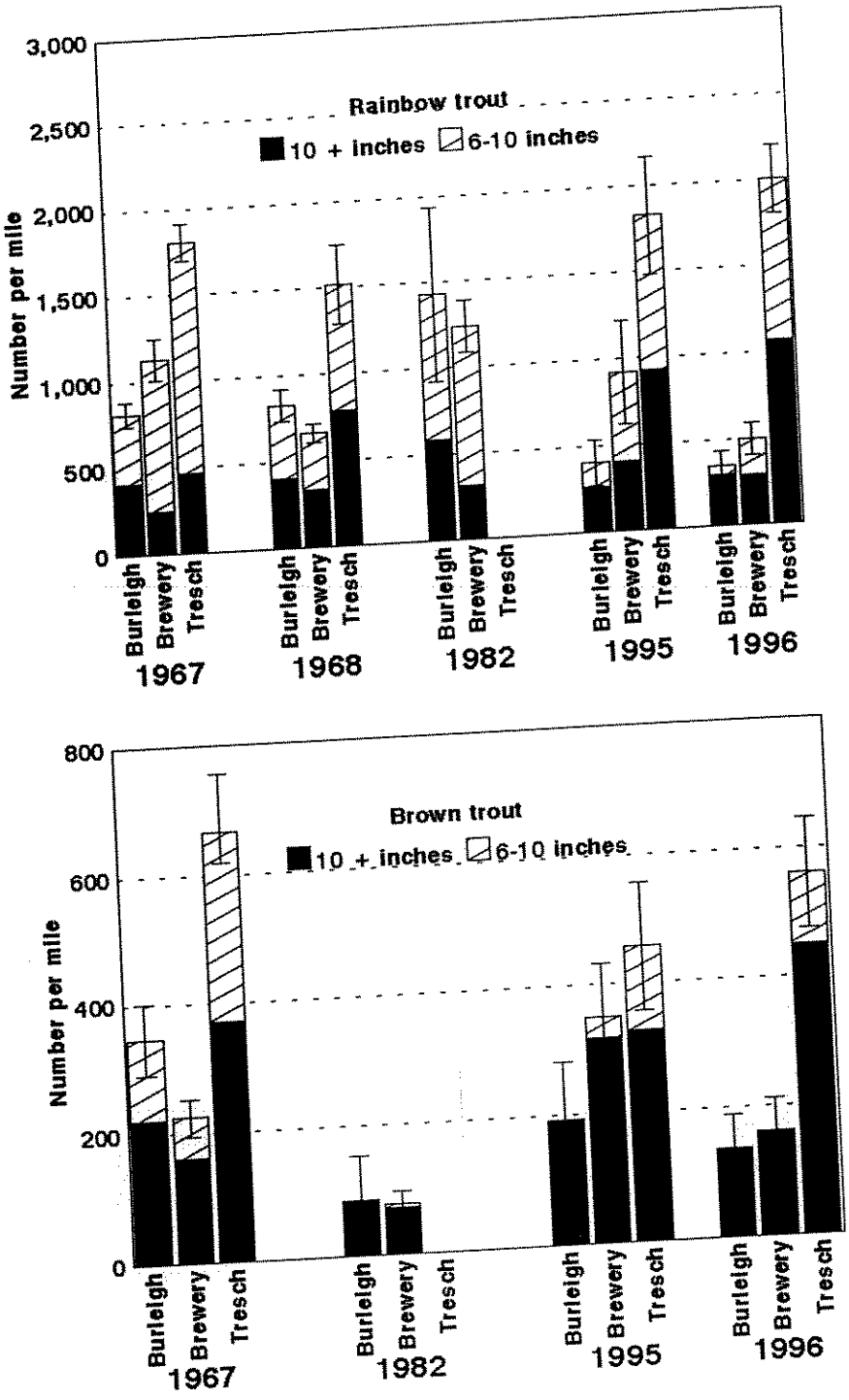

Figure 3. Trout population estimates from three sections of Big Spring Creek. Confidence intervals (95%) assume a normal distribution and are for the entire population. Large confidence intervals generally reflect poor estimates of small fish.

detection limits.

Creel Census

A total of 70 interviews and 60 counts were completed during the creel census on upper Big Spring Creek. The census found a total of 3710 angler-hours (SE of 809 angler-hours) from May 1 - September 31, 1996 on the 6.5 mile reach of stream. This is an underestimate since much of the stream could not be seen from the road. The average completed trip length was 3.2 hours (N=20) resulting in a total of 1159 angler days or 178 angler days per mile. This is considerably less than the 369 angler days per mile estimated for May 1 - September 31, 1995 on the 20 uppermost miles of Big Spring Creek from the MFWP angler mail survey (MFWP 1996). Harvest in 1996 was estimated at 111 rainbow and 83 brown trout. An additional 3325 rainbow and 499 brown trout were caught and released (Table 10). Assuming most of these trout were caught on flies and had a 4% mortality rate (Wydoski 1980) an additional 153 trout were killed. Approximately 11 - 13% of the trout were killed due to angling, nearly half due to catch and release fishing (Table 10).

Small sections of the 6.5 mile reach were also analyzed during the creel survey. Due to the small numbers of interviews in some sections the overall creel numbers discussed above are probably the most accurate. However, it is worth noting that angler days per mile were slightly higher on the Burleigh section than the Brewery Flats section and that catch rate on the Brewery Flats section was less than half of that seen on other sections (Appendix Table 4).

Local residents were the most common anglers, followed by non-residents (Table 11). Nearly 70% of the anglers were fly fisherman. Catch rates were over 1 fish per hour, while harvest rates were 0.05 fish per hour (Table 11). This catch rate is much higher than seen on the Missouri near Craig (Tews et al. 1994) and is higher than was seen on Big Spring Creek in the late 1960's when much of the catch consisted of hatchery stocked rainbow trout (Peterson 1970).

These creel statistics are considerably different from those found during 1968 and 1969 (Peterson 1970). Using a different method, Peterson found an average of 584 angler days per mile on the same reach of stream from mid-May through mid-September. This is more than 3 times the angling pressure that was found in 1996 (Table 12). In the late 1960's rainbow trout were still stocked in Big Spring Creek and composed 69% of the game fish catch in 1968 and 41% in 1969. Peterson's report does not state the percentage of wild fish released, but 27% of game fish were released (Table 12). According to Peterson (1970), the small size of many wild trout resulted in a higher release rate. If 50% of wild trout were released, a total of 2019 wild trout were taken in this section during 1969 which is more than 10 fold higher than the 1996 harvest. Log-likelihood population estimates are not available for 1969 data. However, Peterson's (1970) thesis indicates 1969 estimates were at least as high as those found in 1968. Despite high

Table 10. Catch statistics found during 1996 creel census on upper Big Spring Creek.

	Rainbow trout	Brown trout
Harvested	111	83
Released	3325	499
# in section[1] (turnover)		975
≥ 6 inches	2259 (1.5)	975 (0.5)
≥ 10 inches	1924 (1.7)	
% harvested (%)[2]	5.8	8.5
Release mortality(4%) [3]	133	20
Total mortality (%)	11-13	10

1- calculated by averaging #/mile for Burleigh and Brewery Flats section and multiplying by 6.5.
2- assuming all fish harvested were ≥10 inches.
3- from Wydoski 1980.

Table 11. Angler statistics from Upper Big Spring Creek from 1996 creel census.

Bait type	(%)
Lures	18.6
Flies	68.6
Bait	7.1
Combo	5.7

Origin	(%)
Fergus County	36
Yellowstone County	17
Missoula County	7
Gallatin County	4
Cascade County	3
Non-resident	27

Table 12. Comparison of catch statistics on upper Big Spring Creek for 1996, 1968 and 1969[1].

	1996	1968	1969
Wild rainbow caught	3436	3033	3576
Hatchery rainbow caught	0	8513	3723
Brown trout caught	582	407	462
Percent kept	5	-	73
Percent local anglers	36	62	52
Catch rate (fish/hour)			
Wild rainbow trout	0.93	0.24	0.32
Hatchery rainbow	0.00	0.65	0.33
Brown trout	0.16	0.03	0.04
Total trout	1.08	0.92	0.69

1 - 1968 and 1969 data from Peterson 1970

harvest, wild rainbow trout numbers were higher in the Burleigh section in the late 1960's than they were in 1996 (Figure 3).

Other Lewistown Streams

Several streams in the Lewistown area were sampled by electrofishing in conjunction with stream rehabilitation projects anticipated and/or completed by the United States Natural Resource and Conservation Service (NRCS) and the Fergus County Conservation District (FCCD). Data are presented in Tables 13 and 14. Casino Creek exhibited the highest number of salmonids at least 4 inches long but also held the smallest fish (Tables 13 and 14). No salmonids were sampled in Castle Creek. This creek has several perched culverts which restrict movement of fish between Big Spring Creek and Castle Creek and within Castle Creek. Mottled sculpins and white suckers were found in every stream. Chris Downs from Montana State University sampled fish for whirling disease on Cottonwood Creek (Musselshell drainage), the South Fork of the Judith and the Middle Fork of the Judith River. All fish sampled tested negative.

Beaver Creek

Two pass population estimates were completed on 2 sections of Beaver Creek. Half of one section (Reglies) had severe erosion problems associated with channel downcutting, while the rest of the section had a gravel bottom with pools, riffles and little silt. The other section (Gardners), located less than 1 mile downstream, contained lots of silt, had a

Table 13. Streams in the Lewistown area surveyed with backpack electrofishing.

Stream (location)	Date sampled	Section length (ft)	Temp (F°)	Cond (µohms/cm)[1]	Species[2]	Number captured	Length (inches) mean	Length (inches) range
Beaver Creek (T14N R17E 26)	7/23/96	662	64	740	EB	56	7.0	(5.1-11.5)
					WSU	78	8.6	(4.0-12.9)
					LNSU	82	8.6	(3.7-13.5)
					MTSU	5	7.1	(5.1-9.2)
					LND	2	4.4	(3.8-4.9)
Beaver Creek (T14N R17E 36)	7/31/96	730	66	510	EB	29	9.5	(6.4-13.3)
					LL	2	10.6	(10.5-10.7)
					WSU	18	9.9	(5.1-13.0)
					LNSU	11	11.3	(7.0-12.9)
					MTSU	2	6.6	(5.9-7.2)
Casino Creek (T14N R18E 21)	7/24/96	550	50	818	EB	124	5.2	(2.6-11.4)
					WSU	10	9.1	(7.9-11.4)
					MSC	11	2.9	(2.7-3.8)
Castle Creek (T14N R19E 18; T14N R18E 13)	8/7/96	-	51	1200	WSU	1	4.6	-
E Fk Spring Cr (T15N R19E 32)	9/25/96	790	47	1190	LL	20	14.0	(9.6-17.9)
					RB	3	9.2	(4.0-12.7)
					WSU	19	12.8	(9.3-15.1)
					LNSU	12	11.4	(5.1-14.6)
E Fk Spring Cr (fenced section)	8/22/90	500			LL	3	8.2	(2.7-18.3)
					RB	5	8.6	(6.5-11.2)
					WSU	29	8.3	(4.6-12.2)
					LNSU	34	7.2	(3.3-15.4)
E Fk Spring Cr (grazed section)	8/22/90	500			LL	6	5.3	(2.7-13.0)
					RB	5	7.0	(3.5-9.8)
					WSU	15	7.3	(3.6-13.1)
					LNSU	13	5.5	(3.1-10.8)

1- Standardized to 25° C.
2- All streams also had mottled sculpins. Species abbreviations are EB= brook trout; LL= brown trout; RB = rainbow trout; WSU = white sucker; LNSU=longnose sucker; MTSU= mountain sucker; LND=longnose dace; MSC=mottled sculpin.

Table 14. Size statistics and population estimates for fish 4 inches and larger from streams in the Lewistown area.

Stream (section)	Date	Species[1]	Probability of capture value	Number per 1000 feet (95%CI)
Casino Creek	7/24/96	EB	0.70	112 (±12)
Beaver Creek (Gardners)	7/23/96	EB	0.67	94 (±13)
Beaver Creek (Reglies)	7/31/96	EB	0.92	46 (±1)
E Fk Spring Creek (fenced)	9/25/96	(LL+RB)	0.75	32 (± 6)
		(WSU+LNSU)	0.37[2]	66 (±56)
E Fk Spring Creek (fenced)	8/22/90	(LL+RB)	0.90	12 (± 2)
		(WSU+LNSU)	0.38[2]	98 (±93)
E Fk Spring Creek (grazed)	8/22/90	(LL+RB)	1.00	10 (± 0)
		(WSU+LNSU)	0.64	52 (±11)

1- LL=brown trout; RB=rainbow trout; EB=brook trout; WSU=white sucker; LNSU=longnose sucker;
2 - these values are too low for an accurate estimate (Leathe 1983).

natural channel meander pattern, with deep pools and riffles. Numbers of brook trout were about two times higher in the lower reach when compared with the eroded upper section (Table 14) and catch per effort was higher for suckers in the downstream section. However, brook trout average length was longer in the eroded upstream section. After sampling, a major stream rehabilitation project was undertaken by the FCCD and the NRCS to stabilize Beaver Creek where channel downcutting was occurring.

East Fork Spring Creek

A two pass estimate was done on a 790 foot section of stream that was fenced from heavy winter livestock use in 1988. This data is compared with sampling done in 1990 from fenced and grazed sections in Tables 13 and 14. The exact area sampled differs between years. Fish populations and size structure have changed dramatically between 1990 and 1996. Salmonid numbers increased from 12 to 32 per 1000 feet and average size of all fish species also increased (Tables 13 and 14). The average total length of brown trout, white suckers and longnose suckers increased by at least 50% (Table 13). Endicott (1995) found fewer salmonids and suckers in this area in 1993 than were found in 1990. The cause of these changes is not known. Stocking of 5000 brown trout annually in East Fork Reservoir 8 miles upstream from 1988-1994 may have had some impact. It is possible brown trout numbers were high due to spawning fish in the area during the late September sampling date. However, data collected on East Fork Spring Creek by MFWP on October 1, 1988 had a similar size structure and catch per effort as seen in 1990 (Lewistown data files). Furthermore, the landowner reported catching large brown trout all summer long on this reach of stream. It is interesting to note that average white sucker size corresponded to sizes in East Fork Reservoir located about 8 miles upstream. In 1990, white suckers averaged 8.1 inches (Liknes et al. 1991) in this reservoir while they averaged 13.5 inches in 1996 (Tews et al. 1997). The 1990 and 1993 surveys revealed few differences between the fenced and grazed sections. Future work should be done on both sections to determine if there have been improvements in fishery due to fencing.

Great Falls Area

Smith River

We obtained population estimates during fall 1996 for both rainbow and brown trout from the Eagle Creek and the Deep Creek sections. Data will be presented in the next reporting period.

Missouri River

We also obtained population estimates for brown trout during spring 1996 and for both rainbow and brown trout during fall 1996 in the Craig and Cascade sections. Data will be presented in the next reporting period.

Habitat Protection

Providing input and recommendations about alterations of streambeds or banks by private individuals or government entities are handled through a permit process. The 1975 Natural Streambed and Land Preservation Act (310) involves the private sector while the Stream Protection Act of 1963 (SPA) covers government agencies. In the Choteau area, a total of 23 projects were reviewed and processed under the 1975 Natural Streambed and Land Preservation Act (310) while an additional 3 projects were handled under the 1963 Stream Preservation Act (SPA). In the Lewistown management area 50 Natural Streambed and Land Preservation Act "310" permits and 8 Stream Preservation Act (124) permits were processed. Also, an additional 132 "310's" and 21 "124" permits were processed through the Great Falls office. This resulted in a total of 205 "310's" and 32 "124" permits. Site inspections were made on most of the projects. No significant water discharge permit applications or renewals were received and no significant pollution complaints were received during the report period.

DISCUSSION AND RECOMMENDATIONS

Cooperative projects with the Forest Service involving sampling of westslope cutthroat populations should continue along the Rocky Mountain Front. High priority should be given to protecting all waters containing this species as well as habitat improvement projects, such as maintaining or constructing barriers where needed.

Rainbow and cutthroat trout populations were monitored in both forks of the Sun River as well as at their confluence at the head of Gibson Reservoir. Populations appear healthy; 1996 estimates in both forks were at the highest level since 1992. Harvest at the confluence and for both forks remains low, with cumulative rates of six percent or less. These trout populations should continue to be monitored as time permits.

We also recommend stocking of the Marias River tailwater section with both brown and rainbow trout fingerlings for 4 years. The intended results are to increase brown trout numbers, maintain a two species trout fishery and provide a forage fish (rainbow trout) for the brown trout. Trout population trends will be monitored, as well as the success of brown and rainbow trout fingerling plants and the extent of natural reproduction in Tiber Dam tailwater section by obtaining biannual standing crop estimates at least through 1997. We

will continue to develop management recommendations (such as changes in Tiber Dam operations or habitat improvements) to address limiting factors and enhance the rainbow trout population.

The Burleigh and Brewery Flats sections on Big Spring Creek are located within 2 river miles of each other, but have completely different stream morphologies. Population estimates and creel surveys have recently been completed at Brewery Flats to provide baseline data for a proposed channel re-meandering project. The Brewery Flats section was straightened near the turn of the century. Nearly the entire section is entrenched and most of the banks have been stabilized with rock riprap. About 2/3 of the section is quite shallow with high velocities while the remaining reach is a deep run. In contrast, the Burleigh section meanders, has undercut banks, and is composed of riffles and pools. Surprisingly, during 1995 and 1996, point estimates of rainbow and brown trout in the Brewery Flats section were higher than in the Burleigh section. In the past, the Burleigh section typically held more larger fish than found at Brewery Flats. The main cause for the decline appears to be low numbers of young rainbow trout in the Burleigh section. Local anglers have been concerned that over-harvest has caused a decline in fishing on upper Big Spring Creek. The 1996 creel survey indicates harvest has had little impact on rainbow trout. At least 10 times more wild trout were harvested in 1969 than were harvested in 1996. Trout numbers have not responded to this decreased harvest. Therefore there appears to be no need for catch and release regulations on Big Spring Creek. Population problems appear to be due to low recruitment rather than excessive harvest. In 1997 sediment core samples were taken in rainbow trout spawning areas to determine if siltation is interfering with recruitment. Results are pending.

By July 1, 1997 the MFWP Environmental Assessment for the Brewery Flats re-meandering project had completed the review process. It was decided to construct a single channel with no ponds. Construction is planned for 1998.

Monitoring of the Eagle and Deep Creek sections on the Smith River will continue. We will also continue to electrofish two sections on the Missouri River to obtain population estimates. Additional monitoring on the Missouri River and it tributaries, especially Little Prickley Pear Creek, will be continued to document any impacts from the presence of *Myxobolus cerebralis.*

Stream protection/preservation activities will continue to be processed as projects occur.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the assistance of several individuals in completing work on this project. Paul Hamlin, Kelly Smith, Jim Forrest and Mike Poore Jr. assisted in both field and office activities. Dave Yerk, George Anderson, Rick Bryant, Troy Humphrey, Mark Kornick, Randy Rodencal, Ray Paige, Kathy Weigand, and Tim Hill assisted in

collecting field data. Also, Tony Moline, Ted Hawn and other NRCS personnel assisted in the shocking of Lewistown area streams. The following Forest Service personnel participated in cooperative projects: Mike Enk, Dave Whittekiend, Stan VanSickle and Dan Downing. Dr. Robb Leary from the University of Montana Genetics Lab conducted the laboratory testing to determine the genetic purity of westslope cutthroat trout.

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Date: December, 1997

Principal Fish Species Involved: Rainbow trout, cutthroat trout, westslope cutthroat trout, brown trout, brook trout, mountain whitefish, and mottled sculpin.

Code numbers of Waters Referred to in Report:

14-1320 Deep Creek
14-1840 E. Fk. Teton River
14-2920 Limestone Creek
14-3240 Marias River
14-3480 M. Fk. Dupuyer Creek
14-3920 No. Fk. Little Badger Creek
14-5400 So. Fk. Birch Creek
14-5480 So. Fk. Dupuyer Creek
14-6040 Teton River
16-0200 Beaver Creek
16-0310 Big Spring Creek, Sec 2
16-0780 Casino Creek
16-0800 Castle Creek
16-1445 East Fork Spring Creek
16-2360 Middle Fork Judith
16-3520 South Fork Judith
17-4896 Missouri River Section 09
17-6832 Smith River Section 02
18-1380 Cottonwood Creek
20-2350 Gates Creek
20-4000 Moudess Creek
20-4400 No. Fk. Sun River
20-5600 So. Fk. Sun River

Appendix Table 1. Mark recapture statistics from population estimates done on Big Spring Creek during 1996. SD in parenthesis.

Section	Date marked	Rainbow trout Number of fish M	C	R	Pooled (P)	Number/ mile 6-10in	>10 in	All	Biomass /mile (lbs)
Burleigh*	8/19	109	69	19	0.27	49 (23)	299 (39)	348 (45)	238 (36)
Brewery	8/22	148	89	38	0.05	208 (38)	294 (25)	502 (48)	220 (24)
Tresch	8/21	411	319	99	0.74	929 (91)	1074 (43)	2002 (101)	1170 (73)

Section	Date marked	Brown trout Number of fish M	C	R	Pooled (P)	Number/ mile 6-10in	>10 in	All	Biomass /mile (lbs)
Burleigh	8/19	60	28	11	0.59 (not pooled)	0	137 (27)	137 (28)	182 (47)
Brewery	8/22	62	42	17	0.54	0	163 (25)	163 (25)	157 (26)
Tresch	8/21	157	127	48	0.93	112 (34)	448 (27)	560 (44)	446 (35)

* Extremely poor estimate based on MFWP criteria.

Appendix Table 2. Age statistics from Big Spring Creek during 1995 and 1996.

Year		AGE I	II	III	IV	V+
		Burleigh Section - rainbow trout				
1996*	Number/mile(SD)	51(23)	79(19)	125(24)	93(26)	0
	Average TL	7.2	11.9	12.8	14.3	0
1995*	Number/mile	128(44)	130(27)	106(30)	30(16)	7(8)
	Average TL	7.8	11.8	14.0	14.6	14.8
		Burleigh Section - brown trout				
1996	Number/mile	0	20(8)	64(14)	46(19)	10(8)
	Average TL	-	13.6	15.2	16.7	16.9
1995*	Number/mile	0	64(25)	72(17)	49(19)	9(4)
	Average TL		13.1	15.0	16.3	17.4
		Brewery Flats Section - rainbow trout				
1996	Number/mile	211(38)	162(2)	118(19)	12(7)	0
	Average TL	8.1	11.1	12.5	12.9	-
1995	Number/mile	401(113)	325(60)	155(37)	35(14)	6(5)
	Average TL	7.8	10.0	12.8	13.9	14.3
		Brewery Flats Section - brown trout				
1996	Number/mile	6(5)	54(17)	56(15)	48(11)	0
	Average TL	11.2	12.4	14.2	15.4	-
1995	Number/mile	44(18)	104(24)	139(26)	53(16)	7(6)
	Average TL	9.5	12.7	14.7	15.8	16.8
		Tresch Section - rainbow trout				
1996	Number/mile	1022(94)	372(45)	462(50)	93(28)	30(19)
	Average TL	8.6	11.9	13.7	15.0	15.5
1995	Number/mile	814(151)	479(63)	326(43)	147(28)	0
	Average TL	7.8	11.1	12.9	14.4	-
		Tresch Section - brown trout				
1996	Number/mile	141(36)	171(22)	229(22)	18(10)	0
	Average TL	9.5	12.2	14.3	15.7	-
1995*	Number/mile	138(35)	167(26)	102(25)	50(18)	0
	Average TL	9.0	12.5	13.9	15.2	-

* - Extremely poor estimates as determined by MFWP criteria.

Appendix Table 3. Water chemistry measurements[1] taken on Big Spring Creek.

Date	Sampling Site	Parameter	mg/l
10/07/96	Burleigh	Total ammonia	0.031
		Nitrate/nitrite	0.17
		Total Kjeldahl N	<0.1
		PO4	0.002
		Total P	0.003
10/07/96	Whites (about 2 miles below Old Carrol Trail)	Total ammonia	0.017
		Nitrate/nitrite	0.43
		Total Kjeldahl N	<0.1
		PO4	0.031
		Total P	0.034
3/20/97	Lower Hatchery	Total ammonia	0.04
		Nitrate/nitrite	0.27
		Total Kjeldahl N	<0.1
		PO4	0.036
		Total P	0.064
3/20/97	Burleigh	Total ammonia	0.05
		Nitrate/nitrite	0.37
		Total Kjeldahl N	0.2
		PO4	0.085
		Total P	0.163
3/20/97	Old Carrol Trail	Total ammonia	0.1
		Nitrate/nitrite	0.43
		Total Kjeldahl N	0.9
		PO4	0.168
		Total P	0.269

1- Lab analysis completed by Montana Department of Public Health and Human Services. Helena Montana.

Appendix Table 4. Catch statistics on 4 sections of Upper Big Spring Creek.

Section[1]	Angler hours (angler days/mile)	Kept/hour Rb	Kept/hour LL	Caught/hour Rb	Caught/hour LL	Number of Interviews
1 (Brewery)	688.5 (215)	0.07	0.04	0.41	0.04	22
2	688.5 (120)	0.12	0.12	1.26	0.50	7
3 (Burleigh)	1683 (250)	0.00	0.00	0.95	0.15	33
4	650 (97)	0.00	0.00	1.89	0.00	7
All[2]	3710 (178)	0.04	0.02	0.90	0.13	69

1 - Section 1 was completely visible from the road, section 3 was mostly visible from the road. Much of the area in sections 2 and 4 were not visible from the road so pressure probably was much higher than estimated.
2 - Combined numbers will differ from running the creel as one section due to methods of computation.