MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION
JOB PROGRESS REPORT

STATE: MONTANA PROJECT TITLE: STATEWIDE FISHERIES INVESTIGATIONS

PROJECT NO: F-46-R-3 STUDY TITLE: SURVEY AND INVENTORY OF COLDWATER STREAMS

JOB NO: I-i JOB TITLE: MID-YELLOWSTONE DRAINAGE INVESTIGATIONS

Project Period: October 31, 1988 through June 1, 1990

ABSTRACT

Trout population estimates were completed in the 7.1 mile Big Timber Section of the Yellowstone River. Brown trout populations increased 42% in number and 57% in weight from estimates made in 1986. Not enough age one fish were collected to make an estimate. Rainbow trout population estimates increased 49% in number and 72% in weight from 1986 estimates. The increase was evident in all age classes except age one, for which no estimate was made. A burbot tagged in 1982 near Columbus was recaptured near Big Timber, an upstream movement of about 45 miles.

Several days were spent electrofishing the Yellowstone River near Huntley Diversion and several miles east of Worden. Species of interest collected near Huntley included brown trout, burbot, sauger, and smallmouth bass. Fish species of interest collected east of Worden included burbot, brown trout, channel catfish, and smallmouth bass.

A rainbow trout population estimate was done in the USFS section of the Stillwater River during spring 1989. An estimated 322 rainbows age two and older were in the section. The estimate included a number of spawning fish. No brown trout estimate was made because of limited recaptures.

According to population estimates made in the Rosebud section of Rosebud Creek, brown trout (889) outnumbered rainbow trout (284) by about three to one. The Rosebud does not appear to be used much for spawning by rainbows from the Stillwater River.

Heyneman section located on the West Rosebud was electrofished for the first time in fall 1989. The section contained about 239 rainbow trout and 747 brown trout per mile. By comparison, another section located near the Forest Boundary contained 947 brown trout per mile in 1986 estimates.

Two-pass fish population estimates were conducted at two locations on Butcher Creek, a tributary to the East Rosebud. Two

neighboring Conservation Districts are sponsoring a watershed project to reduce erosion along the badly abused stream. A 1760 ft section near the mouth contained an estimated 205 brown trout, 18 rainbow trout, and 41 whitefish. A 1300 ft section located four miles upstream contained an estimated 96 brown trout and 13 whitefish.

Brown trout population estimates conducted in the B-1 section of the Boulder River during fall 1989 increased from the 581 per mile estimated in 1981 to 801 per mile. The number of young-of-year and age one fish was down when compared to earlier estimates.

Spawning surveys were conducted in the two main rainbow spawning areas located in the Boulder Drainage. A total of 337 spawning fish were counted.

Two-pass fish population estimates were completed in the B-3, B-4, and B-6 sections of the East Boulder River.

Cutthroat inventory work in cooperation with the Gallatin National Forest was continued in the Boulder drainage and several adjacent drainages. Pure-strain Yellowstone cutthroat were identified in the main Boulder above Box Canyon, South Fork of the Boulder, Placer Basin, and in Upper and Lower Deer Creeks.

TABLE OF CONTENTS

LIST OF TABLES

OBJECTIVES AND DEGREE OF ATTAINMENT

1. To maintain the region's streambanks and channels in their present or improved condition.

2. To ensure, within hydrologic constraints, that flows in streams supporting fisheries do not fall below minimums identified during the Yellowstone River instream reservation process.

3. To maintain water quality at or above 1975-85 average levels as measured at U.S. Geological Survey water quality monitoring stations.

4. To maintain fish populations and habitat in streams affected by resource development activity at levels at least as good as present status.

5. To reduce impacts on river stability and fish habitat caused by yearly maintenance at headgate structures.

6. To maintain a minimum of 123,000 angler days per year within the mid-Yellowstone drainage (state funded).

7. To redistribute fishing pressure and minimuze overcrowding through the purchase of additional access sites in key areas. (These areas include Rock Creek between Roberts and Joliet; Yellowstone River at Big Timber, between Columbus and Reedpoint, and between Columbus and Laurel; and on the East and West Rosebud drainages.

8. To maintain riparian and floodplain areas in their natural condition.

9. To complete cutthroat trout inventory in one drainage of the mid-Yellowstone reach each year beginning in 1989 (state funded).

10. To complete inventory of cutthroat trout in the three forks of the Boulder drainage, east fork 1990, west fork 1991, and Main Boulder 1992 (state funded).

11. To increase public awareness of the diversity of opportunities and hazards of water-based recreation on mid-Yellowstone (state funded).

12. To improve level of understanding among anglers regarding management policies and options, and encourage their participation in the decision-making process.

13. To protect and maintain rainbow spawning areas in the upper Stillwater River in their present condition.

14. To maintain cutthroat population numbers in Meatrack Creek at or above 1984 levels.

Progress was made on all objectives as described in this report. Cutthroat trout in Meatrack Creek were not monitored during this report period, but the sheep which were the principle source of concern have been removed from the drainage. The USFS has no immediate plans to allow further grazing in this drainage.

PROCEDURES

Streambanks and channels are protected from poorly designed projects through Montana Department of Fish, Wildlife and Parks' (MDFWP) participation in administration of the Stream Protection Act and Natural Streambed and Land Preservation Act. Information on the latest technology available on design and operation of maintenance-free permanent irrigation headgate structures are made available to local Conservation District Boards and Soil Conservation Service personnel for dispersal to irrigators. MDFWP assists in sponsoring stream dynamics workshops for riparian landowners. MDFWP participates in land and water use planning projects and encourages beneficial floodplain management practices. Comments are submitted to county commissioners through the county planning process on proposed subdivisions which have the potential to impact riparian and floodplain habitats.

Minimum instream flows determined in the Yellowstone River instream reservation process are protected through MDFWP review of new water use permit applications. Water discharge permits issued by the U. S. Environmental Protection Agency and the Montana Department of Health and Environmental Sciences are reviewed. Timber sale plans, grazing allotment management plans, environmental assessments, and environmental impact statements are also reviewed to ensure adequate protection, mitigation, and compensation for fisheries resources. MDFWP personnel assist the Big Timber Ranger District of the Gallatin National Forest with their water quality and turbidity monitoring of grazing impacts upon cutthroat trout populations in Meatrack Creek, and reviews the results yearly. MDFWP assists the Stillwater Mining Company with their sediment monitoring program of rainbow trout spawning areas and reviews the results annually. Numbers of spawning rainbow trout using these areas are counted during peak spawning and compared to previous years.

Trout population density is monitored using electrofishing methods described by Vincent (1971) in sections of the Yellowstone River, Rock Creek, the Stillwater River, Rosebud Creek, and the Boulder River. Inventory electrofishing is used on portions of the mid-Yellowstone River to gather qualitative information about fish populations. Two-pass fish population estimates as described by Leathe (1983) were used to monitor fish population density in Butcher Creek and the East Boulder River.

The first draft of the Boulder River fisheries management plan will be started following selection of a consulting firm to

undertake the project. The final draft of the Stillwater management plan is scheduled to be completed by January 14, 1991. Preferred management alternatives will be implemented to maintain desired fish population levels consistent with planning objectives as determined through public participation.

A floater's guide to the mid-Yellowstone River should be developed in cooperation with the Parks and Con-Ed Divisions. In an effort to improve access and better distribute fishing pressure, acquisition of additional access sites will be pursued at three or more locations along the main stem Yellowstone River, one location on Rock Creek, and on both the East and West Rosebud drainages.

RESULTS AND DISCUSSION

Yellowstone River

Big Timber Section

Trout population estimates were made in the 7.1 mile Big Timber section (Figure 1) of the Yellowstone River during the spring of 1989. The section begins about one half mile below the mouth of Little Timber Creek and extends downstream to one half mile below the mouth of Otter Creek. Trout population estimates were last made in the section during the spring of 1986 (Poore 1987).

Brown trout population estimates made in 1989 increased 42% in numbers and 57% in weight over estimates from 1986 (Table 1). The increase was evident in all age classes except age three fish. Not enough small fish were sampled either year to estimate age one fish. Brown trout population estimates for the Big Timber section are still only about 58% of those from 1984, but 65% of the fish from the 1984 estimate were age two fish. Considering only fish age three and older, population estimates for 1989 are 21% higher than in 1984. Younger age classes of trout were severely impacted by extended drought during 1987 and 1988. Stream flows during the period reached record lows in many Montana streams, including the Yellowstone River. Low flows affect side channels and shallow riffle habitats most severely, and these are the areas used for rearing by young trout. Low fall flows also greatly limit spawning areas available for fall-spawning species, resulting in the weak brown trout year classes observed in 1989.

Rainbow trout population estimates made in the Big Timber section during 1989 increased 49% in numbers and 72% in weight over 1986 estimates. All age classes increased from 7 to 185%, with the most significant increases in age four and older fish. Rainbow trout population estimates for the Big Timber section are about 86% of those from 1984, but 73% of the fish from the 1984 estimate were age two fish. Considering only fish age three and older, population estimates for 1989 are 118% higher than in 1984. Low river flows, which apparently adversely impacted young brown trout,

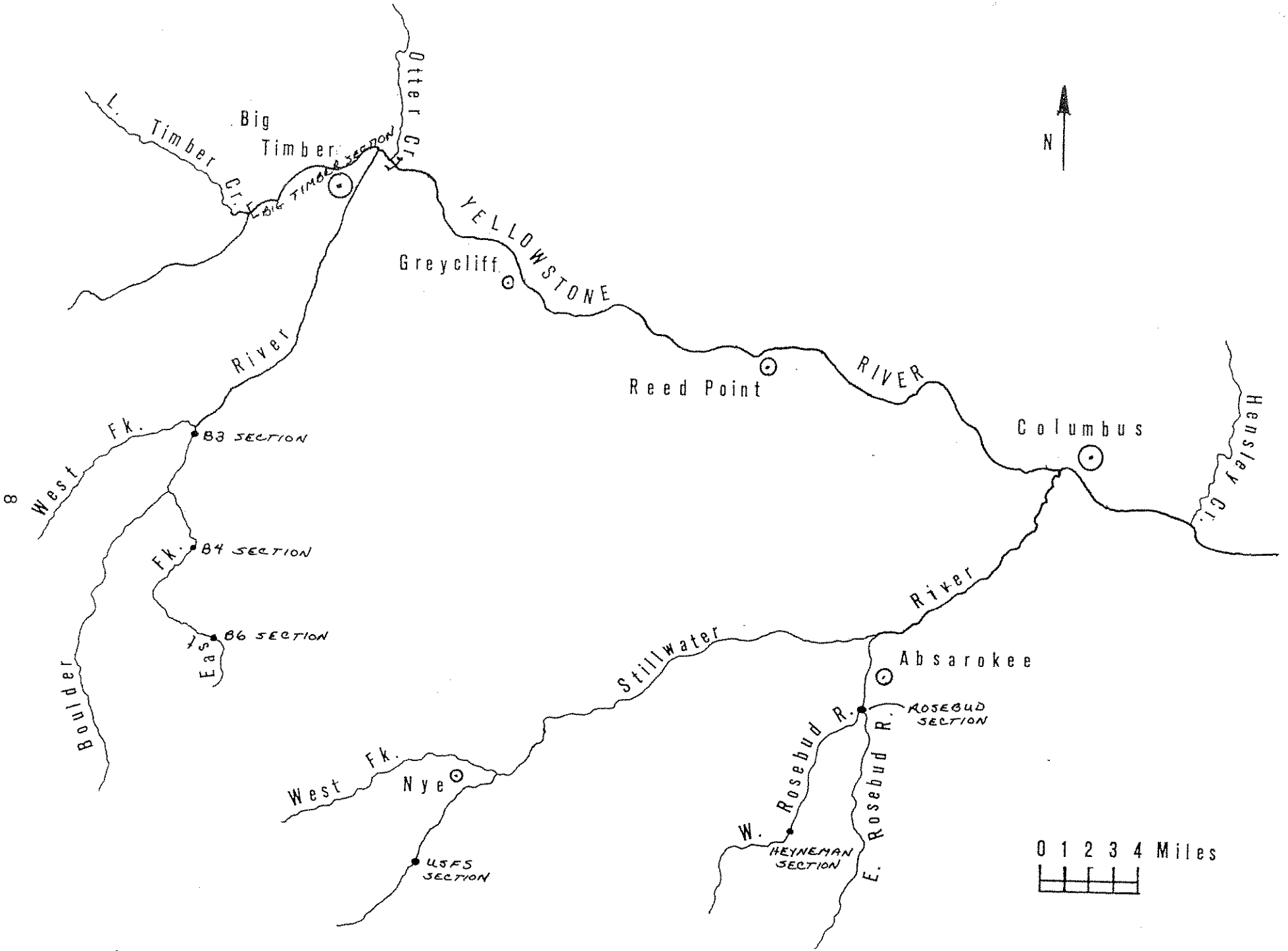

Figure 1. Sampling stations on the Yellowstone, Stillwater and Boulder River drainages.

Table 1. Fish population data collected during the spring of 1986 and 1989 from the Big Timber section of the Yellowstone River.

DATE	AGE CLASS	AVERAGE LENGTH(IN)	AVERAGE WEIGHT(LB)	NUMBER ESTIMATE	ESTIMATED NUMBER/MILE	WEIGHT EST(LB)
			BROWN TROUT			
SPRING	II	9.0	0.27	327	46	102
1986	III	11.4	0.52	427	60	218
	IV	14.5	1.12	580	82	748
	V	18.0	2.00	251	35	472
	VI+	21.0	3.06	48	7	178
			TOTAL	1633	230	1618
SPRING	II	9.7	0.33	615	87	203
1989	III	12.5	0.61	371	52	226
	IV	14.9	1.15	611	86	701
	V	17.3	1.60	450	63	722
	VI	19.8	2.41	228	32	550
	VII+	25.8	3.74	41	6	144
			TOTAL	2316	326	2546
			RAINBOW TROUT			
SPRING	II	9.2	0.30	947	133	353
1986	III	11.9	0.62	647	91	352
	IV	14.4	1.04	373	52	371
	V+	17.3	1.67	126	18	211
			TOTAL	2093	294	1287
SPRING	II	9.2	0.27	1012	143	275
1989	III	11.9	0.57	845	119	483
	IV	14.5	0.96	906	128	874
	V	16.8	1.48	276	39	408
	VI	18.5	1.98	62	9	123
	VII	20.2	2.52	16	2	40
	VIII+	22.2	3.30	5	1	17
			TOTAL	3122	441	2220

had the same impact upon young rainbow trout. Harvest by fishermen was probably not a significant factor in the decline, because harvest usually reduces older age classes (which increased during the period).

Twenty-eight yellowstone cutthroat trout were collected during the marking and recapture runs. Only two of the cutthroats were recaptures, precluding a reliable estimate. Except for five age one fish, all the cutthroats collected were age 2 and older. Swedberg (1984) concluded that the Big Timber section is probably a rearing area for cutthroat trout ages two and three. These fish apparently enter the section from upstream or from tributary streams.

Fifty-four burbot were tagged during the marking runs and 43 during the recapture runs. Two burbot tagged during the marking run were recaptured along with two fish tagged in 1986 and one tagged in 1982. One fish tagged in 1986 was recaptured near the original tagging location and had grown from 21.7 to 24.5 in and 1.83 to 2.60 lbs. Another burbot moved about five miles upstream from the original tagging location and had grown from 25.1 to 28.7 in and 3.10 to 4.71 lbs. A third burbot was tagged near Columbus in 1982 and had moved about 45 river miles upstream to the recapture location. In the seven years between mark and recapture, the fish had grown from 17.6 to 30.3 and 0.95 to 5.18 lbs.

Lower Yellowstone River

During mid-October 1989, approximately three miles of the Yellowstone River from the Huntley diversion dam to the Highway 10 bridge just north of Huntley was survey electrofished. Species collected included three brown trout 9.3 to 16.5 in, thirteen burbot 12.6 to 32.3 in, one sauger 23.9 in and two smallmouth bass 11.8 to 13.2 in. Larger (greater than 12 inches) burbot, sauger, and smallmouth bass were tagged. Other species sampled (in order of decreasing abundance) included redhorse suckers, goldeyes, white suckers, mountain suckers, longnose suckers, mountain whitefish (in spawning condition), stonecats, and emerald shiners. The silty water in and around the mouth of Pryor Creek was particularly rich in small carp, suckers, and minnow species.

Also during mid-October a five mile section of the Yellowstone River centered around the newly acquired Gritty Stone and Voyagers Rest Fishing Access Sites east of Worden was survey electrofished. Species collected included three burbot 15.5 to 26.1 in, four brown trout 9.9 to 12.9 in, three channel catfish 15.1 to 20.1 in, and one smallmouth bass 12.5 in. Burbot and smallmouth bass were tagged. Other species sampled (in order of decreasing abundance) included goldeyes, redhorse suckers, carp, white suckers, river carpsuckers, emerald shiners, mountain suckers, and longnose suckers.

Stillwater River

USFS Section

The USFS section (Figure 1) is located about one mile downstream from the Stillwater mine site and is 7,586 feet long. When the last estimate was completed in the spring of 1986, the section contained approximately 294 brown trout over five inches long. In 1986 not enough rainbow trout were collected to complete a valid estimate.

During the spring of 1989, an attempt was made to repeat population estimates in the section. Water levels rose considerably between mark and recapture runs and made sampling dangerous and inefficient. Unusually cold water temperatures caused rainbow trout spawning activity to be at least a week later than normal, and rainbows were moving more than usual. The marking and recapture runs hit the peak of rainbow spawning activity. With the exception of a few females, all the larger rainbows were ripe; some were already spawned-out by the completion of the recapture run. These problems resulted in a rainbow trout estimate based on the minimum of seven recaptures (Table 2). This first-time estimate for the section included much of the spawning population that had moved into the section. The smallest ripe male was 7.4 in and age two.

Table 2. Rainbow trout population estimate for the USFS section of the Stillwater River, spring 1989.

DATE	AGE CLASS	AVERAGE LENGTH(IN)	AVERAGE WEIGHT(LB)	NUMBER ESTIMATE	ESTIMATED NUMBER/MILE	WEIGHT EST(LB)
			RAINBOW TROUT			
SPRING 1989	II	9.8	0.34	59	41	20
	III	12.6	0.66	62	43	41
	IV	14.6	0.99	106	74	105
	V	16.3	1.42	51	36	72
	VI	17.7	1.77	32	22	57
	VII+	19.2	1.98	12	8	23
			TOTAL	322	224	317

Sampling problems made it impossible to complete a statistically reliable brown trout estimate. An estimate of 149 brown trout over five inches long is based on only three recaptures and a small sample size. It is included as an index of relative abundance for comparison with the 1986 brown trout population estimate of 294 fish over five inches long.

Rosebud Creek

Rosebud Section

Rosebud section (Figure 1) extends 6300 feet from the Smith Bridge, located just downstream from the confluence of East and West Rosebud Creeks, to the old bridge site 1.5 miles south of Absarokee. Sampling in the section began in March and April 1982 when four electrofishing runs were made to monitor migrant rainbow trout distribution (Marcuson, et al. 1982). Information collected included sampling effort; mean number of rainbow trout, brown trout, and mountain whitefish captured per 1,000 feet; percent species composition; size range; and numbers of marked and recaptured fish. The section was sampled weekly to assess numbers of new rainbow trout passing through the area, but Peterson mark-recapture population estimates were not done.

Mark-recapture population estimates were completed in the Rosebud section during April 1989. Brown trout in the section outnumber rainbow trout by about three to one (Table 3). The Rosebud does not appear to be of major importance for spawning to rainbows from the Yellowstone and Stillwater Rivers. Several rainbows handled during the marking and recapture runs had the size and appearance typical of Stillwater fish, but the majority of the rainbows appeared to be resident fish. These observations are consistent with the data collected in 1982, when only two fish tagged in the Yellowstone and Stillwater Rivers were recaptured in the Rosebud section. The majority of spawning fish travel up the main Stillwater to spawning areas near Nye.

Heyneman Section

Population estimates were completed in the Heyneman section (Figure 1) of West Rosebud Creek during early October 1989. The 4400 foot section was sampled to gather information on a portion of the West Rosebud where fisheries data was lacking. The Heynemans were working with the Montana Land Reliance to develop a conservation easement which would protect their ranch from further development. People from the Lane Reliance contacted the Department of Fish, Wildlife and Parks to obtain information on the fish and wildlife resources associated with the ranch. Since no fisheries information was available for that portion of the stream, it provided a good opportunity to complete a mark-recapture assessment of the fishery.

The Heyneman section extends from the Ingersoll Bridge to just upstream from the ranch building at the lower Heyneman Ranch. The section contains many fast riffles with a moderately steep gradient and slippery cobble-boulder substrate. Pools and deeper holding areas favored by larger fish are limited. The section provides excellent habitat for brown and rainbow trout under 13 inches with about 8% of the brown trout (total 1036 per mile) and 1% of the rainbow trout (total 308 per mile) over 13 inches (Table 4). The age structure and relative abundance of brown trout is

Table 3. Rainbow and brown trout population estimates for the Rosebud section, spring 1989.

DATE	AGE CLASS	AVERAGE LENGTH(IN)	AVERAGE WEIGHT(LB)	NUMBER ESTIMATE	ESTIMATED NUMBER/MILE	WEIGHT EST(LB)
			RAINBOW TROUT			
SPRING	I	7.0	0.12	26	22	3
1989	II	9.1	0.26	76	64	20
	III	11.4	0.47	93	78	44
	IV	13.3	0.76	66	55	50
	V	16.3	1.44	20	17	29
	VI+	18.1	2.15	3	3	6
			TOTAL	284	239	152
			BROWN TROUT			
SPRING	I	4.6	0.04	99	83	4
1989	II	7.5	0.15	261	219	38
	III	9.9	0.31	328	276	101
	IV	12.3	0.56	175	147	98
	V+	15.0	1.04	26	22	28
			TOTAL	889	747	269

Table 4. Rainbow and brown trout population estimate for Heynemans section of the West Rosebud, fall 1989.

DATE	AGE CLASS	AVERAGE LENGTH(IN)	AVERAGE WEIGHT(LB)	NUMBER ESTIMATE	ESTIMATED NUMBER/MILE	WEIGHT EST(LB)
			RAINBOW TROUT			
FALL	I	6.7	0.14	84	101	11
1989	II	9.3	0.29	124	149	36
	III	10.8	0.45	42	50	19
	IV+	12.5	0.70	7	8	5
			TOTAL	257	308	71
			BROWN TROUT			
FALL	I	6.7	0.11	367	440	40
1989	II	8.9	0.24	228	273	56
	III	10.6	0.42	150	180	63
	IV	13.5	0.81	97	116	79
	V	17.5	1.93	16	19	32
	VI+	19.2	2.60	7	8	18
			TOTAL	865	1036	288

typical of a healthy viable population. In comparison, a fall 1986 estimate of brown trout numbers near the Forest Service boundary on the West Rosebud was 947 fish per mile with 6% of the population over 13 in. Sampling in spring 1989 on the main Rosebud just downstream of the confluence of the forks provided estimates of 747 brown trout and 239 rainbows per mile with 8% of the browns and 23% of the rainbows over 13 in.

Butcher Creek

Butcher Creek, a tributary to the East Rosebud, has a long history of land abuse problems. Channel straightening, overgrazing, poor irrigation practices, and excess flow resulting from the interbasin transfer of irrigation water all contribute to a severe watershed sediment problem. Stillwater and Carbon Conservation Districts are co-sponsoring a project to inventory the watershed problems, recommend solutions, and explore potential sources of funding to solve the non-point pollution problem. Grants of $4,000 from the Water Quality Bureau and $2,500 from MDFWP provided the initial funds to get the project started. In addition, the MDFWP was asked to provide fisheries information for Butcher Creek.

During late September 1989, two-pass fish population estimates were made in two sections of Butcher Creek. The lower section, located about a quarter mile upstream from the mouth, was 1760 feet long and appeared to be extremely productive and rich in sediment tolerant macroinvertebrates (Mangum 1989). Brown trout, rainbow trout, and mountain whitefish numbers were estimated at 205 fish ranging from 3.5 to 16.5 in, 18 fish from 3.0 to 10.0 in, and 41 fish from 4.0 to 11.5 in, respectively. Also collected were 16 longnose suckers, 40 mountain suckers, 2 white suckers, and numerous longnose dace and lake chubs. Twelve brown trout between 3.5 and 4.5 in, 3 rainbow trout between 3.0 and 3.5 in, and 35 whitefish between 4.0 and 5.5 in were among the fish sampled. This abundance of small fish indicates the lower end of Butcher Creek may have some spawning habitat. These small fish could also have moved into the stream from nearby East Rosebud.

The upper section on Butcher was located about four and a half miles upstream from the mouth. This 1300 foot section was also extremely productive and rich in macroinvertebrates, but was impacted with a heavier sediment load. Several old beaver dams and low gradient reaches had bottoms covered with silt up to a foot in depth. Brown trout and whitefish numbers were estimated at 96 fish ranging from 3.5 to 14.0 in and 13 fish ranging from 8.5 to 14.0 in, respectively. Only one brown trout less than 6.5 in, and no whitefish less than 8.5 in, were taken. Spawning appears very limited throughout this portion of Butcher Creek. Longnose suckers, mountain suckers, white suckers, longnose dace, and lake chubs were all much more abundant than near the mouth of Butcher Creek. No rainbow trout were collected. An irrigation diversion about a half mile upstream from the mouth may be a barrier to upstream fish movements.

Boulder River

The Boulder Drainage has a long history of mining activity dating back to the mid-1800's. More recently, Stillwater PGM Resources Company (SWPGM) is proceeding with development of an underground platinum/palladium mine in the Stillwater Complex of the upper East Boulder drainage. SWPGM has a similar mine in operation on the east end of the Stillwater complex located fifteen miles southeast on the Stillwater River. The proposed mine in the East Boulder is even larger than the Stillwater mine and if permitted, would be the largest hardrock mine in the state, employing nearly 600 people.

SWPGM's interest in the East Boulder project generated a massive baseline environmental study directed by Beak Consultants, Inc. in 1981 and 1982. Interest and development of the East Boulder project was put on hold during the mid 1980's, but resurfaced again in 1987 with renewed vigor. In 1989 SWPGM hired Weston, Inc. to update the original baseline studies and collect additional new information. Weston, working in cooperation with the USFS, MDFW&P, and Department of State Lands, helped collect additional information and submitted an updated report in December 1989.

Because of the potential for an influx of large numbers of people into the Big Timber-Boulder River drainage area, MDFWP decided to proceed with development of a Boulder River Fisheries Management Plan. This decision temporarily shifted the work load emphasis from the mainstem Yellowstone River drainage to the Boulder River drainage. Fortunately, a lot of fisheries information was already collected in the Boulder drainage during the 1970's and 1980's. Projects in the Boulder drainage during 1989 included updating fish population data in three sections of the East Boulder and one on the main Boulder, locating and surveying spawning areas, gathering creel information, and assisting the Gallatin National Forest with cutthroat trout inventories.

B-1 Section

Fish population estimates for the 5140 foot B-1 section (Figure 1), located about three quarters of a mile upstream from the mouth of the Boulder River, were completed in early October 1989 (Table 5). An attempt was made to do a spring population estimate in the section, but it was abandoned after the river rose considerably between mark and recapture runs. In addition, a number of brown trout marked in the Boulder River were recaptured in the Yellowstone River, indicating fish were leaving the section. This movement violates a basic requirement of the Peterson mark-recapture method that fish remain and redistribute within the section between marking and recapture trips.

Table 5. Brown trout population estimates from the B-1 section of the Boulder River, fall 1989.

DATE	AGE CLASS	AVERAGE LENGTH(IN)	AVERAGE WEIGHT(LB)	NUMBER ESTIMATE	ESTIMATED NUMBER/MILE	WEIGHT EST(LB)
			BROWN TROUT			
FALL	I	5.9	0.09	114	117	9
1989	II	8.3	0.20	332	342	67
	III	11.7	0.54	200	206	107
	IV	14.7	1.12	74	76	83
	V	16.0	1.50	28	29	42
	VI	18.4	2.29	21	22	48
	VII+	21.0	3.18	9	9	27
			TOTAL	778	801	383

Too few rainbow trout were recaptured in the fall to complete an estimate. Sixty-two rainbows ranging from 5.4 to 15.3 in with a mean of 9.5 in were collected. Forty percent of the fall-sampled rainbows exceeded 10.5 in (fish three years and older). Forty-two rainbows sampled during the spring of 1989 ranged from 6.7 to 21.8 in with a mean of 14.4 in. Eighty-two percent of the spring-sampled rainbows exceeded 10.5 in. Three rainbows collected during the spring Boulder sampling were fish marked in the Big Timber section of the Yellowstone River. The increase in average size of rainbows during spring and the recaptures of marked Yellowstone River fish indicate movement of spawning fish through the section. Data collected in 1981 (Wiedenheft 1982) showed the same pattern.

In 1989, brown trout 12 inches and larger made up 57% of the spring sample and 39% of the fall sample. In 1981, browns 12 inches and larger made up 34% and 32% of spring and fall populations, respectively (Wiedenheft 1982). The low numbers of small brown trout collected plus the increase in average size of fish between 1981 and 1989 shows a decrease in the number of small browns. This probably results from several years of drought which has impacted the lower four miles of the Boulder River. Low flows block movement of spawning fish, reduce spawning areas, and limit the habitat available for rearing small fish.

Spawning Surveys

Spawning fish were counted at two locations along the Boulder River on May 5, 1989. A nine mile reach of river from the base of the Natural Bridge to the county bridge at the mouth of the East Boulder was floated in a canoe. Rainbow trout concentrated in shallow clear water over spawning sites were counted, and the spawning areas were noted on a map. Two hundred thirty-seven

rainbows were counted. The most fish counted at one location was 45, but fewer numbers of spawning fish were observed throughout the entire section wherever suitable gravels were present. This section of river has a moderate gradient with many wide, flat riffles interspersed with pools and runs. Many riffles throughout the reach contain clean gravels suitable for spawning. Suitable spawning substrate is rare in the Boulder River from the mouth of the East Boulder downstream. Resident fish from the Boulder River along with many fish from the Yellowstone River travel to the reach upstream from the mouth of the East Boulder for spawning. An attempt was made to inventory these spawning rainbows again in 1990, but high flows during the spawning period made it impossible to observe the fish.

On the same day (May 5, 1989), spawning rainbows were counted just upstream from the falls at Natural Bridge on the Aller ranch. In the first four miles above the falls, the river has a moderate gradient with wide flat riffles interspersed with runs and deep pools. Clean gravels throughout much of this reach provide some of the best spawning substrate in the Boulder Drainage. One hundred rainbows on redds were counted along a half mile section in the middle of the spawning reach. Fish were scattered throughout the reach wherever substrate, water depth, and flows were suitable. Tagging studies have shown that fish living within this reach move very little, and most spend their entire life within three or four miles of river.

East Boulder River

B-3 Section. Two-pass fish population estimates were done in B-3 section (Figure 1), located near the mouth of the East Boulder, during late August 1989. The estimated 116 brown trout per 1000 feet of stream (Table 6) were considerably lower than the 611 estimated by Wiedenheft (1982) in fall 1981 using Peterson mark-recapture estimates. Estimates made in 1981 included all fish ages 0-5+; while 1989 estimates included only fish 3 in and larger. Fifty-five percent of the 1981 estimates were age 0 fish, many of which were less than 3 in, accounting for most of the difference between estimates. Another factor influencing the estimates was the timing of the sampling. Wiedenheft's fall estimates were done in late October and November, and were probably inflated somewhat by the movement of spawning brown trout and whitefish into the lower East Boulder.

Table 6. Fish population data and two-pass estimates for three sections of the East Boulder River, fall 1989.

SECTION (LENGTH, FT)	NUMBER SAMPLED 1ST PASS	NUMBER SAMPLED 2ND PASS	NUMBER EST.* (NUMBER/1000')	SIZE RANGE IN (MEAN IN)	WEIGHT RANGE LB (MEAN LB)
			BROWN TROUT		
B-3 (1350') 8/31/89	133	21	157(116)	2.2-16.9(6.7)	0.01 1.73(0.19)
			RAINBOW TROUT		
	20	1	22(16)	2.1-10.7(6.9)	0.01-0.49(0.16)
			BROWN TROUT		
B-4 (700') 8/30/89	58	19	86(123)	2.7-16-1(7.7)	0.01-1.50(0.28)
			RAINBOW TROUT		
	22	5	28(40)	5.0-11.8(7.6)	0.04-0.58(0.20)
			BROWN TROUT		
B-6 (700')	88	15	106(151)	3.2-13.8(6.6)	0.01-0.99(0.14)
8/29/89	115	33	161(230)	2.7-10.4(6.2)	0.01-0.39(0.11)

*FISH POPULATION ESTIMATES ARE FOR FISH THREE INCHES AND LONGER.

Part of the decrease in numbers of brown trout in the lower East Boulder, however, is the result of several years of extended drought. The lower end of the East Boulder is severely dewatered by irrigation withdrawals even in good water years. A major decline in the number of small brown trout indicates spawning and recruitment problems. Low fall flows in the lower East Boulder limit access for spawning fish from the main Boulder and greatly reduce spawning habitats and nursery areas for sub-adult fish.

Rainbow trout population estimates from 1989 (16) were only down slightly from 1981 estimates (26). Rainbow trout populations in the lower East Boulder are apparently more severely impacted by the harsh environmental consequences of severe dewatering than are brown trout. Young-of-year brown trout and mountain whitefish were abundant in the shallow riffles, but only one young-of-year rainbow was sampled. During several surveys of the lower East Boulder in April, no spawning rainbows were located. Conversations with landowners living near the mouth and electrofishing data confirms that the Lower East Boulder is not very important for rainbow trout spawning; however, it appears to be used extensively by spawning brown trout and mountain whitefish.

During electrofishing in B-3, three brook trout, one rainbow x cutthroat hybrid, one cutthroat trout, and numerous mottled sculpins were also collected. Species composition for trout in

1989 was 12% rainbow, 85% brown trout, and 3% others (brook trout and cutthroat trout). Species composition in 1981 was 4% rainbow trout, 95% brown trout, and 1% brook trout.

B-4 Section. Two-pass fish population estimates were also done in the B-4 section (Figure 1), seven hundred feet of stream just upstream from the mouth of Elk Creek. The estimated 123 brown trout per 1000 feet of stream (Table 6) compares closely with the fall 1981 (Wiedenheft 1982) mark-recapture estimate of 157 brown trout. The fall 1981 number appears inflated by an influx of fall spawning browns, similar to B-3. Movement of brook trout, another fall spawning species, was also evident in B-4 during fall 1981 when ten were sampled as compared to none from spring 1982 samples. Additional evidence supporting this conclusion comes from the distribution of browns 12 inches and over between spring and fall samples, i.e. 28% during fall 1981 versus 1% during spring 1982.

The rainbow trout population estimate for fall 1989 (40) is more than double the fall 1981 estimate (17). No rainbow trout sampled in 1981, 1982, or 1989 were 12 inches or larger. Species composition for 1989 was 75% brown trout and 25% rainbow trout as compared to 1981 figures of 90% brown trout and 10% rainbow trout. Mottled sculpins were abundant throughout the section.

B-6 Section. Two-pass fish population estimates were made in the B-6 section (Figure 1) of the East Boulder River during late August 1989. Seven hundred feet of stream centered on the mouth of the Dry Fork was electrofished. Estimated brown trout numbers per 1000 ft of stream (151) exceeded mark-recapture estimates made in 1981 (89) by 70%. The largest brown trout sampled in 1981 was 11.3 in, while two browns over 13 inches were taken in 1989. Young-of-year brown trout and rainbow trout were both abundant indicating adequate reproduction.

Estimated rainbow trout populations from 1989 (230) decreased about 26% from estimates made in 1981 (311). With the increase in brown trout and the decrease in rainbow trout, total trout populations remained about the same. Species composition changed somewhat from 22% brown trout and 78% rainbow trout in 1981 to 40% brown trout and 60% rainbow trout in 1989. Age structure and relative abundance of both populations indicates good recruitment. No other fish species were collected in 1989.

Boulder River Creel Survey

The new SWPGM mine proposal for the East Boulder River would be the largest hard rock mine in the state and would employ 600 full-time people. With a projected hiring rate of 30% local people, approximately 180 employees would be local people and 420 would come from elsewhere. If the average family size of these new employees is three, we could see the influx of an additional 1260

people moving into an area with a present population of about 1600 people. This would nearly double the population and does not include the people associated with various other spin-off jobs. An increase in the number of people will put additional pressure on the rich fish and wildlife resources found in the area. It's important from a management perspective to have a reliable estimate of the pressure prior to this influx of people associated with mining development.

Weston, Inc. conducted a creel survey in the Boulder drainage during the summer of 1989 to collect baseline fishing pressure estimates for the river. The creel survey was concentrated in areas with public access, especially upstream from the Natural Bridge (the upper 30 miles of river). The lower 32 miles of river, downstream from the Natural Bridge, only received cursory coverage at two access locations. Fishermen using private land were not interviewed unless they were just leaving the area and the creel clerk knew they had been fishing. Instead, an attempt was made to include the anglers using private land through the use of a landowner survey of a few key people who own riverfront property along the main Boulder and lower East Boulder River. Information collected during the creel survey and examples of the survey forms are included in Appendix A.

Limiting the creel survey to public land and access sites and primarily to the main river above the Natural Bridge greatly influenced the results. Mail fishing pressure surveys conducted by MDFWP from 1965 through 1986 have consistently shown the 32 mile reach from the Natural Bridge to the mouth receives the heaviest fishing pressure. The average for the years from 1982 through 1986 gave 15,052 angler days in the reach below the falls and 2,719 angler days in the reach above the falls. Total fishing pressure for the Boulder has been fairly consistent through that period ranging from 17,793 to 18,841 angler days. Even though 85% of the fishing pressure has historically been concentrated downstream from the falls, only 22% (including the East Boulder) of the fishermen interviews from 1989 were from this area. Uneven distribution of sampling effort biased the results of the survey.

Preconceived limitations placed upon the scope of the creel survey from the onset limited the reliability of the information obtained. The sampling schedule and effort was inconsistent during certain periods. For example, of the 314 total anglers interviewed, 34 were checked during 5 days in May, 10 during 3 days in June, 141 during 13 days in July, 90 during 8 days in August, and 39 during 3 days in September. Sampling during late July and early August was particularly limited, with no interviews conducted during the two weeks from the 30th of July to the 11th of August (typically a period of high use). In order to collect statistically reliable data, a random sampling schedule must be adhered to. Diversion of the survey clerk from his primary job to other duties resulted in inconsistency and data gaps in the creel information.

Information gathered from the landowner survey is highly variable and inconsistent. For example, for two different landowners at the same bridge location, one reported 100 visiting anglers while the other reported 4-6 anglers. At another bridge, three different landowners reported 6, 20, and 60 visiting anglers at the same locations. This information may be correct, but it is highly variable and inconsistent. Fishing information gathered from some landowners is probably very accurate, but that gathered from others can be very inaccurate for a number of reasons. Trained surveyors must gather information directly from the users in order to assure accuracy.

As pointed out in Weston's report, creel survey information collected during 1989 showed below average fishermen use in the Boulder drainage. Part of the decline in fishing pressure was attributed to the extended period of spring runoff, rainy weather during weekends, and the implementation of 2-fish drought limits during 1989. Additional problems with the survey information resulted from preconceived limitations placed on the scope of the survey, inconsistent sampling schedules and effort, and questionable reliability of the landowner survey. Information collected from the 1989 creel survey will be very helpful in designing and implementing the complete creel survey required to provide the necessary management information that is warranted. This information should be collected as soon as possible prior to the anticipated influx of people into the area.

Cutthroat Trout Inventory

A cooperative project between the Gallatin National Forest and MDFWP to inventory cutthroat trout populations was started in 1989. A sample of 25 fish was collected from each stream where cutthroat trout were known or expected to exist and sent to the University of Montana for electrophoretic analysis (Foster and May 1990). Fish were collected at ten locations in the Boulder drainage.

Pure-strain Yellowstone cutthroat populations were identified in the main Boulder River upstream from Box Canyon, in the south fork of the Boulder, and the East Boulder from Placer Basin. Fish collected from the lower end of the East Fork of the Boulder, which were thought to be pure-strain fish, were instead Yellowstone X Westslope hybrids. Fish sampled in Bridge Creek, Meatrack Creek, Davis Creek, and the West Boulder (3 locations) were all hybrids. Pure-strain Yellowstone cutthroat populations were also confirmed in Upper and Lower Deer Creeks.

Additional streams are scheduled for sampling if funds and manpower are available. Because the only known locations of pure Yellowstone cutthroat trout in the Boulder drainage are in the very upper headwater areas, potential gold mining proposals near Independence require special considerations to protect this species of special concern.

MANAGEMENT RECOMMENDATIONS

1.) Continue to monitor the Yellowstone and Stillwater River drainages to follow the effects of drought and increased fishing pressure on fish populations.

2.) Continue to support development of a watershed project to reduce nonpoint source pollution in Butcher Creek, tribuatry to East Rosebud Creek.

3.) Continue development of the Fisheries Management Plan for the Boulder Drainage to meet the projected completion date of January 1991.

4.) Continue monitoring fish populations throughout the Boulder River Drainage in anticipation of Stillwater PGM mining development. Monitor rainbow and brown trout spawning areas in the Boulder drainage during fall 1990 and spring 1991.

5.) Coordinate with PGM to gather additional creel information in the Boulder drainage prior to mine development.

6.) Continue cutthroat inventory and assessment work in the Boulder drainage in cooperation with the USFS.

7.) Transplant pure-strain Yellowstone cutthroat from lower to upper end of Lower Deer Creek.

8.) Collect cutthroat from Placer Gulch for genetic purity testing.

LITERATURE CITED

Foster, G.M., and B.E. May. 1990. Distribution of Yellowstone and Westslope Cutthroat Trout in the Gallatin National Forest (Update). U.S. Forest Service, Gallatin National Forest, Bozeman, Montana.

Leathe, S. 1983. Specific information on two-catch fish population estimation technique. Montana Department of Fish, Wildlife and Parks internal memorandum.

Mangum, F.A. 1989. Aquatic Ecosystem Inventory for Butcher Creek and East Rosebud Creek. Annual Progress Report, Forest Service, Intermountain Region, Aquatic Ecosystem Analysis Laboratory, Brigham Young University, Provo, Utah.

Marcuson, P., P. Toennis, and M. Schollenberger. 1982. Inventory of Waters of Project Area, south central Montana Fisheries study. Montana Department of Fish, Wildlife and Parks Job Progress Report F-20-R-26, Job I-a (Supplement).

Poore, M.D. 1987. Mid-Yellowstone River Study, south central fisheries investigations. Montana Department of Fish, Wildlife and Parks. Job Progress Report F-20-R-31, Job II-a.

Swedberg, S. 1985. Mid-Yellowstone River study, south central Montana fisheries investigations. Montana Department of Fish, Wildlife and Parks Job Progress Report F-20-R-29 Job II-a.

Vincent, E.R. 1971. River electrofishing and fish population estimates. Progressive Fish Culturist 33(3):163-167.

Weston, R.F. 1989. Stillwater P.G.M. Resources East Boulder project, supplemental biological studies, final report. Roy F. Weston Inc. and Western Technology and Engineering, Inc.

Wiedenheft, W. 1982. Inventory of waters of project area, south central Montana fisheries investigations. Montana Department of Fish, Wildlife and Parks Job Progress Report F-20-R-26, Job 1-a (supplement).

Prepared by: Michiel Poore

Date: July 2, 1990

Waters referred to:

Boulder River Sec. 01	5-22-0742-01
Boulder River Sec. 02	5-22-0756-01
Boulder River Sec. 03	5-22-0770-01
Bridge Creek	5-22-0792-01
Butcher Creek	5-22-0924-01
Davis Creek	5-22-1638-01
Dry Fork	5-22-1904-01
East Boulder River	5-22-2002-01
East Fork of the Boulder	5-22-2114-01
Lower Deer Creek	5-22-3864-01
Meatrack Creek	5-22-3962-01
Rosebud Creek	5-22-5026-01
Stillwater River Sec. 02	5-22-6118-01
Upper Deer Creek	5-22-6454-01
West Boulder River	5-22-6552-01
West Rosebud Creek	5-22-6804-01
Yellowstone River Sec. 03	5-22-7000-01
Yellowstone River Sec. 07	5-22-7056-01

APPENDIX A

Survey forms and information summaries for the Weston, Inc. 1989 creel survey of the Boulder River Drainage.

ANGLER OPINION SURVEY

ID#	Mo	Day	Yr	Angler type	No. of Anglers	District	Beat	Area	Trip type	Hours Fished	comments

Rainbow Trout				
Species	Kept	RTN'D	Total	RTN'D >13"
001				

Brown Trout				
Species	Kept	RTN'D	Total	RTN'D >13"
004				

Brook Trout				
Species	Kept	RTN'D	Total	RTN'D >13"
003				

Whitefish				
Species	Kept	RTN'D	Total	RTN'D >13"
085				

Other Species				
Species	Kept	RTN'D	Total	RTN'D >8"

Species	Length	Species	Length	Species	Length	Species	Length	Species	Length	Species	Length	Species	Length	Species	Length

Species	Length	Species	Length	Species	Length	Species	Length	Species	Length	Species	Length	Species	Length	Species	Length

1. How many years have you been fishing the Boulder River Drainage? _____

2. In an average year, how many trips do you make to fish in the Boulder River Drainage? _____

3. Your seasonal fishing use of the Boulder Drainage is: (choose an answer to each question from group 1 on the response card)

   Spring (Mar.-May) _____
   Summer (June-Aug.) _____
   Fall (Sept.-Oct.) _____
   Winter (Nov.-Feb.) _____

4. In future years, do you plan to fish the Boulder?

   |___| more frequently
   |___| less frequently
   |___| about the same

   If more or less frequently, why?_____

5. There are several possible reasons for going fishing. How would you rate the importance of each of the following in your decision to fish the Boulder River Drainage today? (choose an answer for each question from group 2 on the response card)

   Be with friends or family _____
   Get out of the house _____
   Scenic value of river _____
   Fish close to home _____
   Quality of Boulder fishery _____

6. Which species of fish do you prefer to catch in the Boulder Drainage?

   a. Brown Trout (004)
   b. Rainbow Trout (001)
   c. Brook Trout (003)
   d. Cutthroat
   e. Trout - Any species
   f. Whitefish (085)
   g. Other_____

7. When you fish the Boulder River Drainage, how important is it to you to: (choose a response to each question from group 2 on the response card)

   Catch at least one fish _____
   Catch many fish _____
   Catch large (>13") fish _____
   Catch trophy (>18") fish _____
   Catch fish to eat _____
   Fish regardless to success _____

8. When you fish the Boulder Drainage, do you normally keep:

   a. No fish
   b. All fish
   c. Some fish (explain)_____

9. Since you began fishing the Boulder River Drainage, in your opinion has the fish population of the river:

   a. Improved
   b. Declined
   c. Stayed about the same
   d. Comments _____

Figure 2-3. Creel census form. FROM WESTON 1989.

10. Considering other stream fishing opportunities in Montana, is the Boulder River:

a. Your favorite stream to fish?
b. One of your favorite streams to fish?
c. Not on of your favorite streams to fish?
d. No opinion

11. What is your age? _____

12. Would you be willing to participate in a more detailed follow-up mail survey?

a. Yes b. No

If yes, Name _____
Street _____
City, State _____
Zip _____

BOULDER RIVER DRAINAGE ANGLER
OPINION SURVEY
RESPONSE CARD

GROUP 1

A. Not at all
B. Rarely (average 1 or less trips)
C. Occasionally (2-4 trips)
D. Frequently (5 or more trips)

GROUP 2

A. Extremely important
B. Very important
C. Somewhat important
D. Not very important
E. Not at all important

Figure 2-3. Continued.

BOULDER VALLEY
LANDOWNER FISHING CENSUS

NAME: _____

RESIDENCE: _____

TELEPHONE: _____

PERSONS IN HOUSEHOLD THAT FISH:____ # OF ADULTS _____
OF CHILDREN _____

AVG # OF DAYS FISHED PER PERSON DURING THE 1988 SEASON ON THE BOULDER OR ITS TRIBUTARIES: _____

AVG # OF HRS SPENT FISHING PER ANGLER PER DAY IN 1988:_____

AVG # OF FISH CAUGHT PER ANGLER PER DAY IN 1988:_____

PLEASE RECORD YOUR FAMILY'S 1989 FISHING DATA FOR THE BOULDER RIVER OR ITS TRIBUTARIES-- YEAR TO DATE

DATE	HRS/FISHED	STREAM/NAME	# FISH/CAUGHT	# FISH/KEPT	SPECIES

DO YOU ALLOW OTHER ANGLERS ACCESS TO FISHING THROUGH YOUR PROPERTY?_____

IF YES, HOW MANY ANGLERS A SEASON _____

AVG # OF HRS FISHED PER ANGLER PER DAY____

AVG # OF FISH CAUGHT PER ANGLER PER DAY_____

WHAT PERCENTAGE OF THESE ANGLERS SUBSCRIBE TO CATCH AND RELEASE____

WHAT PERCENTAGE OF THESE ANGLERS-FLYFISH____ LURE____ BAITFISH___

ON A RELATED SUBJECT, WHERE (AND DURING WHICH MONTHS) HAVE YOU SEEN BALD EAGLES IN THE BOULDER VALLEY?

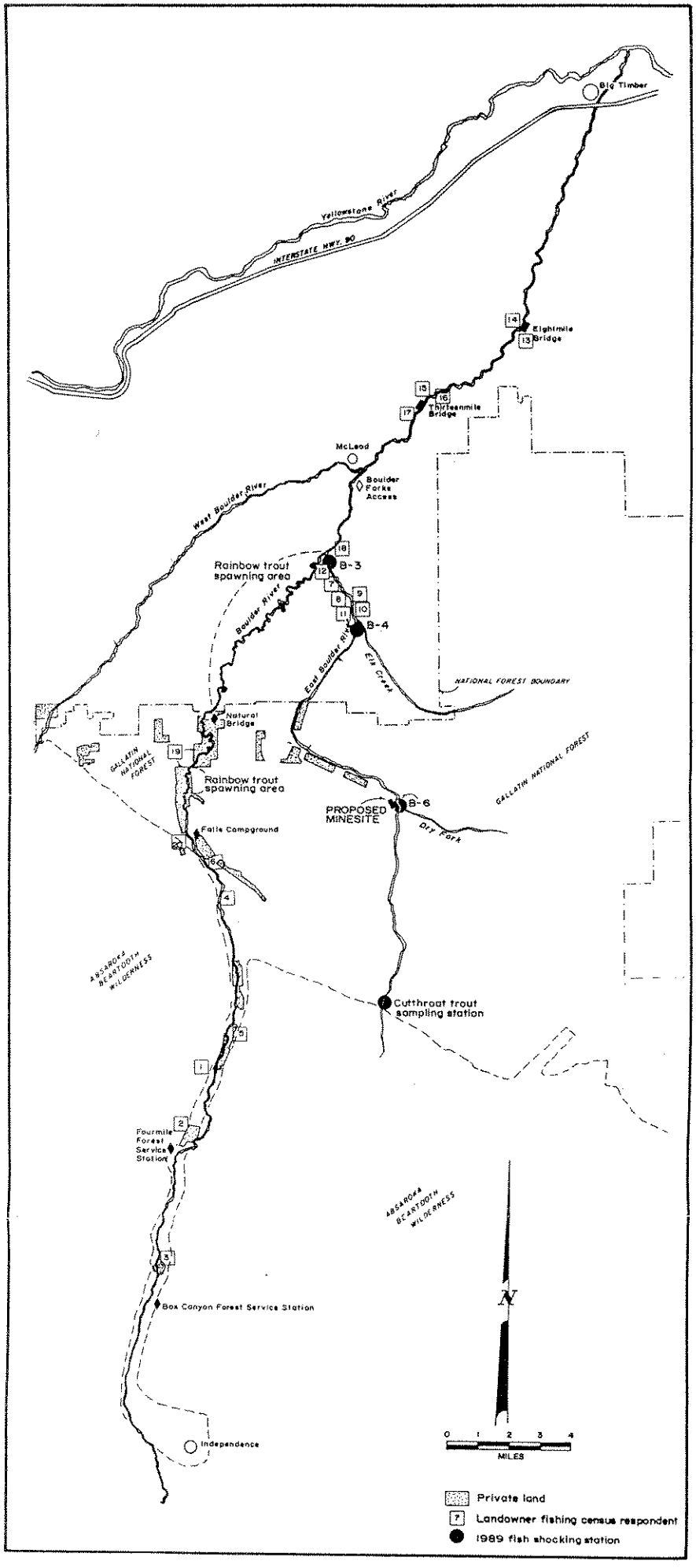

Figure 2-2. Locations of fisheries study activities. FROM WESTON 1989.

Table 2-6 [1]
Conditions of the Creel Census
Boulder River Drainage, Summer 1989

Condition	Number of Parties Queried	Day of Week	Number of Days Censused
Day of Week		Sunday	11
Sunday	36	Monday	18[a]
Monday	12	Tuesday	3
Tuesday	4	Wednesday	2
Wednesday	2	Thursday	5
Thursday	5	Friday	5
Friday	6	Saturday	10
Saturday	72		
Origin of Party			
Sweet Grass County	6		
Other Montana	98		
Out of state	23		
Mixed parties	7		
Method Used			
Flies	50		
Lures	17		
Bait	18		
More than one method	37		
Unknown	15		
Reach Fished			
1 Box Canyon to 4-mile	23		
2 4-Mile to Natural Bridge	85		
3 Below Natural Bridge	24		
4 East Boulder River	5		
More than one area	1		
Private access	3		
Trip Finished When Queried			
Finished fishing	37		
Not finished	100		

Total number of anglers, all parties	314
Average number of anglers per party	2.3
Average time fished when queried	2.2 hours
Total hours fished, all anglers	697

a. 13 half-days and 5 whole days. All others whole days.

[1] FROM WESTON 1989.

Table 2-7'
Fish Caught in the Boulder Drainage,
Summer 1989 Creel Census

Species		Number of fish per reach 1[a] MBR	2[b] MBR	3[c] MBR	4[d] EBR
Rainbow trout	kept	4	33	0	5
	returned	1	231	8	2
Brown trout	kept	0	5	5	2
	returned	0	5	17	13
Brook trout	kept	9	23	0	0
	returned	15	37	0	0
Cutthroat trout	kept	34	22	0	0
	returned	49	91	3	0
Whitefish	kept	0	0	1	0
	returned	0	0	6	0
Total fish caught		112	447	40	22
Angler-hours per reach		115	482	84	21
Fish per angler-hour		0.97	0.93	0.48	1.05

Species	Numbers of fish, by size class Total Fish	Size range <6 in.	6-10 in.	≥10 in.
Rainbow trout	218	24	151	43
Brown trout	42	0	16	26
Brook trout	63	2	60	1
Cutthroat trout	164	14	129	21
Whitefish	2	0	0	2

a. Main Boulder, Box Canyon to 4-mile
b. Main Boulder, 4-mile to Natural Bridge
c. Main Boulder, below Natural Bridge
d. East Boulder River

'FROM WESTON 1989.

Table 2-9[1]
Summary of Results, Landowner Fishing Survey

Property[a]	Type	Number of Resident Anglers	Number of Visiting Anglers[b]	Approximate Catch per Summer	Catch and Release
1	church camp	-	50	-	mostly
2	guest ranch	none	5-10	-	-
3	church camp	-	unknown	-	-
4	church camp	-	40	25	mostly
5	private home	none	numerous trespassers	-	-
6	private home	2	2-3/week	-	mostly
7	leased land	4	none	5-10	mostly
8	private home	2	6	20	-
9	private home	-	5-6	-	yes
10	private home	2	6	-	-
11	private home	none	none ask	-	-
12	private home	none	10	-	-
13	private home	1	100	-	partly
14	private home	2	4-6	60-80	yes
15	private home	none	6	-	-
16	private home	2	60	-	-
17	private home	1	20	50	partly
18	private home	none	none	none	-
19	guest ranch	3	150	>1000 rainbows	entirely
20	outfitter	3	35-40	-	mostly

a. See Figure 2-3 for property locations
b. Includes campers, guests, anglers asking permission to fish, and trespassers

[1] FROM WESTON 1989.

Table 2-8'
Angler Profile
Boulder River Drainage, Summer 1989

Question	Number of Parties	Percent of Parties
First summer on the Boulder?	33	27
Preferred species to catch from the Boulder		
brown trout	12	10
rainbow trout	21	18
brook trout	9	8
cutthroat trout	10	8
any trout	67	56
Future plans for Boulder River fishing		
more trips each year	33	28
fewer trips each year	5	4
about the same	77	67
On the Boulder, how many fish does angler normally keep?		
none	22	29
all that are caught	4	3
some	93	81
Boulder River fishing has		
improved over time	4	5
declined	45	56
stayed about the same	31	39
Rate the Boulder River		
angler's favorite river	23	19
one of favorites	67	55
not a favorite	31	26
Average number of years fished the Boulder (first year denoted by 0)	8	
Average number of trips to the Boulder each year (anglers who have fished it more than one year)	5	
Average angler age	39	

'FROM WESTON 1989.