MONTANA FISH, WILDLIFE AND PARKS
FISHERIES DIVISION

JOB PROGRESS REPORT

State:	MONTANA	**Project Title:**	STATEWIDE FISHERIES INVESTIGATION
Project No:	F-46-R-7	**Study Title:**	SURVEY AND INVENTORY OF COLDWATER STREAMS
Job. No:	I-i	**Job Title:**	MID-YELLOWSTONE DRAINAGE INVESTIGATIONS

Project Period: July 1, 1990 - June 30, 1994

ABSTRACT

We sampled trout populations in the 5.5 mile Laurel section of the Yellowstone River in 1993. Forty-two percent of the estimated 4572 rainbows in the section were yearling fish. Considering only fish two and older, estimates for 1993 are about the same as in 1987. Brown trout estimates for 1993 (1239) are intermediate between estimates for 1987 (1181) and 1988 (1476).

The rainbow trout population estimate (4789) completed in the 7.1 mile Big Timber section of the Yellowstone River in 1992, is somewhat higher than the 1989 estimate (3122). Seventy-one percent of the 1992 estimate is fish from 7.0 to 12.0 inches, which represents a significant increase in two- and three-year old fish in the section. Brown trout estimates for 1992 (1979) fall between estimates done in 1986 (1633) and 1989 (2316). Although we sampled 57 cutthroat trout, we recaptured too few to calculate an estimate.

We evaluated four spring-fed streams which enter the Yellowstone River just downstream from Big Timber for potential use by spawning fish from the main river. Because several of these streams have good spawning enhancement potential, the River Basin Studies program of the SCS selected this project in 1993 for additional funding and evaluation.

Montana Afloat, a Missoula based company, in 1993, produced a floaters guide for the mid-Yellowstone River from Big Timber to Huntley. Although development of a float guide for this portion of the river has been a priority for FWP for many years, funding was always a problem. This new guide was developed with our assistance and participation and should be a big help to prospective floaters.

Rainbow trout population estimates done in the fall of 1991 for Allers section of the Boulder River give a total estimate of 2288 fish including 252 fish over 13.0 inches. A fall 1993 snorkeling count of 212 rainbows over 13.0 compares fairly closely with the 1991 fall electrofishing estimate.

Brown trout population estimates done in B-2 section of the Boulder River in 1991 (864) are about the same as in 1988 (904). Estimates done in 1994 show a decline of 17% from 1991, but the number of browns over 13.0 inches has increased 31% since 1991 and 64% since 1988. Rainbow trout numbers increased 65% in 1991 (964) over 1988 estimates (583), but declined again in 1994 (634) by 34% from the 1991 numbers. As in the Stillwater River, the numbers of larger brown trout have increased following implementation of more restrictive fish limits on the Boulder River.

Fish population estimates done in the Moraine section of the Stillwater River in 1994 show an increase in the number of browns over 13.0 inches of 121% and 1346% over 1991 and 1987 estimates, respectively. This increase in the brown trout population is probably primarily a response to the more restrictive fish limits initiated in 1990. An estimated 222 rainbow trout are within the section.

In 1992, we sampled fish populations in a new section of the Stillwater River located near Absarokee. Seventy-one percent of the estimated 4070 rainbow trout in the 4750 foot section are fish under 10.0 inches. The brown trout estimate of 1154 fish per mile compares fairly closely with that from the Whitebird section (1081) located downstream.

Fish population estimates done in 1991 on the TO-Bar Ranch section of East Rosebud Creek show a decline of 41% in the number of brown trout age two and older from 1985 estimates. This decline is probably related to increased angling pressure as the area is being sub-divided and developed. More restrictive fishing limits effective in 1994 should help this harvest-related problem.

In 1991, we electrofished an additional section on Butcher Creek as part of a cooperative watershed enhancement project. Using the two-pass method in a 900-foot section located at the upper boundary of the project, we estimated the section held 44 brown trout, 13 brook trout, 29 longnose suckers, 71 white suckers, 32 mountain suckers and 17 lake chubs.

We conducted fish spawning surveys on the Stillwater and Boulder Rivers during the spring of 1992 and 1993. In the fall of 1993, we used a helicopter to locate brown trout spawning areas on these same two rivers.

We collected additional fisheries information and thermograph data for use in the preparation of an environmental assessment (EA) for a proposed smallmouth bass introduction into the lower Clarks

Fork River. The EA, completed in 1993 by a consultant, concluded that because of the cool water temperature, high turbidity, dewatering, and falling post-spawning water levels, the probability of a successful introduction was low.

Brown trout population estimates done in 1993 for the Fox section of Rock Creek are down 61% from 1990 following extremely high flood flows in 1992. Rainbow trout population estimates follow the same pattern and are down 46% from 1990 levels. Particularly hard hit were the small fish from both species, with age classes two and three declining the most.

Fish population estimates done in 1990 for a new section of Rock Creek located near Joliet show a brown trout population of 307 fish per mile. Eighty-one percent of these fish are over 10.0 inches and these browns exhibit better growth rates than fish from other sections of Rock Creek. We also found a few rainbow trout (5) and numerous whitefish.

We sampled fish populations in Slough Creek and Buffalo Fork in 1991 and 1992. Overharvest of larger rainbow trout appeared to be a problem in Buffalo Fork, so the more restrictive wilderness limit of three fish (none over 12.0 inches) was adopted for the 1994-95 fishing season. The standard stream limit was maintained on Slough Creek within the Absaroka-Beartooth Wilderness.

We collected additional baseline fisheries data from streams near Cooke City which may be further impacted by the gold mine proposed by the Noranda Company from Canada. Because of its location in this environmentally sensitive area, the project is highly controversial. We made two-pass fish population estimates in Soda Butte Creek, the upper Clarks Fork River and Lady of the Lake Creek.

We continued to inventory Yellowstone cutthroat trout within the Boulder drainage. We found purestrain cutthroat in six streams and, except for the population in the headwaters of the East Boulder River, all were located in the upper headwaters of the main Boulder. We also found purestrain cutthroat in the headwaters of Upper Deer Creek, Lower Deer Creek, and Placer Gulch. To enhance the current population, we moved cutthroat upstream from a barrier falls on Lower Deer Creek. We found no cutthroat in Bridger Creek, Trout Creek, or any of their tributaries.

Yellowstone cutthroat trout from the headwaters of Bad Canyon Creek were identified as purestrain. An interagency team completed an enhancement project which involved installation of a fish barrier and removal of brown trout from upstream of the barrier. We transplanted additional cutthroat collected from the upper East Boulder into the headwaters of Bad Canyon Creek. We also found cutthroat trout in the headwaters of Iron Creek.

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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 minimize 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

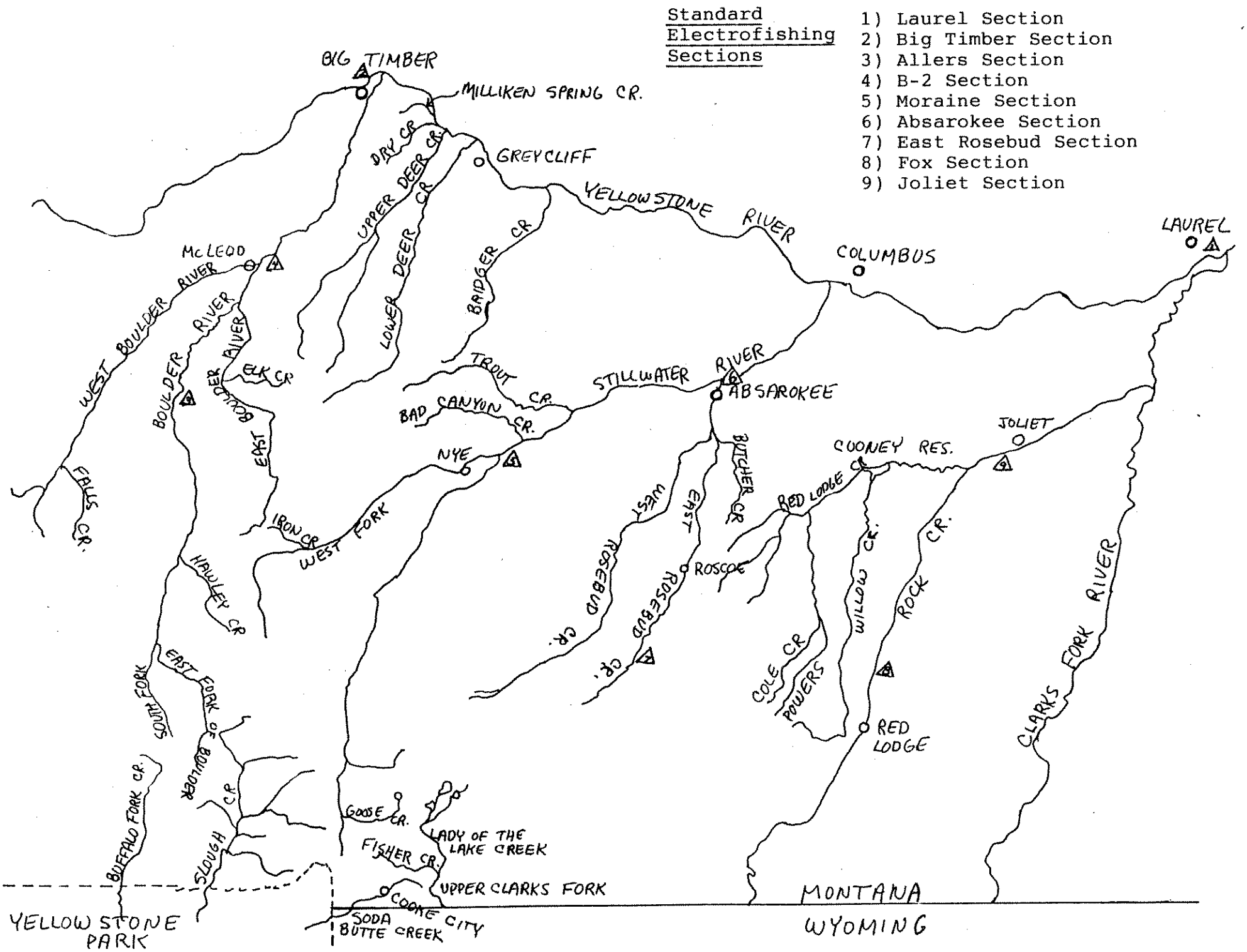
Streambanks and channels are protected from poorly designed projects through Montana Fish, Wildlife and Parks' (FWP) participation in administration of the Stream Protection Act and Natural Streambed and Land Preservation Act. Information on the latest technology available on design and operation of maintenance-free permanent irrigation headgate structures are made available to local Conservation District boards and Soil Conservation Service personnel for dispersal to irrigators. FWP assists in sponsoring stream dynamics workshops for riparian landowners. FWP 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 FWP review of new water use permit applications. Water discharge permits 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. FWP assists the Stillwater Mining Company with their sediment monitoring program of rainbow trout spawning areas and reviews the results annually. We count numbers of spawning rainbow trout using these areas during peak spawning and compare them to previous years.

Using electrofishing methods described by Vincent (1971), we monitor trout population density in sections of the Yellowstone River, Rock Creek, the Stillwater River, Rosebud Creek, and the Boulder River (Figure 1). We use inventory electrofishing on portions of the mid-Yellowstone River to gather qualitative information about fish populations. We use two-pass fish population estimates as described by Leathe (1983) to monitor fish population density in Butcher Creek, Soda Butte Creek and the Upper Clarks Fork River. We used dry suits and snorkeling equipment while counting trout within Allers section of the Boulder River. We used backpack electrofishing equipment for the cutthroat inventory sampling, and hook and line to sample fish in Slough Creek and Buffalo Fork Creek.

We calculated fish population estimates using the new MR4 log-likelihood method. Because the new method gives a more reliable estimate of the number of small and large fish when compared to the old Peterson method, the new MR4 estimates are not directly comparable to our prior estimates. For several fish population estimates where both the sample size and number of recaptures were small, we used the modified Peterson method. (These estimates are noted in the text.)

FIGURE 1. STUDY AREA



In an effort to improve access and better distribute fishing pressure, we are pursuing acquisition of additional access sites at three or more locations along the main stem Yellowstone and on both the East and West Rosebud Drainages. We purchased a new access site in 1993 on Rock Creek near Joliet.

RESULTS AND DISCUSSION

Yellowstone River

Laurel Section

The Laurel section (Figure 1) extends for about 29,040 feet from Buffalo Mirage Fishing Access Site to the Laurel Bridge. Laurel section ends about two miles upstream from the confluence of the Clarks Fork River. In 1993, fall flows in the Yellowstone River were still moderately high following above average flows throughout the entire summer. These high flows were the result of record amounts of spring and early summer rainfall. Higher flows and off-color water resulted in decreased sampling efficiency. In 1993, recapture rates, which were about 10% in 1987 and 1988, declined to 7.5%.

Rainbow trout population estimates in 1993 (4572, Table 1) are higher than those from 1987 (2716) and 1988 (3856). Forty-two percent of the 1993 estimate is yearling fish, whereas, the estimates from 1987 and 1988 are only for fish two and older. The large increase in yearling rainbows in 1993 can probably be attributed to the new log-likelihood program plus the mass displacement of yearling fish into the section from upstream caused by higher than normal spring and summer flows. If we disregard the yearling fish and consider only fish two and older, the 1993 estimate is about the same as that from 1987. Fall flows for 1987 and 1993 were more similar than those for 1988 which were at record lows following several years of drought (Poore 1988). As with previous estimates from this section, annual variability in age class makes it difficult to follow an age class cohort from year to year. This problem is further compounded by limited reproduction and extensive fish movements.

Brown trout population estimates in 1993 (1239) are intermediate between estimates from 1987 (1181) and 1988 (1476). Estimates for all three years are for fish age two and older. In 1993, 56% of the estimate was composed of age two fish as compared to 32% in 1987 and 30% in 1988. As in previous years, very few yearling fish were sampled. The low numbers of small fish plus the yearly variability between age classes indicate very limited reproduction and significant movement of brown trout to and from this section. Population characteristics for both brown and rainbow trout inhabiting the Laurel section indicate spawning and rearing of small fish occurs elsewhere in the river system.

Higher fall flows and reduced water clarity in 1993 made it impossible to sample enough burbot to make a population estimate. In addition, we used only straight DC current in 1993, which is less harmful to trout, but not nearly as effective for sampling burbot. In 1993, we captured only 12 burbot, whereas, in 1987 we took 176 with 21 recaptures and 180 with 20 recaptures in 1988. Even without a formal estimate, burbot numbers have clearly declined.

TABLE 1. Fish population data collected during the fall of 1993 from the Laurel section of the Yellowstone River.

DATE & SPECIES	AGE CLASS	AVERAGE LENGTH (IN)	AVERAGE WEIGHT (LB)	NUMBER ESTIMATE	ESTIMATED NUMBER/MILE	WEIGHT ESTIMATE (LB)
SEPTEMBER	1	6.85	0.13	1941	353	245
1993	2	8.09	0.21	1648	300	346
RAINBOW	3	10.74	0.46	143	26	65
TROUT	4	11.87	0.60	373	68	224
	5	13.30	0.84	314	57	263
	6 & older	15.03	1.17	153	28	179
			TOTALS	4572	832	1322
SEPTEMBER	2	8.38	0.21	691	126	148
1993	3	10.16	0.37	125	23	46
BROWN	4	12.14	0.61	69	13	42
TROUT	5	14.09	1.01	192	35	194
	6 & older	14.47	1.08	162	29	176
			TOTALS	1239	226	606

Big Timber Section

The 7.1 mile Big Timber section (Figure 1) of the Yellowstone River 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. We attempted a spring 1992 estimate, and the marking portion of the Peterson estimate was completed. Spring river flows were relatively low and declining. Before we could complete the recapture portion of the estimate, the river dropped to the point we could no longer negotiate the section with our river electrofishing boat. The spring estimate was abandoned and the section was rescheduled for the fall of 1992.

Because of faulty age data, which resulted when some scales collected during spring sampling were inadvertently mixed with fall scale samples, we made no age class population estimates. Therefore, we report estimates for both brown and rainbow trout (Table 2) by inch size classes.

Rainbow trout population estimates for 1992 include fish from 4.0 to 21.1 inches. We found only five fish under 5.0 inches and six fish over 19.0 inches. Seventy-one percent (3394) of the rainbow estimate (4782) are fish 7.0 to 12.0 inches and 42% (2023) are fish from the 8.0 to 10.0 inch group. The total rainbow trout

estimate of 4782 fish is somewhat higher than estimates of 2093 from 1986 and 3122 from 1989. Because we used two different methods to calculate these estimates, the numbers are not directly comparable, but they do indicate a significant increase in two- and three-year old rainbow trout within the section.

Brown trout population estimates for 1992 include fish from 6.0 to 23.9 inches. The 1992 estimated number of brown trout (1979) falls midway between estimates done in 1986 (1633) and 1989 (2316). Both the 1986 and 1989 estimates are for fish age two and older. Because no reliable age data is available for 1992 and the log-likelihood method was used to calculate the estimate, the numbers are not directly comparable. Numbers indicate, however, that no major changes have occurred in the brown trout population within the section since 1989.

In the section we also sampled 57 Yellowstone cutthroat trout ranging in length from 6.4 - 15.6 inches. With only three cutthroat recaptures, we were unable to make a statistically valid population estimate. In addition, we sampled 48 burbot ranging in length from 13.8 - 29.4 inches. Most of these burbot were tagged with individually numbered tags; however, with only two recaptures, we were unable to make a burbot population estimate.

Interviews with fishing guides who fish the mid-Yellowstone area, above and below Big Timber, confirmed that fishing was quite good in spite of the abnormally high flows. Several also commented that they were catching more Yellowstone cutthroat than usual in the river downstream from Big Timber. Our 1992 total estimated rainbow and brown populations per mile of 953 trout is the highest we have measured over the past ten years.

TABLE 2. Fish population data collected during the fall of 1992 from the Big Timber section of the Yellowstone River.

DATE	FISH SPECIES	SIZE CLASS	NUMBER ESTIMATE	ESTIMATED NUMBER/MILE	WEIGHT ESTIMATE (LB)
OCTOBER	RAINBOW	4.00-5.99	287	40	18
1992	TROUT	6.00-7.99	532	75	84
		8.00-9.99	2023	285	585
		10.00-11.99	912	128	429
		12.00-13.99	347	49	280
		14.00-15.99	297	42	369
		16.00-21.99	384	54	750
		TOTALS	4782	673	2515
OCTOBER	BROWN	6.00-7.49	12	2	1
1992	TROUT	7.50-8.99	118	17	27
		9.00-10.49	486	68	164
		10.50-11.99	424	60	209
		12.00-13.49	178	25	129
		13.50-14.99	114	16	116
		15.00-16.49	90	13	124
		16.50-17.99	83	12	164
		18.00-23.99	474	67	1306
		TOTALS	1979	280	2240

Spring Creeks

In September 1989, at the request of a local fishing guide who spends considerable time fishing the Yellowstone River between Big Timber and Greycliff, we floated the river to look at several spring creeks which enter from the south along this reach. This stretch was one of his favorite areas to fish, and he felt the abundance of fish might be related to spawning use of these spring creeks by fish from the main Yellowstone River. In addition, tagging studies have shown the Boulder River, which also enters in this reach, is heavily used for spawning by both rainbow and brown trout from the Yellowstone River.

We proposed exploring the potential for enhancing the spawning use of these small tributary streams along this reach of the river. In 1993, the Soil Conservation Service (SCS) selected this proposed Yellowstone River Spring Development project as one of two projects in Montana for funding through their Cooperative River Basin Study program. Funding was approved for fiscal year 1994.

The upland adjacent to the Boulder River comprises 11,000 irrigated acres served by a system of six ditches tapping the lower Boulder River. The wide alluvial fan at the mouth of the Boulder and the adjacent area downstream is highly permeable glacial till and outwash material. Much of this irrigation water plus additional flow from the Boulder River and Upper and Lower Deer Creeks goes underground and resurfaces as spring flows in the bottomland along the Yellowstone River. Several areas along the bottomland have developed into cattail marshes and ponds connected by spring creeks which eventually flow to the river. Following the irrigation season when ditches are closed down, flow in some of these spring creeks drops significantly.

Thompson Spring Creek. Thompson spring Creek enters the Yellowstone River about a mile and a half downstream from the mouth of the Boulder River (T1N R15E S18AA). This spring creek appeared to have adequate flow, but a fish barrier blocks the mouth where it enters the river. During a follow-up visit in April 1994, when flows were at their lowest, we found very little water in this stream. Flows in this spring creek are apparently highly dependent on irrigation return water, and the fisheries potential is limited during much of the year.

Milliken Spring Creek. The stream formed at the outlet from Milliken Sloughs has a relatively good year-round flow and also the most potential for fish spawning enhancement. An advantage associated with this spring creek is that high flows are moderated and sediment is filtered out as the water passes through the Milliken Slough marsh complex. The stream also flows directly into the river with no barriers to fish passage at its mouth. Another advantage is that the new landowner controls the entire project area and has expressed interest in the proposed project. This spring creek enters the Yellowstone River about a mile and a half upstream from the mouth of Upper Deer Creek (T1N R15E S27BB). In November 1990, we electrofished about 800 feet from the mouth upstream. We collected 12 brown trout from 4.2 to 14.6 inches and three rainbow trout from 6.2 to 11.6 inches. We also sampled hundreds of small (3 to 6 inches) mountain whitefish, a few lake chubs and white suckers, and numerous sculpins.

In March of 1994, this spring creek complex was inspected by representatives from the River Basin Studies team who agreed that it has excellent potential for spawning development. Unfortunately, the entire area from the sloughs to the river has been badly

overgrazed for many years. The banks are eroding, the stream channel is wide and shallow, and the gravels are badly clogged with fine silts and sands. The SCS representatives felt that a major improvement could be accomplished in three or four years simply by fencing the stream banks on both sides, planting willows and allowing nature to heal the area. A grazing management plan would be required for future protection. They felt that over time a small amount of stream channel manipulation may eventually be required, but that it would probably be minimal.

Dry Creek. Dry Creek is a small stream that enters the Yellowstone River about a half mile downstream from the outlet of Milliken Slough. Some fish use it, but flows are highly dependent on irrigation return water. During the peak of the irrigation season, the creek may carry 15 to 20 cfs, but when the ditches are shut down, the flow drops to almost nothing. In March 1994, where Dry Creek crosses under Interstate 90 near its mouth, it flowed only a small trickle of water.

In November 1990, with flows declining but still between 3 and 5 cfs, we electrofished about 1000 feet of stream from the Interstate to the mouth. We sampled 17 rainbow trout from 4.2 to 11.7 inches, 17 brown trout from 3.8 to 11.5 inches, and 12 whitefish from 4.3 to 13.7 inches. Sculpins were also numerous. These fish near the mouth of Dry Creek either came upstream from the Yellowstone River, or moved downstream from the irrigation system ditches as flows began dropping. A rancher along lower Dry Creek commented that when flows were good in the fall, he had observed large brown trout (14 to 18 inches) in the stream at spawning time.

In mid-April 1991, we surveyed the stream for spawning rainbows. Flows were very low, less than 1 cfs, and fish were probably unable to move from the Yellowstone River into Dry Creek. We observed no fish nor redds. Fish present in the stream during the fall of 1990 had probably moved back into the river as flows dropped following the irrigation season.

The lower end of Dry Creek has fairly good fish habitat with some adequate bank cover, aquatic vegetation, and good spawning gravels along with adequate riffle-pool development. If flows could be enhanced during the off-irrigation period, the lower end of the stream could support both spawning and resident fish. The stream is already used by a surprising number of fish considering the variability of existing flows.

Upper Deer Creek. Upper Deer Creek (Figure 1), which is also discussed later in this report in connection with our cutthroat inventory work, is utilized along its lower end by fish from the Yellowstone River. Although the stream has good flows in its headwaters, it often dries up along 3 to 4 miles in the middle. It

resurfaces again as spring flow and always has some water in the lower half mile to the river. This spring is located between the interstate highway bridge and the old frontage road. Upper Deer Creek has a large drainage area and can carry flows of 2000 to 3000 cfs during runoff or major storms. Flood flows have even threatened the interstate bridge and the adjacent railroad bridge. High flows often move a tremendous amount of bed load which is deposited in the alluvial fan adjacent to the Yellowstone River and all along the lower stream channel. The stream channel is wide with pools that are shallow and widely spaced, and has a tendency to split and braid across the alluvial fan at the mouth.

These stream channel morphology characteristics make survival difficult for fish in the lower end of the stream. Fish have difficulty moving in and out of the lower end from the river. Once in the stream, the scarcity of pools, the shallow water, and the lack of cover make them vulnerable to many environmental hazards.

In spite of all the problems, a considerable number of fish utilize the lower end of Upper Deer Creek. In November 1991, we electrofished approximately 450 feet near the interstate bridge, and found 17 brown trout from 3.6 to 16.2 inches. Ten of these browns were over 13 inches including several gravid females along with some spawned-out fish. We also sampled 2 small rainbows (7.9 and 8.9 inches), hundreds of small whitefish from 4.3 to 5.8 inches, sculpins, lake chubs and white suckers. Most of the trout came from the only deep hole in this section.

We also visually surveyed for spawning fish on April 5 and 15 of 1991. On April 5, we counted approximately 50 fish, most of which appeared to be 8 to 11 inch rainbows, along with several larger 15 to 18 inch browns in the same deep hole. Flows were so low (1-2 cfs) that fish were probably not able to move upstream from the Yellowstone. On April 15, following a storm which dropped nearly two inches of precipitation (snow and rain), flows in the stream had increased to around 10 to 12 cfs. We observed no spawning fish or redds because visibility was poor in the turbid water. During March 1994, while inspecting the steam with SCS personnel, we observed approximately fifty 6 to 12 inch rainbow and brown trout scattered throughout the stream from the interstate to the Yellowstone River. Stream flow was low (1 to 2 cfs) and fish were isolated in shallow holes from 6 to 18 inches deep.

Apparently fish move into Upper Deer Creek from the Yellowstone River when flows are adequate, but they become stranded in the few remaining shallow holes as the water drops. There is already some limited spawning use in the lower end by rainbows and brown trout along with whitefish. Along its lower half mile, Upper Deer Creek contains abundant clean spawning gravels. Factors which limit fish use of this stream include the braided channel and steep gradient where it enters the Yellowstone River and the lack of deep pools and holding areas.

Upper Deer Creek is to be included as part of the feasibility study by the River Basin Study Team. Preliminary indications are that installing structures able to withstand the large flood flows and bed load movement characteristic of Upper Deer Creek would be difficult and costly.

Float Guide

For many years, FWP has recognized the importance of developing a floaters guide for the mid-Yellowstone River. Of particular concern was the danger to floaters posed by irrigation diversion structures. These concrete structures, whether across a side channel of the river or blocking the entire river (Huntley Diversion), at certain flows can be deadly to the unwary floater. Other water hazards such as sweepers (overhanging trees), rapids and strong currents, can also be dangerous. We submitted requests many times to fund the development of a guide for floaters, but other projects have always had a higher priority.

In early 1993, a Missoula-based company, Montana Afloat, expressed an interest in producing a floaters guide for the mid-Yellowstone from Big Timber to Huntley. The firm has produced float guides for rivers all over Montana. We assisted Montana Afloat with the development of the river guide by supplying information, touring the river while pointing out hazardous areas, identifying points of interest and reviewing the preliminary draft for content and accuracy. This new float guide not only provides a detailed map with important information on river hazards and access points, but also includes historical information, rules of the river, hydrography, and other items of interest to floaters. The finished product is now available, and to those who use it, should help provide a safer, informative and more enjoyable float down this portion of the Yellowstone River.

Boulder River

Allers Section

Allers section, located about two miles upstream from the natural falls (Figure 1) is 5,236 feet long. The section is located within the boundaries of a guest ranch where fishing is primarily restricted to catch and release. Moderate gradient with wide, flat, slow riffles connecting runs and deep holes characterizes the section. The section is an important spawning area for rainbow trout because it is one of the few areas in the upper Boulder where the gradient and substrate are ideal for spawning.

Previously, we sampled fish populations in Allers section during early spring at about the time rainbow trout were

congregated in the area for spawning. Length-frequency distributions plotted for rainbows in the section at this time of year are bimodal (Poore 1988). The graph shows a peak on the lower end of fish from 3.5 to 6.5 inches and another peak at the upper end of fish from 13.0 to 17.0 inches with very few fish from 6.5 to 13.0 inches. Information from tags placed in 399 large rainbows shows very limited upstream movement from these fish. Large fish using spawning areas within Allers section are resident fish from the first three to four river miles above the falls at Natural Bridge.

Because of potential injury problems associated with electrofishing large spawning rainbows, and possible affects of electricity upon incubating eggs that has been reported from other studies, we electrofished Allers section in fall 1991. The total estimate of 2,288 fish includes all rainbows over 4.0 inches long (Table 3). The fall estimate of 273 fish over 13.0 inches is a great deal less than the spring estimates of 562 for 1987 and 956 for 1988. The fall estimate represents the large resident fish actually living year-round within the section, whereas, the spring estimates measure the mature spawning population associated with three or four miles of river that only move into the section to spawn.

On October 5, 1993, we counted fish in Allers section using snorkeling equipment. Counting conditions were ideal with low crystal-clear water and bright, calm sunny weather. We were confident that, given the ideal conditions, the count, particularly of fish larger than 13 inches, was fairly reliable. We counted 212 rainbows over 13 inches, and 145 between 5 and 13 inches. Small fish were much harder to count because of their smaller size and often close association with the rocky substrate, overhanging banks, logs and brush. Although done in different years, the fall electrofishing estimate of 273 rainbows over 13 inches compares fairly closely with the snorkeling count of 212 fish and probably represents a fairly reliable average for the resident population of larger fish living within the section.

The management goal from the Boulder River Management Plan for this river reach to maintain approximately 1,500 age one and older trout per mile and at least 500 13-inch and larger trout per mile, is met for small fish but not for larger fish. Heavy fishing pressure and harvest of large fish from this popular area undoubtedly reduced the number of fish over 13-inches prior to the initiation of catch-and-release regulations now in effect for this portion of the river. We anticipate it will take several years for the number of large fish to again reach the carrying capacity within this section. As explained above, 500 13-inch and larger fish is based on inflated spring estimates from 1987 and 1988, and the resident population may stabilize at a lower number under the catch-and-release only restriction.

TABLE 3. Fish population data collected in the fall of 1991 from the Allers section of the Boulder River.

DATE & SPECIES	AGE CLASS	AVERAGE LENGTH (IN)	AVERAGE WEIGHT (LB)	NUMBER ESTIMATE	ESTIMATED NUMBER/MILE	WEIGHT ESTIMATE (LB)
OCTOBER	1	5.23	0.06	1596	1608	89
1991	2	8.09	0.18	163	164	30
RAINBOW	3	12.28	0.78	256	258	200
TROUT	4	14.74	1.22	117	118	143
	5	17.21	1.78	39	39	69
	6 & older	18.52	2.09	117	118	245
			TOTALS	2288	2305	776

B-2 Section

The B-2 section is 6,040 feet long and is located approximately 8 miles downstream from the natural bridge near the mouth of the West Boulder River (Figure 1). The section has a steep-to-moderate gradient with wide, fast riffles, and large rocks and boulders creating numerous pockets of holding water. Pools and runs are widely spaced.

Comparing only brown trout age two and older from 1991 samples (Table 4), total estimated numbers (864) are about the same (904) as the last estimate done in 1988 (Poore 1988). In 1991, there were fewer fish in each age class two through five, but more large fish age six and older.

We sampled fish populations again in B-2 during the spring of 1994. Because age data for these estimates is not yet available, population statistics by length groups are used for comparison (Table 4). Although total estimated brown trout numbers decreased 17% from 1991, the number of fish over 13.0 inches increased 31% since 1991 and 64% since 1988. Most of the observed decline was in fish from 6.0 to 10.9 inches.

The 1991 estimate (Table 4) for rainbow trout age two and older increased noticeably (964) over the 1988 estimate (583). Rainbow trout from age classes five and six increased 121% (i.e. 240 in 1988 versus 530 in 1991). Estimates for the remaining age classes were about the same for both years. The estimate of 705 fish from 11.0 to 19.0 inches is based on only three recaptures of 61 marked fish from that group. This estimate for these larger rainbows is somewhat inflated because many of these larger rainbows

are only moving through the section enroute to upstream spawning areas, and they are seldom recaptured.

The 1994 rainbow trout population estimates from B-2 (Table 4) declined 34% when compared to 1991, but they are based on better data. Estimates from 1991, as explained above, are somewhat inflated and are based on only eight recaptures (7%) from 109 marked rainbows. Population estimates from 1994 are based on 39 recaptures (22%) from 174 marked fish, and the recaptures were well distributed throughout the size classes.

Brown and rainbow trout populations in B-2 section have shown erratic fluctuations for many years. Population fluctuations are probably the result of variable spawning success and recruitment as they relate to lower than average fall flows over the past several years. Flow fluctuations have been particularly variable within the East and West Boulder Rivers, tributaries located close to the B-2 section. The extent of movements, interchange, seasonal use, and spawning inter-relationships between fish from the main Boulder and these major tributaries, is not obvious. Another factor relates to accelerated predation on small trout from the increasing numbers of larger brown trout inhabiting the section. As in the Stillwater River, the numbers of larger brown trout have increased following implementation of more restrictive fish limits, i.e, two trout, only one of which can be over 13.0 inches.

Management goals from the Boulder River Management Plan for this river reach call for maintaining 400 resident age one and older rainbow trout and approximately 1,100 age one and older brown trout per mile (1,500 total trout). As explained above, fish populations in B-2 have fluctuated erratically over many years. Although the ratio of browns to rainbows from the last two estimates has recently shifted somewhat toward rainbows, the total number of trout within the section has not changed significantly; i.e. 1,589 in 1991 and 1,201 in 1994. Although the 1994 total estimate is lower, the numbers of larger rainbow and brown trout increased significantly. Fish populations have responded positively under the new fish limits intended to protect more of the large fish,and these large fish have reduced the number of small fish through predation.

STILLWATER RIVER FISH SAMPLING

In 1992, as part of an ongoing cooperative effort by the Montana Department of Fish, Wildlife and Parks and the United State Forest Service, trout populations were sampled in several locations in the Stillwater Drainage. This project was directed toward gathering baseline fisheries information for the New World Project. Previous sampling in 1974 and 1990 in the headwaters of the Stillwater River failed to take any fish. The still unanswered question was, at what point did fish inhabit the river. To help answer this question, we sampled the Stillwater River at the confluence of Goose Creek, since we knew Goose Creek contained trout.

On September 1, 1992, with the help of Scott Schuler from the USFS, we electrofished the lower 500' of Goose Creek down to the Stillwater, 500' of the Stillwater River about one quarter mile downstream from its confluence with Goose Creak, and 500' of the Stillwater River from the mouth of Goose Creek upstream. Fish populations were sampled with a battery operated back-pack shocking unit (Smith-Root Model 12). Two electrofishing passes were made through the Goose Creek and lower Stillwater sections and fish populations were estimated using the "two-pass estimate" technique. Since the stream in the upper Stillwater section was small and shallow, only one pass was made through this section. The results of sampling in these three sections are summarized in the following table.

STREAM NAME & LOCATION	SECTION LENGTH	FISH SPECIES	NUMBER	EST. POP.	AVG. LENGTH (in)	REMARKS
Goose Creek T8SR14ES33BAC	500'	Eb Ct	22 10	23 10	8.2" 9.0"	Moderate number of invertebrates present. Cobble-Boulder substrate
Stillwater River T8SR14ES33BBB	500'	Eb Ct	28 7	29 8	7.7" 8.6"	Moderate number of invertebrates present Boulder-Cobble substrate
Stillwater River T8SR14ES33BDB	500'	Eb Ct	4 2	- -	6.9" 11.6"	Bed rock - Boulder-Cobble substrate. Fine precipitate on bottom. Few invertebrates present. One 16.2" Ct was extremely thin

From where the Stillwater River leaves the long open meadow (downstream approximately one mile from where FS road 212 crosses) to the confluence of Goose Creek, the river drops over 500 feet in the lower half mile. It flows through a steep narrow canyon and over several falls which are barriers to upstream fish movement. The most downstream barrier falls, approximately 10 feet high, is located about 200 yards upstream from the confluence of Goose Creek. Several brook trout were observed in the deep plunge pool at the base of the falls. This falls appears to be the most upstream limit of fish distribution in the mainstem Stillwater River. Although habitat, which appears suitable for fish, exists upstream from these barriers, apparently no fish have ever been introduced.

TABLE 4. Fish population data collected during the spring of 1991 and 1994 on the B-2 section of the Boulder River.

DATE & SPECIES	AGE CLASS	SIZE CLASS	AVERAGE LENGTH (IN)	AVERAGE WEIGHT (LB)	NUMBER ESTIMATE	ESTIMATED NUMBER/MILE	WEIGHT ESTIMATE (LB)
APRIL	1	-	6.52	0.09	228	198	21
1991	2	-	9.50	0.29	249	217	72
BROWN	3	-	12.13	0.59	130	113	76
TROUT	4	-	13.83	0.85	128	111	109
	5	-	15.37	1.13	116	101	131
	6 & Older		16.77	1.47	13	11	19
				TOTALS	864	751	428
APRIL	2	-	6.43	0.08	151	131	12
1991	3	-	8.46	0.21	90	78	19
RAINBOW	4	-	13.86	0.95	123	107	116
TROUT	5	-	14.45	1.04	278	242	289
	6	-	15.53	1.32	252	219	333
	7 & Older	-	18.00	2.00	70	61	140
				TOTAL	964	838	909
MARCH	-	4.00-4.99	-	0.03	12	10	1
1994	-	5.00-5.99	-	0.05	116	101	6
BROWN	-	6.00-6.99	-	0.09	47	41	4
TROUT	-	7.00-7.99	-	0.13	35	30	5
	-	8.00-8.99	-	0.20	21	18	4
	-	9.00-9.99	-	0.28	38	33	11
	-	10.00-10.99	-	0.38	28	24	11
	-	11.00-11.99	-	0.50	41	36	21
	-	12.00-12.99	-	0.64	48	42	31
	-	13.00-13.99	-	0.84	90	78	75
	-	14.00-14.99	-	0.98	129	112	127
	-	15.00-15.99	-	1.18	102	89	121
	-	16.00-16.99	-	1.38	29	25	40
	-	17.00-17.99	-	1.68	12	10	20
				TOTALS	748	649	473

TABLE 4. Fish population data collected during the spring of 1991 and 1994 on the B-2 section of the Boulder River. (Cont)

DATE & SPECIES	AGE CLASS	SIZE CLASS	AVERAGE LENGTH (IN)	AVERAGE WEIGHT (LB)	NUMBER ESTIMATE	ESTIMATED NUMBER/MILE	WEIGHT ESTIMATE (LB)
MARCH	-	4.00-5.99	-	0.05	87	76	21
1994	-	6.00-7.99	-	0.10	103	90	72
RAINBOW	-	8.00-9.99	-	0.25	33	29	76
TROUT	-	10.00-11.99	-	0.45	74	64	109
	-	12.00-13.99	-	0.74	114	99	131
	-	14.00-19.99	-	1.26	223	194	19
				TOTALS	634	552	423

Stillwater River

Moraine Section

The 3,300 foot Moraine section (Figure 1) is located 2.7 miles below the mouth of the West Fork of the Stillwater River and about 8 miles downstream from the Stillwater Mining Complex. Moraine is located within a Fish, Wildlife, and Parks (FWP) Fishing Access Site and, consequently, receives relatively heavy fishing pressure. The Moraine section is one of several long-term fish population monitoring sites located along the Stillwater.

The 1991 total estimated number of brown trout (1376) for the section (Table 5) consists of 803 (58%) yearling fish and is based on no recaptures from within this age group. Even though we marked 37 of these fish during the marking run and 44 during the recapture run, we recaptured none. If we remove this group from the estimate and consider only fish age two and older, the estimate of 573 brown trout is fairly close to our last estimate of 458 fish made in 1987. Considering only fish age four and older, numbers increased about 86% (from 93 in 1987 to 173 by 1991).

We ran another population estimate (Table 5) was done in the spring of 1994. As in 1991, although we marked 36 browns from the yearling age group and handled 30 more during the recapture run, we took no recaptures from this group. If we exclude this yearling group and consider only fish age two and older, the 1994 estimate is 40% higher than in 1991 and 75% more than the 1987 estimate. In 1994, estimated numbers of brown trout over 13.0 inches increased 121% and 1346% over 1991 and 1987, respectively.

This increase in the number of larger browns in the Moraine section corresponds closely with the implementation of more restrictive fishing regulations in 1990. The trout limit was reduced from five fish with one over 18 inches to two fish with only one larger than 13 inches in possession.

We obtained no estimate for rainbow trout in 1991 because of the low number of recaptures. We sampled 95 rainbows during the mark and recapture runs but only one marked fish was recaptured. During the April sampling of 31 rainbows larger than 12 inches, 19 were ripe males with some as small as 5.9 inches.

In 1994, we recaptured five rainbows from 54 marked fish. Because this data did not provide a valid log-likelihood estimate, we applied a modified Peterson estimate instead. The Peterson estimate for rainbow trout in the section was 222 fish ranging in length from 2.0 to 18.9 inches. Although this estimate is not very statistically reliable, we include it to give a relative number for rainbows in the section. Of 54 rainbows over 12.0 inches sampled, 16 were ripe males.

During spring electrofishing in Moraine, we always sample a number of large rainbows migrating to spawning areas located further up the Stillwater River near Nye. Because these fish are only passing through the section, they are seldom recaptured. Moraine is a rearing area for small rainbows, the majority of which apparently leave the section prior to reaching maturity.

Management objectives from the Stillwater River Management Plan for this river reach call for maintaining 1,000 to 1,500 age one and older brown trout per mile, with 100 to 150 of these fish over 13 inches. The latest estimate for 1994 of 300 browns over 13 inches and 2,392 total browns per mile exceeds our goal for this species and probably reflects a positive response to the implementation of more restrictive fish limits in 1990. The management plan also calls for maintaining 200 to 400 age one and older rainbow trout per mile and protecting larger rainbow trout during spawning. This management goal is also met with an estimated 355 rainbows per mile and the more restrictive regulations protecting the spawning rainbows.

TABLE 5. Fish population data collected from Moraine section of the Stillwater River during the spring of 1991 and 1994. (No age data available yet for 1994 estimate)

DATE & SPECIES	AGE CLASS	SIZE CLASS	AVERAGE LENGTH (IN)	AVERAGE WEIGHT (LB)	NUMBER ESTIMATE	ESTIMATED NUMBER/MILE	WEIGHT ESTIMATE (LB)
APRIL	1	-	3.95	0.03	803	1285	24
1991	2	-	7.26	0.15	299	478	44
BROWN	3	-	10.60	0.41	100	160	41
TROUT	4	-	12.54	0.64	118	189	76
	5	-	14.47	1.01	54	86	2
	6 & Older		14.83	1.08	2	3	2
				TOTALS	1376	2201	241
MARCH	-	3.00-3.99	-	0.02	466	746	8
1994	-	4.00-4.99	-	0.04	51	82	2
BROWN	-	5.00-5.99	-	0.06	177	283	11
TROUT	-	6.00-6.99	-	0.11	340	544	31
	-	7.00-7.99	-	0.13	83	133	11
	-	8.00-8.99	-	0.02	25	40	5
	-	9.00-9.99	-	0.29	24	38	7
	-	10.00-10.99	-	0.39	51	82	20
	-	11.00-11.99	-	0.50	36	58	18
	-	12.00-12.99	-	0.63	54	86	34
	-	13.00-13.99	-	0.78	87	139	68
	-	14.00-14.99	-	0.96	54	86	52
	-	15.00-17.99	-	1.28	47	75	60
				TOTALS	1495	2392	327

Absarokee Section

We established a new long-term fish population monitoring section near Absarokee, and electrofished it during the fall of 1992. We selected the 4750 foot Absarokee section (Figure 1) to replace the 16,900 foot Whitebird section located several miles downstream. Whitebird section has always been difficult to electrofish because of its remoteness (it requires a long float into and out of the section), length, steep gradient and slippery,

rocky substrate. In addition, it usually takes nearly a month to complete mark-recapture fish population estimates within this section. The new Absarokee section begins at the confluence of the Stillwater River and Rosebud Creek and extends downstream about a mile to the "Old Iron Bridge." The Absarokee section receives considerably more fishing pressure than Whitebird. A county road parallels the river and numerous ranches and cabins are located along the river corridor.

Rainbow trout population estimates for the section (Table 6) seem inflated when compared to what we actually observed while conducting the electrofishing surveys. Small rainbow trout (fish smaller than 10 inches) may have been moving from the section between our marking and recapture runs. The estimate of 3370 fish between 5.0 and 10.0 inches is based on only four recaptures (3%) of 147 marked fish. The movement of marked fish from the section between the marking and recapture runs would explain the somewhat inflated estimate of fish in these smaller size classes. The estimates for fish in the larger size classes, fish from 10 to 18 inches, are much better. The estimate of 700 fish is based on 23 recaptures (25%) of 90 marked fish, and the recaptures are well distributed throughout the larger size classes.

Brown trout population estimates for the section are more statistically reliable than those for rainbow trout. We excluded age zero fish and fish older than age five from the estimate, because we recaptured no fish in these groups. Although not directly comparable, because of the two different methods of estimation utilized, total brown trout numbers from the Whitebird section in 1988 (1081 per mile) are close to those from the Absarokee section (1154 per mile).

Extensive fish population work on the Stillwater River over the past twenty years has shown that the river upstream from the confluence of the Rosebud does not support a very large resident rainbow population (Poore 1988). Although the upper river is heavily used for spawning by rainbows, at some point most of the offspring from these fish move back into the lower Stillwater and Yellowstone Rivers when they reach a certain size or age. This latest population work in the Absarokee section indicates this movement of small rainbows may take place in the fall as days shorten and water temperatures start to drop. Additional sampling is required to confirm the timing and extent of this rainbow trout movement within the Stillwater system.

Management goals from the Stillwater River Management Plan for this river reach call for maintaining 500 to 1,000 age one and older brown trout per mile, with 100 to 150 of these fish over 13 inches. The plan also calls for maintaining 2,000 to 2,500 age one and older rainbow trout per mile with 150 to 200 of these fish over 13 inches. Population estimates (Table 6) for both species in this section fall within or exceed the parameters outlined in the management plan.

TABLE 6. Fish population data collected during the fall of 1992 from the Absarokee section of the Stillwater River.

DATE & SPECIES	AGE CLASS	AVERAGE LENGTH (IN)	AVERAGE WEIGHT (LB)	NUMBER ESTIMATE	ESTIMATED NUMBER/MILE	WEIGHT ESTIMATE (LB)
OCTOBER	1	6.61	0.11	2659	2925	282
1992	2	8.33	0.21	706	777	150
RAINBOW	3	11.22	0.51	506	557	257
TROUT	4	13.76	0.93	117	129	109
	5	15.35	1.25	60	66	75
	6 & older	15.49	1.28	22	24	28
			TOTALS	4070	4478	901
OCTOBER	1	7.32	0.14	145	160	20
1992	2	8.34	0.20	425	468	85
BROWN	3	10.88	0.43	311	342	132
TROUT	4	12.77	0.73	145	160	105
	5	14.87	1.17	16	18	19
	6 & older	14.87	1.17	8	9	9
			TOTALS	1050	1157	370

East Rosebud Creek

East Rosebud Creek originates high in the Absaroka-Beartooth Wilderness and flows northward to its confluence with the West Rosebud several miles south of Absarokee. East and West Rosebud Creeks are major tributaries to the Stillwater River. The TO-Bar electrofishing section (Figure 1) of the East Rosebud is located near the Forest boundary in the rolling hills where the stream leaves the steep Beartooth Mountain face. The area is one of the more picturesque locations in Montana and for that reason has become an increasingly popular area for summer cabins and retirement homes. Several hundred acres along the stream bottom have been sub- divided, and each year more development takes place (two homeowner associations representing approximately 100 property owners have been formed). The East Rosebud area also contains several wilderness trailheads, USFS campgrounds, and many additional cabins located on private lands along the stream corridor and around East Rosebud Lake.

Recreation use and fishing pressure has increased significantly with the growing influx of people. In 1991, people began expressing concerns about what they perceived was a decline in the East Rosebud fishery. In the fall of 1991, we completed fish population estimates within the 8200 foot TO-Bar section (Table 7). Because the 1991 estimates are based on the new MR4 program, the numbers of small fish, those ages zero and one, are not comparable with those from the 1985 estimates (Poore 1985). Considering only older brown trout, aged 2 and older, the numbers declined about 41% from 1985 to 1991. The brown trout population of fish over 5.0 inches in length per mile was estimated at 669 in 1991 (827 in 1985). Of these fish, 99 (15%) were fish 13.0 inches or over. We estimated the total number of brown trout from 2.5 to 21.0 inches at 2428 per mile in 1991. Eighty-six percent of these fish were from age class one.

In 1991, we estimated rainbow trout at 86 fish per mile using a modified Peterson method. Because of the low number of recaptures (9) and their distribution, we were unable to use the log-likelihood method. The estimate was for rainbows 2.5 to 10.0 inches long. We sampled seventy-five rainbows during the mark and recapture runs, including nine fish between 9.0 and 13.5 inches. Because we recaptured none of these larger fish, we excluded this group from the actual estimate. In 1985, we collected 35 rainbows with only three fish larger than 9.0 inches, and too few recaptures for an estimate. We also sampled eight brook trout in 1991.

Numbers of larger brown trout declined noticeably (41%) between 1985 and 1991. The decline in larger fish suggests the problem is related to angling pressure and harvest which normally selectively affects this group. The lack of quality bank cover, increased erosion of undercut banks resulting from heavy livestock grazing and clear water make the larger fish particularly vulnerable to angling pressure. Because the stream is not very productive, the population of larger fish is slow to recover. In response to the decline in the numbers of larger highly predatory brown trout, rainbow trout numbers, particularly small fish, have increased.

Now that the problem has been recognized there is a concerted effort underway by concerned anglers and landowners to restore the area and improve the fishery. First, the new fishing regulations for 1994-95 have a more restrictive limit of two fish with only one over 13 inches. Second, private landowners who control access to much of the stream are promoting a voluntary "catch and release" only for the stream. Third, the landowners are organizing and exploring options to better control livestock grazing along the riparian area and to improve fish habitat along the stream. Implementation of these various management changes should have definite positive future benefits for the East Rosebud fishery.

TABLE 7. Fish population data collected during the fall of 1991 from the TO-BAR Ranch section of East Rosebud Creek.

DATE & SPECIES	AGE CLASS	AVERAGE LENGTH (IN)	AVERAGE WEIGHT (LB)	NUMBER ESTIMATE	ESTIMATED NUMBER/MILE	WEIGHT ESTIMATE (LB)
SEPTEMBER	1	4.16	0.04	2083	1344	77
1991	2	8.23	0.19	150	97	29
BROWN	3	12.33	0.66	57	37	38
TROUT	4	14.42	1.07	51	33	54
	5	17.59	1.95	49	32	95
	6 & older	18.18	2.14	38	25	82
			TOTALS	2428	1568	375
SEPTEMBER	1	4.89	0.05	60	39	3
1991	2	5.87	0.08	64	41	5
RAINBOW	3	10.23	0.38	3	2	1
TROUT*	4	12.72	0.77	6	4	5
			TOTALS	133	86	14

*Rainbow trout estimates are based upon a modified Peterson program because of the low number of recaptures and their distribution.

Butcher Creek. Butcher Creek (Figure 1), a tributary to East Rosebud Creek, has a long history of land abuse problems (Poore 1990). A cooperative watershed enhancement project jointly sponsored by the Carbon and Stillwater Conservation Districts has procured more than $417,000 in federal and state money for projects designed to reduce pollution. Funding comes from the Department of Health and Environmental Sciences, Montana Fish, Wildlife and Parks (FWP), and the Soil Conservation Service. Funds have gone toward developing off-stream water sources for livestock, improving irrigation systems, improving fish passage, planting willows, installing riprap to stabilize banks, fencing, lengthening the stream channel, and restoring meanders. The project involves private lands and, therefore, is voluntary and based on landowner cooperation. Landowner participation has been sporadic, particularly along the upper reach of the stream that is within Carbon County. Although landowner participation has been somewhat limited, the improvements made so far should help to reduce the sediment load carried by the steam.

In addition to providing funding for the project, the FWP was asked to provide baseline fisheries information for Butcher Creek.

In 1991, we added a fish population monitoring section to the two original sections done in 1989. On October 15, 1991, we make a two-pass fish population estimate for all species in a 900 foot section beginning at the culvert where Montana highway 78 crosses Butcher Creek, about three miles southeast of Roscoe. This location marks the upstream boundary of the Butcher Creek watershed project. We estimated trout numbers in this section at 44 brown trout from 6.4 - 16.8 inches in length, and 13 brook trout from 6.2 - 12.6 inches long. Other fish population estimates for this section included 19 longnose suckers (5.0-10.1 in), 71 white suckers (3.5-12.2 in), 32 mountain suckers (3.7-6.8 in), and 17 lake chubs (3.8-5.2 in).

Future plans include fish population monitoring in these same sections to determine whether fish populations show a positive response to anticipated improvements in water quality. With fish passage improvements completed on two irrigation structures, fish from the East Rosebud should have much better access to lower Butcher Creek.

Spawning Surveys

In 1992, we counted spawning rainbow trout within traditional spawning areas near Nye on the upper Stillwater River (Figure 1). We counted over seven days spaced from March 25 to May 5 when river flows were finally too high to continue. Fish numbers increased steadily and peaked at 66 fish on March 24 when water temperatures were around 49°F. We counted 7 rainbows in the same area on April 27, 1993, but were hampered by high turbid flows and an unusually cold water temperature of 37°F. Unstable flows and major water temperature fluctuations made it nearly impossible to get additional spawning counts at Nye during the spring of 1993.

On April 27, 1992 and April 20, 1993 we attempted to count spawning rainbows upstream and downstream from the Natural Bridge on the Boulder River. High turbid water and windy conditions made it impossible to get accurate fish counts. In 1993, we also attempted to locate spawning rainbows in Elk Creek, a small tributary to the East Boulder River. Someone had reported seeing a number of spawning fish in Elk Creek in the spring of 1992. In spite of good conditions for observation, we found none in April 1993.

On October 26, 1993, we used a helicopter to locate brown trout redds along the Stillwater and Boulder Rivers. Brad Shepard (personal communication) had successfully used a helicopter the previous fall to locate redds on the Yellowstone River around Livingston. We flew the Stillwater River from the mouth to the Beartooth Mountain face near Nye. We found no redds downstream from the confluence of the Rosebud but counted sixteen from the confluence upstream to Keogh's Bridge. We observed no redds upstream from Keogh's Bridge. Most of the brown trout redds were

located in the small gravel pocket areas behind mid-stream boulders.

On the same day, we flew the Boulder River for redds from the Natural Bridge to the mouth of the East Boulder River. By the time the helicopter reached the east Boulder, the wind had come up and clouds had increased, which greatly decreased visibility. We counted 25 redds throughout the riffle areas of this river reach. Brown trout redds in this section were located in the same places used by rainbows in the spring (Poore 1990). In some instances, we found the redds of both species within several feet of each other.

The helicopter worked well for locating spawning areas, particularly because so much area can be covered so rapidly. If a clear, calm, sunny day can be selected along with the usual fall low flow clear water conditions, a helicopter can be used to gather a lot of valuable spawning information in a short time. The biggest problem is scheduling the flight when the required weather conditions can be matched with peak spawning activity.

Clarks Fork of the Yellowstone River

Smallmouth Bass EA

The Clarks Fork River (Figure 1) originates high in the Beartooth Mountains along the Montana-Wyoming border. It leaves Montana east of Cooke City, flows through the northwestern corner of Wyoming and then re-enters Montana about 15 miles southeast of Red Lodge. From that point, it flows northward for about 70 miles to its confluence with the Yellowstone River near Laurel. The upper 30 miles of river in Montana has a whitefish trout fishery, but the lower 40 miles has only a limited population of desirable game fish species. In an attempt to establish an improved recreational fishery, the FWP proposed to introduce smallmouth bass into the lower river. Because this is a new species in the drainage, Montana law required the preparation of an Environmental Assessment (EA) to evaluate the proposed introduction. We hired a consultant to prepare the required EA.

Fisheries information available for the lower Clarks Fork was limited, so during 1992 and 1993, we collected additional fisheries data needed to prepare the EA. In April 1992, we electrofished a four mile section of river from Silesia Bridge (approximately seven miles upstream from the mouth) downstream. The river was relatively high and turbid. We found 12 burbot ranging from 11.5 to 27.9 inches along with two brown trout 11.2 and 12.7 inches, one rainbow trout 13.8 inches and one sauger 19.7 inches. Other species sampled listed in order of their relative abundance included redhorse suckers, mountain whitefish, longnose suckers, carp, white suckers, flathead chubs, goldeyes, longnose dace, river carpsuckers, stonecats and mountain suckers.

In March of 1993, we electrofished a three mile section from the bridge at Fromberg downstream. Game fish species sampled included 21 brown trout ranging from 5.4 to 17.8 inches, two rainbow trout 6.1 and 10.3 inches, two burbot 17.1 and 20.2 inches, and a 10.7 inch cutthroat trout. Other species sampled included mountain whitefish, redhorse suckers, white suckers, longnose suckers, longnose dace, mountain suckers, river carpsuckers, carp, and lake chubs. We also thought we observed, but were unable to capture, a bass.

This additional electrofishing information helped confirm what we concluded from electrofishing surveys done in 1983 and 1984 (Swedberg 1984); i.e. that the lower Clarks Fork River contains only a small number of game fish available for recreational fishermen. In addition to gathering fisheries information, we monitored water temperatures from 1990 to 1993 using a thermograph installed at RM 33.7 during the ice-free periods.

In the EA which was completed in August 1993, Thomas (1993) concluded that, based on the available information, the probability of success for the proposed smallmouth bass introduction was low. She felt that when you consider the combined effects of cool water temperatures, high turbidity, dewatering, and falling water levels post-spawning, that smallmouth would probably not provide the objective of increasing the fishing opportunities in the lower Clarks Fork River.

Rock Creek

Fox Section. Water shortages in Rock Creek are so severe that the entire drainage has been temporarily closed to any additional new water appropriations. Many of the earliest water rights for Rock creek are for diversions located around Red Lodge. Much of the water diverted from this area ends up in the Clarks Fork drainage via an interbasin transfer system. Rock Creek, from Red Lodge downstream to the confluence of Red Lodge Creek, a distance of approximately 20 miles, often has major water shortages especially during summer and early fall. The Fox section (Figure 1) is located within this heavily impacted portion, approximately seven miles downstream from Red Lodge.

Red Lodge Creek, a major tributary to Rock Creek, carries irrigation water stored in Cooney Reservoir to irrigators who use most of that water along the lower seven miles of Rock Creek. The lower two to three miles of Rock Creek go dry most summers during the irrigation season. For fish living in Rock Creek, their growth and chances for survival are closely linked to where they are found along the stream corridor during the low flow periods, and whether they are able to move to areas with better flows.

USGS flow records indicate spring and late fall flows in Rock Creek, prior to and following the irrigation season, are

historically adequate during the rainbow and brown trout spawning times. Most years, spawning and recruitment appear adequate to sustain the fishery at a moderate level.

We surveyed fish populations in the Fox section of Rock Creek during April of 1990 (Figure 1). Because these trout estimates (Table 8) are based on the new log-likelihood method, the estimated numbers of small fish are not comparable with previous estimates from the section. Considering only brown trout two and older, the total population in 1990 (683) is about the same as it was in 1987 (725). Numbers of fish four and older increased 60% over 1987 estimates, whereas two and three-year-old fish decreased 21% during the period. In 1990, 50% of the population was over 10.0 inches with only one fish over 16.0 inches.

Rainbow trout numbers within the section increased slightly from 82 in 1987 to 104 in 1990. Age two fish decreased about 20% while fish age three and older increased 94%. We sampled too few brook trout (12) and mountain whitefish to make an estimate. We found tiger trout, which is a hybrid cross between a brook trout and a brown trout, during both the marking and recapture runs. Mottled sculpins and longnose dace were abundant throughout the section.

We again surveyed fish populations in the Fox section during April 1993. High flows in 1992 which followed heavy June rains caused extensive erosion and movement of bedload throughout Rock Creek. Numerous locations that had been holes and runs in 1990, when the Fox section was last electrofished, were now riffles, and several riffle areas were now holes and runs. In places, highwater had downcut the channel four to five feet, redistributing thousands of yards of rocks, sands and gravels throughout the section.

Flood waters and shifting bedload disrupted fish populations within the Fox section. Estimated brown trout numbers in the section (Table 8) declined 61% from 1990 estimates. Particularly hard hit were the smaller fish, with the number of fish from age classes two and three down 78% from 1990 estimates. Fish over 10.0 inches made up 62% of the population and 11 fish over 16.0 inches were taken while electrofishing.

The same pattern was evident in rainbow trout population estimates from 1993, with total estimates down 46%, and smaller rainbows (ages two and three) down 74% from 1990. Because the rainbow population was so small, we also estimated the population using the modified Peterson method; the two estimates calculated by the two separate methods only differed by one fish. We also ran a Peterson estimate of 30 mountain whitefish in the section. Only two of the 27 total whitefish sampled were less than 13.7 inches long. In 1993, we found seven brook trout compared to 12 in 1990. In general, populations of all fish checked in 1993 were down roughly 50% from estimates last made in 1990, and smaller fish of all species were hit particularly hard.

TABLE 8. Fish population data collected in the spring of 1990 and 1993 from the Fox section of Rock Creek.

DATE & SPECIES	AGE CLASS	AVERAGE LENGTH (IN)	AVERAGE WEIGHT (LB)	NUMBER ESTIMATE	ESTIMATED NUMBER/MILE	WEIGHT ESTIMATE (LB)
APRIL	2	5.02	0.06	362	398	21
1990	3	9.05	0.26	76	84	20
BROWN	4	11.35	0.50	155	170	77
TROUT	5	13.07	0.75	83	91	62
	6 & older	14.63	1.00	7	8	7
			TOTALS	683	751	187
APRIL	2	6.21	0.09	38	42	3
1990	3	8.97	0.28	40	44	11
RAINBOW	4	11.26	0.52	16	18	8
TROUT	5	12.26	0.69	10	11	7
			TOTALS	104	115	29
APRIL	2	6.75	0.11	78	86	8
1993	3	9.26	0.26	43	47	11
BROWN	4	11.35	0.48	45	50	21
TROUT	5	13.52	0.81	47	52	38
	6 & Older	15.39	1.17	52	57	61
			TOTALS	265	292	139
APRIL	2	5.21	0.05	17	19	1
1993	3	8.97	0.25	3	3	1
RAINBOW	4	12.32	0.67	23	25	16
TROUT	5	13.20	1.76	11	12	8
	6 & older	14.6	1.16	3	3	4
			TOTALS	57	62	30

Joliet Section. In April 1990, we electrofished a new section of Rock Creek near Joliet (Figure 1). This section extends from the highway 212 bridge located a mile southwest of Joliet downstream for about 5300 feet. The upper end of the section is

the new "Black Diamond" Fishing Access Site purchased in 1993. We lacked fisheries information from lower Rock Creek and wanted a section downstream from the mouth of Red Lodge Creek, which is the largest tributary to lower Rock Creek. In addition to increased water availability, the Joliet section has a higher sediment load, warmer summer temperatures, and greater nutrient levels when compared to the Fox section.

Brown trout and mountain whitefish are the primary game fish species found in the section. We estimated brown trout numbers at 307 fish per mile (Table 9) with 81% of those fish over 10.0 inches and 26% over 15.0 inches. Low numbers of small brown trout, 12% of fish less than 8.0 inches, indicate that spawning within the section is probably limited. Faced with severe irrigation-related water shortages throughout many sections of Rock Creek, fish are probably forced to move into this area where stream flows are usually more reliable, particularly during drought years. Other fish species that are abundant throughout the Joliet section include mountain whitefish of all sizes, longnose dace and suckers. In addition to brown trout, a few rainbow trout inhabit the section with five ranging from 11.7 to 15.3 inches collected during 1990 sampling. Average size and growth of trout is considerably better within this more productive nutrient-rich section of Rock Creek than in sections located further upstream.

TABLE 9. Fish population data collected in the spring of 1990 from the Joliet section of Rock Creek.

DATE & SPECIES	AGE CLASS	AVERAGE LENGTH (IN)	AVERAGE WEIGHT (LB)	NUMBER ESTIMATE	ESTIMATED NUMBER/MILE	WEIGHT ESTIMATE (LB)
APRIL	2	7.10	0.16	61	61	10
1990	3	10.59	0.42	47	47	20
BROWN	4	12.49	0.69	84	84	58
TROUT	5	14.66	1.06	50	50	53
	6 & older	17.17	1.78	65	65	115
			TOTALS	307	307	256

Slough Creek

In 1992, in addition to the Buffalo Fork project, we evaluated the Yellowstone cutthroat fishery in upper Slough Creek. Slough Creek (Figure 1), which is a considerably larger drainage than Buffalo Fork, drains the A-B Wilderness to the north off the northeast corner of Yellowstone National Park. Slough Creek flows south to its confluence with the Lamar River approximately 15 miles

inside the Park. The majority of fishing pressure on Slough Creek is concentrated within the Park and around the Silvertip Ranch, a guest ranch located just north of the Park boundary and surrounded by the A-B Wilderness.

Fires in 1988 burned much of the main Slough Creek drainage and undoubtedly altered the timing and duration of traditional seasonal runoff patterns. We noted some stream instability manifested in bank sloughing, channel braiding and bed load movement, around the middle of Frenchy Meadows. The stream channel was wide and shallow. Some of the stream channel instability appeared to have been going on for a long time, and was probably accelerated by higher peak flows which resulted from the fires of 1988. This area of the stream was nearly devoid of fish even though good populations were found just upstream and downstream.

Fish sampled near the Guard Station at the lower end of Frenchy Meadows, an area that appeared to receive relatively heavy fishing pressure, were fat, healthy and easy to catch. Thirteen cutthroat averaged 14.1 inches and ranged in age from 3 to 6 years. Six of the 13 fish were 15.0 to 17.0 inches. A puzzling observation was the lack of small fish. Except for a couple of fish we observed in a spring house near the guard station and several small fish in an isolated pool area, we found no fish under 10 inches anywhere along several miles of stream. The water was crystal clear and fish were easy to see. Twenty two fish sampled towards the upper end of Frenchy Meadows averaged 12.3 inches and ranged in age from 3 to 4 years. One large hole, just below the mouth of Bull Creek, held a school of 45 to 50 cutthroat from 11 to 14 inches long.

Because the cutthroat population in Slough Creek appeared healthy and contained a good number of large fish, we did not feel that fishing pressure at the present levels was adversely impacting this fishery. At this time, we recommend no changes in the standard fishing regulations that now apply in Slough Creek.

Buffalo Fork of Slough Creek

In 1991, we were contacted by an outfitter who felt there was a problem with the rainbow trout fishery in the Buffalo Fork of Slough Creek. He had guided fishermen in the drainage for years and felt there had been a marked decline, particularly in the number of large fish, over the past several years. His feeling was that as fishing pressure had increased, more and more of the large fish were removed from the system leading to this decline. Apparently, rainbows from 17 to 20 inches were once common but are now rarely taken. This same observation was expressed by several other people familiar with the stream.

Buffalo Fork (Figure 1) begins high in the mountains of the A-B Wilderness and flows south for about 22 miles to its confluence

with Slough Creek in Yellowstone National Park. The majority of the fishing and camping use on Buffalo Fork is concentrated in the lower three to four miles from the Park boundary upstream into the A-B Wilderness. The lower 10 miles within the Park has a steep gradient where the stream drops through a remote rock canyon with very limited access and virtually no fishing pressure.

The lower 5 miles of Buffalo Fork within the wilderness is divided into 2 large meadow areas, each with a moderate stream gradient and predominant willow shrub overstory. The meadows are separated by a mile of rocky, steep-gradient canyon area. The mile long lower meadow showed evidence of relatively heavy use including numerous campsites, a semi-permanent outfitters' camp and eroding banks and trails caused by grazing from horses, elk and moose. Forest Service trail #99, the primary access route through the Park, first intersects Buffalo Fork at the Park boundary, which is also the downstream end of the lower meadow. Many people camp in this area following the long dry 11 mile trek from the trailhead. Although this area is remote, it receives a surprising amount of use from hikers and horse traffic. While summer recreational use has been steadily increasing, use by hunters in the fall in this wildlife rich area has also been increasing. Many of these hunters also fish Buffalo Fork. The two-mile-long upper meadow shows less evidence of pressure from recreationists and domestic stock.

Much of the Buffalo Fork and main Slough Creek drainage burned in 1988 at the same time fires ravaged much of Yellowstone Park. Although by 1992 the understory of grasses, fireweed and other low vegetation has recovered fairly well, the forest canopy of larger trees is much slower to recover. Loss of the forest canopy has affected the timing and duration of the traditional runoff pattern. Snow now melts faster, resulting in higher spring and early summer flows, but reduced late summer and fall flows. Erosion rates have increased with sloughing stream banks and shifting gravel bars common in some areas. Deeper, slower areas are covered with fine sediments originating from accelerated bank erosion and runoff from burned areas. Fall flows in late August 1992 were quite low which tended to concentrate fish in deeper pools making them much more vulnerable to fishing pressure. Increased sediment load may also have future effects on spawning success and recruitment into the population.

In July 1991 and August 1992, we assessed the status of the fishery and the condition of the watershed in the Buffalo Fork drainage. Because the area is Wilderness, we sampled with hook and line. The stream database noted that Buffalo Fork contained brook trout, but we found only rainbow trout.

Fifteen rainbows collected from the lower meadow area averaged 9.3 inches and ranged in age from 2 to 4 years. Eight fish from the mid-canyon area, which separates the 2 meadows, averaged 6.9 inches and ranged in age from 2 to 3 years. Ten fish collected from the lower end of the upper meadow area averaged 12.4 inches

and ranged in age from 3 to 5 years. We found several 15 inch and one 17 inch fish in this area. Sixteen fish collected from the Buffalo Fork Guard Station downstream to the upper end of the upper meadow averaged 8.2 inches and ranged in age from 1 to 3 years.

One indication that fishing pressure could be a problem was the average size difference of 3.1 inches between fish collected from the lower meadow and those from the less heavily fished, more remote upper meadow. We also found several larger fish in the upper meadow. This fisheries information, along with the apparent overall deterioration of stream habitat following the 1988 fires and the concentrated increasing fishing pressure, led us to propose a change in fishing regulations to help protect the larger rainbows in the stream. With public support, we changed the fishing regulations for the 1994-95 period from the standard stream limit of five trout, only one over 18 inches, to the wilderness limit of three trout, none over 12 inches. This new limit should still allow anglers to catch some of the smaller, more abundant rainbows to eat while protecting the larger fish Buffalo Fork has a history of producing.

Hidden Lake

While in the area in 1991, we collected some rainbows from Hidden Lake which is the only lake in the Buffalo Fork Drainage with fish. Hidden Lake sits on a small bench just above the downstream end of the upper Buffalo Fork meadow. The outlet stream cascades a short distance down a steep hill prior to entering the stream. Fish can move downstream from the lake into Buffalo Fork, but the steep gradient precludes upstream fish movement.

We collected ten rainbows ranging from 6.5 to 14.8 inches and one to four years of age with hook and line. We observed several larger fish cruising the shoal areas, and outfitters reported catching three to five pound fish. The various ages and sizes of fish sampled indicate that rainbows reproduce in the lake's outlet stream.

Cooke City Area Baseline Information Study

We collected additional baseline fishery information from streams near Cooke City that may be further impacted by the large underground mining project proposed by Noranda (New World Mine). Several streams in this environmentally sensitive region still show the effects of extensive mining during the early 1900's, and recovery of the aquatic community has been slow. The area is slow to recover because of the difficulties of reclamation at 9300 foot elevation, and because the ore is high in sulfide which produces acid mine drainage when exposed to air and water. Noranda proposes to keep tailings from the new mine flooded and anaerobic to prevent acid mine drainage after reclamation. This is new and untested

reclamation technology and has never been attempted on this scale. The large tailing impoundment would be located in the Fisher Creek drainage which drains into the Clarks Fork River. After leaving Montana, the Clarks Fork flows into Wyoming where it is designated that state's only wild and scenic river. Both Montana and Wyoming have major water quality concerns about the consequences should the tailings impoundment fail to function as designed.

This mining project is very controversial both at the local level with residents of Cooke City and at the state and national level with politicians from Wyoming, Montana and other parts of the country. Its location at the headwaters of three river drainages, Yellowstone, Stillwater and Clarks Fork Rivers and proximity to Yellowstone National Park and the Absaroka Beartooth Wilderness has generated additional controversy. The Forest Service (FS) and Department of State Lands (DSL), the two primary permitting agencies, are currently involved in preparing an EIS for this proposed project.

Noranda has been doing various reclamation projects to help improve existing water quality problems which date back to historical mining activity. They have smoothed and recontoured the old McLaren and Como pits to help prevent surface waters from leaching through the exposed sulfide bearing ore. They have also reclaimed most of their access and drill roads and have reseeded many disturbed areas using native seeds developed to tolerate the harsh sub-alpine climate and acidic soils. They also plan to seal the Glengarry and several other adits which are the sources of the acid mine drainage now impacting Fisher Creek. These reclamation projects along with other future proposals should help solve some of the existing water quality problems that have impacted streams in this area for many years.

Initial collection of fisheries information from streams in this area began in 1974 (Marcuson 1974). Since 1990, when the New World Project proposal first surfaced, we have been gathering the additional fisheries information anticipated as necessary for preparation of the EIS. Our data from 1974 and 1990, which is included in Appendix A, was primarily qualitative information, but information collected since that time has been more quantitative. Because we anticipate that improved water quality will result in improved fisheries, we need quantitative baseline data to measure this improvement.

Clarks Fork of the Yellowstone River

Electrofishing done in the two Clarks Fork River sections (Figure 1) in the fall of 1991 (Table 10) consisted of only one pass through the sections, but conditions for electrofishing were ideal enough that we felt we captured 95% of the fish within the section. The flow was low, the water was clear and the habitat was rocky and shallow (maximum depth was two feet). All of the fish

population information collected since 1991 is based on 2-pass fish population estimates. Rainbow trout sampled in the upper section probably came from a plant made into a lake located upstream in the Lady of the Lake drainage. These fish were all the same age and probably moved downstream from the lake.

The negative impacts to the fish population from the acidic, heavy-metal-laden waters of Fisher Creek are reflected in the population estimates. Nearly 10 times as many trout per 100 feet of stream were found in Lady of the Lake Creek immediately upstream from the confluence of Fisher Creek as were found downstream. From the confluence downstream into the mixing zone, trout were confined to the opposite edge away from the polluted waters of Fisher Creek. On September 20, 1993, fisheries people from the FS collected 20 brook trout and 5 rainbow trout just downstream from the mouth of Fisher Creek for heavy metal contamination analysis of their body tissues.

Soda Butte Creek

Soda Butte Creek (Figure 1) near Cooke City has been negatively impacted by acid drainage from old mine tailings for many years. The tailings from the McLaren pit at Daisy Pass were processed in a mill located near Cooke City and were then deposited in a large pile adjacent to the stream channel. Surface and subsurface waters seeping through these sulfide rich tailings produced acid and heavy metal-contaminated flow which entered the stream. The McLaren Tailings Site was designated an "Emergency Response Action" site by the EPA and a corrective action plan was developed. In 1991, a diversion channel was constructed to carry runoff and spring flows around the upslope side of the tailings, in order to reduce infiltration of these waters through the tailings. In addition, some tailings located outside the containment dam were excavated and moved back inside.

Table 10. Additional fisheries data collected from streams near Cooke City during 1991 and 1993.

NAME OF STREAM AND LOCATION	DATE	SECTION LENGTH	SPECIES	NUMBER SAMPLED	AVERAGE LENGTH	POPULATION ESTIMATE
Clarks Fork River just downstream from confluence of Fischer Creek (T9SR15E S.17CDB)	9/10/91	1000'	Eb Rb	50 21	6.4" 6.9"	- -
Clarks Fork River Bridge at Sawmill (T9SR15E S.20DAC)	9/12/91	500'	Eb	57	5.8"	-
Clarks Fork River downstream from confluence of Fischer Creek (T9SR15E S.17CDB)	9/29/93	1400'	Eb Rb	56 15	5.9" 8.2"	85 20
Lady of the Lake Creek from mouth upstream (T9SR15E S.17CDB)	9/29/93	75'	Eb Ct	42 1	5.6" 9.4"	47 1
Soda Butte Creek at powerline crossing .6 mile west Cooke City (T9SR14E S.26CAC)	9/30/93	1000'	Ct	32	9.2"	33
Soda Butte Creek from road to McLaren tailings near confluence of Miller Creek (T9SR14E S.25ACA)	9/30/93	1000'	Eb Ct	1 1	5.1" 8.2"	1 1

Following the partial cleanup of the McLaren Tailings Site, downstream fish populations have responded positively by moving upstream into areas where they have been scarce for many years. In 1974, when Marcuson and others sampled a 300 foot section about a mile upstream from the Park boundary, they took no fish. Locals reported catching cutthroat in the 1940's and 1950's near Cooke City, but since that time they have been scarce upstream from the mouth of Sheep Creek (located about 2 miles downstream from Cooke City). In 1989, FS fisheries biologists collected 25 cutthroat from near Silver Gate for genetic testing. Some of these fish were hybrids between Yellowstone cutthroat and westslope cutthroat trout. Some cutthroat collected in the Park showed similar hybridization (Carty 1993).

In 1993, we electrofished a 1000 foot section about a half mile downstream from Cooke City, and it contained a healthy appearing population of cutthroat trout. We collected 32 fish from 3.6 to 13.3 inches long and from 1 to 4 years of age. In another 1000 foot section adjacent to the McLaren tailings, we took a cutthroat and a brook trout, and saw one other fish in a stream section where we found no fish in 1990.

Of particular concern to the various fish management agencies involved with Soda Butte Creek, which includes the Fish and

Wildlife Service within Yellowstone Park, FS, and FWP, are the brook trout and westslope cutthroat hybrids in the headwaters. With the partial cleanup of the McLaren tailings and resultant improvements in the water quality, the likelihood of brook trout and hybrid cutthroat contamination spreading further downstream into the Yellowstone cutthroat population of the Lamar Valley increases. Because neither of these scenarios is desirable and because of potential impacts to the Park's native fish species, a joint project involving all the agencies to locate and eliminate these problem species from the headwaters of Soda Butte Creek is scheduled for the fall of 1994.

Another area of concern is the potential increased recreational impacts upon the finite fish and wildlife resources of this area of Wyoming and Montana due to the additional people involved with the mine. Information on existing use levels on the streams, rivers and high mountain lakes in the area is limited. FWP has some limited voluntary trailhead creel information collected in 1988 and 1989, but that study involved all the major access points to the Wilderness. During 1993, the FS in cooperation with the FWP collected some additional voluntary trailhead creek information for major access points to waters located around the Cooke City area. Plans for 1994 include a cooperative baseline recreation use study involving Wyoming Fish and Game Department, FS and FWP. This study should provide the additional use information needed to adequately address this issue in the EIS process.

Cutthroat Trout Inventory and Special Projects

Stillwater River

Genetic testing of a small sample (3 fish) of cutthroat from Goose Creek (Appendix B) was inconclusive. A larger number of cutthroat were collected in 1994 and sent in for analysis.

Main Boulder River

In 1989, we entered into a cooperative project with the Gallatin National Forest to locate purestrain populations of Yellowstone cutthroat trout in this region (Poore 1988, 1990 and Foster and May 1990). In sampling the main Boulder River and its major tributaries, we have found purestrain cutthroat in six streams. Except for a population in the upper East Boulder, all the purestrain populations were along the main Boulder River system.

Genetic analysis of fish collected from the main Boulder confirmed the presence of pure Yellowstone cutthroat upstream from Box Canyon. Fish below this point were hybrids and there are no

substantial physical barriers to prevent undesirable species from moving up the drainage. Fish sampled from three locations along the East Fork of the Boulder River (which enters the main Boulder just downstream from Box Canyon), from its mouth to the headwaters, showed some degree of hybridization with westslope cutthroat or rainbow trout. Trout collected from the South Fork of the Boulder, which is located near Independence, are also pure Yellowstone cutthroat trout.

We collected pure Yellowstone cutthroat in 1993 upstream from a fish barrier in Bridge Creek. Bridge Creek enters the Boulder from the west about a mile downstream from Box Canyon. Fish collected lower down in Bridge Creek in 1989 were hybridized with rainbow trout.

The only other location in the main Boulder where we collected pure cutthroat was Hawley Creek, which enters the river from the east about a mile downstream from Fourmile Creek. We collected these fish in 1990 just downstream from the mouth of the North Fork of Hawley Creek. The steep gradient towards the lower end of Hawley Creek is probably an effective barrier to upstream fish movement. Planting records show McBride cutthroat were planted into the headwaters in 1978.

West Boulder River

We found no pure Yellowstone cutthroat trout populations in the West Boulder River Drainage (Figure 1). At the Forest boundary, the fishery consists of brown trout and mountain whitefish. Proceeding upstream from the Forest boundary into the wilderness, brown trout and whitefish numbers progressively diminish as hybrid cutthroat numbers increase. Approximately three miles upstream from the Forest boundary, between Basin and Second Creeks, are two falls. First Falls does not appear to be a fish barrier, but Second Falls is apparently a barrier and marks the upstream limit for brown trout and whitefish (Zubick 1990). From Second Falls to Third Falls, located about five miles further upstream and about a quarter mile upstream from the confluence of Falls Creek, the fishery consists of hybridized cutthroat trout. Some fish collected from a deep pool below Third Falls in 1991 had coloration patterns characteristic of golden trout. Golden trout could have moved downstream from Kaufman Lake (located in the Falls Creek Drainage) from a plant made in 1958. Third Falls, with a drop of about 30 vertical feet, is a definite fish barrier. Electrofishing in 1991 in the main West Boulder upstream from Third Falls and on up into the East and West Forks confirmed that the headwaters above the falls are barren of fish. The stream in and around Beaver Meadows appeared to be particularly good trout habitat. Except for about a mile on the lower end, where the West Boulder River leaves the Gallatin National Forest boundary, the entire headwaters are inside the Absaroka-Beartooth (A-B) Wilderness.

The three miles of river between Third Falls and the confluence of the forks along with several miles of stream within each fork would be an excellent area to introduce pure Yellowstone cutthroat trout. Cutthroat trout planted into the upper West Boulder would be isolated from other fish species by a barrier falls in an area with excellent trout habitat. Such an introduction would help expand Yellowstone cutthroat distribution within their historic range at a time when their numbers are dwindling in many areas.

East Boulder River

The East boulder River enters the main Boulder about three miles south of McLeod (Figure 1). It cascades through a steep canyon with huge boulders and vertical drops of 15 feet, which form definite fish barriers about one-half mile below the confluence of Brownlee Creek.

Below these barriers we found rainbow x cutthroat hybrids. Yellowstone cutthroat trout collected just upstream from the barriers in 1990 were genetically pure, as were fish collected in 1989 about four miles upstream near the wilderness boundary. These cutthroat are probably descendants from a plant made into Placer Basin in 1973.

We tested additional Yellowstone cutthroat from near the wilderness boundary in 1993 in preparation for transplanting some into Bad Canyon Creek, where the cutthroat population was badly depleted.

Upper Deer Creek

Proceeding downstream along the Yellowstone River from the Boulder River Drainage, Upper Deer Creek (Figure 1) is the next drainage where pure Yellowstone cutthroat trout were identified from fish collected in 1989. The stream is barren of fish upstream from FS Road #1713 (Zubick 1990). Below this point, cutthroat trout coexist with a population of brook trout.

Cutthroat trout appear to be restricted to only the remote headwaters of main Upper Deer Creek, since none have been collected from any other tributaries of Upper Deer Creek or from downstream of the Forest boundary. Although planting records show cutthroat trout were planted 12 to 15 miles downstream in 1946 to 1948, this headwater population may be a remnant from wild fish which originally had much easier access to the drainage from the Yellowstone River.

Lower Deer Creek

Lower Deer Creek (Figure 1), the next drainage downstream entering the Yellowstone River from the south, also has genetically pure Yellowstone cutthroat trout in its headwaters. Lower Deer Creek is dry at the mouth most years, only flowing during runoff or major storm events. The stream has a good flow from its headwaters on the Forest to two or three miles upstream from its mouth. We collected pure cutthroat in 1989 from two locations inside the Forest boundary. Planting records show cutthroat trout were planted into Lower Deer Creek six to seven miles downstream from the Forest boundary several times between 1935 and 1950. As in Upper Deer Creek, these fish in the upper reaches of Lower Deer Creek could also be remnants from wild fish which originally had better access to the stream from the Yellowstone River.

A steep gradient area with several barrier falls located about six miles upstream from the Forest boundary blocks fish from the upper headwaters. Sampling above the falls in 1987 confirmed the stream was barren of fish, but appeared to contain several miles of good fish habitat. Because of recognized fishery problems in the drainage associated with livestock grazing, the presence of competitive brown trout, logging and a road up the stream bottom, we decided to transplant cutthroat from below the falls to the fishless area upstream. The intent of this cooperative project between the Forest Service (FS) and FWP was to isolate the cutthroat upstream from the various watershed problems and from interspecific competition which could eventually eliminate them from the system.

In the vicinity of Todd's cabin, we electrofished 33 cutthroat and 44 brown trout within about 750 feet of stream. In late 1990, a fire burned much of the west side of the drainage downstream from the West Fork and in the vicinity of Dave's Gulch and Ellis Mountain. In the fall of 1991 we were unable to collect enough fish for transplant, because the stream had been devastated by runoff from logged areas and the area burned in 1990 on the west side of the drainage. We had to go upstream from the confluence of the West Fork to collect enough cutthroat for the project and even then were only able to capture about 65 fish. From the West Fork confluence downstream, the channel had been inundated with sediment and debris. The cutthroat population which had been relatively abundant the previous fall, had been nearly wiped out. A helicopter equipped with fish tanks was used to transfer the fish into the headwaters near where Lodgepole Trail #22 crosses the stream. In 1993, we found 12 cutthroat at the release site; all were in good condition.

Placer Gulch

In Placer Gulch, a small drainage which joins Lower Deer from the west about a mile and a half upstream from the Forest boundary,

we also found a limited population of genetically pure Yellowstone cutthroat trout. These cutthroat are restricted to about a mile of stream along a steep-sided canyon area. This population is at risk from the cumulative impacts associated with past mining activity, road building, and heavy livestock use along the narrow riparian area. Although no physical barriers exist, this population has remained isolated from the brown trout of Lower Deer Creek. The stream is intermittent, except during runoff, at the very lower end. Because of the limited population size, restricted distribution and heavy, concentrated livestock use, any additional environmental pressures could easily eliminate cutthroat from this drainage.

Bridger Creek

The next large drainage, Bridger Creek (Figure 1), enters the Yellowstone River about seven miles down-river from the mouth of Lower Deer Creek. Like Lower Deer Creek, it goes dry most years along the lower two to three miles. We sampled Bridger Creek and its tributaries over several years but failed to locate any cutthroat populations. Various combinations of brook trout and brown trout are distributed throughout the Bridger Creek drainage.

With the exception of some additional cutthroat inventory work still needed in a few streams draining the Crazy Mountains, the cooperative inventory project with the Gallatin Forest is essentially completed within the Boulder River Drainage and eastward to the Custer Forest boundary. More recently, we have shifted our cutthroat sampling efforts eastward into the Custer Forest and are now concentrating upon tributaries to the Stillwater and Clarks Fork River systems.

Trout Creek

Trout Creek (Figure 1), with headwaters in the Custer Forest, flows eastward to join the Stillwater River about one-half mile upstream from Cliff Swallow Fishing Access Site. The lower 10 miles of stream flow through privately owned lands. Spawning rainbows and brown trout, which move in from the Stillwater River, use the lower end of Trout Creek. In August 1991, we surveyed fish populations and stream habitat conditions from the Forest boundary upstream about three miles to a fish barrier (a 10 to 12 foot falls). The stream above the falls is barren of fish and appears to be a good isolated location for a future introduction of cutthroat.

We electrofished at four locations from the falls to the Forest boundary and found only brook and brown trout, with brook trout dominating in the upper reaches and brown trout dominant lower down. The brook and brown trout populations were in

surprisingly good shape, with various age classes and good numbers of fish ranging up to 16 inches long.

The watershed within the Forest is in poor condition particularly on the lower end, and shows a long history of overgrazing (May 1991). The channel is wide and downcut with many riffles and few pools. In several areas, heavy grazing has completely changed the vegetative community. Cottonwood bottoms are disappearing as older trees die out and new growth is destroyed by heavy concentrated livestock grazing. Near the Forest boundary sediment covered the stream bottom.

Downstream, private lands adjacent to the Forest were in considerably better vegetative condition. Proposed new grazing management guidelines for this allotment will hopefully result in improvements along the stream channel and riparian zone. Trout Creek has the potential to support a substantial fishery, but it will only decline further unless major changes are made in longtime livestock distribution patterns and use levels, and animal access to the stream corridor.

Bad Canyon Creek

In 1976, Pat Marcuson identified what he believed was an indigenous cutthroat population in the upper reaches of Bad Canyon Creek. Bad Canyon Creek (Figure 1) with its headwaters on the Forest, flows easterly through about four miles of a steep rocky canyon administered by the Bureau of Land Management (BLM), and then through about a mile of privately owned lands to its confluence with the Stillwater River near Beehive. Water only flows in the lower mile of stream during runoff or major storm events. Natural dewatering, combined with an irrigation diversion, normally take all the water from the stream where it exits Bad Canyon.

In August 1991, we found four cutthroat adult trout in electrofishing nearly 2,000 feet of stream at three locations in the headwaters of Bad Canyon Creek. Genetic analysis of these fish identified them as purestrain Yellowstone cutthroat trout. The cutthroat in the stream were outnumbered about 100 to 1 by a healthy population of brown trout with numerous fish of all size classes. No juvenile cutthroat were observed, indicating a problem with reproduction and recruitment in the face of an overwhelming population of brown trout. We concluded that the brown trout would soon totally eliminate cutthroat from the streams' headwaters. Marcuson also reported cutthroat spawning activity in Tepee Creek, a small headwater tributary, but in 1991 we found no fish in the stream.

Livestock grazing, although not as significant as noted in Trout Creek, has resulted in increased sediment yield from impacts to streambanks and the adjacent riparian zone. Grazing impacts were particularly evident in the very upper reaches where the drainage is more open. Downstream, where the valley narrows into

the steep canyon and the stream channel is more incised, livestock use was more restricted to upland areas away from the stream. After evaluating the available options, the BLM, FS, and FWP decided to undertake a cooperative project to enhance an existing fish barrier located on BLM land about one-half mile downstream from the Forest boundary, and remove brown trout from the drainage upstream from the barrier. (Most of the headwaters of Bad Canyon Creek are very isolated except for jeep trails that provide access to the upper and lower ends of the canyon.)

Just prior to the planned initiation of the project, two private landowners who control access to the two jeep trails, and who also graze livestock on the public lands involved, decided to block access. They felt threatened by proposed changes in established grazing use that were needed to help reduce sediment yield and enhance the riparian zone along the stream. The BLM provided a standby fire helicopter to transport people and equipment to and from the area, and the FS provided pack stock. In August 1993, eleven volunteers from the management agencies initiated the project. Some of the crew enhanced the fish barrier at the lower end, and four backpack shocker crews made a minimum of two trips through the entire three miles of stream and its tributaries upstream from the barrier. Although we removed an estimated 1,000 to 1,500 brown trout, only 12 cutthroat were found. Unfortunately, in spite of the major effort expended, we were unable to remove all the brown trout from the system. Fish hiding in log jams and numerous one- to two-inch fingerlings associated with the rocky substrate were particularly difficult to capture. Also, although we electrofished the lower portion of Smith Coulee, we did not have sufficient time to remove brown trout from the headwaters.

We were unaware of just how few cutthroat were left in the stream until after we finished electrofishing. Because we felt the 12 remaining cutthroat were probably below the threshold number required to re-establish the population, we decided to transplant additional fish from another source. The closest donor stream with a healthy population of purestrain Yellowstone cutthroat trout was the upper East Boulder. Although 25 of these fish were already confirmed as genetically pure in 1989, we collected an additional sample of 25 fish for confirmation. These additional fish were immediately collected and sent off for analysis. Upon confirming their genetic purity, we collected 63 additional fish in September from the East Boulder and transferred them by helicopter into the headwaters of Bad Canyon Creek.

In future projects we will include some follow-up electrofishing to remove brown trout missed during the original project. Plans also include the transplant of additional Yellowstone cutthroat into the stream. Proposed changes in the grazing management plan should also help to reduce the sediment yield and restore the riparian zone, which should also eventually benefit the cutthroat fishery.

Iron Creek

Iron Creek (Figure 1) flows eastward from its headwaters near Iron Mountain to its confluence with the West Fork of the Stillwater River, about a mile upstream from the Forest boundary. In August 1993, when we collected additional fish from the upper East Boulder, we also collected a sample of cutthroat trout for genetic testing from the headwaters of Iron Creek. Genetic analysis confirmed these fish are pure Yellowstone cutthroat. These cutthroat are probably descendants from a cutthroat plant made into Iron Creek in 1971. Although Marcuson (1976) reported sampling rainbow trout in the lower half mile of stream, the stream drops nearly 1,000 feet per mile over its 5 mile length, and the steep gradient probably prevents rainbows from moving further upstream into the headwaters.

Cole Creek and Powers Creek

Both Cole Creek and Powers Creek (Figure 1) flow northward, crossing highway 78 about six miles northwest of Red Lodge, and join about a quarter mile north of the highway to form the East Fork of Red Lodge Creek. They both drain the area just north and west of Red Lodge Mountain Ski Area, where a proposed new expansion of facilities could potentially impact the headwaters of both streams.

Planting records for both streams show they were stocked with cutthroat trout at the highway from 1932 to 1934. When Marcuson sampled each stream at the highway in 1975, he found only brook trout. During additional electrofishing near the highway in late October 1993, we collected 37 brook trout and three sculpins in a 500 foot section of Powers Creek and 53 brook trout in 500 feet of Cole Creek. To determine if cutthroat trout were present further upstream in the headwaters, we electrofished a 1500 foot section on both streams near the Forest boundary. We found no fish at either location. Apparently, the cutthroat trout introductions made into these streams in the 1930's were unsuccessful.

Additional cutthroat inventory work is planned for 1994 in the Stillwater River, Rock Creek and Clarks Fork Drainages. Sampling in tributary streams to the Crazy and Pryor Mountains will also continue. All these scheduled projects are cooperative efforts between the FWP and the FS.

MANAGEMENT RECOMMENDATIONS

1) Continue to monitor the Yellowstone, Boulder and Stillwater River Drainages to follow the effects of drought, fishing pressure changes and management changes on fish populations. This information will also be used to update the Stillwater and Boulder River fishery Management Plans.

2) Continue to pursue development of potential spawning areas in spring creeks entering the Yellowstone River near Big Timber.

3) Continue monitoring fish populations in the TO-BAR section of East Rosebud Creek to assess the results of management changes implemented to improve the fishery.

4) Continue to monitor the distribution and numbers of fish using spawning areas in the Stillwater and Boulder Rivers.

5) Continue to monitor fish populations at established sections along Rock Creek.

6) Coordinate with the USFS and Noranda Mining Company to gather additional baseline recreational use and fisheries information for the area potentially impacted by proposed mining activity around Cooke City.

7) Participate in a cooperative project with the USFS, USFWS, and Wyoming Fish and Game Department to locate and eliminate the source of brook trout and westslope cutthroat trout from the headwaters of Soda Butte Creek.

8) Continue cutthroat inventory and assessment work in the Stillwater and Clarks Fork River Drainages, and Crazy and Pryor Mountain ranges, in cooperation with the USFS.

9) Pursue the possible introduction of Yellowstone cutthroat trout upstream from the third falls in the West Boulder River and into Trout Creek upstream from the falls.

10) Coordinate with the USFS to collect and transfer additional purestrain Yellowstone cutthroat trout into the headwaters of Bad Canyon Creek. Additional work is also planned to remove the remaining brown trout from the stream upstream from the fish barrier.

WATERS REFERRED TO

Bad Canyon Creek	5-22-0168-01
Boulder River Sec. 01	5-22-0742-01
Boulder River Sec. 02	5-22-0756-01
Bridger Creek	5-22-0792-01
Bridger Creek	5-22-0798-01
Buffalo Fork Creek	3-22-0882-01
Butcher Creek	5-22-0924-01
Clarks Fork River Sec. 01	5-22-1162-02
Clarks Fork River Sec. 02	5-22-1176-01
Clarks Fork River Sec. 03	5-22-1190-01
Cole Creek	5-22-1260-01
Dry Creek	5-22-1841-10
East Boulder River	5-22-2002-01
East Fork of the Boulder River	5-22-2114-01
East Rosebud Creek	5-22-2240-01
Elk Creek	5-22-2352-01
Falls Creek	3-22-2408-01
Fisher Creek	5-22-2484-01
Goose Creek	5-22-2758-01
Hawley Creek	5-22-3010-01
Hidden Lake	3-22-8092-03
Iron Creek	5-22-3360-01
Kaufman Lake	5-22-8225-03
Lady of the Lake Creek	5-22-3444-01
Lower Deer Creek	5-22-3864-01
Powers Creek	5-22-4774-01
Rock Creek Sec. 01	5-22-4928-01
Rock Creek Sec. 02	5-22-4942-01
Rosebud Creek	5-22-5026-01
Slough Creek	5-22-5586-01
Soda Butte Creek	5-22-5684-01
South Fork of the Boulder River	5-22-0770-01
Stillwater River Sec. 01	5-22-6104-01
Stillwater River Sec. 03	5-22-6132-01
Trout Creek	5-22-6384-01
Upper Deer Creek	5-22-6454-01
West Boulder River	5-22-6552-01
Yellowstone River Sec. 04	5-22-7014-01
Yellowstone River Sec. 07	5-22-7056-01

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Prepared by: Michiel Poore

Date: 1/5/95

APPENDIX A

COOKE CITY ACID MINE DRAINAGE SAMPLING

Montana Department of Fish, Wildlife & Parks

2300 Lake Elmo Drive
Billings, MT 59105
August 8, 1990

Mark Bennett
c/o Hydrometrics
2727 Airport Road
Helena, MT 59601

Dear Mr. Bennett:

Enclosed is our report of fish sampling conducted at the proposed New World Mine site. This survey was by necessity qualitative, because we found so few fish. You will probably want to eventually upgrade Figure 1, which was hastily sketched to meet the August 10 deadline.

Please call me at 252-4654 if you have any questions.

Sincerely,

Jim Darling

Jim Darling
Regional Fisheries Mgr.

JD/pk

Enclosures

COOKE CITY ACID MINE DRAINAGE SAMPLING

Acid drainage from old mine tailings just north of Cooke City adversely impacts several streams. These streams include the headwaters of the Stillwater, the Clarks Fork of the Yellowstone, and the upper Yellowstone Rivers. Water seeping from the tailings and old mine shafts has the orange color characteristic of acid drainage. Fish and aquatic invertebrates are almost entirely absent from the upper four or five miles of each drainage. Dilution and precipitation of toxic chemicals results in a slow recovery of the aquatic community downstream from the highly toxic zone.

Renewed interest and improved gold mining technology has led to extensive exploration and testing in and around the old mine locations. Large scale gold mining in this environmentally sensitive area appears imminent. Personnel from the Montana Department of Fish, Wildlife and Parks sampled acid drainage streams in the area for fish during late August 1974 (Table 1). To document potential recovery and gather current fisheries information, we sampled the 1974 stations from July 25 to 27, 1990 (Figure 1, Table 2).

Clarks Fork of the Yellowstone Drainage

Using a backpack shocker, we electrofished at the same two locations along Fisher Creek surveyed in 1974 and found no fish. The stream substrate had the brownish-yellow staining typical of acid mine drainages. We examined the stream bottom and noted only a few caddis flies at the upper location and a few mayflies and caddis flies at the mouth. We observed a number of dead aquatic earthworms and no aquatic vegetation at both locations. Stream habitat appears otherwise ideal for trout.

Table 1. Fish taken with backpack shocker in acid mine drainage area near Cooke City August 27-29, 1974.

Name of Stream & Location	Section Length	Species	Number	Avg. Length	Remarks
Fisher Creek (T9S, R15E, Sec. 18CAA)	350'	No fish			
Fisher Creek (at mouth) (T9S, R15E, Sec. 17CDB)	75'	No fish			
Lady of the Lake Creek just above Fisher Creek (T9S, R15E, Sec. 17CBD)	300'	EB	12	5.6	3 escaped
Clarks Fork Yellowstone River below Fisher Creek (T9S, R15E, Sec. 20ACB)	350'	EB	9	5.7	3 escaped
Middle Fork headwaters Stillwater River (T9S, R14E, Sec. 9BAC)	300'	No fish			
West Fork headwaters Stillwater River (T9S, R14E, Sec 9BAC)	250'	No fish			
Stillwater River headwaters below & above Forks (T9S, R14E, Sec. 9BAB)	400'	No fish			
Soda Butte Creek Soda Butte Campground (T9S, R15E, Sec. 30BCB)	250'	No fish			1 5-inch EB in hand built pool
Soda Butte Creek below Woody Creek (T9S, R14E, Sec. 26DBC)	300'	No fish			
Soda Butte Creek near Silver Gate (T9S, R14E, Sec. 34BCB)	300'	No fish			1 10-12-inch trout escaped, local resident reports Ct & Eb catches here frequently

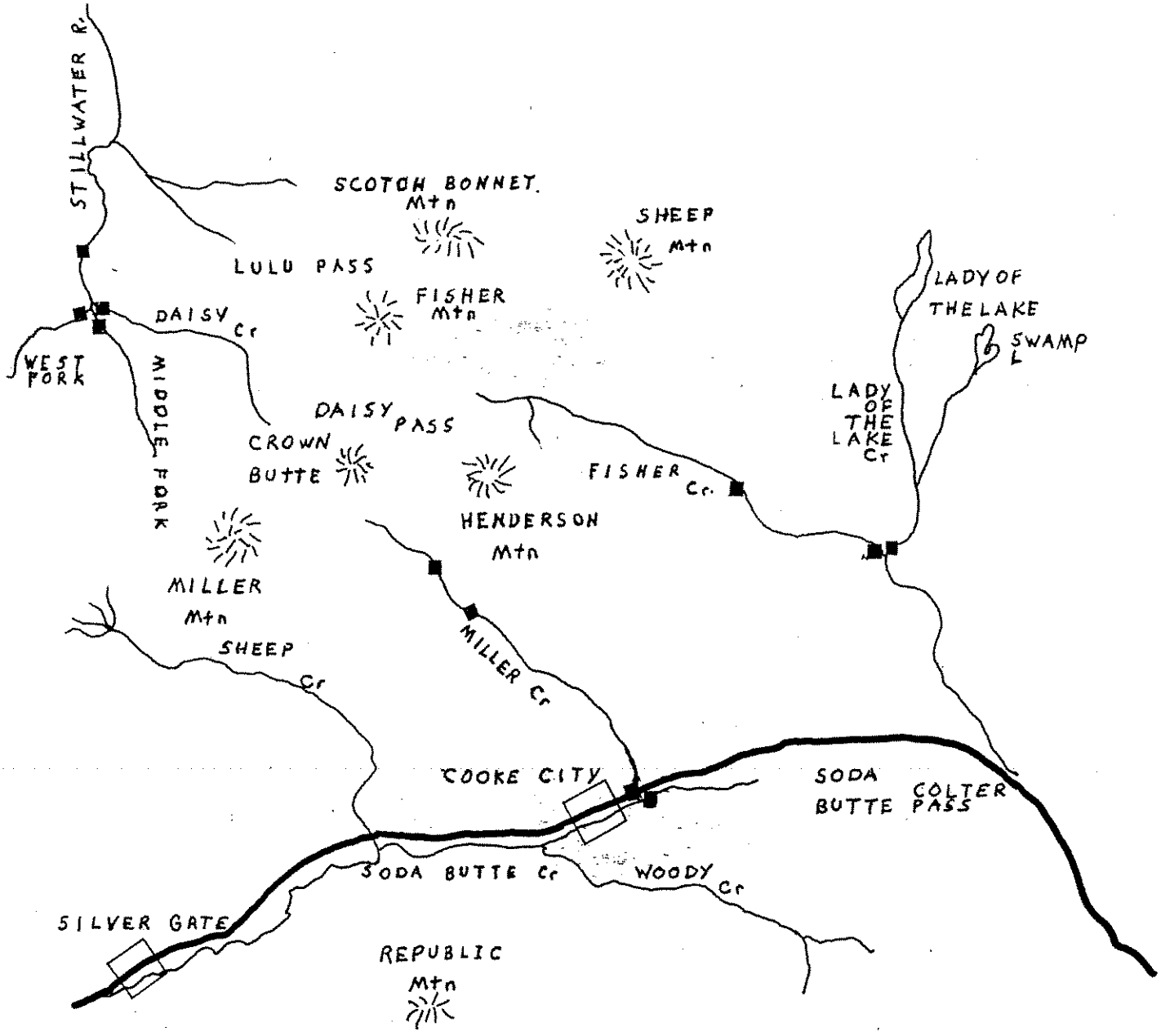

Figure 1. Stations within acid mine drainage area sampled July 25-27, 1990, to determine status of fishery.

Table 2. Fish taken with backpack shocker in acid mine drainage area near Cooke City July 25-27, 1990.

Name of Stream & Location	Section Length	Species	Number	Avg. Length	Remarks
Fisher Creek (T9S, R15E, Sec.18 CAA)	450'	No fish			Very few invertebrates
Fisher Creek (at mouth) (T9S, R15E, Sec. 17CDB)	300'	No fish			Very few invertebrates
Lady of the Lake Creek just above Fisher Creek (T9S, R15E, Sec. 17CBD)	300'	Eb	11	6.6	Invertebrates abundant
West Fork-headwaters Stillwater River (T9S, R14E, Sec. 9BAC)	300'	No fish			Invertebrates abundant, some fish potential
Middle fork-headwaters Stillwater River (T9S, R14E, Sec. 9BAC)	350'	No fish			Invertebrates abundant, good fish potential
Daisy Creek-just upstream of confluence with middle fork (T9S, R14E, Sec. 9BAC)	300'	No fish			No invertebrates yellow acid color and precipitate
Stillwater River head-waters below & above forks at road crossing (T9S, R14E, Sec. 4CCA)	660'	No fish			No invertebrates or algae, yellow precipitate
Miller Creek (T9S, R14E, Sec. 23ABC)	450'	No fish			Some invertebrates algae, some staining
Miller Creek (T9S, R14E, Sec. 24CBB)	300'	No fish			Invertebrates abundant
Miller Creek (T9S, R14E, Sec. 25ACA)	200'	No fish			Road culvert barrier to fish movement
Soda Butte Creek - above Miller Creek (T9S, R14E, Sec. 25ACA)	300'	No fish			Some invertebrates

In Lady of the Lake Creek, upstream from its confluence with Fisher Creek we sampled a healthy population of brook trout and aquatic invertebrates. We were unable to sample downstream from the confluence of the two streams because the water was too deep and swift for the backpack shocker.

Stillwater Drainage

We electrofished stations on the West Fork of the Stillwater River, which drains the east side of Wolverine Pass, and found no fish at the mouth. The small stream has a steep gradient and, although aquatic invertebrates and algae were abundant, the stream has only limited fisheries potential.

In the Middle Fork of the Stillwater River just upstream from its confluence with Daisy Creek we found no fish. The stream has a moderate gradient and appears to be ideal trout habitat. Aquatic invertebrates and aquatic vegetation are diverse and abundant. This stream may be a good location to introduce cutthroat trout.

Electrofishing just upstream from the mouth within Daisy Creek we collected no fish. The substrate has the yellow staining typical of acid mine drainages. In addition, a yellow precipitate covers the stream bottom. We observed no aquatic invertebrates or algae. The West Fork, Middle Fork and mainstem of Daisy Creeks all join at about the same location. From that point downstream for some distance the stream appears sterile. We electrofished approximately one half mile downstream from this confluence, where the road to Lake Abundance crosses and collected no fish. At this location, the stream appeared sterile with no aquatic invertebrates or algae present.

Upper Yellowstone Drainage

Miller Creek is a small stream which drains southeast from the proposed mine location into Soda Butte Creek. The upper one and a half miles of the stream has a moderate gradient flowing through a high mountain valley. The lower mile cascades down a steep slope, dropping nearly 1,300 feet, before entering Soda Butte Creek near Cooke City.

No previous fisheries information is available for the Miller Creek drainage. We sampled two sites upstream from the steep area and the third site at the mouth and found no fish in Miller Creek. We observed little or no evidence of acid mine drainage. The stream has a good population of aquatic invertebrates and contains some aquatic vegetation. The upper reach of Miller Creek has moderate fisheries potential, but the steep gradient and two highway culverts block upstream fish movement. We electrofished approximately 300 feet of Soda Butte Creek just upstream from the mouth of Miller Creek and found no fish. Soda Butte Creek appears to have good fisheries potential.

Summary

Our fisheries sampling and observations of aquatic invertebrates and aquatic vegetation indicate that Fisher Creek and Daisy Creek have shown little or no recovery from acid mine drainage problems documented in 1974. The lack of aquatic life, extends into the streams these creeks enter for varying distances. Most of the streams in both drainages, as well as the upper end of Soda Butte Creek, would have good fisheries potential if water quality improves. The technology and potential exist to clean up the acid drainage problems which have polluted the area's streams for many years. Problems

caused by past mining abuses have plagued this fragile, beautiful part of Montana.

Miller Creek shows little or no visual sign of acid drainage. The absence of fish from the stream is probably due to barriers to fish passage and the lack of a fish introduction above the barriers. Habitat in the mid and upper reaches of Miller Creek appears satisfactory to support a fishery.

APPENDIX B

STILLWATER RIVER FISH SAMPLING

STILLWATER RIVER FISH SAMPLING

In 1992, as part of an ongoing cooperative effort by the Montana Department of Fish, Wildlife and Parks and the United State Forest Service, trout populations were sampled in several locations in the Stillwater Drainage. This project was directed toward gathering baseline fisheries information for the New World Project. Previous sampling in 1974 and 1990 in the headwaters of the Stillwater River failed to take any fish. The still unanswered question was, at what point did fish inhabit the river. To help answer this question, we sampled the Stillwater River at the confluence of Goose Creek, since we knew Goose Creek contained trout.

On September 1, 1992, with the help of Scott Schuler from the USFS, we electrofished the lower 500' of Goose Creek down to the Stillwater, 500' of the Stillwater River about one quarter mile downstream from its confluence with Goose Creak, and 500' of the Stillwater River from the mouth of Goose Creek upstream. Fish populations were sampled with a battery operated back-pack shocking unit (Smith-Root Model 12). Two electrofishing passes were made through the Goose Creek and lower Stillwater sections and fish populations were estimated using the "two-pass estimate" technique. Since the stream in the upper Stillwater section was small and shallow, only one pass was made through this section. The results of sampling in these three sections are summarized in the following table.

STREAM NAME & LOCATION	SECTION LENGTH	FISH SPECIES	NUMBER	EST. POP.	AVG. LENGTH (in)	REMARKS
oose Creek 8SR14ES33BAC	500'	Eb Ct	22 10	23 10	8.2" 9.0"	Moderate number of invertebrates present. Cobble-Boulder substrate
tillwater iver 8SR14ES33BBB	500'	Eb Ct	28 7	29 8	7.7" 8.6"	Moderate number of invertebrates present Boulder-Cobble substrate
tillwater iver 8SR14ES33BDB	500'	Eb Ct	4 2	- -	6.9" 11.6"	Bed rock - Boulder-Cobble substrate. Fine precipitate on bottom. Few invertebrates present. One 16.2" Ct was extremely thin

From where the Stillwater River leaves the long open meadow (downstream approximately one mile from where FS road 212 crosses) to the confluence of Goose Creek, the river drops over 500 feet in the lower half mile. It flows through a steep narrow canyon and over several falls which are barriers to upstream fish movement. The most downstream barrier falls, approximately 10 feet high, is located about 200 yards upstream from the confluence of Goose Creek. Several brook trout were observed in the deep plunge pool at the base of the falls. This falls appears to be the most upstream limit of fish distribution in the mainstem Stillwater River. Although habitat, which appears suitable for fish, exists upstream from these barriers, apparently no fish have ever been introduced.