MONTANA DEPARTMENT OF FISH AND GAME
FISHERIES DIVISION
JOB PROGRESS REPORT

STATE: Montana TITLE: Southwestern Montana Fisheries Study.

PROJECT NO.: F-9-R-26 TITLE: Inventory of Waters of the Project Area.

JOB NO.: I-b

PROJECT PERIOD: July 1, 1977 to June 30, 1978

REPORT PERIOD: July 1, 1977 to May 30, 1978

ABSTRACT

Discharge in the Big Hole River during the 1977 water year was the lowest since 1973. Water temperatures reached 73.8° F in the lower river in mid-August and were in excess of temperatures considered optimal for growth of trout (55° - 65°) for much of the summer period.

Spring numbers of brown trout age II and older increased and numbers of large (18 inch +) brown trout decreased in the 4.5 mile Melrose Section of the Big Hole from 1970-71 to 1977. Numbers of rainbow trout decreased from 1970-71 to 1977.

Spring and fall population estimates in the 10-mile Mel-Glen Section indicated summer mortality rates of 43 and 54 percent for brown and rainbow trout, respectively.

Standing crops of brown trout and mountain whitefish were estimated in side channels of the Jefferson River at Three Forks and Whitehall. Fish populations in sections of Willow Creek, Pipestone Creek, the South Boulder River, and the Boulder River were also censused. Spawning brown trout captured and tagged at a barrier near the mouth of the Boulder River were recaptured in Willow Creek, the Jefferson River, and the Missouri River as far as 30 miles downstream of the tagging site.

BACKGROUND

The Big Hole River is one of Montana's blue-ribbon waterways and consequently receives a great deal of fishing pressure. The waters of the Big Hole are also used by irrigated hay and cattle ranches and, during low water years, this demand is sufficient to totally dewater the river near its mouth. Dams have been or currently are proposed for this free-flowing river and many of its tributaries.

The Jefferson River supports a cold and warm-water fishery of unknown quality. A basic inventory of the aquatic resources of the Jefferson River drainage is essential in formulating a management plan for maintaining the fishery resource of this area. In fall, 1977 an evaluation of the fishery in selected tributaries was begun.

OBJECTIVES AND DEGREE OF ATTAINMENT

1. To investigate the relationship between irrigation season flow and water temperatures at selected sites on the Big Hole River. Data is presented.

2. To make population estimates of wild trout in the 4.5 mile Melrose Section of the Big Hole River to compare with estimates made in 1970 and 1971. Data is presented.

3. To make spring and fall population estimates of wild trout in the 10-mile Mel-Glen Section of the Big Hole River. Data is presented.

4. To measure fishermen use and harvest on this 10-mile section of the Big Hole River from May 21 to November 31, 1977. Data is presented.

PROCEDURES

Taylor thermographs were installed at three locations on the Big Hole River. Analysis was made using a computer program. Stream flow was monitored at the U.S.G.S. gage station near Melrose.

Fish populations in the Big Hole and Jefferson Rivers were censused using a boat-mounted electrofishing unit. Some trout were permanently marked with numbered T-tags. Population and standing crop estimates were made using methods summarized by Vincent (1971 and 1974) and adapted for computer analyses.

Fish populations in four tributaries of the Jefferson River (excluding the Big Hole River) were censused using an electrofishing unit placed on the bank. Some captured trout were marked with numbered T-tags.

Fishing pressure and harvest were determined from a creel census sampling program developed by Dr. David Bowden, Colorado State University.

FINDINGS

Big Hole River

Flow

Snowpack in the Big Hole Basin was subnormal during the 1977 water year and discharge was the lowest since 1973 (U.S.G.S., 1973-77). Average daily flow (ADF) at the U.S.G.S. station near Melrose peaked at 4,630 cfs on June 12, 1977 and decreased throughout July and August. ADF reached a low of 174 cfs on August 21, 1977.

Diversion of river water for irrigation purposes takes place the length of the Big Hole, but is most apparent in the lower river from Melrose to Twin Bridges. August is perhaps the most critical month on the lower Big Hole with irrigation diversions having a greater impact on decreased natural flows. Table 1 depicts mean and minimum recorded August flows at the U.S.G.S. gaging station near Melrose from 1968-1977 and indicates 1977 to be a very low water year. Flow was maintained throughout the river in 1977 but was less than 300 cfs for much of August and September at the U.S.G.S. gaging station near Melrose (U.S.G.S., 1977).

TABLE 1. Mean and minimum August flow in the Big Hole River (U.S.G.S. gaging site near Melrose) from 1968-1977.

	Mean	Minimum
1968	626	411
1969	407	230
1970	504	248
1971	611	301
1972	650	503
1973	165	113
1974	341	290
1975	1457	925
1976	927	715
1977	304	174

Water Temperatures

Water temperatures were monitored at Divide, U.S.G.S. gaging site near Melrose and at Seidensticker Bridge near Twin Bridges, MT. (Fig. 1). Figure 2 depicts maximum weekly temperatures reached at the three sites from June 1 to September 15, 1977. In general, maximum temperatures increased from Divide downstream. The highest water temperature recorded was 73.8° F on August 18 at Seidensticker Bridge. While thermally stressed trout were not observed in this area during 1977, temperatures were in excess of those considered optimal for growth (55° - 65°).

Air temperatures during July and August, 1977 were subnormal as measured at the National Weather Service station in Dillon. Should the low flows recorded in August, 1977 be combined with normal or above normal air temperatures, potentially lethal water temperatures or associated lethal dissolve oxygen concentrations could result.

Trout Populations (Melrose Section)

Trout were not aged in 1970 and 1971 and therefore age group estimates are not made. Trout were aged in 1977, but for purposes of comparison, estimates are made only for length groups. The boundaries of length groups were not the same from year to year as each year the groups were selected to achieve uniform efficiency of capture within each. Population estimates for the Melrose Section essentially represent numbers of age II and older trout.

Brown trout population estimates made for this 4.5 mile section of the river in April of 1970 (Elser and Marcoux, 1970), 1971 (Peterson, 1971) and 1977 are compared in Table 2.

Estimated total numbers of brown trout age II and older were very similar in 1970 and 1971 but had increased by nearly 1000 fish in 1977. The estimate made in April, 1977 followed the two exceptionally high water years of 1975 and 1976 (Table 1) which probably increased survival and recruitment into the population. The increase in numbers of brown trout in 1977 was due to increased numbers of small fish (age II).

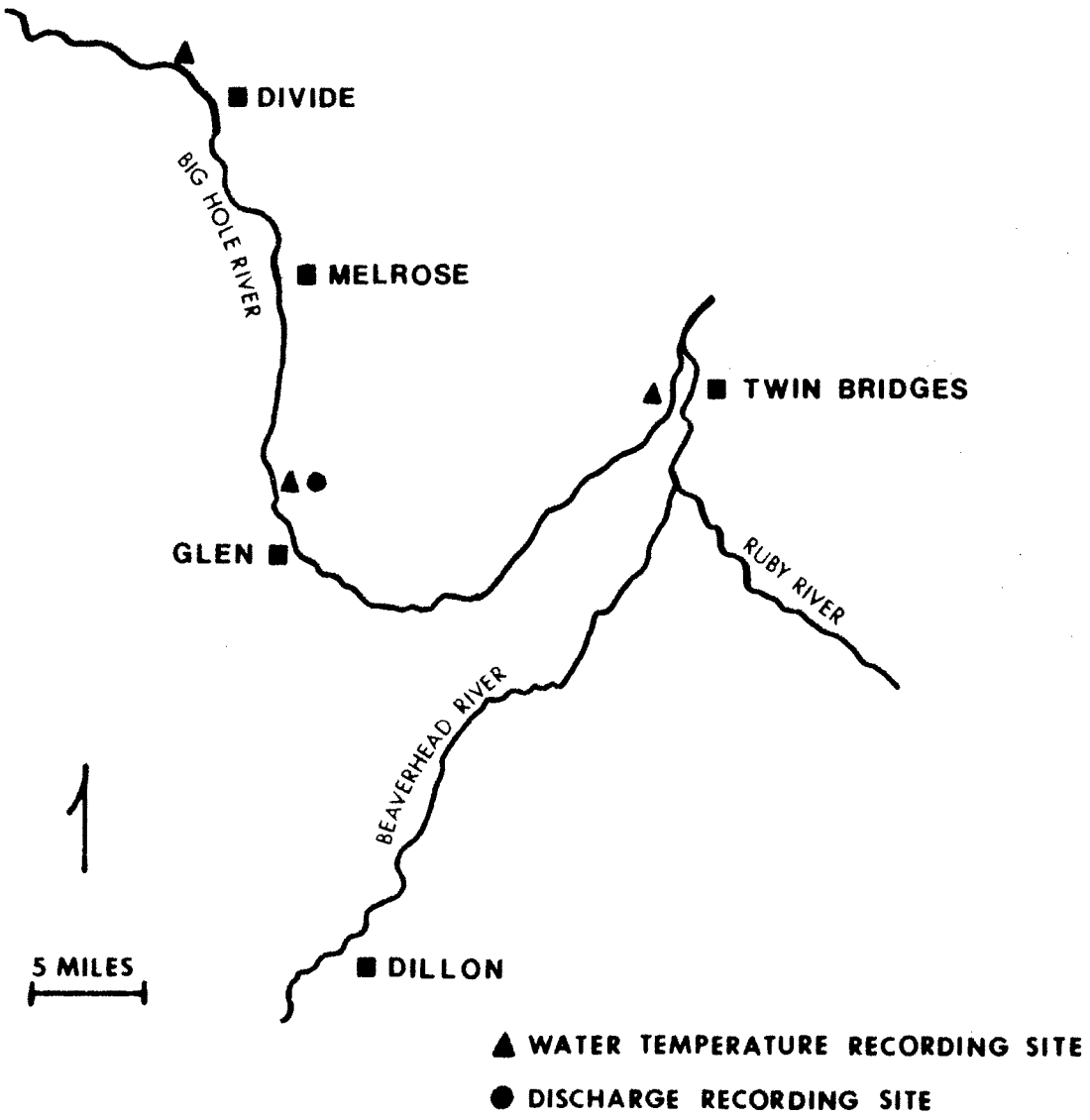

Fig. 1. Map of the Big Hole River Study Area

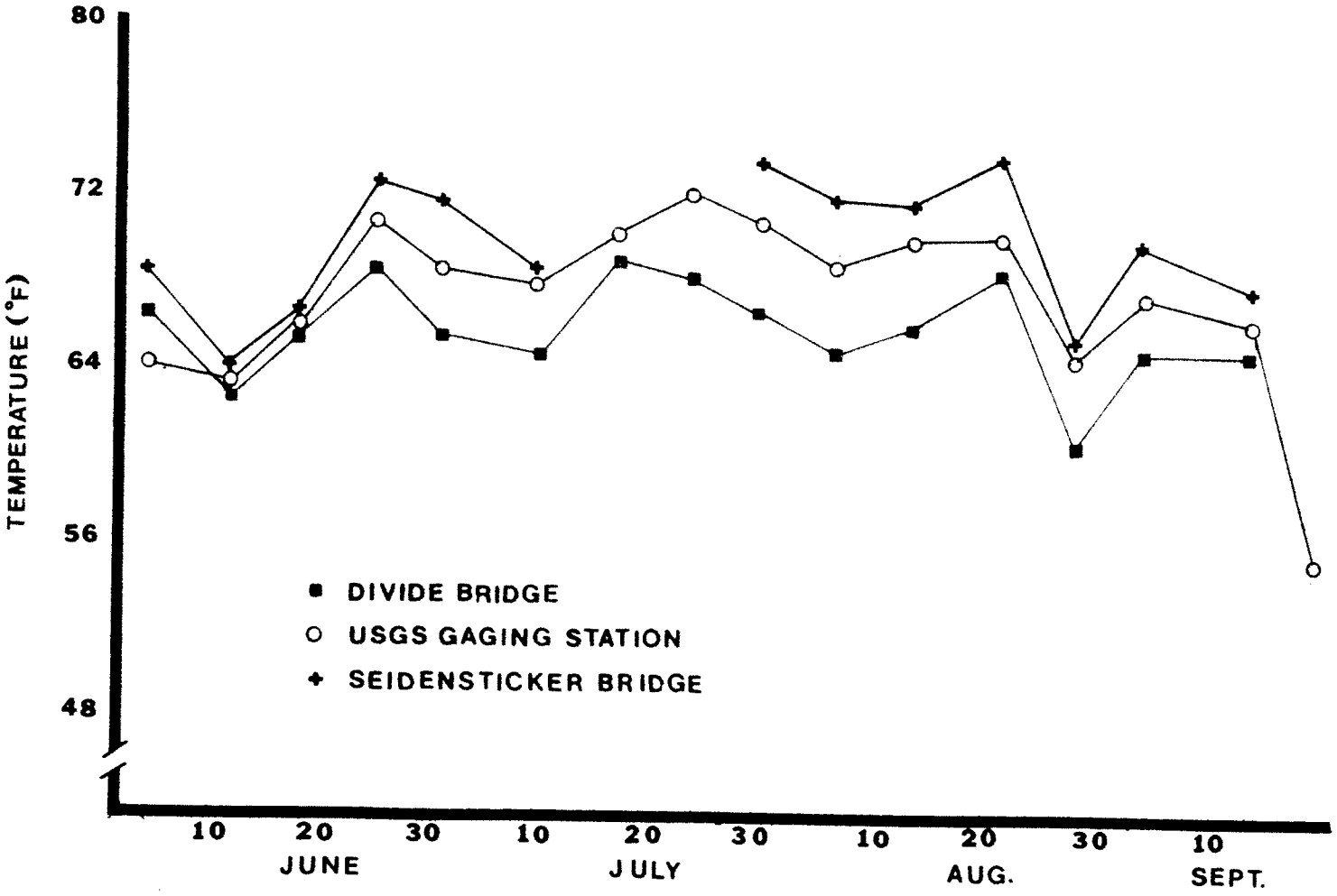

Fig. 2. Maximum weekly water temperatures at the recording sites on the Big Hole River from June 4 - Sept. 18, 1977.

TABLE 2. Population estimates for brown trout in the Melrose Section (22,500 feet) of the Big Hole River. (80% C.I. in parenthesis)

Date	Species	Size Group (inches)	Estimated Number	Estimated Biomass (lbs)
April, 1970	Brown trout	6.0- 9.9	184	50
		10.0-13.9	439	312
		14.0-17.9	889	1281
		18.0+	262	743
			1774 (±214)	2386 (±252)
April, 1971	Brown trout	6.0-13.9	866	487
		14.0-17.9	609	919
		18.0+	363	964
			1838 (±392)	2370 (±426)
April, 1977	Brown trout	7.0-11.5	1439	523
		11.6-12.9	77	53
		13.0-17.9	1090	1494
		18.0+	188	484
			2794 (±835)	2554 (±440)

Estimated numbers of large (18 inch +) brown trout in the population increased from 1970 to 1971 but had decreased to approximately half of 1971 numbers by 1977. The reason for this decrease in numbers of larger brown trout despite two successive excellent water years preceding 1977 is not clear. However, the exceptionally low water year of 1973 may have been partially responsible.

Brown trout larger than 18 inches long are more than four years old (Table 4) and if the low flow in 1973 caused high mortality, the population may still be recovering. Increasing fishing pressure may also have contributed to the decline of older and larger brown trout.

Wild rainbow trout population estimates made in April of 1970 (Elser and Marcoux, 1970), 1971 (Peterson, 1971) and 1977 are compared in Table 3.

As a result of low survival of hatchery, catchable size rainbow trout (Elser and Marcoux, 1970) in the Big Hole River and stresses to wild trout caused by these introductions, planting was curtailed on the Big Hole below Divide in 1974. Therefore, the population of wild rainbow trout in April, 1977 reflects the response of the population to the cessation of stocking.

Estimated total numbers of age II and older rainbow trout were similar in 1970 and 1971 but had decreased by 1977. This decrease followed the elimination of competition with hatchery rainbow trout and the two successive excellent water years of 1975-76. The reasons for this unfavorable response are not clear. However, as will be shown later in this report, fishermen had a much more severe impact on the rainbow trout than brown trout in the 1977 fishing season.

TABLE 3. Population estimates for rainbow trout in the Melrose Section (22,500 feet) of the Big Hole River. (80% C.I. in parenthesis)

Date	Species	Size Group (inches)	Estimated Number	Estimated Biomass (lbs)
April, 1970	Rainbow	7.0-12.9	336	176
		13.0-15.9	417	493
		16.0+	120	270
			873 (±183)	939 (±199)
April, 1971	Rainbow	7.0-12.9	329	155
		13.0+	425	623
			854 (±219)	778 (±287)
April, 1977	Rainbow	7.0-13.0	317	162
		13.1-15.9	209	259
		16.0+	88	170
			614 (±181)	591 (±148)

Trout Populations (Mel-Glen Section)

Spring and fall, 1977 population estimates for brown and rainbow trout are compared for this 10-mile section in Table 4.

Age II and older brown trout suffered an overall mortality rate from April to September of 43 percent. Age III fish had the highest (47%) mortality followed by age II (43%) and age IV and older (37%).

Age II and older rainbow trout suffered an overall mortality rate from April to September of 54 percent. Age III and older rainbow experienced mortality of nearly 70 percent.

Fishermen Pressure and Harvest

Estimates of fishermen pressure and catch rates from May 21 to September 18, 1977 are given in Table 5. They were obtained through a cooperative Fish and Game and Montana Cooperative Fishery Unit study. The following data is provisional and provided by Vince Kozakiewicz, graduate student. A more complete analysis will be presented in his thesis.

Bank fishermen accounted for nearly 80 percent of the fishing pressure during the census period and boat fishermen 20 percent. Boat fishermen had the highest catch rate (0.67 trout/hr.) followed by week-day shore fishermen (0.49 trout/hr.) and weekend shore fishermen (0.40 trout/hr.).

Estimates of numbers of trout caught and caught and released are given in Table 6.

TABLE 4. Comparison of spring and fall, 1977 brown and rainbow trout population estimates for the 10-mile Mel-Glen Section of the Big Hole River. (80% Confidence Intervals)

	APRIL, 1977				SEPTEMBER, 1977			
Species	Age	Avg Length (inches)	N	Biomass (lbs)	Age	Avg Length (inches)	N	Biomass (lbs)
Brown Trout	II	9.3	4951	1417	II	12.6	2805	2192
	III	12.9	3729	3009	III	15.3	1974	2698
	IV+	17.0	2176	3807	IV+	17.9	1376	2936
	TOTAL		10,856 (2771)	8233 (1071)	TOTAL		6146 (982)	7826 (1206)
Rainbow Trout	II	9.5	442	140	II	12.2	377	257
	III	12.1	465	327	III	14.5	137	152
	IV+	15.0	655	851	IV+	16.5	201	345
	TOTAL		1563 (393)	1318 (330)	TOTAL		715 (315)	754 (264)

TABLE 5. Estimates of fishermen pressure and catch rates from May 21 to September 18, 1977 in the 10-mile Mel-Glen Section of the Big Hole River. 1/

	Fishermen	Hours	Catch Rate
Bank Fishermen			
Weekdays	2517	6861	0.49 Trout/Hour
Weekends	2273	7530	0.40 Trout/Hour
Boat Fishermen	1097	3706	0.67 Trout/Hour
	5887	18,097	0.48 Trout/Hour

1/ From V. Kozakiewicz, personal correspondence.

TABLE 6. Estimated numbers of trout caught and caught and released by fishermen from May 21 to September 18, 1977 in the 10-mile Mel-Glen Section of the Big Hole River (95% C.I.) 1/

	Brown Trout		Rainbow Trout	
	Kept	Released	Kept	Released
Bank Fishermen				
Weekdays	1007	1517	349	503
Weekends	1304	969	456	264
Boat Fishermen	1100	924	228	108
	3411 (1194)	3410 (900)	1033 (342)	875 (174)
TOTAL HANDLED	6821		1908	

1/ From V. Kozakiewicz, personal correspondence.

Fishermen harvested approximately 3400 brown trout or 31 percent of the spring population. This harvest accounted for 75 percent of the brown trout mortality experienced between April and September, 1977. Combining fish kept and fish released, fishermen had the potential to handle 62 percent of the spring age II and older brown trout.

Fishermen harvested approximately 1030 rainbow trout or 66 percent of the estimated spring population. This harvest accounted for all of the mortality experienced by rainbow trout from April to September, 1977. Combining fish kept and fish released, fishermen had the potential to handle 122 percent of the age II and older rainbow population.

Jefferson River and Tributaries

Jefferson River - Buttleman Side Channel at Three Forks

Standing crops of brown trout and mountain whitefish were estimated in a 6281 ft side channel of the Jefferson River at Three Forks. Three marking and two recapture trips were made between March 21 and April 26, 1978. Estimates by age group were not available for inclusion in this report. Preliminary results are given in Table 7.

TABLE 7. Preliminary estimates of numbers of brown trout and mountain whitefish in a 6281 ft side channel of the Jefferson River at Three Forks, spring, 1978.

Species	No. Marked (M)	No. Catch (C)	No. Recaptured (R)	Est. No.	Est. No/Mile
Brown Trout	83	41	6	503	423
Mountain Whitefish	942	365	63	5392	4533

Other species captured were carp (common), white sucker (common), longnose sucker (common(, longnose dace (uncommon), mountain sucker (uncommon), rainbow trout (4), and yellow perch (2).

Green numbered T-tags were attached to 88 brown trout and 4 rainbow trout. Four tagged brown trout were recaptured by anglers in April, May and June, 1978. Three of the trout were caught in the study section and one was reported caught in the Beartrap Canyon of the Madison River, about 30 miles upstream of the tagging site.

Jefferson River - Nelson Side Channel Near Whitehall

Standing crops of brown trout and mountain whitefish were estimated in a 7139 ft side channel of the Jefferson River near Whitehall. Three marking and four recapture trips were made between March 14 and April 28, 1978. Estimates by age group were not available for inclusion in this report. Preliminary results are given in Table 8.

TABLE 8. Preliminary estimates of numbers of brown trout and mountain whitefish in a 7139 ft side channel of the Jefferson River near Whitehall, spring, 1978.

Species	No. Marked (M)	No. Catch (C)	No. Recaptured (R)	Est. No.	Est. No./Mile
Brown Trout	140	69	9	986	729
Mountain Whitefish	1156	989	128	8878	6566

Other species captured were white sucker (common), longnose sucker (common), mountain sucker (uncommon), longnose dace (uncommon(, carp (1), brook trout (1), and rainbow trout (1).

Green and orange numbered T-tags were attached to 163 brown trout. An angler caught one tagged brown trout in the study section in April, 1978.

Boulder River

A 200 ft section of the Boulder River immediately below the Shaw ranch irrigation diversion dam (T2N, R3W, Sec. 35) was electrofished on October 28, 1977. The section is located about 2 miles upstream of the river's mouth. The diversion dam is a barrier to brown trout entering the Boulder River to spawn. Two hundred and sixteen brown trout, averaging 15.3 inches in length and ranging from 7.6 to 23.3 inches were captured. Orange and white numbered T-tags were attached to 203 brown trout. Seven tagged trout were recaptured by angling and electrofishing in spring, 1978. Four of the seven trout were recaptured in the Jefferson River approximately 6 to 25 miles downstream of the tagging site, two were recaptured in Willow Creek approximately 15 miles downstream of the tagging site, and one was recaptured in the Missouri River approximately 30 miles downstream of the tagging site. Limited tag return data suggests that considerable spawning movement does occur and the spawning brown trout move in an upstream direction.

South Boulder River

A 500 ft section of the South Boulder River, located about one mile above its mouth, was electrofished on April 18, 1978. Results are summarized in Table 9.

TABLE 9. Summary of fish species captured by electrofishing in a 500 ft section of the South Boulder River (T1N, R3W, Sec. 24) on April 18, 1978.

Species	No. Captured	Total Length Range (inches)	Ave. Total Length (inches)
Rainbow Trout	29	3.4 - 13.9	7.5
Brook Trout	20	4.3 - 9.9	7.1
Brown Trout	13	4.1 - 15.0	9.4
Sculpin	28	-	-

Green numbered T-tags were attached to 6 brown trout and 6 rainbow trout. No recaptures have been reported.

Pipestone Creek

A 425 ft section of Pipestone Creek behind the Brooke Processing Plant at Whitehall was electrofished on March 16, 1978. Results are summarized in Table 10.

TABLE 10. Summary of fish species captured by electrofishing in a 425 ft section of Pipestone Creek (T1N, R4W, Sec. 4) on March 16, 1978.

Species	No. Captured	Total Length Range (inches)	Ave. Total Length (inches)
Brown Trout	14	4.6 - 14.3	8.2
White Sucker	8	4.4 - 12.4	8.7
Sculpin	4	-	-

Willow Creek

Two 500 ft sections of Willow Creek were electrofished on April 18, and April 28, 1978. The sections were located about 3/4 and 2 miles above the mouth. Results are summarized in Table 11 (lower section) and Table 12 (upper section).

TABLE 11. Summary of fish species captured by electrofishing in a 500 ft section of Willow Creek (T1N, R1W, Sec. 25) on April 18, 1978.

Species	No. Captured	Total Length Range (inches)	Ave. Total Length (inches)
Brown Trout	22	4.3 - 17.6	10.2
Mountain Whitefish	18	4.6 - 14.4	9.8
White Sucker	16	2.8 - 7.3	4.6
Longnose Sucker	1	4.3	-
Rainbow Trout	1	8.3	-
Sculpin	Common	-	-
Longnose Dace	Uncommon	-	-

TABLE 12. Summary of fish species captured by electrofishing in a 500 ft section of Willow Creek (T1N, R1E, Sec. 31) on April 28, 1978.

Species	No. Captured	Total Length Range (inches)	Ave. Total Length (inches)
White Sucker	16	4.4 - 12.6	8.1
Mountain Whitefish	13	5.8 - 13.8	10.5
Brown Trout	12	5.9 - 16.4	12.6
Longnose Sucker	9	3.4 - 15.5	5.6
Rainbow Trout	6	10.4 - 14.9	11.4
Longnose Dace	4	2.8 - 4.5	3.9
Mountain Sucker	1	3.4	-
Sculpin	Common	-	-

Green numbered T-tags were attached to a total of 20 brown trout in both sections. An angler caught one tagged brown trout in Willow Creek in May, 1978.

RECOMMENDATIONS

This project should be continued. Emphasis should be given to evaluating the effect of fishermen on trout populations, particularly rainbow trout, in the Big Hole River. Investigation of fish populations in the Jefferson River should be continued.

Investigation of the effects of flows and temperatures on fish populations in the entire Jefferson River drainage should be continued.

LITERATURE CITED

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Waters referred to:

Big Hole River, Sec. 1	3-02-0425-01
Boulder River	3-10-0840-01
Jefferson River	3-10-3840-01
Pipestone Creek	3-10-0680-10
South Boulder River	3-10-6760-01
Willow Creek	3-10-8000-01