MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION

JOB PROGRESS REPORT

State: Montana Title: Southwest Montana Fisheries Study

Project No.: F-9-R-30 Title: Inventory and survey of the waters of

Job No.: I-b the Big Hole, Ruby and Beaverhead River Drainages

Project Period: July 1, 1981 through June 30, 1982

Report Period: July 1, 1981 through June 30, 1982

ABSTRACT

Water year 1981 was a low water year in the Big Hole River drainage. Discharge at Melrose was lower than recommended instream flows for a four-week period in summer, 1981. Water temperatures measured at three sites on the Big Hole River were similar to previous years. Flows and temperatures in the lower Ruby River were similar to previous years.

Rainbow trout population density increased dramatically in 1981. Rainbow trout comprised nearly 50 percent of the total trout population in Melrose section. Brown trout population density decreased slightly in 1981. Trout populations are still responding to termination of the catchable rainbow trout planting program in 1973.

Special regulations designed to increase the number of large trout in a section of the Big Hole River were instituted in 1981. Baseline data on fish populations are presented.

Brown trout population density in Heron section was lower in spring, 1981 than in the previous two years. Low flows and warm water temperatures have adversely affected trout in the lower Big Hole River.

Electrofishing and tag return information suggested that the Ruby River may be a major brown trout spawning stream for the entire Jefferson River drainage.

BACKGROUND

The Big Hole River is one of Montana's blue ribbon trout streams and one of the most heavily fished streams in the state. An estimated 66,277 angler-days of fishing pressure were expended on the Big Hole in 1975-76, second only to the Madison River for streams in southwestern Montana. The Big Hole was fished by more Montana residents than any other stream in western Montana.

Irrigation withdrawals occur throughout the length of the free-flowing Big Hole. Demand for irrigation water peaks in late summer when natural flows are at or near their annual minimum level. During drier than normal years, the lower Big Hole River may be completely dewatered.

Special regulations designed to increase the number of large (13-18 in.) trout were instituted in 1981 on the portion of the Big Hole River between Divide and Melrose (Figure 1). The regulations allow anglers to harvest three trout under 13 inches and one over 22 inches. All trout between 13 and 22 inches must be released.

The Ruby River downstream of Ruby Dam provides a good trout fishery, with an estimated 6,945 angler-days expended in 1975-76. The lower Ruby is also important as a spawning area for migratory brown trout (Salmo trutta).

OBJECTIVES AND DEGREE OF ATTAINMENT

1. To determine spring and fall population estimates in three sections of the Big Hole River and one section of the Ruby River. Data are presented.

2. To assess the effect of special angling regulations on the trout population of one section of the Big Hole River. Data are presented.

3. To monitor daily discharge and water temperature at three locations on the Big Hole River and one location on the Ruby River. Data are presented.

4. To assess the effect of flow and water temperature on growth of trout. Data are presented.

5. To mitigate or enhance habitat alterations due to agricultural, residential, mining and industrial development. Data are presented.

PROCEDURES

Discharge and water temperature were monitored at three U.S.G.S. gauges on the Big Hole River. The gauges were located near Wise River, near Melrose and near Twin Bridges. A U.S.G.S. gauge on the Ruby River near Twin Bridges monitored discharge and water temperature.

Fish populations in all sections were censused using boat-mounted, mobile anode electrofishing gear. Population and standing crop estimates were made using methods described by Vincent (1971) and Holton et al. (1981).

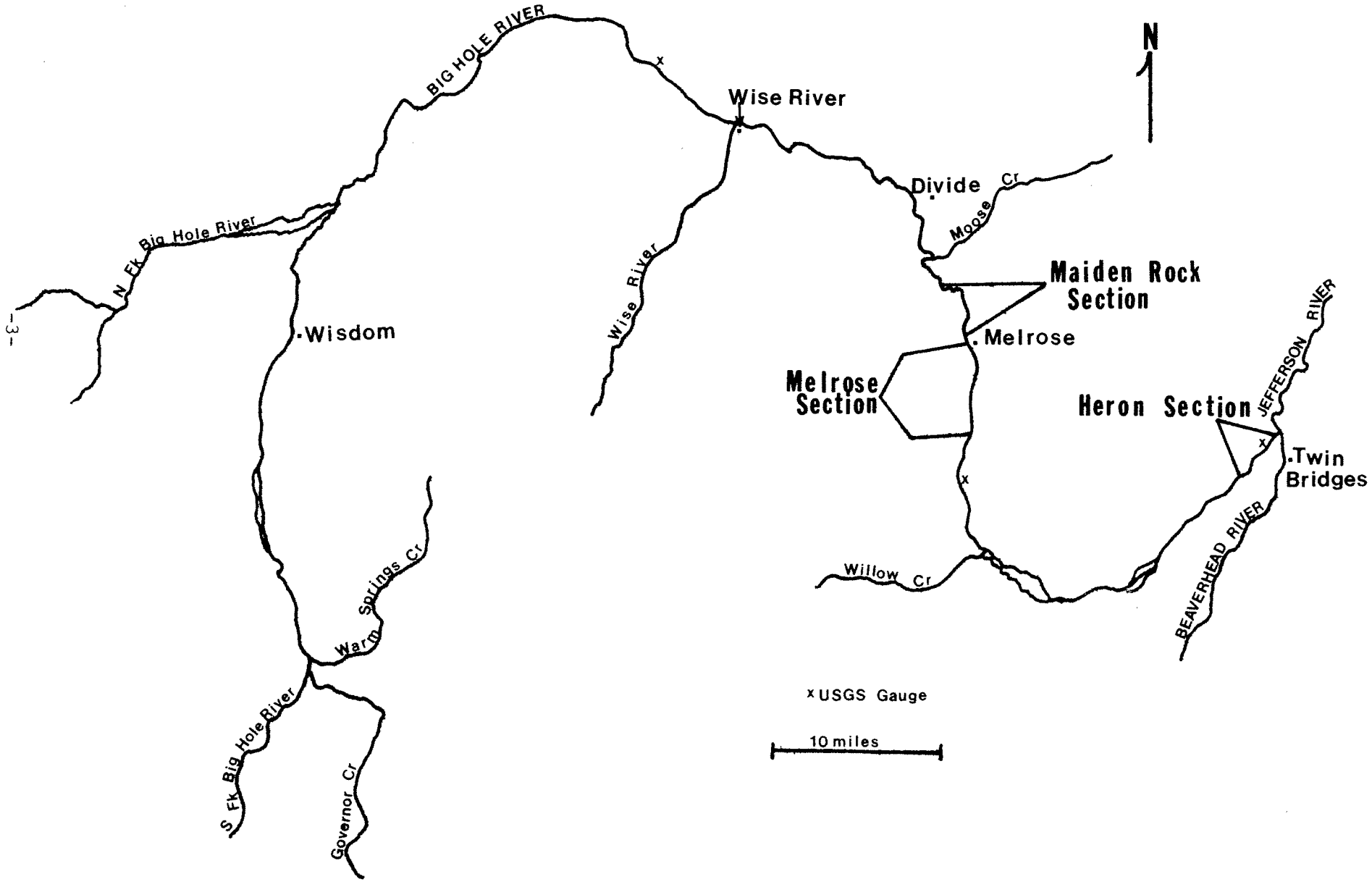
FINDINGS

Big Hole River

Discharge

Summer, 1981 flows in the Big Hole River were low. Mean discharge at Melrose in August and September was 313 cfs, nearly 200 cfs lower than the mean for a 19-year period (Table 1). Mean August-September flow in 1981 fell into the 68th percentile, i.e., in approximately seven out of ten years, flows during that period would be equal to or higher than 313 cfs. Minimum recorded flow during the late summer period was 199 cfs at Melrose, more than 100 cfs below the mean for a 19-year period (Table 1).

Figure 1. The Big Hole River drainage.



Seasonal variation of late summer flows at three gauging sites on the Big Hole River in 1981 was similar to previous years (Wells and Decker-Hess 1981a, 1981b). Discharge throughout the year was highest at Melrose. Melrose guage station is located downstream of all major tributaries except Willow Creek (Figure 1). Discharge was lowest at Wise River except during late summer when flows were lowest at Twin Bridges (Figure 2).

Table 1. Mean and minimum flows of the Big Hole River near Melrose for the August-September period, 1963-1981, and percentage of flows during the period 1925-1973 that equaled or exceeded those flows.

Water Year	Mean Flow (cfs)	Percentile	Minimum Flow (cfs)
1963	372	52	269
1964	528	27	385
1965	930	1	625
1966	170	95	118
1967	381	50	204
1968	659	15	411
1969	342	59	208
1970	507	29	248
1971	521	27	301
1972	559	22	386
1973	207	88	113
1974	290	73	192
1975	1088	0	578
1976	898	2	591
1977	322	65	173
1978	706	11	408
1979	324	64	233
1980	526	26	368
1981	313	68	199
Mean	508		316

Irrigation withdrawals occur throughout the river basin, but are heaviest below Melrose. Decreases in flow of up to 220 cfs between Melrose and Twin Bridges during summer, 1981 were attributed to irrigation withdrawals. Discharge at Twin Bridges dropped as low as 55 cfs in September, 1981.

During a four week period in August and September, 1981, flows at Melrose were lower than required for low levels of aquatic habitat potential (Montana Department of Fish, Wildlife and Parks 1979). Flows after August 1 were lower than required for high levels of aquatic habitat potential.

Water Temperature

Seasonal water temperatures at three gauge sites followed patterns similar to 1979-80. Maxima at all sites occurred in mid-August (Figure 3). Warmest

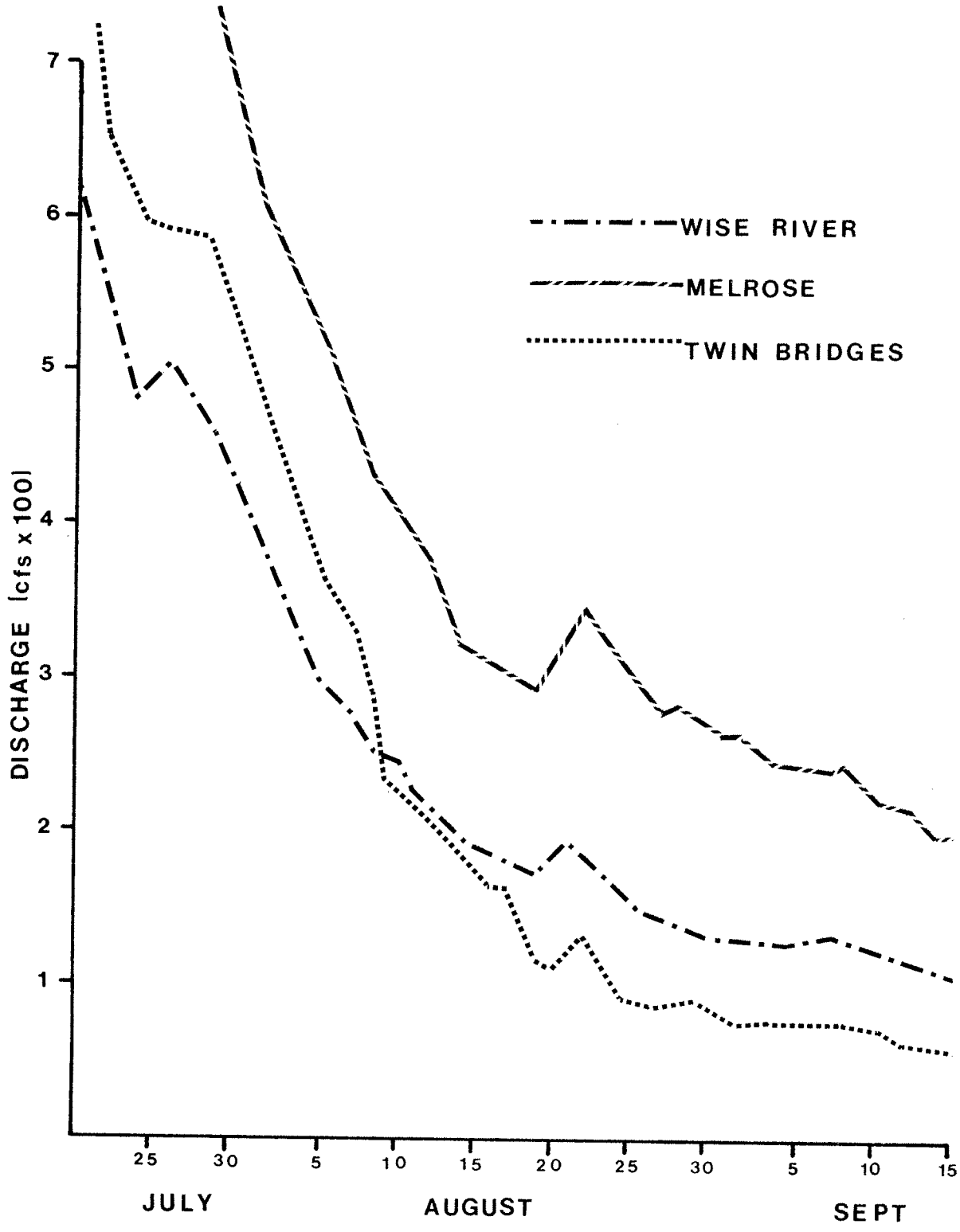


Figure 2. Flows measured at three U.S.G.S. gauges on the Big Hole River, summer, 1981.

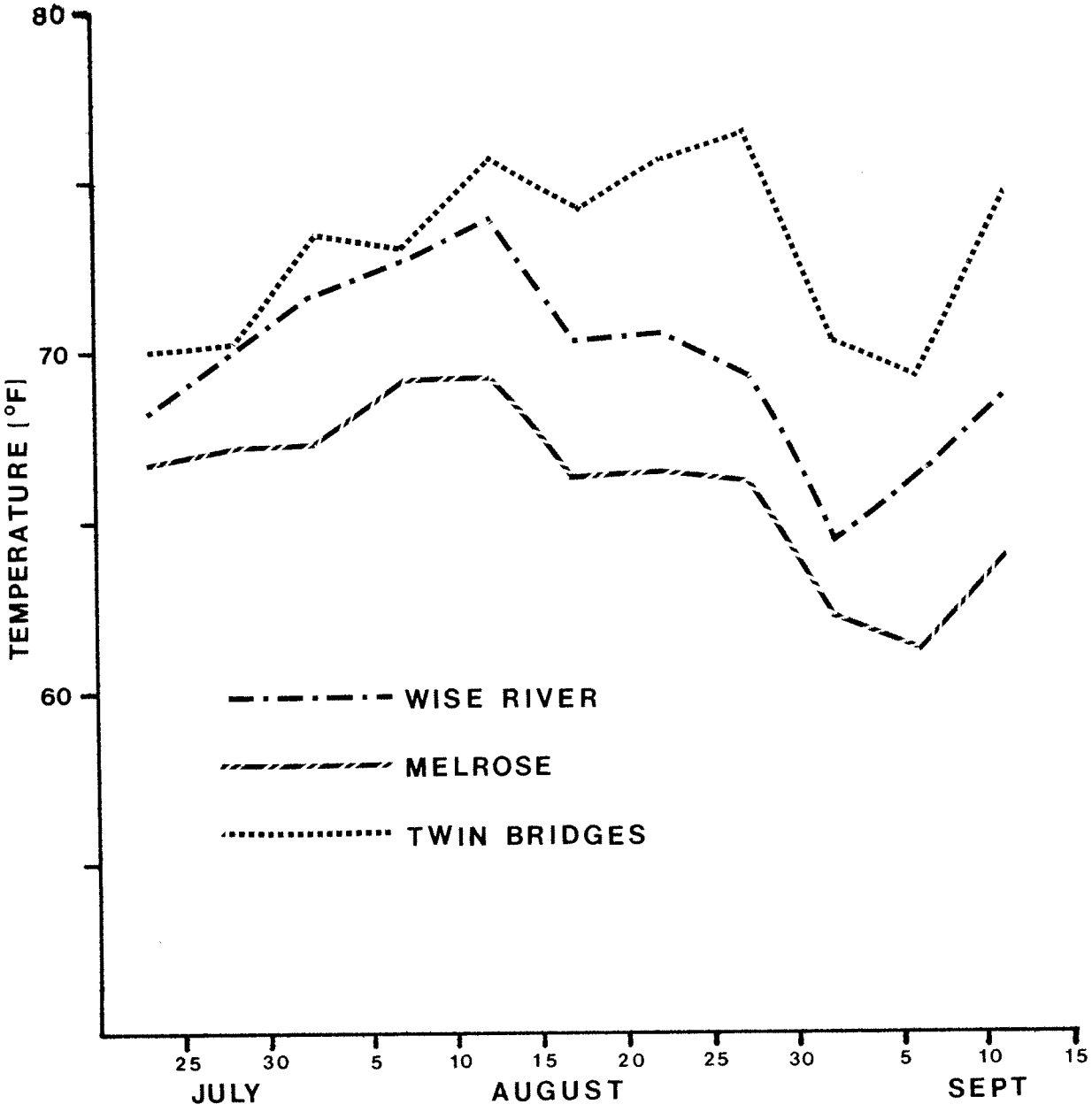


Figure 3. Five-day mean maximum water temperatures measured at three U.S.G.S. gauges in the Big Hole River, summer, 1981.

temperatures were recorded at Twin Bridges (77°F). Melrose had the coolest maximum (71°F), while Wise River was intermediate (76°F). Maximum temperatures at Twin Bridges and Wise River during late summer were often high enough to stress trout. Temperatures at Melrose were not warm enough to cause significant stress.

Fish Populations

Melrose Section

The population of rainbow trout (Salmo gairdneri) in Melrose section increased dramatically in 1981, compared to previous years. Rainbows comprised nearly one-half the total fish population in Melrose section during March, 1981 (Table 2).

Brown trout in Melrose section decreased slightly between 1980 and 1981. The decrease was most evident in age IV and older browns, which were approximately one-half as numerous in 1981 as in 1980.

Summer mortality of brown trout in Melrose section was not estimated in 1981. Fall estimates of age III and older brown trout were inflated by movement of spawners between mark and recapture trips. Summer mortality of rainbow trout was much higher in 1981 than in 1980 (Wells and Decker-Hess 1981b) but similar to summer mortality in 1979 (Wells and Decker-Hess 1981a) another low flow year. Kozakiewicz (1979) attributed a large portion of rainbow summer mortality to angling.

Maiden Rock Section

Maiden Rock section was established in 1981 to monitor the effects of special regulations. Regulations instituted in May, 1981 allowed anglers to keep three trout under 13 inches and one over 22 inches. All trout between 13 and 22 inches must be released. Special regulations were put into effect to satisfy public demand for the opportunity to catch more large (13-18 in.) trout. Special regulations are in effect for that portion of the Big Hole between Divide and Melrose. Maiden Rock sampling section begins approximately three miles downstream of Moose Creek, extending 15,500 ft. downstream to within one-half mile of Melrose (Figure 1).

An estimated 4,113 rainbow trout and 3,011 brown trout inhabited Maiden Rock section when it was first sampled in March, 1981 (Table 3). Fall populations of both species were substantially lower.

Summer mortality rates for both species were similar to mortality rates in the Melrose section from 1977-80 (Wells and Rehwinkel 1980, Wells and Decker-Hess 1981a). Age III and IV+ brown trout suffered summer mortalities of 50 percent and 58%, respectively in the Maiden Rock section. No comparison to Melrose section could be made due to an inflated fall estimate. Summer mortality of rainbows in Maiden Rock section was similar to summer mortality in Melrose section in 1981.

Heron Section

Spring, 1981 population density of brown trout in the Heron section was considerably lower than spring populations in 1979 or 1980. Only 1,511 brown

Table 2. Estimated populations, biomass, summer mortality and mean length by age class of brown and rainbow trout in the Melrose section (22,500 ft.) of the Big Hole River, 1981. (80% confidence intervals)

March, 1981							September, 1981					
Age	Mean Length(in.)	Number	Number/ Mi.	Biomass (lbs.)	Biomass (lbs./mi.)	Summer Mortality	Age	Mean Length(in.)	Number	Number/ Mi.	Biomass (lbs.)	Biomass (lbs./mi.)
					Brown Trout							
II	9.5	1104	259	353	83	--	II	13.5	1093	256	1097	257
III	13.2	1380	324	1201	282	--	III	16.0	1426	335	2312	543
IV+	17.6	620	145	1234	290	--	IV+	18.3	423	99	1002	235
		3104	728	2788	655				2942	690	4411	1035
		(±441)							(±688)			
					Rainbow Trout							
II	9.4	1631	383	523	123	47%	II	11.9	868	204	587	138
III	12.4	1042	245	743	174	52%	III	14.3	504	118	579	136
IV+	14.8	381	89	463	109	83%	IV+	16.6	65	15	115	27
		3054	717	1729	406				1437	337	1281	301
		(±855)							(±215)			

Table 3. Estimated populations, biomass, summer mortality and mean length by age class of brown and rainbow trout in the Maiden Rock section (15,500 ft.) of the Big Hole River, 1981. (80% confidence intervals)

March, 1981							September, 1981					
Age	Mean Length (in.)	Number	Number/ Mi.	Biomass (lbs.)	Biomass (lbs./mi.)	Summer Mortality	Age	Mean Length (in.)	Number	Number/ Mi.	Biomass (lbs.)	Biomass (lbs./mi.)
					Brown Trout							
II	10.1	876	298	348	119	--	II	13.5	1106	377	1100	375
III	13.5	1669	569	1602	546	50%	III	16.0	833	284	1370	467
IV+	18.2	466	159	983	335	58%	IV+	18.9	198	67	517	517
		3011 (±844)	1026	2933	1000				2137 (±465)	728	2987	1019
					Rainbow Trout							
II	9.1	1859	633	550	187	45%	II	11.8	1027	350	639	218
III	11.8	1701	579	1062	362	64%	III	14.0	615	209	644	219
IV+	14.4	553	188	631	215	73%	IV+	16.5	151	51	255	87
		4113 (±1551)	1400	2243	764				1793 (±305)	610	1538	524

trout inhabited the section in 1981, versus over 3,000 in previous years. Sample sizes were inadequate to provide a reliable age class breakdown.

Summer mortality estimates were not made in 1981 due to lack of age class data in spring and gross inflation of the fall estimate by spawning movements.

Brown trout in Heron section continue to display ill effects from low flows and excessive water temperatures. Condition factors (C) of 11.0-11.9 inch brown trout at Heron in spring, 1981 averaged 38.29, versus 41.14 at Melrose. Brown trout 15.0-15.9 inches in length had average C values of 38.11 at Heron and 39.70 at Melrose.

Ruby River

Discharge and Temperature

Flows in the lower Ruby River in summer, 1981 were similar to previous years. Flows ranged from 107 cfs to 195 cfs with the minimum occurring in mid-August (Figure 4). All daily mean flows were well above those required for low levels of aquatic habitat potential (Montana Department of Fish, Wildlife and Parks 1979). Only during 10 days in August were daily mean flows lower than those required for high levels of aquatic habitat potential.

Water temperatures in the lower Ruby River were also similar to previous years. Maximum recorded temperature was 71°F and the highest five-day mean maximum was less than 70°F (Figure 4). Water temperatures in the Ruby River throughout the summer are excellent for trout growth.

Fish Populations

Sailor Section

Numbers of age III and older brown trout in Sailor section decreased 19 percent between 1980 and 1981, and 34 percent between 1979 and 1981 (Table 4). Efficiency in sampling age II brown trout varies from year to year. A reliable estimate of age II browns was not obtained in spring, 1981.

Fall brown trout populations in the lower Ruby River can not be estimated after September due to a large influx of spawners in October. Brown trout over 16 inches in length make up only a small portion of the Ruby's resident population. When migratory spawners enter the population, as many as one-fourth of the total population may exceed 16 inches in length (Figure 5).

A tagging program was initiated in fall, 1981 to determine the origins of migratory brown trout in the Ruby River. A total of 111 brown trout were tagged with Floy anchor tags. Three tags have been returned. One fish was caught in the lower Ruby within one month after being tagged. A second fish was caught in April, 1982 by a Montana Dept. of Fish, Wildlife and Parks electrofishing crew in the Jefferson River near Three Forks, approximately 85 miles downstream of the tagging site. The third fish was caught by an angler in June, 1982 in the Jefferson River near Willow Creek, 75 miles downstream of the tagging site.

The limited tag return information gathered thus far indicates the Ruby River may be a major spawning stream for the entire Jefferson River drainage. Efforts to tag fish and identify migration patterns will increase in subsequent years.

Table 4. Estimated spring populations and biomass of brown trout in the Sailor section of the Ruby River, 1979-81. (80% confidence intervals)

	Age Class	Mean Length (in.)	Number	Number/ mi.	Biomass (lbs.)	Biomass (105/mi.)
1979						
	II	9.5	406	130	122	39
	III	11.7	1,361	436	757	242
	IV+	14.8	365	117	409	131
			2,132	683	1,289	412
			(± 582)			
1980						
	II	9.5	1,300	416	444	142
	III	12.0	849	272	533	171
	IV+	14.1	553	177	561	180
			2,702	865	1,538	493
			(± 412)			
1981						
	II	--	--	--	--	--
	III	11.9	778	249	496	159
	IV+	14.4	355	114	385	123
			1,133	363	881	282
			(± 210)			

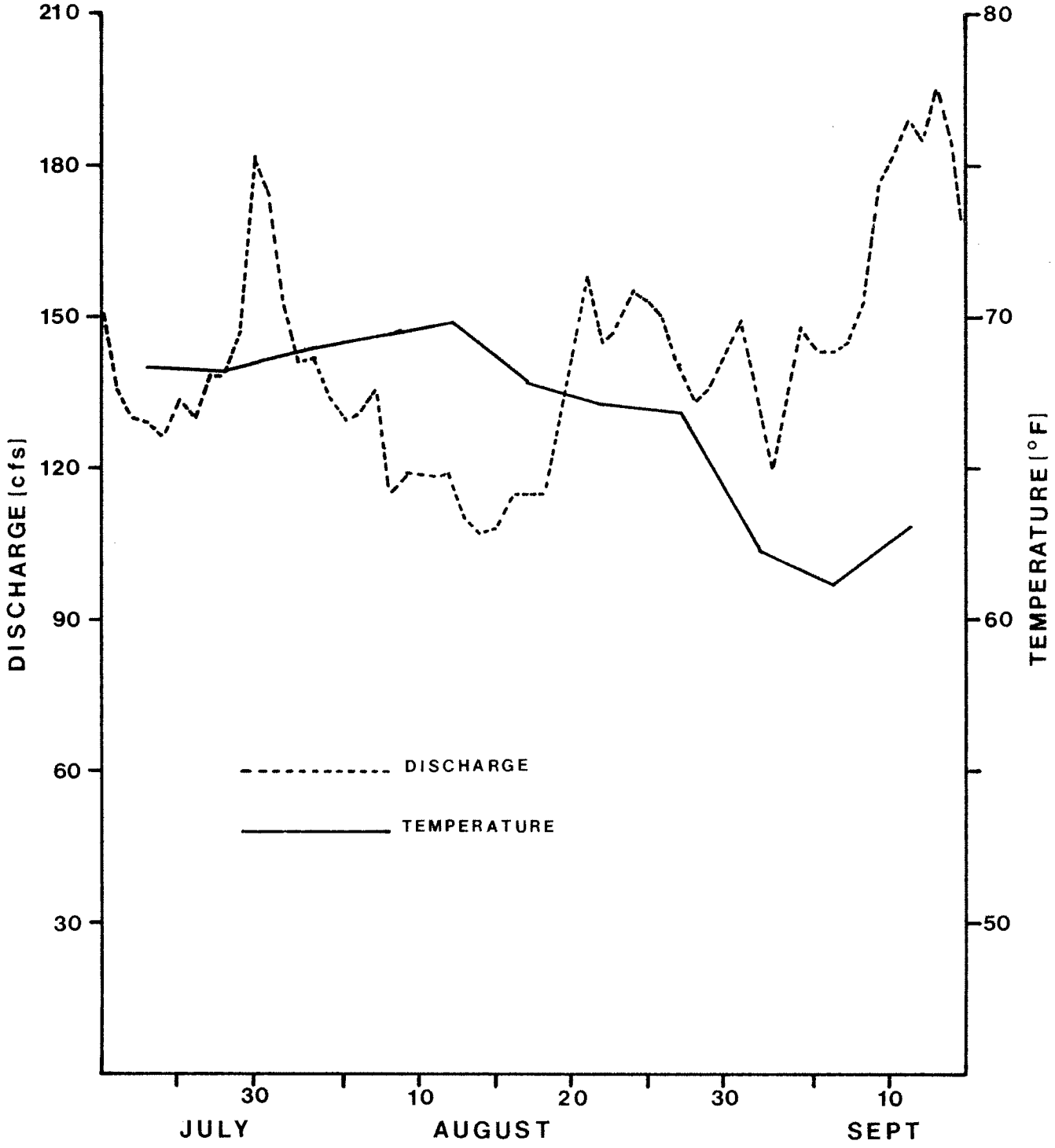


Figure 4. Discharge and temperature in the lower Ruby River during late summer, 1981.

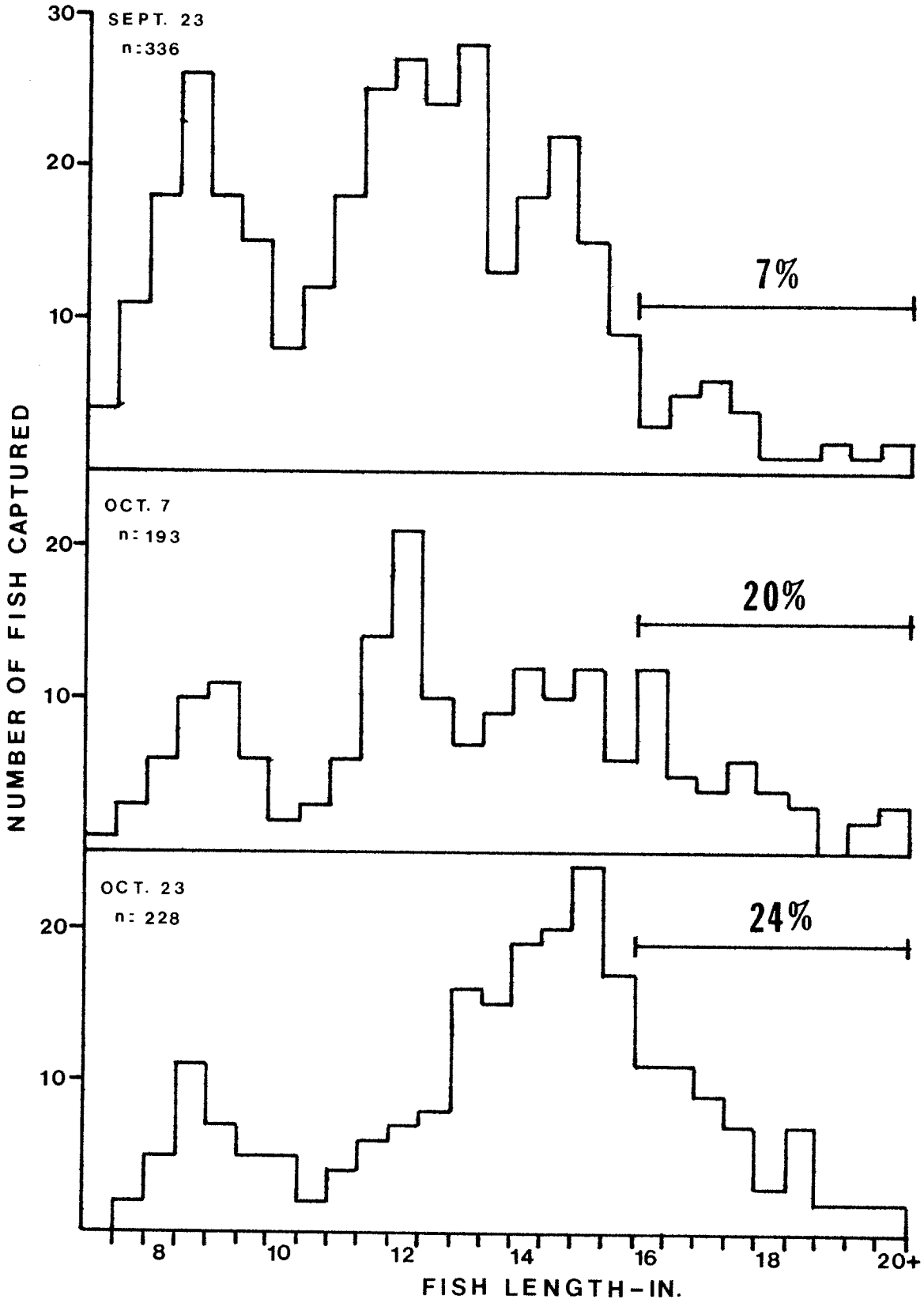


Figure 5. Length frequencies of brown trout captured in Sailor section of the Ruby River on three different dates in fall, 1981.

DISCUSSION

Big Hole River

Fish Populations

Annual plants of catchable hatchery rainbow trout were made in the Big Hole River through 1973. An average of 34,607 catchables were planted annually between 1965 and 1971. Plants were reduced to 12,566 in 1972 and 10,036 in 1973 before the planting program was terminated. Since 1973, no catchables have been planted in the Big Hole downstream of Divide, however, approximately 3,000 catchables have been planted annually upstream of Divide (near Sportsmens Park).

Brown trout population density increased rapidly after planting of catchable rainbows ceased. Brown trout increased 56 percent in number between 1971 and 1977 in Melrose section. Melrose section was not sampled from 1972 through 1976, however, sampling in Reichle section (20 miles downstream of Melrose) showed an increase of 28% in brown trout population density between 1972 and 1974. Brown trout numbers at Melrose continued to increase through 1980, before falling off slightly in 1981 (Figure 6).

Increases in brown trout population density immediately upon suspension of rainbow planting suggests that competition rather than reproductive inhibition may have been the mechanism of interaction between hatchery rainbows and wild brown trout. Further, it appears that competition was most intense upon age II and III brown trout. Large increases in brown trout population density in recent years have been made up entirely of age II and III fish. Age IV and older brown trout were more abundant when hatchery fish were planted annually than they were in the late 1970's.

In contrast, population density of wild rainbow trout apparently remained relatively constant for four years after planting of catchables ceased. A substantial increase in population density occurred in 1978 (Figure 6). No rainbow trout population estimates are available for the period 1972-76.

The five-year lag in population density increases suggests all age classes of wild rainbow trout were adversely affected by hatchery fish. A full generation passed before substantial increases in wild rainbows occurred. Further increases in 1981 were apparently a result of recruitment to the population of the third generation after planting ceased.

Total trout biomass in Melrose section has increased from just over 3000 lbs. in 1977 to nearly 5000 lbs. in 1980 (Figure 7). Total biomass declined slightly in 1981 but should stabilize at some point in the future as populations of both trout species finally adjust to the cessation of planting. Patterns observed thus far in the Big Hole River are similar to patterns observed in the Madison and Yellowstone Rivers after planting of catchable rainbows ceased (E. R. Vincent, MDFWP, personal communication).

The proportion of rainbow and brown trout in the population when equilibrium is established may be determined by fishing pressure. Differential harvest of rainbow and brown trout tends to limit rainbow trout densities

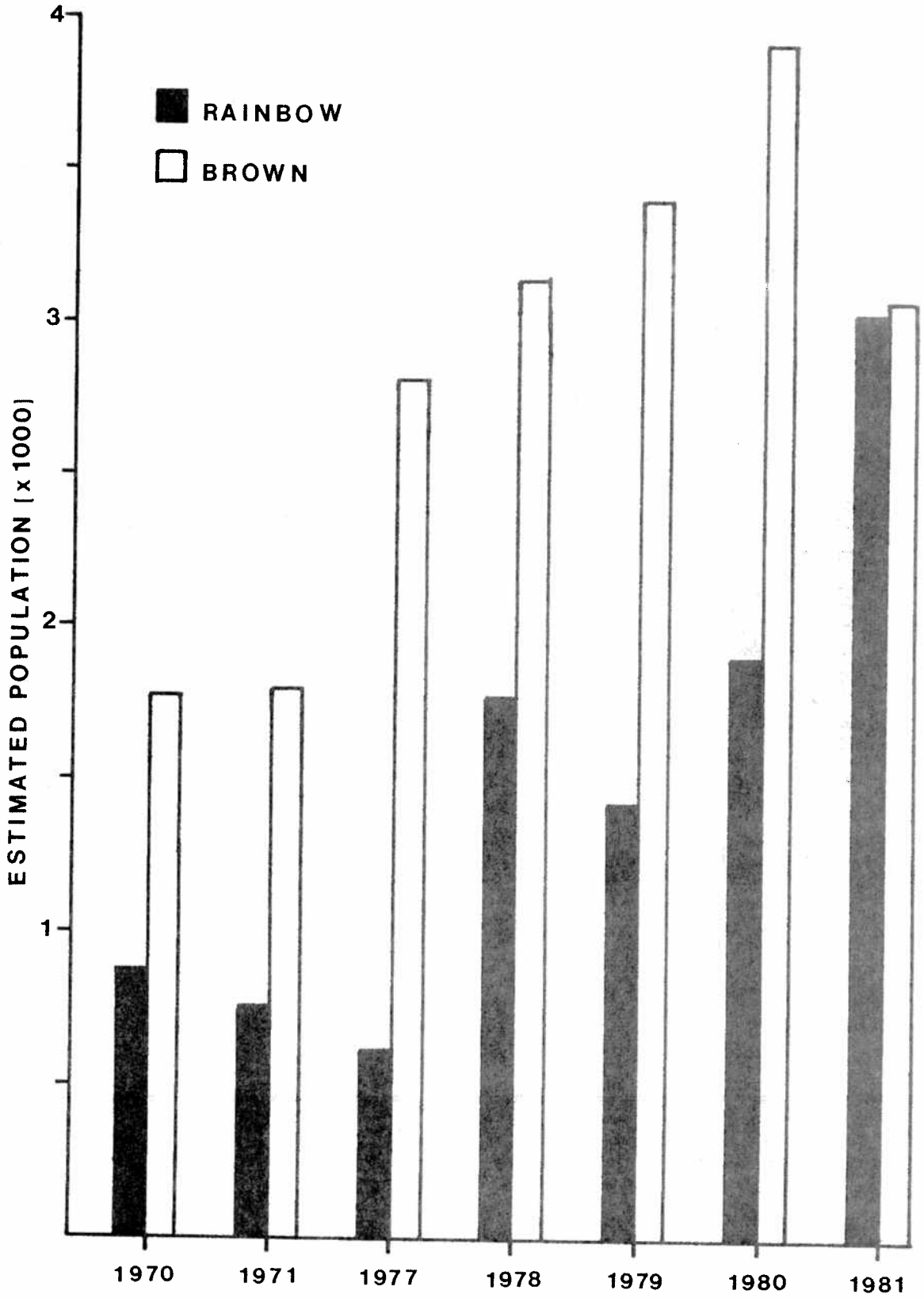


Figure 6. Estimated spring populations of rainbow and brown trout in Melrose section of the Big Hole River, 1970-81.

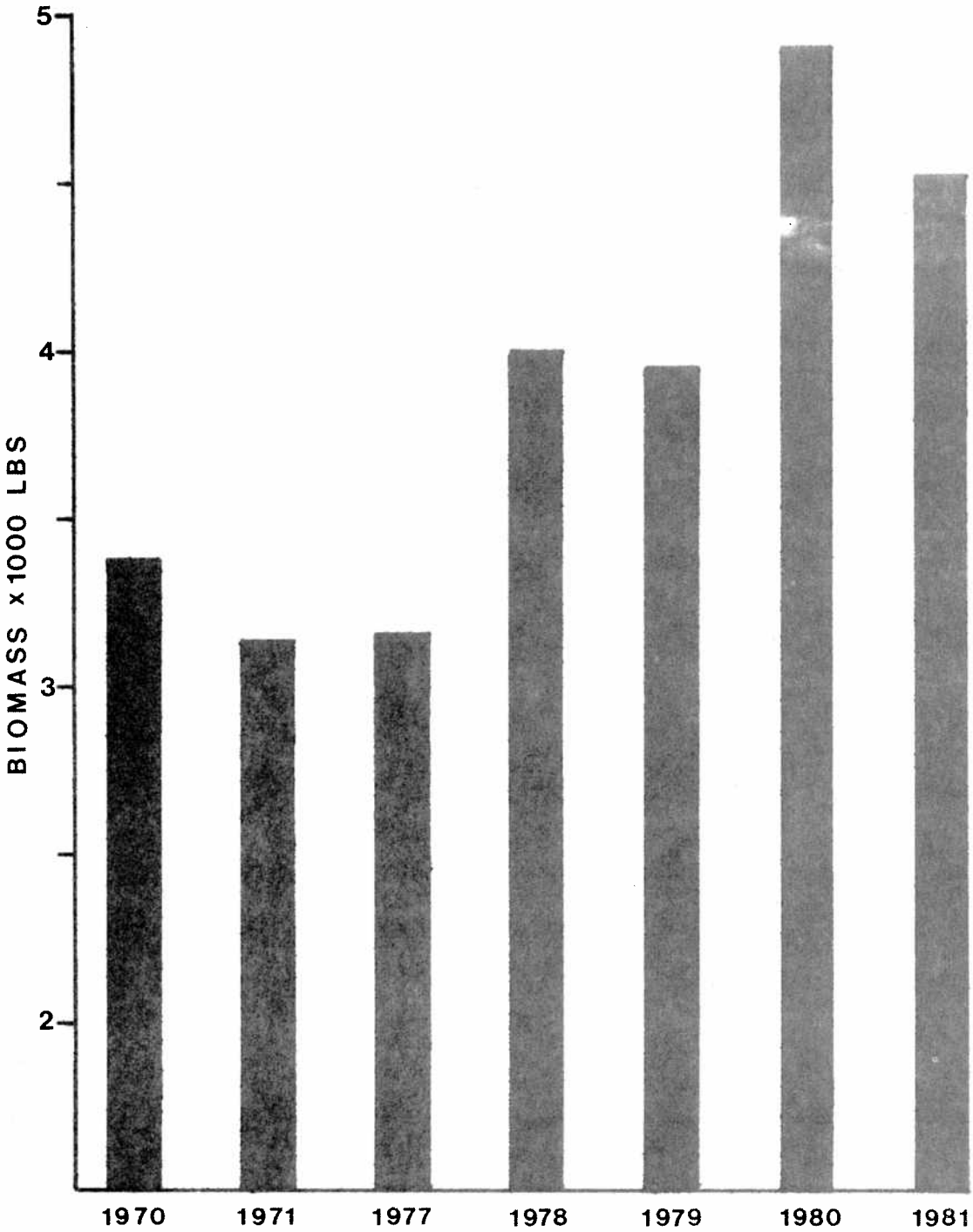


Figure 7. Estimated spring total trout biomass in Melrose section of the Big Hole River, 1970-81.

more than brown trout (McMullin 1982). Consequently, trout populations in Maiden Rock section could differ significantly from those in Melrose section. Further, growth of trout populations resulting from termination of the stocking program may confound evaluation of special regulations in the Big Hole River.

The need for proper streambank and streambed management cannot be over-emphasized. A great deal of time is spent enforcing stream protection laws in the Big Hole and Beaverhead River drainages.

During the reporting period, a total of 12 projects in Beaverhead County and 13 projects in Madison County were inspected under the National Streambed and Land Preservation Act of 1975. Three projects in Beaverhead County and two in Madison County were inspected under the provisions of the Stream Protection Act of 1963.

RECOMMENDATIONS

This project should be continued. Evaluation of special regulations should continue for at least two more years. Trout population responses to termination of catchable rainbow planting should continue to be monitored. Sampling of Heron section should be discontinued. A new section should be established near Wisdom, Montana to monitor status of fluvial grayling.

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Waters Referred to:

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Big Hole River Sec. 2	3-02-0450-01
Ruby River Sec. 1	3-01-6360-01

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	population density