MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION

JOB PROGRESS REPORT

State: Montana Title: Southwest Montana Fisheries Study

Project No.: F-9-R-31/F-9-R-32 Title: Inventory and Survey of the Waters of the

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

Project Period: July 1, 1982 through June 30, 1984

Report Period: March 1, 1982 through February 29, 1984

ABSTRACT

Water years 1982 and 1983 were marked by high flows in the Big Hole River. Summer flows were above those necessary to provide low levels of aquatic habitat potential resulting in high summer survival of Age IV and older brown trout. Summer water temperatures were not high enough to cause significant stress to trout populations.

Populations of wild brown and rainbow trout increased in 1982 followed by decreases in 1983 in the Melrose section. These wild populations have been increasing since the cessation of the stocking of hatchery rainbow trout in 1973.

Populations of large (18 inch +) brown trout and (15 inch +) rainbow trout have increased dramatically in the Maiden Rock section of the Big Hole River since the implementation of special regulations in 1981. Data indicate the regulations have channeled higher percentages of the brown trout population and biomass into the larger (18 inch +) segment of the population while affording protection to a larger size range of rainbow trout.

Populations of arctic grayling in the upper Big Hole River appear to be present in relatively low densities. Estimated numbers of Age II and older grayling of 105 per mile coexist with introduced brook trout (222 per mile) and rainbow trout (14 per mile).

Electrofishing and tag return information have confirmed the Ruby River provides spawning habitat for migratory brown trout from the Jefferson River.

BACKGROUND

The Big Hole River is one of Montana's Blue Ribbon trout streams and sustains heavy fishing pressure from resident and nonresident anglers. Fishing pressure on the Big Hole River from 1975 through 1976 was estimated at 66,277 angler days--second only to the Madison River among southwest Montana streams. A 10-mile study section within the Blue Ribbon reach was found to support in excess of 500 fisherman days per stream mile in 1977 (Kozakiewicz 1979).

Irrigation demands, in association with hay and cattle ranches, represent another use of Big Hole River water. Irrigation withdrawals generally peak in late summer when normal stream flows approach the annual minimum and water temperatures attain maximum levels. Low summer flows have been shown to have adverse effects on Big Hole River trout populations (Wells and Decker-Hess 1980 and 1981).

Special regulations designed to increase numbers of large trout were implemented in 1981 on a reach of the Big Hole River between Divide and Melrose. The "slot limit" regulations allow fishermen to harvest three trout under 13 inches and one trout over 22 inches in length. All trout between 13 and 22 inches must be released; thus anglers have been restricted to the use of artificial lures and flies to reduce hooking mortality of released fish.

The upper reaches of the Big Hole River support the last native fluvial grayling population of significance in the contiguous United States. The grayling is a species of special concern in Montana (Deacon, et al 1979) and represents a unique angling opportunity in the upper Big Hole. The upper reach of the Big Hole provided an estimated 12,700 angler days of recreation during 1975-76, largely for brook trout and arctic grayling. Fisherman harvest of grayling was restricted from five per day to one per day in 1982. The limit was further restricted in 1983 to one grayling in excess of 13 inches.

The lower Ruby River has been identified as an important spawning stram from migratory Jefferson River brown trout. The Ruby River also supports a good fishery for resident brown trout and provided 6,945 angler days of recreation downstream from Ruby Reservoir.

OBJECTIVES AND DEGREE OF ATTAINMENT

1. To determine spring and fall trout population estimates in two sections of the Big Hole 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 one location on the Big Hole River. Data are presented.

4. To monitor spring brown trout populations in one section of the Ruby River. Final data are presented.

5. To monitor fisheries throughout the drainages. As a part of this objective, the following specific tasks were completed:

a. To determine fall arctic grayling populations on one section of the Big Hole River. Data are presented.

b. To determine fall spawning migrations of Jefferson River brown trout in the lower Ruby River. Data are presented.

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

PROCEDURES

Discharge and water temperature data were collected at a USGS gage site on the Big Hole River near Melrose. Data were computer analyzed and adjusted by the USGS.

Fish populations were censused through the use of boat-mounted mobile anode electrofishing equipment. Fish were aged by the scale method. Population and standing crop estimates were made using methods described by Vincent (1971 and 1974) and adapted for computer analysis (Holton, et al. 1981).

FINDINGS

Big Hole River

Discharge

Summer flows in the Big Hole River were markedly above average in water years 1982 and 1983 (Table 1). Mean August-September flows in water years 1982 and 1983 were ranked as the seventh and fifth highest in the 20-year period spanning 1964-1983. Mean August flows of 677 cfs in 1982 and 801 cfs in 1983 exceeded the 600 cfs identified as the instream flow required to maintain high levels of aquatic habitat potential, while mean September flows of 466 cfs in 1982 and 577 cfs in 1983 were markedly above the 300 cfs delineated as the instream flow required to maintain low levels of aquatic habitat potential (Montana Department of Fish, Wildife and Parks 1979). The 1982-83 summer flow regime can be contrasted with 1981 when flows were below the minimum 300 cfs level for a four-week period in August and September (McMullin 1982).

August-September flow regimes for the Big Hole River near Melrose are depicted in Figure 2. Summer flows in 1982 and 1983 generally followed pat-

favorable contrast with the minimum flow of 199 cfs recorded in 1981 (McMullin 1982). August 1983 was marked by two discharge peaks (August 11-14th and 21-27th) during which flows exceeded 800 cfs and attained a maximum of 1040 cfs.

Flows in the Big Hole River during the critical month of August have been linked to abundance of Age IV and older brown trout in the fall. A significant relationship ($P \leq .05$) between minimum August flow and estimated fall numbers of Age IV and older brown trout has been demonstrated through linear regression analysis (Wells and Decker-Hess 1980 and 1981). This relationship has been expanded through the addition of 1981-1983 data in Figure 3. The additional data indicate a continuation of the trend under which low August flows in 1981 were followed by low numbers of Age IV and older brown trout, while higher August flows in 1982 and 1983 resulted in a greater September abundance of Age IV and older fish.

Water Temperature

Summer water temperatures at the Melrose gage site are presented in Figure 4. Seasonal temperature variation in 1982 and 1983 followed normal patterns with the attainment of summer maxima in August followed by a cooling trend in September. Mean water temperatures for the month of August were 62.6°F in 1982 and 63.5°F in 1983. Mean temperatures in September averaged 9°F lower than the August means in both years. Maximum summer temperatures of 73.4°F and 73.2°F were recorded on August 23, 1982 and August 4, 1983. Daily thermal maxima reached or exceeded 70°F on two days in 1982. Maximum daily temperatures in excess of 70°F occurred on four days during a six-day period in early August, 1983. These high maximum temperatures coincided with a rapid drop in flow over the same time period; however, mean daily temperatures of 65 to 67°F and minimum temperatures of 60 to 63°F were sufficiently low to mitigate any significant stress to trout populations.

Fish Populations

Melrose Section

This study section was established in 1969 (Elser and Marcoux 1972) and its trout population described by numerous investigators, most recently Wells and Decker-Hess (1981) and McMullin (1982). The present length of the study section is 22,500 feet (4.26 miles). Population and standing crop estimates of brown and rainbow trout in the section are presented in Table 2 for spring and fall of 1982 and 1983.

Spring numbers of Age II and older brown trout in 1982 showed a 21 percent increase over 1981 levels (McMullin 1982). This increase resulted from increases of 94 Age III fish per mile and 104 Age IV+ fish per mile between the two years. Spring numbers of Age II and older brown trout in 1983 underwent a slight (6%) decline from 1982. The overall decline resulted primarily from a loss of 108 Age III fish per mile compensated for by gains of Age II and Age IV+ fish.

The standing crop of Age II and older brown trout in the spring of 1982 increased by 35 percnet over 1981 levels to 892 lbs per mile. The 1983 estimate represented a 12 percent decline from 1982 to 785 lbs per mile.

Fall numbers of Age II and older rainbow trout in 1982 showed a 22 percent increase over 1981 levels. This increase was due primarily to increases in numbers of Age III and Age IV+ fish. Fall numbers of Age II and older rainbow trout in 1983 underwent a 27 percent decline from 1982 due almost entirely to a 110 fish-per-mile decline in the number of Age II fish.

The standing crop of Age II and older rainbow trout in the fall of 1982 increased by 20 percent over 1981 levels to 358 lbs per mile. The 1983 estimate represented a 21 percent decline from 1982 to 282 lbs per mile.

Spring brown trout and fall rainbow trout estimates are emphasized to describe stable population numbers and minimize error due to fish movement. Estimate inflation has been observed due to fish spawning movements in the past (McMullin 1982). For this reason, no attempt was made to estimate summer mortality for brown or rainbow trout.

Maiden Rock Section

The Maiden Rock section was established in March, 1981. This section and its trout population were described by McMullin (1982). Sampling programs were instituted in the Maiden Rock section to monitor the effects of special regulations which were implemented in 1981 to increase numbers of large (13-18 inch) trout. These special regulations limit fisherman harvest to three trout under 13 inches and one trout over 22 inches, and restrict angler method to artificial lures and flies. The length of this study section is 15,500 feet (2.94 miles). Population and standing crop estimates of brown and rainbow trout in the section are given in Table 3 for spring and fall 1982 and 1983.

Spring numbers of Age II and older brown trout in 1982 showed a seven percent decline from 1981. The 1983 estimate showed a two percent decline from 1982 numbers. Numbers of Age IV and older brown trout, however, exhibited an increase of 187 percent between 1981 and 1982 followed by a decrease of 25 percent between 1982 and 1983. Spring numbers of Age IV+ brown trout in 1983 remained 117 percent higher (344 per mile versus 159 per mile) than in 1981 prior to special regulations.

While total numbers of brown trout in the section have decreased since 1981, biomass has increased. Brown trout biomass increased 19 percent between 1981 and 1982, and decreased nine percent between 1982 and 1983 for a net increase of nine percent over 1981, while the net decline in brown trout numbers was nine percent over the same period.

Fall numbers of Age II and older rainbow trout showed a 69 percent increase between 1981 and 1982 followed by a slight (6%) increase between 1982 and 1983. The 1983 estimate represents a gain of 479 Age III+ rainbow trout per mile over 1981, the first season of special regulation. Similarly, the Age IV and older rainbow trout increased from 51 to 172 per mile for an increase of 237 percent over the same time period.

Rainbow trout fall standing crops followed increased abundance gaining 70 percent between 1981 and 1982, and increasing slightly (4%) between 1982 and 1983. The 1983 estimate represents a biomass of 928 lbs per mile compared to 524 lbs per mile in 1981.

Comparisons can be made between the Maiden Rock and Melrose sections to indicate effects of special regulation. Estimated spring numbers of 13-inch and larger and 18-inch and larger brown trout, and estimated fall numbers of 13-inch and larger and 15-inch and larger rainbow trout are given in Table 4. Patterns of abundance of 13-inch and larger brown trout followed similar trends in both the Maiden Rock and Melrose sections over the 1981-1983 period. The 1983 estimate for Maiden Rock section represented a net 33 percent increase over the 1981 estimate, while the Melrose estimate showed a net 22 percent increase over the same time span. Patterns of abundance of large brown trout (18 inches+), however, exhibited widely divergent trends. Numbers of 18-inch+ brown trout increased markedly between 1981 and 1982, and increased by a larger margin between 1982 and 1983 in the Maiden Rock section. Numbers of these large brown trout increased slightly in 1982 followed by a decrease in 1983 in the Melrose section. The 1983 Maiden Rock estimate represented a net 175 percent increase over the 1981 estimate, while populations of 18-inch+ brown trout remained virtually unchanged in the Melrose section.

Rainbow trout exhibited a different response to the special regulations than brown trout. Thirteen-inch and larger rainbow trout increased by a net 105 percent in the Maiden Rock section while the Melrose section showed a net seven percent gain over the 1981-1983 period. The large rainbow trout (15-inch+) increased by a net 181 percent between 1981 and 1983 in the Maiden Rock section compared to a net 21 percent increase in the Melrose section. A high percentage of rainbow trout mortality in the Big Hole River has been attributed to angler harvest (Kozakiewicz 1979).

While numbers of large (18-inch+) brown trout have increased markedly since the institution of special regulations in the Maiden Rock section, total numbers of brown trout have decreased slightly. This shift in population distribution can be further demonstrated through an examination of brown trout standing crop (Table 5). The data indicate relatively little change has occurred in the Melrose section over the 1981-1983 period in the standing crop of 18-inch+ brown trout. Since the institution of special regulations in the Maiden Rock section, however, biomass has shifted to the larger segment of the brown trout population. Data from 1983 indicate nearly one-fourth of the brown trout standing crop was accounted for by 18-inch+ fish in the Maiden Rock section; data from the Melrose section indicate a stable biomass of nine to 10 percent of the total accounted for by the large fish.

Wisdom Section

The Wisdom section was established in the fall of 1983 to gather information on the status of arctic grayling (Thymallus arcticus) populations in the upper Big Hole River. The study section originated at the Highway 43 bridge in Wisdom, Montana and extended downstream to the mouth of Sand Hollow Creek for a distance of 34,320 feet (6.5 miles). Angler harvest was restricted to a one grayling limit from a previous five grayling limit in 1982. The

restriction was based on data presented by Liknes (1981) which suggested low populations of arctic grayling in the upper Big Hole River. The restriction was supported by fishermen interested in affording protection to the Pig Hole grayling, which is classified as a species of special concern in Montana (Deacon, et al 1969). Population and standing crop estimates of arctic grayling in the section for the fall of 1983 are given in Table 6.

The 1983 data suggest the arctic grayling population of the Wisdom section is present in relatively low levels of abundance. The Age II and older grayling estimate of 105 per mile is representative of a delicate population which could be severly reduced by overharvest, habitat deterioration, or severe environmental conditions. Observations during electrofishing trips suggest the fluvial grayling of the Big Hole River are restricted to a pool habitat type marked by laminar flows.

Only 13 Age I grayling and two Age 0 grayling were handled during the six sampling runs made through the section. No reliable estimate could be made on these younger fish. It is not possible to determine at this time if these numbers are indicative of poor recruitment, sampling error, or use of tributary streams by younger fish. Liknes (1981) documented collections of grayling fry in seven Big Hole River tributaries.

It is difficult to compare the 1983 data to past population estimates due to a lack of data. Liknes (1981) set up four study sections in the upper Big Hole River and was able to handle enough grayling to calculate an estimate in one of the sections. This estimate was limited to grayling 9.9 to 11.7 inches and was calculated as 65 per mile. By comparison, the 1983 estimate for 10.0-11.9-inch grayling in the Wisdom section was 62 per mile. The lower boundary of Liknes' estimate section was nearly continuous with the upper boundary of the current Wisdom section.

Competition with introduced species has been cited as one reason for the decline or loss of native grayling populations (Vincent 1962; Liknes 1981). Population estimates were obtained for brook and rainbow trout in the Wisdom section. The brook trout population was estimated to be 222 per mile (7.0-inch to 16.4-inch) in the fall of 1983. The estimate was not considered reliable due to brook trout spawning movements. The rainbow trout population was estimated to be 14 per mile (10.5-inch to 20.8-inch). While rainbow trout were present in very low numbers per mile in 1983, no estimate of rainbow trout could be calculated by Liknes (1981) due to scarcity of the fish in 1978 and 1979. Estimatable numbers of rainbow trout in 1983 may be indicative of an invasion of the upper Big Hole River by wild rainbow trout.

Ruby River

The lower Ruby River, downstream from Ruby Reservoir, has been identified as an important spawning stream for migratory Jefferson River brown trout. Begining in the fall of 1981, larger (generally in excess of 16 inches) brown trout have been implanted with numbered orange floy tags. Numbers of fish tagged and numbers of tag returns for the 1981-1983 period are presented in Table 7. Tag return information thus far indicates the Ruby River provides

spawning habitat for fish from the Jefferson River drainage from as far downstream as the Three Forks vicinity--approximately 85 stream miles distant. Most of the tag returns came from the Hell's Canyon area of the upper Jefferson River.

Sampling of resident brown trout in the Sailor section was terminated after the April 1982 sample. Data collected from 1979-1982 indicate relatively stable brown trout populations, adequate summer flow regimes, and an excellent thermal regime for trout growth (Wells and Decker-Hess 1981; McMullin 1982).

DISCUSSION

Wild trout populations in the Big Hole River have expanded over the past decade in response to the cessation of annual stocking with hatchery rainbow trout in 1973 (McMullin 1982). The expansion of the brown trout population has probably leveled off in the Melrose section at 3500 to 4000 fish compared to pre-1973 estimates of less than 2000. Data suggest rainbow trout numbers may still be increasing.

Summer flows and water temperatures in the Big Hole River were well above average during the 1982-1983 period and conducive to excellent trout growth and survival. Continued analysis of summer flow-trout population data strongly suggest adequate summer flows are essential to maintain high level trout populations in the Big Hole River as indicated by Wells and Decker-Hess (1981) and Kozakiewicz (1979).

Special angling regulations, designed to increase numbers of larger trout in the Big Hole River, have been highly successful since their implementation in 1981. While special regulations have had little discernable effect on 13.0-inch to 17.9-inch brown trout, numbers of 18-inch and larger brown trout have increased 175 percent between 1981 and 1983 in the Maiden Rock section and remained relatively static in the Melrose section. For brown trout management, the special regulations have thus far had the effect of channeling more of the population and biomass into the older age groups. Kozakiewicz (1979) indicated angler harvest was not a limiting factor for Age IV+ brown trout in the Big Hole River; however, Wells and Decker-Hess (1980) suggest fishermen may have been limiting the larger segment (18-inch+) of this age group.

Comparisons between the rainbow trout populations of the Maiden Rock and Melrose sections indicate special regulations have been instrumental in increasing numbers of 13-inch+ and, to a greater extent, 15-inch+ fish. Differential susceptibility to angler harvest between brown and rainbow trout (McMullin 1982) is the probable cause of the special regulations affording greater protection to a larger size range of fish in the rainbow trout population.

Population densities of arctic grayling in the upper Big Hole River appear to be relatively low. Baseline data collected in 1983 in the Wisdom section can be used to monitor future changes in the grayling population.

The arctic grayling has been found to be intolerant of numerous man-caused perturbations, including sedimentation, habitat alteration, low flows, high temperatures, and competition from introduced species (Vincent 1962; Liknes 1981). In addition to these environmental factors, grayling are highly susceptible to fishing pressure. Grayling captured during the 1983 sample exhibited an incidence of 12 percent hooking scars. Continued monitoring of the Big Hole River grayling population should be tailored to account for flow/temperature relationships, competition from increased numbers of rainbow trout, and restricted fishing harvest.

Continued analysis of tag returns from Jefferson River brown trout will provide more information on the importance of the Ruby River as a spawning habitat for the drainage.

Good streambank and channel management are essential to the maintenance of stream trout fisheries. An ongoing effort to enforce stream protection laws, through the inspection of proposed projects, has been continued in the Big Hole, Beaverhead and Ruby River drainges. Through the report period, a total of 29 projects in Beaverhead County and 37 projects in Madison County were inspected under the Natural Streambed and land Preservation Act of 1975. An additional five projects in Beaverhead County and four projects in Madison County were inspected under the Stream Protection Act of 1963.

RECOMMENDATIONS

This project should be continued. Evaluation of the response of wild trout populations to the cessation of planting hatchery rainbow trout should be continued until rainbow trout populations stabilize. Effects of special regulations should continue to be monitored as numbers of larger trout continue to increase. The status of the native fluvial grayling population of the upper Big Hole River should continue to be monitored as a species of special concern. A new section in the tailwater of the Ruby Reservoir should be established to attempt to ascertain effects of reservoir flow management upon the fishery.

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Date:

Waters Referred To:	Big Hole River, Section 1	3 02 0425 01
	Big Hole River, Section 3	3 02 0475 01
	Ruby River, Section 1	3 01 6360 01

Key Words:	Flow Regime	Special Regulations
	Trout Numbers	Trout Migration
	Trout Biomass	Grayling Population
	Trout Population Dynamics	

FIGURES AND TABLES

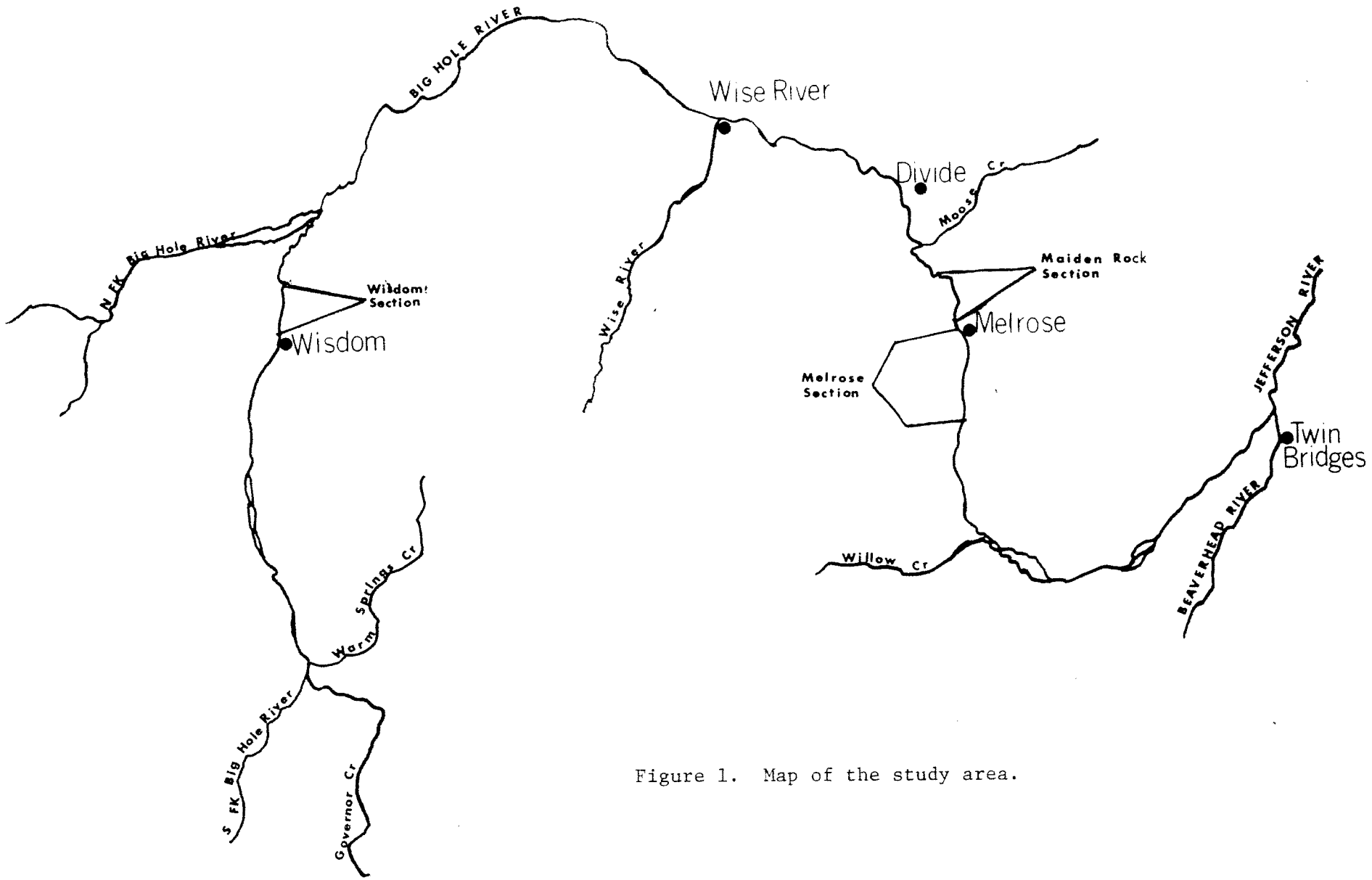

Figure 1. Map of the study area.

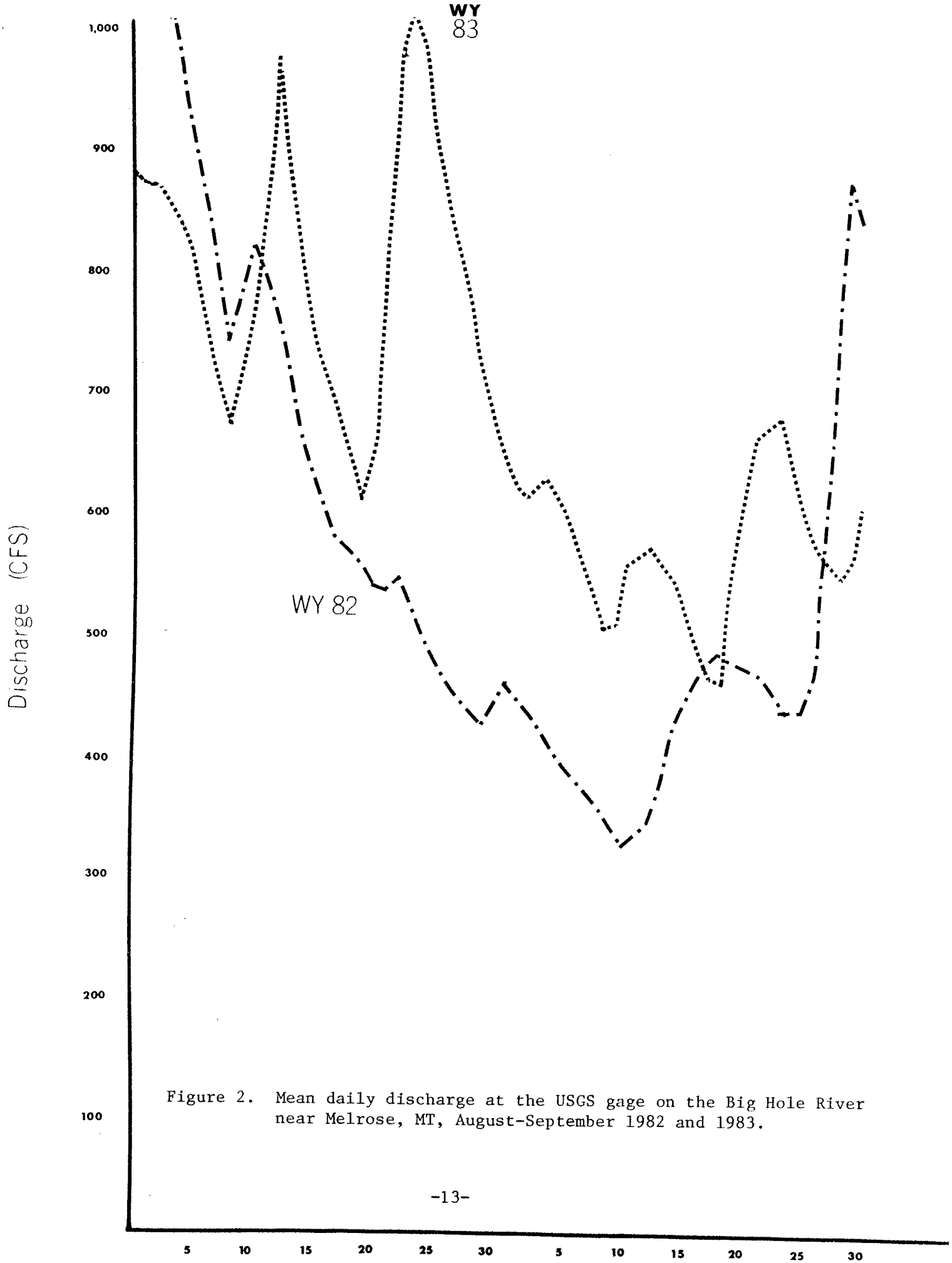

Figure 2. Mean daily discharge at the USGS gage on the Big Hole River near Melrose, MT, August-September 1982 and 1983.

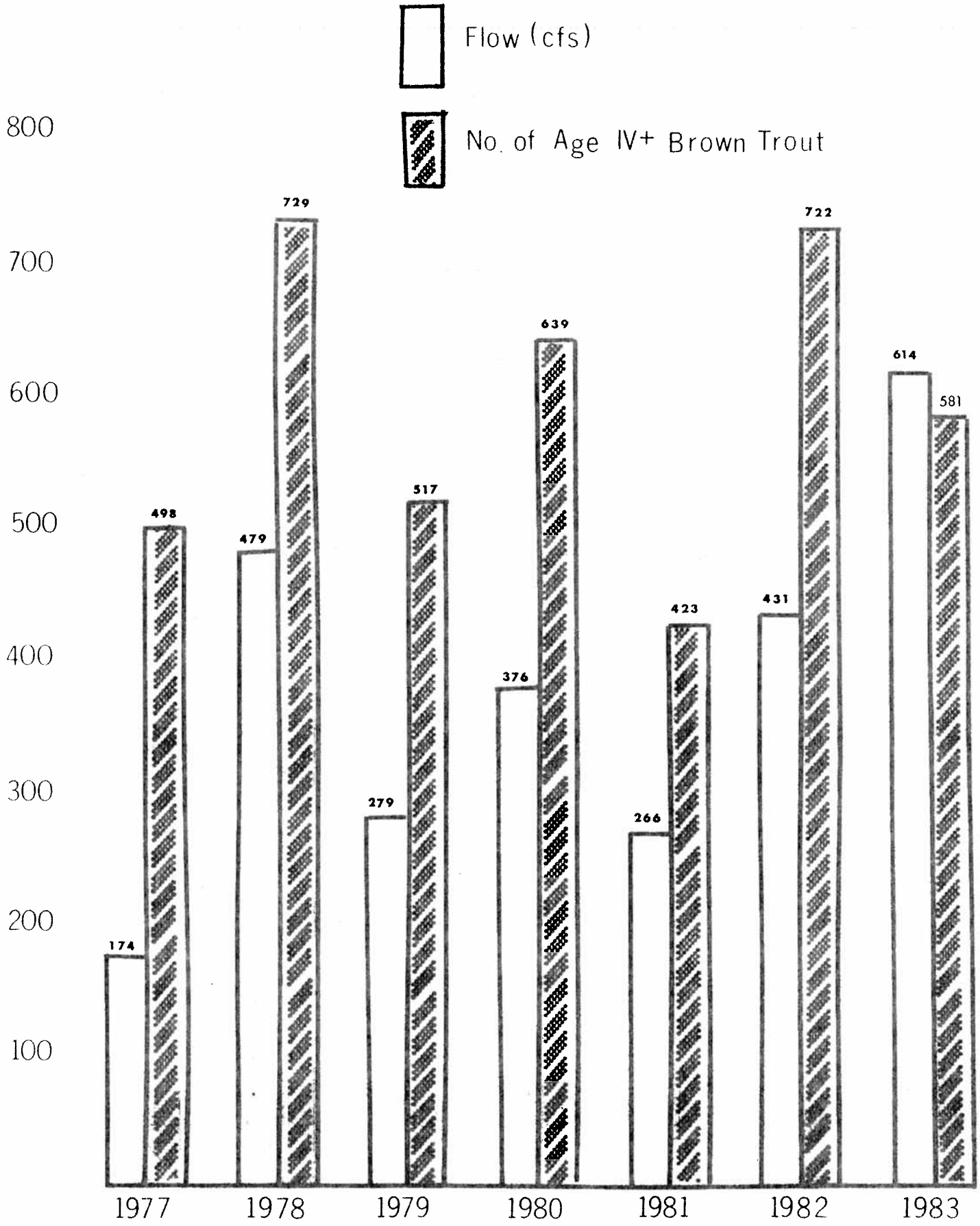

Figure 3. Minimum August discharge and September numbers of Age IV and older brown trout in the Melrose section of the Big Hole River 1977-1983.

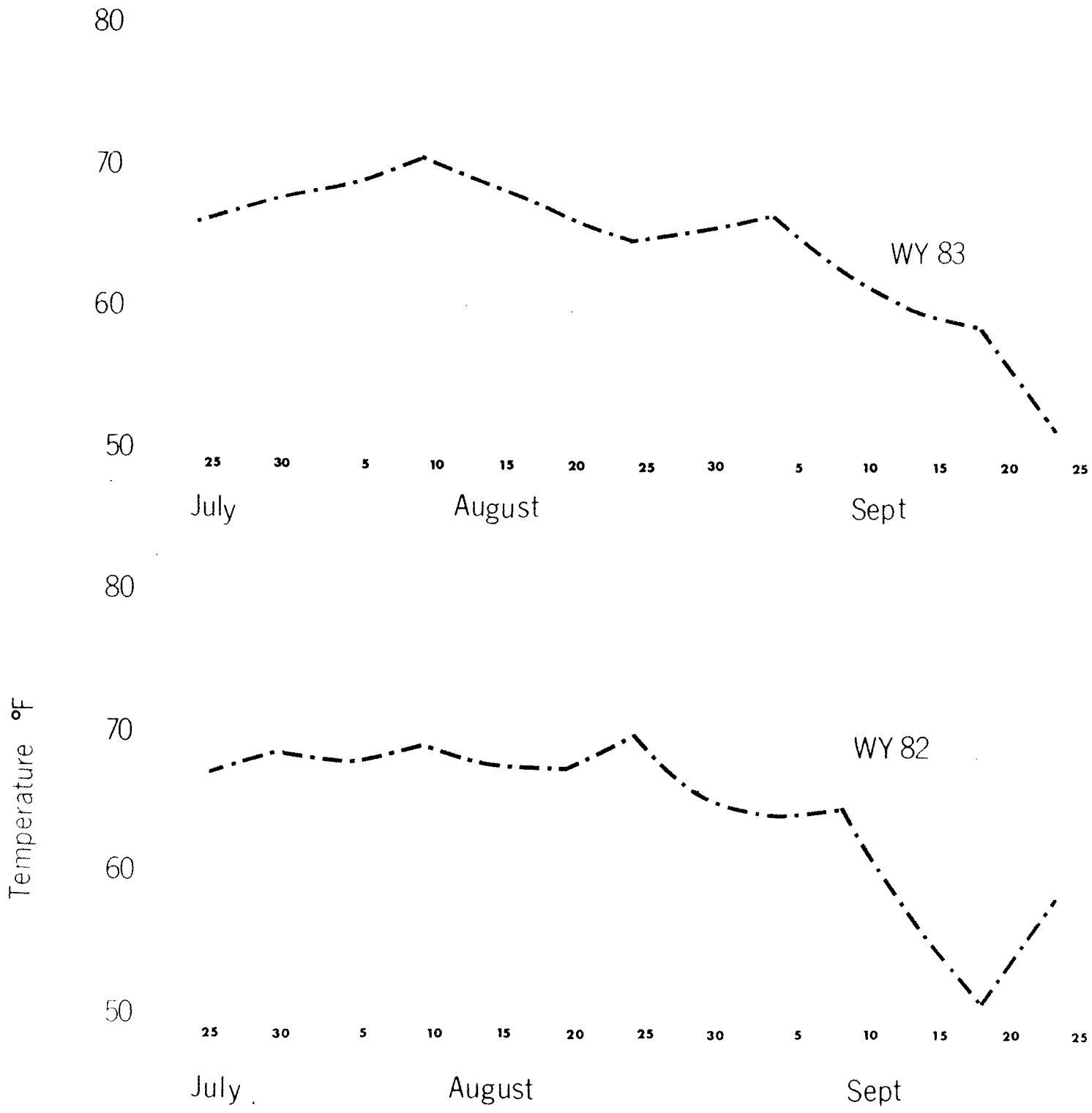

Figure 4. Five-day mean maximum water temperatures measured at the USGS gage near Melrose on the Big Hole River, summer 1982 and 1983.

Table 1. Mean and minimum August-September discharge of the Big Hole River near Melrose for the 20-year period 1964-1983.

Water Year	Mean (cfs)	Rank	Minimum (cfs)
1964	528	9	385
1965	930	2	625
1966	170	20	118
1967	381	13	204
1968	659	6	411
1969	342	14	208
1970	507	12	248
1971	521	11	301
1972	559	8	386
1973	207	19	113
1974	290	18	192
1975	1088	1	578
1976	898	3	591
1977	322	16	173
1978	706	4	408
1979	324	15	233
1980	526	10	368
1981	313	17	199
1982	573	7	333
1983	691	5	465
Mean	527	--	462

Table 2. Estimated populations biomass and mean length by age group of borwn and rainbow trout in the Melrose section (22,500 ft) of the Big Hole River, 1982 and 1983 (standard deviations [80% confidence interval] are in parentheses).

March, 1982				September, 1982			
Age	Mean Length (in.)	Number	Biomass (lbs)	Age	Mean Length (in.)	Number	Biomass (lbs)
			Brown Trout				
II	10.2	904	363	II	12.6	1155	929
III	13.7	1780	1731	III	15.5	1592	2310
IV+	16.4	1066	1705	IV+	18.0	722	1570
		3750 (± 477)	3799 (± 420)			3469 (± 338)	4809 (± 526)
			Rainbow Trout				
II	9.8	1742	628	II	11.5	909	544
III	12.6	802	601	III	14.1	617	661
IV+	15.2	446	586	IV+	15.7	220	320
		2990 (± 461)	1815 (± 236)			1746 (± 205)	1525 (± 174)

(continued on next page)

Table 2. Estimated populations biomass and mean length by age group of brown and rainbow trout in the Melrose section (22,500 ft) of the Big Hole River, 1982 and 1983 (standard deviations [80% confidence interval] are in parentheses)(continued).

March, 1983				September, 1983			
Age	Mean Length (in.)	Number	Biomass (lbs)	Age	Mean Length (ins)	Number	Biomass (lbs)
			Brown Trout				
II	9.4	1043	334	II	12.2	1338	964
III	13.5	1319	1192	III	15.4	2007	2853
IV+	16.4	1173	1816	IV+	17.8	581	1224
		3535 (± 358)	3342 (± 328)			3926 (± 622)	5041 (± 871)
			Rainbow Trout				
II	9.3	750	242	II	11.5	441	263
III	12.5	1019	739	III	13.6	611	600
IV+	15.3	430	553	IV+	15.7	229	337
		2199 (± 281)	1534 (± 156)			1281 (± 199)	1200 (± 152)

Table 3. Estimated populations, biomass and mean length by age group of brown and rainbow trout in the Maiden Rock section (15,500 ft) of the Big Hole River, 1982 and 1983 (standard deviations [80% confidence interval] are shown in parentheses).

March, 1982				September, 1982			
Age	Mean Length (in.)	Number	Biomass (lbs)	Age	Mean Length (in.)	Number	Biomass (lbs)
Brown Trout							
II	10.2	286	112	II	12.7	566	463
III	13.7	1184	1120	III	15.1	1649	2212
IV+	16.6	1339	2267	IV+	17.6	894	1864
		2809 (± 448)	3499 (± 481)			3109 (± 674)	4539 (± 796)
Rainbow Trout							
II	9.3	1438	435	II	11.1	1244	657
III	11.9	1352	837	III	13.9	1461	1464
IV+	14.9	750	937	IV+	15.9	329	489
		3540 (± 893)	2209 (± 394)			3034 (± 602)	2610 (± 475)

(continued on next page)

Table 3. Estimated populations, biomass and mean length by age group of brown and rainbow trout in the Maiden Rock section (15,500 ft) of the Big Hole River, 1982 and 1983 (standard deviations [80% confidence interval] are shown in parentheses)(continued).

March, 1983				September, 1982			
Age	Mean Length (in.)	Number	Biomass (lbs)	Age	Mean Length (in.)	Number	Biomass (lbs)
			Brown Trout				
II	9.8	538	195	II	12.6	896	698
III	14.0	1191	1202	III	15.9	1626	2545
IV+	17.3	1010	1804	IV+	18.6	657	1614
		2739 (± 429)	3201 (± 432)			3179 (± 527)	4857 (± 849)
			Rainbow Trout				
II	9.1	1218	360	II	10.9	1420	708
III	12.1	1452	943	III	13.8	1275	1241
IV+	15.0	831	999	IV+	16.2	507	778
		3501 (± 725)	2302 (± 332)			3202 (± 1031)	2727 (± 604)

Table 4. Estimated numbers per mile of selected sizes of brown (spring estimates) and rainbow (fall estimates) trout in Maiden Rock and Melrose sections, 1981-1983 (annual percent change in parentheses).

Size	1981	1982	1983
Maiden Rock Brown Trout			
13-in.+	506	773 (+53%)	657 (-13%)
18-in.+	40	70 (+75%)	110 (+57%)
Melrose Brown Trout			
13-in.+	390	570 (+46%)	475 (-17%)
18-in.+	28	36 (+29%)	29 (-19%)
Maiden Rock Rainbow Trout			
13-in.+	250	567 (+127%)	513 (-10%)
15-in.+	89	111 (+25%)	250 (+125%)
Melrose Rainbow Trout			
13-in.+	140	195 (+39%)	150 (-23%)
15-in.+	43	70 (+62%)	52 (-26%)

Table 5. Estimated total spring brown trout biomass, estimated spring biomass accounted for by 18-in. and larger brown trout and percentage of total biomass accounted for by 18-in. and larger brown trout (parentheses) for the Maiden Rock and Melrose sections, 1981-1983.

	1981	1982	1983
Maiden Rock			
Total Biomass (lbs)	2793	3499	3201
18-in.+ Biomass (lbs)	315	566	743
Percent of Total	(11.3)	(16.2)	(23.0)
Melrose			
Total Biomass (lbs)	2801	3802	3342
18-in.+ Biomass (lbs)	283	368	295
Percent of Total	(10.1)	(9.7)	(8.8)

Table 6. Estimated population, biomass and mean length by age group of arctic grayling in the Wisdom section (34,320 ft) of the Big Hole River in September, 1983 (standard deviations [80% confidence interval] are in parentheses).

Age	Mean Length (in.)	Number	Number/ Mile	Biomass (lbs)	Biomass (lbs/mile)
II	10.4	245	38	91	14
III	11.8	274	42	144	22
IV+	13.0	164	25	109	17
Totals		683 (± 200)	105	344 (± 98)	53

Table 7. Numbers of brown trout tagged in the lower Ruby River and numbers of tag returns from the Jefferson River and other upper Missouri River tributaries for the 1981-1983 period.

Year	Number Tagged	Tag Returns Jefferson River	Tag Returns Other Streams[1]
1981	115	3	1
1982	317	18	3
1983	173	4	0

[1] Ruby River; Madison River.

Table 8. Estimated spring population and biomass of brown trout in the Sailor section of the Ruby River, April 1982 (80% confidence intervals).

Age Group	Mean Length (in.)	Number	Biomass (lbs)
II	9.5	897	301
III	12.3	830	556
IV+	14.1	245	248
		1972 (± 337)	1105 (± 150)