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MONTANA DEPARTMENT OF FISH AND GAME
ENVIRONMENT AND INFORMATION DIVISION

JOB PROGRESS REPORT

State: Montana

Project No: FW-3-R-2

Job No: I-a

Title: Fish and Game Planning, Upper Yellowstone and Shields River Drainages

Title: Planning Inventory, Fisheries

Period Covered: July 1, 1973 through June 30, 1974

ABSTRACT

Fish populations were surveyed in 16 tributary systems to the Yellowstone River. Twelve tributary systems contained cutthroat trout, ten contained rainbow, six contained rainbow-cutthroat hybrids, nine contained brown trout and nine brook trout. Mountain whitefish were found in four tributaries, longnose or white suckers in three, and lake chubs in one. Mottled sculpin were prevalent in most of the streams.

The cutthroat spawning run out of the Yellowstone River into Cedar Creek was monitored again this year. Five of the 30 cutthroat which were tagged in Cedar Creek during the spawning run survey in 1973 were again captured during the 1974 survey. Three cutthroat captured during the 1974 run contained tags from a population study section located on the Yellowstone River approximately 12 river miles downstream from Cedar Creek. Migratory cutthroat trout were captured in five of nine additional tributaries monitored during the cutthroat spawning season.

The Upper Yellowstone has excellent access for fishing and floating purposes. At least 19 access points are located on public land adjacent to the river where boats can be launched or taken out.

BACKGROUND

A basic inventory is essential in formulating management plans for maintaining and utilizing the fishery resource of a given area. Seldom is this information complete for an entire drainage. The Upper Yellowstone and Shields River drainages support a cold water fishery of national significance and complete inventory data on the aquatic resources of this area are lacking.

The aquatic resources of Montana are becoming increasingly threatened by an expanding population. Not only is more recreation use being placed on the resource, but human activities are encroaching on the aquatic habitat at an alarming rate. Man's activities on the floodplain and streambanks have altered many of our streams beyond the point at which they can naturally adjust. Unless present and future problems are identified, little can be done to eliminate or minimize adverse impacts to the aquatic resources.

Montana's vast coal reserves have again become economically important and are a valuable national resource in light of the present energy crisis.

The large scale conversion of coal to more usable forms of energy requires vast quantities of water. The exploitation of the vast coal reserves in eastern Montana and the development of an associated coal-energy technology have the potential for placing severe water demands on the upper and lower Yellowstone River and its tributaries.

As of February, 1974, industry has shown interest in at least 3.36 million acre feet per year (MAFY) of Yellowstone basin water. Of this amount, industry has filed appropriations on 1.17 MAFY, has been granted options on 0.71 MAFY, and has requests pending for an additional 1.48 MAFY (Northern Great Plains Resource Council 1974).

If these water demands become a reality, mainstem or offstream storage would be required to insure availability of water during dry periods (Anderson, 1973). The Allenspur dam site, located 2½ miles upstream from Livingston, was the only mainstem storage site on the Yellowstone River considered in the Bureau of Reclamation's Appraisal Report - Montana-Wyoming Aqueducts (1972). Allenspur dam would extend upstream 31 miles and inundate approximately 40 miles of blue ribbon trout stream. The possible construction of Allenspur dam represents the greatest single threat to the aquatic resources of the upper Yellowstone River.

OBJECTIVES

The objectives of this study are to follow the inventory procedures used on the Smith River to prepare recommendations for aquatic resources management on the upper Yellowstone and Shields River drainages and to monitor the southeastern Montana coal field development as related to probable watershed demands on the upper Yellowstone drainage. Basic fish and wildlife inventory data will be collected from the upper Yellowstone and Shields River drainages to formulate this plan. The purpose of this job is to determine the physical, chemical and biological characteristics of the waters of importance or potential importance to the recreational fishery of the study area. Immediate and future problems affecting this resource will be identified and solutions proposed.

DESCRIPTION OF STUDY AREA

The study area lies in southcentral Montana and includes the Yellowstone River drainage from Gardiner to Springdale and the entire Shields River drainage. The Yellowstone River, from Gardiner to Livingston, flows north through Paradise Valley and is flanked on the east by the Absarokee Mountains and on the west by the Gallatin Range. At Livingston, the Yellowstone flows eastward. The Shields River originates in the Crazy Mountains and flows south, entering the Yellowstone River approximately five miles downstream from Livingston (Figure 1).

The Yellowstone River offers a variety of unique angling experiences along its entire length. The upper Yellowstone supports a cold water fishery of national significance. In Yellowstone National Park above Tower Junction, a pure cutthroat trout fishery exists. The Yellowstone River in Montana is classified by the Montana Fish and Game Commission as a blue ribbon trout stream from Gardiner to Big Timber. An excellent fishery exists in this area for mountain whitefish and rainbow, brown and cutthroat trout. The middle portion of the Yellowstone from Reedpoint to Billings provides both cold and warm water angling opportunities.

Numerous tributaries arise in the Absarokee Mountain Range to join the Yellowstone River. The major tributaries include Bear, Cedar, Sixmile, Emigrant, Mill, Pine, Deep, Suce and Mission Creeks. With the exception of Bear, Cedar and Mission Creeks, these are completely diverted for irrigation purposes during July and August. Major tributaries arising in the Gallatin Range and flowing east to join the Yellowstone include Mol Heron, Tom Miner, Rock, Big, Fridley, Eightmile, Trail and Billman Creeks. With the exception of Mol Heron, Tom Miner, Rock and Billman Creeks, these also are completely diverted for irrigation during the summer months. Fleshman Creek originates in the southern end of Bangtail Ridge and joins the Yellowstone at the city of Livingston.

Major tributaries entering the Shields River from the west include Canyon, Brackett and Flathead Creeks. Those entering the Shields from the east include Cottonwood and Rock Creeks.

The climate within the two drainages is greatly influenced by the surrounding mountain ranges. The extreme topographical conditions afforded by the mountain ranges and intermountain valleys cause the climate to be quite variable.

Four weather stations are located within the boundaries of the study area. The Gardiner station is on the southern border of the project area. Two stations are located in the center of the area in the Livingston vicinity, and one station is in the northern section of the Wilsall area.

The average annual temperature for the project area from 1958-1967 was 44.2°F with an average annual precipitation of 14.67 inches. The average annual temperatures and total precipitation for each of the four stations were as follows: Gardiner, 44.2°F - 11.2 inches; Livingston, 46.8°F - 14.12

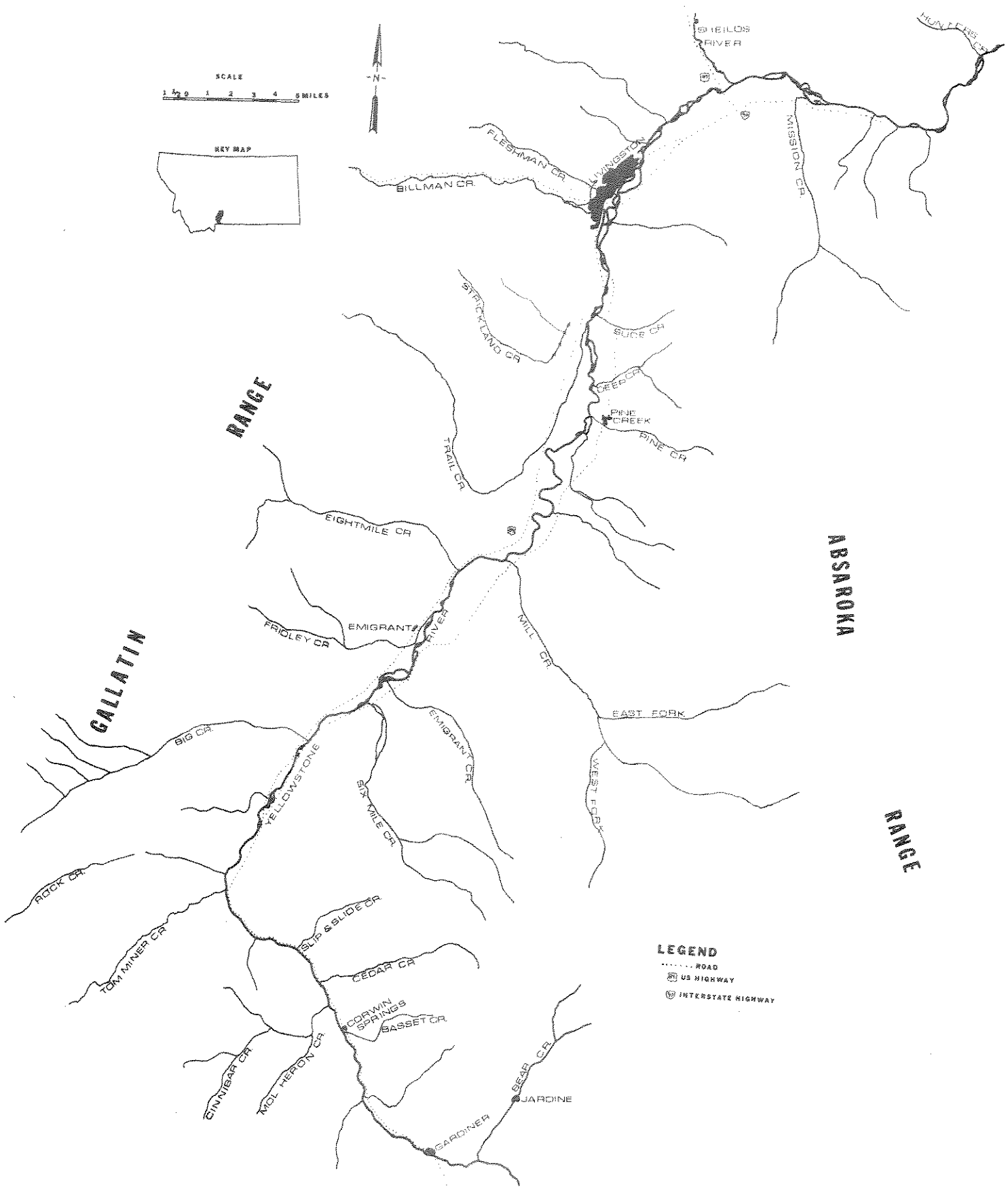

Figure 1. Yellowstone River drainage and major tributaries.

inches; Livingston, 45.1°F - 13.96 inches; and Wilsall, 40.8°F - 14.67 inches (Montana annual weather summary 1958-1967).

A definite north-south gradient was noted in total precipitation, with Gardiner recording 11.2 inches, Livingston averaging 14.04 inches and Wilsall 19.43 inches, for a difference of 8.23 inches between the northernmost and southernmost station (Montana annual weather summary 1958-1967). May, June and September were the three months that normally received the greatest amount of precipitation.

PROCEDURES

Migratory cutthroat trout were captured in tributary streams by electrofishing with a stationary generator (2500 watt), a Fishery Shocker Model FS-103, and 250 feet of cord. All mature cutthroat captured were tagged with individually numbered red or yellow Floy tags and weighed, measured, sexed and released. Scale samples were taken for age determinations.

Tributary streams to the Yellowstone River were surveyed by electrofishing with a Smith-Root backpack shocker (Model 5) or a stationary generator (2500 watt) with Fisher Shocker Model FS-103, and 250 feet of cord. All fish captured during the survey operations were weighed and measured. The method used for measuring the quality and quantity of habitat available to the fishery resource largely followed that described by Wipperman (1973).

A Foxboro 30-day constant recording thermograph is maintained in the Yellowstone River below Springdale to supplement temperature data previously collected upstream. A gage station and water stage recorder is in operation on the Shields River near its mouth to monitor flow regimes in that system.

Aquatic insect and periphyton sampling was initiated during this report period. Aquatic insect samples were taken using a Waters Round one square foot sampler with three square foot samples taken at each station. Periphyton samples were taken by scraping rocks, logs, etc. in different habitat types at each station. Sampling stations for both aquatic insects and periphyton are located at Corwin Springs, the Mallard Rest Fishing Access Site, Livingston, the Highway 89 Bridge below Livingston, below the mouth of the Shields River, and at the Grey Bear Fishing Access Site. Data obtained at these stations will be presented in the final report.

YELLOWSTONE RIVER

Cutthroat Trout Spawning Migrations

Yellowstone cutthroat trout are native to the Upper Yellowstone River Drainage, but now occur in only a fraction of their former abundance. Competition and predation by introduced rainbow and brown trout have been detrimental to the cutthroat, which usually do best in waters where other

trout species are absent (Bjorn, 1957; Cope, 1956; Needham and Gard, 1959). In many waters, introduced rainbow have hybridized extensively with native cutthroat resulting in contamination of the gene pool and a decline in the abundance of genetically pure cutthroat. Hybridization is common in resident populations of tributary streams in the Upper Yellowstone drainage.

A segment of the cutthroat population in the mainstem of the Yellowstone River appears to be a visually pure strain of Yellowstone cutthroat. This segment of the population migrates from the mainstem of the Yellowstone River into tributary streams to spawn. This behavior pattern is similar to that reported by Huston (1969) for the adfluvial strain of cutthroat trout in Hungry Horse Reservoir which migrate out of the reservoir into tributary streams to spawn. Because of the present limited distribution and abundance, especially of the visually pure strain of Yellowstone cutthroat, every effort should be made for perpetuation and improvement of the remaining population of these cutthroat.

In addition to the factors previously mentioned, another element probably significant in the cutthroat's decline is the complete diversion of most major tributaries for irrigation purposes immediately after spring runoff, leaving only a few that are suitable for maintaining spawning runs. Tributaries which presently do not become completely dewatered include the Shields River, Mission, Billman, Tom Miner, Cedar, Rock, Mol Heron and Bear Creeks. In 1973, surveys during June and July revealed spawning utilization of the lower reaches of Cedar and Mol Heron Creeks by cutthroat from the Yellowstone River (Peterman, 1974).

From early June through late July of 1974, the lower reaches of ten major Yellowstone River tributaries were surveyed by electrofishing for possible cutthroat spawning runs. Cutthroat trout captured in the tributaries during the spawning season were assumed to be from the Yellowstone River if they were visually a pure cutthroat, in a ripe spawning condition and obviously oversize for the habitat present. Also, some fish captured in tributaries had tags attached from previous population study sections on the Yellowstone River which confirmed the fish's origin.

Migratory cutthroat trout were found in six of the ten tributaries monitored. These included Cedar, Mol Heron, Tom Miner, Rock, Big and Mill Creeks. Cedar Creek was the most intensively surveyed tributary of the ten selected for monitoring during 1974. A highway culvert located approximately 620 feet upstream from the mouth of Cedar Creek constitutes a barrier to fish movement and concentrates them in a short reach of stream, thus facilitating capture.

Cedar Creek was sampled at irregular intervals from June 10 to July 19, 1974. Eight days were sampled during the 40-day period with only one capture run made each day. Twenty-three migrating cutthroat trout were captured. They ranged in length from 9.4 to 16.8 inches and in weight

from 0.30 to 2.25 pounds. The average length was 13.9 inches and average weight was 1.18 pounds. Males averaged 13.4 inches and 1.06 pounds compared to the slightly larger females which averaged 14.7 inches and 1.41 pounds. The peak fo the spawning run in 1974 apparently occurred from about July 9 to 11. The sex ratio of all new fish captured was 1.9 males/female. In recaptured fish, the ratio was nearly doubled at 3.3 males/female, indicating that males entered the stream more frequently or stayed longer than females. Males in spawning condition were taken from June 10 to July 19 while females were captured only during an eight-day period from July 9 to 16. Ball and Cope (1961) found that cutthroat males spent 12-35 days upstream to spawn (average 17 days) while females remained upstream 6-21 days (average 7 days) in Arnica Creek, Yellowstone National Park. A large number of cutthroat fry were observed in Cedar Creek on August 13, 1973 and numerous fry were observed during a period from mid-August through early September, 1974.

Five of the 30 cutthroat which were tagged and released in Cedar Creek during the spawning run survey in 1973 were recaptured in Cedar Creek during the 1974 survey. Three cutthroat captured during the 1974 run contained tags from a population study section located on the Yellowstone River approximately 12 miles downstream from the mouth of Cedar Creek.

A thermograph was maintained at a location 325 feet upstream from the mouth of Cedar Creek from June 25 to August 31, 1973. The five-day average maximum and minimum water temperatures for the station are shown in Figure 2. Temperatures were highest about the middle of August with a maximum of 68^{o}F recorded on August 16. During the 1973 period of record, the mean diurnal temperature fluctuation was 10F^{o}.

The flow regime of Cedar Creek was monitored from July 3 to November 4, 1973 by actual measurements of the flow with a Gurley current meter and flow interpolations from a discharge curve constructed for a staff gage installed on July 23. The discharge curve and flow regime for Cedar Creek are shown in Figure 3. The low flow period occurred from late July through late September (minimum of 0.25 cfs on August 13 and 14). The severely reduced flow during this time period is due primarily to dewatering for irrigation.

Cutthroat trout spawning run surveys were conducted on Mol Heron Creek from June 10 to July 24, 1974, (seven days sampled during the 45-day period), on Big Creek from July 3 to 19 (five days sampled during the 17-day period), and on Tom Miner and Rock Creeks from July 2 to 16 (five and three days sampled, respectively, during the 15-day period). Two migrating cutthroat trout were captured in Mol Heron Creek on July 19, one was caught on Tom Miner Creek on July 2, one was taken each day on July 9 and 16 on Rock Creek and two were found in Big Creek on July 5. One migratory cutthroat was captured, tagged and released in Mill Creek during a one-day survey on July 19. The eight migratory cutthroat trout captured in the five tributaries mentioned above ranged in length from 15.5 to 16.9 inches and in weight from 1.34 to 2.20 pounds, averaging 16.4 inches and 1.73 pounds. The sex ratio was six males/female.

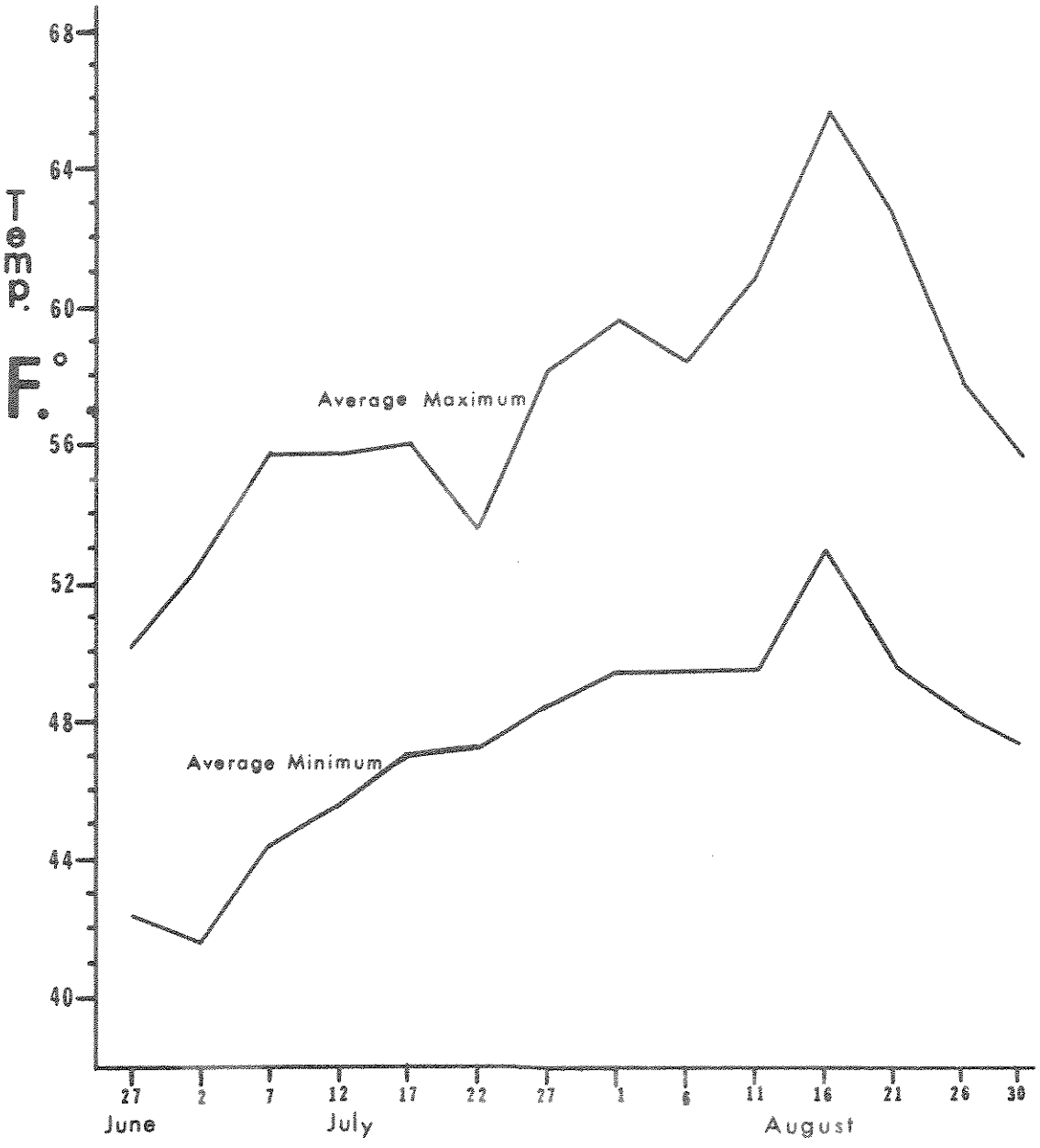

Figure 2. Five-day average maximum-minimum water temperatures for lower Cedar Creek. June 27 through August 30, 1973.

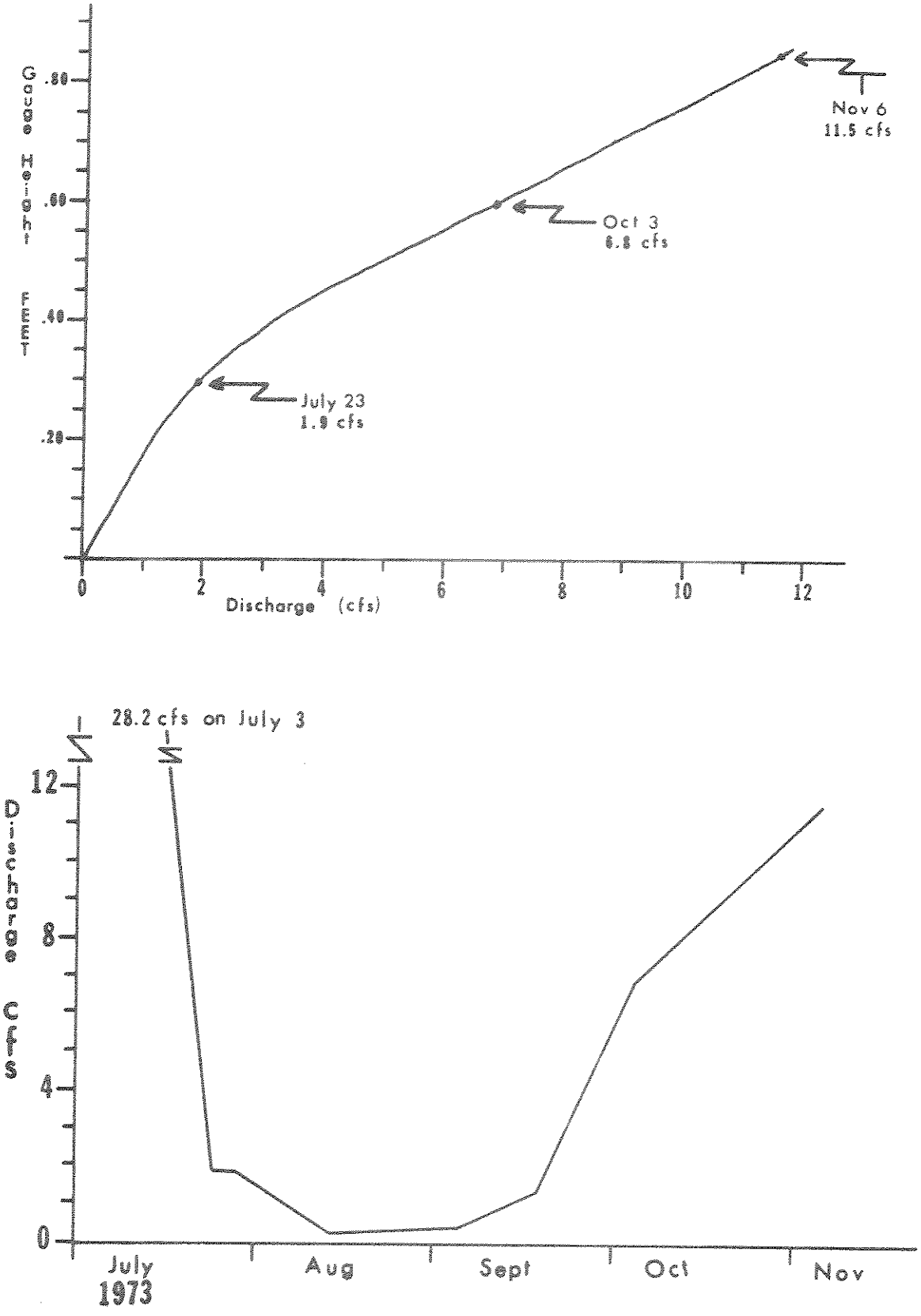

Figure 3. Top - Discharge curve constructed from flow measurements and staff guage readings.

Bottom - Flow regime of Cedar Creek from July through November, 1973.

A plunge pool below a railroad culvert located approximately 225 feet upstream from the mouth of Rock Creek and a debris jam at a railroad bridge located approximately 250 feet upstream from the mouth of Tom Miner Creek appear to be barriers which would prohibit passage of fish. We are uncertain at this time whether the small number of fish taken in Tom Miner, Rock, Mill, Big and Mol Heron Creeks is due to a lack of spawners or difficulty of sampling. The sex ratio of six males/female for cutthroat captured during the survey suggests that, if a significant spawning run did occur, the sampling did not coincide with the peak of the run.

No migratory cutthroat were found in Billman, Mission, Dry or Eight-mile Creeks during the survey. Due to the limited sampling conducted on these tributaries, it is not possible at this time to determine the presence or absence of a cutthroat spawning run.

Water Temperatures

Water temperatures have been recorded on the Yellowstone River at a thermograph station located 5.9 miles downstream from the Springdale bridge since April 9, 1973. The five day average maximum and minimum water temperatures from April 19, 1973 - June 30, 1974 are shown in Figure 4. In 1973 a warming period occurred in mid-May (maximum 58°F - May 15), followed by cooler temperatures until mid-June. The water temperature reached 60°F on June 22 and rose to 65°F on July 5. The highest water temperatures were achieved during July and August. During the period from July 16 to August 17, water temperatures reached 68°F or higher on nine days. The highest temperature recorded in 1973 below Springdale was 69°F on July 28. Temperatures cooled gradually from late August through late November and remained stabilized between 32°F and 42°F until the first week of March. A warming period prevailed from early March through late April. Temperatures fluctuated erratically from 42°F to 56°F during May. A consistent warming trend prevailed during June. During the April 1973 through June 1974 period, the mean diurnal difference between the average maximum and average minimum temperature was 4.5F°.

Water Based Recreation Opportunities

The Upper Yellowstone River offers many excellent and varied opportunities for water based recreation. The major attraction in this area is the excellent cold water fishery which exists for mountain whitefish and rainbow, brown, and cutthroat trout. The Yellowstone from Gardiner to Big Timber has been classified as a blue ribbon trout stream by the Montana Fish and Game Commission. This stretch of river has national recognition and attracts anglers from many parts of the country.

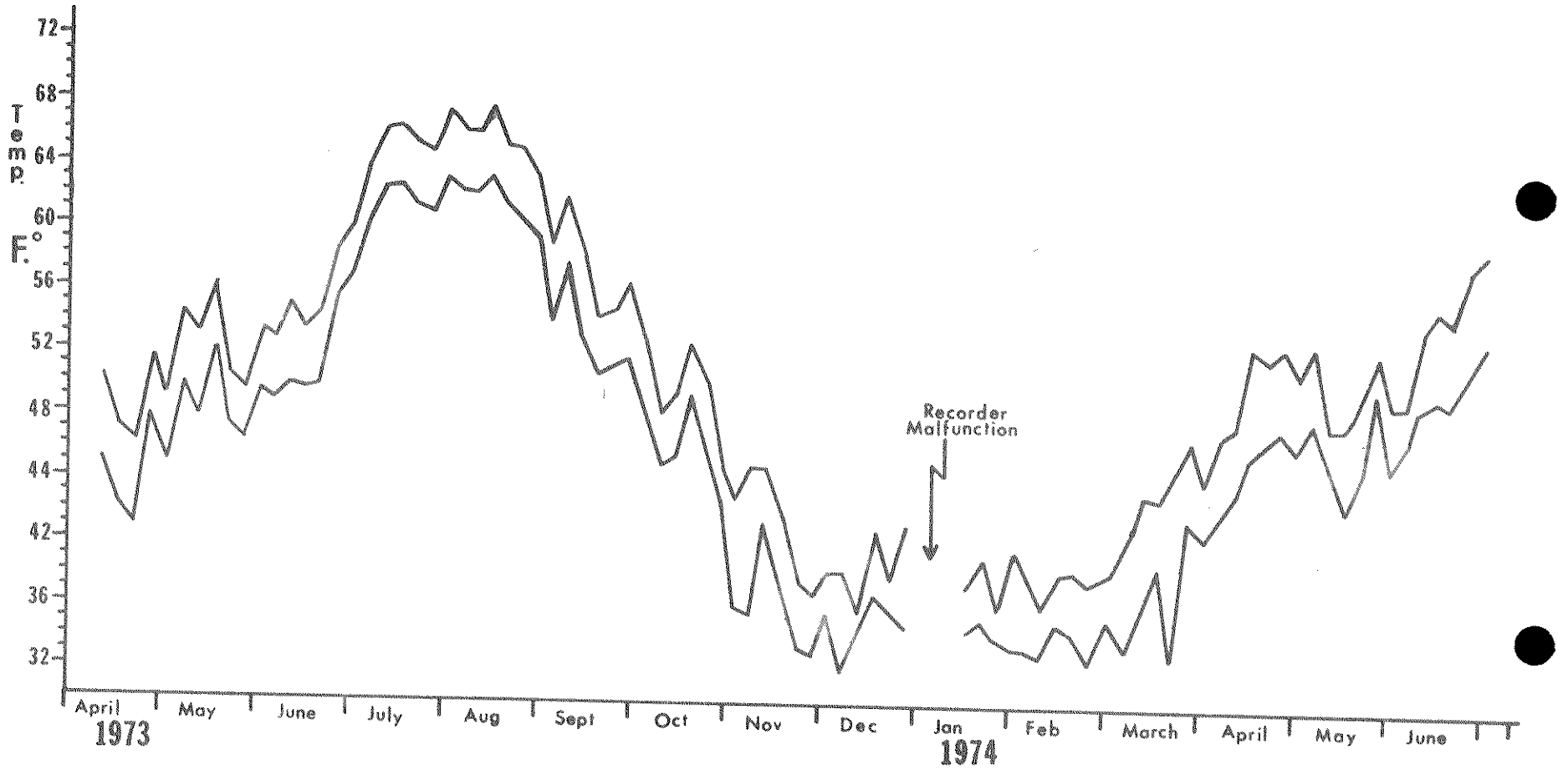

Figure 4. Five-day average maximum-minimum water temperatures for the Yellowstone River 5.9 miles below Springdale for the period April 1973 through June 1974.

Boat floating is also a very popular recreational activity on the Upper Yellowstone. Floating is often done in conjunction with fishing and/or camping. The free flowing nature of the Yellowstone and the varied topography through which it flows offers a variety of conditions for the floater. This reach of river contains areas which are suitable for the novice floater and others that should be attempted only by the experienced.

Craft commonly used for floating on the Upper Yellowstone include jon boats, canoes, and rubber rafts. Outboard motors are restricted to ten horsepower or less on the Yellowstone River from the Interstate 90 bridge upstream to the state line.

Access to the river for launching and taking out boats is excellent with at least 19 locations where public land borders the river (Table 1). In addition to the areas on public lands, several sites exist on private land where launching boats is permitted. Few of the launching sites listed have launching ramps, however craft used on the upper river are commonly launched and loaded by hand.

Camping is a popular pastime in the study area and many opportunities exist along the Upper Yellowstone River. The Montana Department of Fish and Game has five fishing access sites in this area with camping facilities (Emigrant, Paradise, Loch Leven, Mallard Rest and Sheep Mountain) and the Bureau of Land Management has one (Carbella). In addition, several private campgrounds exist on or near the river. Extended float trips often require camping at one or more of these areas.

YELLOWSTONE RIVER TRIBUTARIES

Fish populations were inventoried in 16 Yellowstone River tributary systems from July 1973 to September 1974. Information gathered from the inventory is presented in Table 2. Based on the sections surveyed, 12 tributary systems contained cutthroat, ten contained rainbow, six contained rainbow-cutthroat hybrids, nine contained brown trout and nine contained brook trout. Mountain whitefish were found in four tributaries, longnose or white suckers in three and lake chubs in one. Mottled sculpin were prevalent in most of the streams. Additional information is presently being gathered on these tributaries.

Channel morphology and overhanging shoreline cover were measured in 15 stream sections encompassing seven tributary systems. A summary of the information gathered is presented in Table 3. The data were collected to describe the existing quality and quantity of physical stream habitat and to serve as baseline information prior to possible habitat changes in the future. The actual location of these sections is described on standard Fish and Game Department stream survey cards. Brush provided 57 percent, debris 35 percent and undercut banks 8 percent of the streambank cover in the sections measured. The sections averaged 303 ft^2 brush cover/1000 feet of stream, 185 ft^2 debris cover/1000 feet and 46 ft^2 undercut bank cover/1000 feet. Total streambank cover (both banks) averaged 534 ft^2 cover/1000 feet of stream.

TABLE 1. List of access points located on public lands adjacent to the Yellowstone River which are suitable for launching or taking out boats.

Name	Yellowstone River Mile[1/]	Bank of River	Location	Administrator
Buffalo Hump	479.5	South	T2S,R12E,S5	BLM
Sheep Mountain Fishing Access Site	486.5	North	T1S,R11E,S20	F&G
Hy 89 Bridge - East of Livingston	489.6	North & South	T1S,R10E,S26	State
Hy 10 Bridge at Livingston	494.8	West	T2S,R10E,S7	State
Harvats Bridge at Livingston	495.4	West	T2S,R10E,S18	Park County
Sacajawea Park at Livingston	497.2	West	T2S,R9E,S24	City of Liv.
Carters Bridge	501.4	East	T3S,R9E,S12	USGS
Bell Crossing	502.0	West	T3S,R9E,S11	State
Mallard Rest Fishing Access Site	511.7	West	T4S,R9E,S16	F&G
Loch Leven Fishing Access Site	514.0	East	T4S,R9E,S28	F&G
Paradise Fishing Access Site	518.0	East	T5S,R9E,S8	F&G
Emigrant Fishing Access Site	524.8	East	T5S,R8E,S27	F&G
Highway 89 Rest Area	533.3	West	T6S,R7E,S23	State
Highway Dept. Gravel Area	535.5	West	T6S,R7E,S34	State
Carbella	540.6	West	T7S,R7E,S19	BLM
Yankee Jim Canyon	544.7	East	T8S,R7E,S3	USFS
Corwin Springs	550.0	West	T8S,R8E,S30	USFS
La Duke Hot Springs	551.4	East	T8S,R8E,S32	USFS
Queen of Waters	555.7	East	T9S,R8E,S15	F&G

[1/] Yellowstone River mile 0 is at confluence of Missouri and Yellowstone Rivers.

TABLE 2. Yellowstone River Tributaries - Electrofishing Stream Survey Data

Water	Section Length (ft)	Location T	R	S	Game Fish Species	Number Caught	Length Range (inches)	Average (inches)	Date
Mol Heron Cr.									
(Sec. 1)	500	8S	7E	24	Ct [2]	6(6) [3]	13.3 - 16.5	14.4	
					Rb	2(1)	4.7 - 10.4	7.6	
					LL	1(1)	6.0		7-13-73
					Wf	2(2)	11.7 - 11.9	11.8	
					Ln Su	2(2)	16.0 - 18.7	17.4	
(Sec. 2)	500	8S	7E	24	Rb x Ct	11(5)	2.8 - 11.3	6.2	7-17-73
(Sec. 3)	1482	8S	7E	25	LL	2(2)	6.8	6.8	
					Wf	1(1)	13.0		7-24-73
					Rb x Ct	46(26)	2.7 - 12.1	6.5	
(Sec. 4)	500	8S	7E	35	Rb	2(2)	9.4 - 10.3	9.9	7-20-73
					Ct	6(2)	4.4 - 6.8	5.7	
Cinnibar Cr. [1]									
(Sec. 1)	500	8S	7E	26	Rb	8(5)	2.8 - 11.1	6.2	7-20-73
					Rb x Ct	2(0)	3.7 - 3.8	3.8	
(Sec. 2)	500	8S	7E	28	Rb x Ct	23(12)	3.0 - 11.0	6.2	7-20-73
					Eb	2(1)	5.9 - 6.2	6.1	
Tom Miner Cr.									
(Sec. 1)	1000	7S	6E	35	Ct	46(32)	3.0 - 12.0	7.2	8-17-73
					LL	1(1)	16.0		
(Sec. 2)	1000	8S	6E	4	Ct	25(12)	2.5 - 12.0	6.3	8-17-73
Fridley Cr.									
(Sec. 1)	500	5S	8E	31	Rb	3(3)	7.3 - 8.8	8.0	9-20-73
					Eb	102(26)	2.2 - 9.9	4.9	
(Sec. 2)	1000	5S	7E	35	Ct	15(8)	3.7 - 12.3	7.1	9-20-73
					Rb	19(7)	3.0 - 9.7	5.4	
					Eb	83(46)	2.8 - 10.2	6.4	

TABLE 2. (continued)

Water	Section Length (ft)	Location T R S	Game Fish Species	Number Caught	Length Range (inches)	Average (inches)	Date
Eight Mile Cr.							
(Sec. 1)	1000	4S 8E 33	Ct	4(2)	3.9 - 11.5	6.7	10-29-73
			Rb	14(1)	2.2 - 8.7	3.7	
			Eb	57(28)	3.1 - 10.7	6.6	
(Sec. 2)	500	3S 7E 35	Ct	2(2)	9.0 - 13.7	11.4	8-21-73
			Rb	1(1)	9.9		
			Eb	35(18)	1.9 - 10.7	6.0	
Trail Cr.							
(Sec. 1)	1000	4S 8E 11	LL	78(10)	2.4 - 11.3	5.8	8-30-73
			Rb x Ct	102(18)	1.9 - 10.9	5.5	
(Sec. 2)	1000	3S 8E 20	LL	6(2)	5.2 - 6.1	5.7	8-20-73
			Rb x Ct	121(46)	2.8 - 9.5	5.5	
West Pine Cr.[1/]							
(Sec. 1)	500	4S 8E 10	Ct	16(6)	4.5 - 8.8	6.1	9-4-73
			Rb	2(0)	5.5 - 5.6	5.5	
(Sec. 2)	500	4S 8E 5	Ct	16(13)	5.3 - 9.2	7.2	9-4-73
Billman Cr.							
(Sec. 1)	500	2S 9E 26	Ct	2(2)	7.5 - 9.7	8.6	7-22-73
			Rb	2(2)	6.5 - 9.2	7.9	
			LL	20(18)	5.7 - 12.6	7.9	
(Sec. 2)	500	2S 9E 26	Ct	4(4)	6.1 - 10.6	7.6	8-6-73
			Rb	2(2)	8.5 - 9.4	9.0	
			LL	2(2)	9.4 - 10.3	9.9	
			Ln Su	5(4)	5.5 - 9.3	7.0	
(Sec. 3)	500	2S 9E 18	Ct	11(10)	3.5 - 10.5	7.8	8-6-73
			Rb x Ct	14(3)	3.4 - 7.3	4.7	
			Eb	3(3)	8.0 - 10.2	8.9	
(Sec. 4)	500	2S 8E 16	Ct	13(11)	5.9 - 9.9	7.6	8-6-73
			Rb	6(5)	4.7 - 6.8	6.1	
			Rb x Ct	19(15)	4.2 - 8.3	6.5	

TABLE 2. (continued)

Water	Section Length (ft)	Location T R S	Game Fish Species	Number Caught	Length Range (inches)	Average (inches)	Date
Fleshman Cr.	1000	2S 9E 23	Rb	5(0)	3.5 - 4.5	4.1	5-15-74
			Ct	9(3)	5.4 - 6.5	5.9	
			Eb	35(25)	4.6 - 10.8	6.7	
			LL	1(1)	9.0		
			LC	5(0)	2.9 - 4.1	3.6	
Bear Cr.	400	9S 9E 8	Rb	11(7)	4.5 - 11.3	7.1	9-9-74
			Rb x Ct	7(6)	5.0 - 8.8	7.4	
Cedar Cr.							
(Sec. 1)	520	8S 7E 13	Ct	1(1)	15.5		6-19-73
			Rb	3(2)	4.8 - 10.8	8.7	
			LL	4(3)	5.0 - 9.0	6.9	
			Eb	1(1)	9.8		
			Wf	21(21)	8.0 - 13.0	10.5	
(Sec. 2)	500	8S 8E 7	Eb	4(1)	4.9 - 7.6	5.8	8-13-73
Six Mile Cr.	500	6S 8E 29	Ct	1(1)	13.0		8-9-74
			LL	38(28)	3.8 - 13.8	7.6	
Emigrant Cr.	500	6S 8E 13	Ct	2(2)	8.0 - 11.6	9.8	8-3-73
			Eb	1(1)	8.3		
Mill Cr.							
(Sec. 1)	500	6S 9E 3	Ct	6(4)	3.1 - 7.6	5.8	8-28-74
			Rb x Ct	1(1)	8.5		
(Sec. 2)	500	6S 9E 24	Wf	1(1)	12.9		5-21-74
			Ct	2(2)	6.2 - 6.9	6.6	
(Sec. 3)	500	6S 10E 34	Ct	5(4)	5.1 - 8.7	7.1	9-5-73
W. Fork Mill Cr.[1/]	500	6S 9E 25	Ct	5(3)	5.1 - 7.9	6.4	8-3-73
E. Fork Mill Cr.[1/]	500	6S 10E 17	Ct	24(8)	3.1 - 10.0	5.4	9-5-73
			Rb x Ct	2(1)	5.5 - 6.2	5.9	

TABLE 2. (continued)

Water	Section Length (ft)	Location T R S	Game Fish Species	Number Caught	Length Range (inches)	Average (inches)	Date
Pine Cr.	100	4S 10E 8	Eb	1(0)	4.8		8-28-74
Deep Cr.	300	3S 10E 30	Eb	5(2)	3.7 - 8.1	5.2	7-30-73
Suce Cr.							
(Sec. 1)	300	3S 10E 19	Ct	7(1)	3.9 - 7.2	5.1	7-30-73
			LL	10(1)	3.8 - 11.1	4.9	
(Sec. 2)	300	3S 10E 17	Rb	2(0)	2.9 - 3.0	3.0	7-30-73
			Ct	1(0)	5.2		
			Rb x Ct	2(0)	4.9 - 5-5	5.2	
Mission Cr.	1000	1S 11E 29	Rb	2(1)	5.7 - 6.0	5.9	5-21-74
			LL	39(27)	4.1 - 18.5	10.9	
			Wf	16(8)	3.5 - 15.2	9.1	
			Ln Su	3(3)	10.1 - 16.7	14.9	
			W Su	5(5)	8.2 - 14.9	11.6	

1/ Secondary tributary streams.

2/ Abbreviations used: Rb-rainbow trout; LL-brown trout; Ct-cutthroat trout; Eb-brook trout; Rb x Ct-rainbow, cutthroat hybrids; Wf-mountain whitefish; Ln Su-longnose sucker; W Su-white sucker; Lc-lake chub.

3/ Figure in parenthesis is number of fish in sample greater than six inches total length.

TABLE 3. Channel morphology and shoreline cover characteristics in 15 stream sections encompassing seven tributary systems in the Yellowstone River drainage.

Water	Location T	R	S	Date Mapped	Channel Length (ft)	Average Water Width (ft)	Average Channel Width (ft)	Average Thalweg Depth (ft)	Cover ft^2/1000 ft Brush	Undercut	Debris	Total
Mol Heron												
Section 3	8S	7E	25	8-27-73	1482	22.9	30.5	1.37	383	66	37	486
Cedar												
Section 1	8S	7E	13	9-6-73	520	8.3	--	0.52	-	-	-	-
Section 2	8S	8E	7	9-6-73	2000	15.5	22.3	1.12	48	54	103	205
Tom Miner												
Section 1	7S	6E	35	8-28-73	1000	19.7	26.9	1.51	925	51	88	1064
Section 2	8S	6E	4	8-28-73	1000	20.3	30.1	1.15	127	13	215	355
Fridley												
Section 1	5S	8E	31	10-1-73	500	11.5	15.0	0.73	0	96	76	172
Section 2	5S	7E	35	10-9-73	1000	17.7	23.1	1.15	267	96	429	792
Eight Mile												
Section 1	4S	8E	33	9-7-73	2000	18.9	20.4	1.33	269	91	483	843
Section 2	4S	7E	35	8-23-73	1000	30.7	42.9	1.21	226	47	230	503
Trail												
Section 1	4S	8E	11	8-29-73	1000	16.9	24.1	1.32	574	32	121	727
Section 2	3S	8E	20	8-29-73	1000	20.3	27.7	1.12	530	56	201	787
Billman												
Section 1	2S	9E	26	10-12-73	500	12.0	14.6	1.37	112	28	40	180
Section 2	2S	9E	26	10-12-73	500	10.0	10.2	1.64	320	0	250	570
Section 3	2S	9E	18	10-12-73	500	11.6	16.5	0.79	200	6	270	476
Section 4	2S	8E	16	10-12-73	500	5.6	8.0	0.54	261	4	57	322

Stream flows were determined on several Yellowstone River tributaries during 1973 by measurements of the discharge with Gurley current meter. Date will be presented in a later report. Most of the flow measurements were taken near the mouths of the streams. Highest annual flows occur in these tributaries during the spring runoff. Severe dewatering caused by irrigation demands occurs from late July through late September. During the irrigation season the lower reaches of most of the tributaries are completely dewatered and the low flow in several others is below the apparent minimum necessary to support a good fishery.

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Date: November 27, 1974