MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
ECOLOGICAL SERVICES DIVISION

JOB PROGRESS REPORT

State: Montana

Title: Middle Missouri River Planning Project

Project No. FW-3-R-11

Job No. 1-a Fisheries

Period Covered: July 1, 1982 through June 30, 1983

ABSTRACT

A fishery inventory and planning study was continued on the blue ribbon segment of the Missouri River downstream from Holter Dam. Fishery studies were initiated on the Holter/Hauser Reservoir complex located immediately upstream from Holter Dam. The fishery of the study area is predominantly salmonid with rainbow and brown trout comprising the bulk of the sport fishery.

A Fall, 1982 population estimate indicated 2,528 trout seven inches and larger (catchable) per mile in the Craig study section of the Missouri River. A total standing crop of 2,473.6 pounds of trout per mile and 99 trophy trout per mile were estimated for the Craig section. Catchable trout numbers, trophy trout numbers and total trout biomass are lower in the Hardy and Cascade study sections located farther downstream from Holter Dam. The catchable trout population is about 90 percent rainbow and 10 percent brown trout in all three study sections, but the trophy trout population is comprised predominantly of brown trout.

Studies were continued to evaluate spawning periodicity and sources of wild trout recruitment in the Missouri River below Holter Dam. The most important source of natural recruitment for both rainbow and brown trout is the main stem of the river itself, particularly side channels. Tributaries also collectively provide an important source of recruitment of wild trout to the river fishery.

Measurements were made of physical characteristics of rainbow trout and brown trout redds located in the Missouri River and its tributaries to define conditions required for successful spawning. Findings of fishery studies initiated on the Holter/Hauser Reservoir complex are contained in a seperate report (Berg and Lere, 1983) Fish Populations of Hauser and Holter Reservoirs, Montana with Emphasis on Tributary Recruitment).

BACKGROUND

A basic inventory is essential in formulating management plans for maintaining and utilizing the fishery resources of a given area. Seldom is this information complete for an entire area or drainage. The Missouri River from Holter Dam

to the confluence of the Smith River supports a cold water fishery of considerable significance, and prior to this study, basic data on the aquatic resources of this area were lacking.

Because of the increasing demand for Montana's limited water supplies for hydropower, irrigation, industrial and domestic uses, water resource development proposals for this section of the Missouri River appear likely. Proposals which remove significant amounts of stream flow or modify existing flow regimes could ultimately affect the fishery resource and the associated aquatic community. Unless stream flow levels necessary to maintain the aquatic resources of the middle Missouri River are determined, little can be done to evaluate conflicting demands and minimize adverse impacts on the fishery. In addition, there is concern that one or more of the upstream dams will be converted to a power peaking mode of operation. For these reasons, the Montana Department of Fish, Wildlife and Parks (DFWP) initiated this study on April 1, 1980.

DESCRIPTION OF AREA

Missouri River below Holter Dam

This study area lies in north central Montana and includes a 99.0 kilometer (km) (61.5-mile) reach of the mainstem of the Missouri River from Holter Dam to the confluence of the Smith River. Four study sections, Craig, Hardy, Cascade and Ulm were established in this reach (Figure 1). In addition, limited studies were conducted on the lower reaches of the Dearborn River, and Little Prickly Pear, Sheep, Rock, Stickney, Hardy and Wegner Creeks. These are the prinicpal tributaries to the Missouri River in the study area. The tributaries add considerable flow to the Missouri during spring runoff, but contribute very little flow during the remainder of the year.

The Missouri is the nation's longest river, 3982 km in length from its origin at Three Forks, Montana, to its confluence with the Mississippi River at St. Louis, Missouri. The river segment covered by this study represents one of the last free-flowing reaches of the entire river. Most of the Missouri River has been impounded by dams and reservoirs.

The river flows in a northeasterly direction through two distinct geologic zones in the study area. From Holter Dam to the confluence of Sheep Creek, a distance of 38.7 km, the river flows through a mountain canyon having an average width of 1,000 m. The Big Belt Mountains lie to the southeast, while the east front of the Rocky Mountains lies to the northwest. A narrow band of riparian vegetation consisting primarily of willow and some cottonwood lies along the riverbanks. Several brushy islands surrounded by extensive side channels are found in the upper portion of this reach between Holter Dam and the confluence of the Dearborn River (Craig study section, Figure 1). From the Dearborn River to the confluence of Sheep Creek, the river is confined by precipitous rock cliffs and other hydraulic controls to a single, deeper channel with very few islands and side channels (Hardy study section, Figure 1). Below the confluence of Sheep Creek, the river abruptly leaves and mountain area and meanders through a wide and generally flat prairie zone. The upper portion of this zone, from

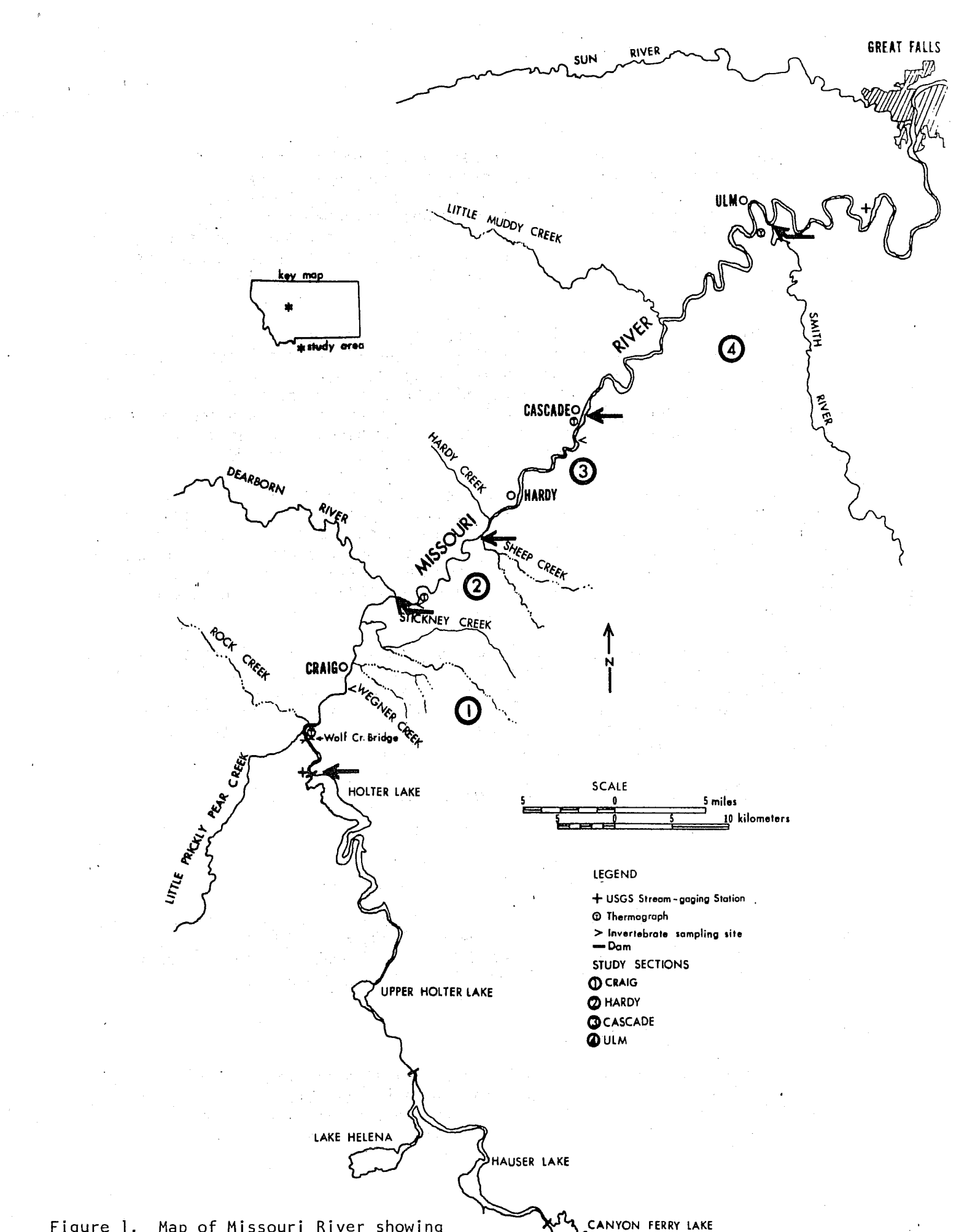


Figure 1. Map of Missouri River showing location of study sites.

Sheep Creek to Cascade, is characterized by well defined pools and riffles with some large brushy islands and side channels (Cascade study section, Figure 1). The lower segment of the prairie zone, from Cascade to the confluence of the Smith River, is characterized by a deep meandering channel with very few riffles. Several old oxbows have created shallow sloughs and backwater areas in this reach (Ulm study section, Figure 1). Extensive growths of riparian vegetation consisting of a willow/cottonwood overstory are found on the floodplain throughout most of the prairie zone.

Many species of waterfowl are seasonally associated with the river. Mallards, mergansers, Canada geese and teal nest along the river on islands, backwater areas and sloughs. Some mallards, goldeneyes and geese spend the winter in ice-free areas along the river. During spring migration, the river is often an important resting area for thousands of pintails, mallards and other waterfowl enroute to northern nesting areas. Several species of shorebirds, such as killdeer, snipe, phalarope and gulls are also seasonally associated with the river.

The extensive riparian vegetation along the lower half of the study section provides excellent habitat for many important wildlife species. Large numbers of white-tailed deer, mule deer and ring-necked pheasant are found here year-around. Small patches of riparian vegetation along the river in the mountain canyon area also provide habitat for a few deer. Mink, muskrat, beaver, raccoon and a few river otter are found throughout the study section. Bald eagles are often observed along the river corridor during the winter.

Access to the river is good throughout the study area. There are several public access areas along the upper half of the river. Old U.S. Highway 91, now designated as a recreation road, parallels considerable portions of the river and also provides easy access. River flow is always good for floating, and many recreationists take advantage of this sport. The outstanding scenery and fishing add to the enjoyment of this activity.

Holter Reservoir, Hauser Reservoir, Lake Helena and Tributaries

A description of this study area is found in Berg and Lere (1983).

OBJECTIVES AND DEGREE OF ATTAINMENT

The long range objective of the study is to follow inventory procedures developed in earlier studies (Wipperman 1973, Berg 1975 and 1981a) and use the resulting data to prepare recommendations for aquatic resource management on this section of the Missouri River. Specific objectives during this report period are:

Missouri River below Holter Dam

1) Obtain spring and fall population estimates of rainbow and brown trout in the Hardy study section using a mark/recapture technique. Obtain fall population estimates of rainbow and brown trout in the Cascade and Craig study sections using a mark/recapture technique.

2) Continue to identify and monitor spawning migrations of rainbow and brown trout in the Missouri River mainstem from Holter Dam to Cascade and in the lower reaches of the Dearborn River, Little Prickly Pear Creek, Sheep Creek and Rock Creek.

3) Continue to attempt to locate spawning sites of rainbow and brown trout in the Missouri River and its tributaries from Holter Dam to Cascade by searching for redds. Determine the conditions required for successful spawning by measuring physical parameters including water depth, velocity and substrate composition of the redds. Attempt to determine time of emergence of larval trout from redds by sampling with appropriate equipment.

4) Maintain thermograph stations at two sites on the Missouri River below Holter Dam. The thermograph sites are located in the Craig and Ulm study sections.

Holter Reservoir, Hauser Reservoir, Lake Helena and Tributaries

1) Begin to conduct baseline surveys of resident fish populations in Holter Reservoir, Hauser Reservoir, Lake Helena and perennial tributaries of these waters. Begin to determine species composition, distribution, relative abundance and size composition of the fish populations.

2) Begin to tag key sport fish species in Holter Reservoir, Hauser Reservoir, Lake Helena and perennial tributaries of these waters with individually numbered tags to determine angler harvest and monitor movements of individual fish.

3) Mark an appropriate percentage of the 1982 hatchery plants of rainbow trout in Holter and Hauser Reservoirs with permanent fin clips. Mark an appropriate percentage of the 1982 hatchery plant of rainbow trout in Canyon Ferry Reservoir using tetracycline dye. Use marked fish to evaluate possible displacement of hatchery fish between reservoirs during high flow periods. Also use marked fish to determine the growth rate of hatchery fish and to ascertain the percentage of the Arlee stock of hatchery fish which reach sexual maturity and spawn in tributaries of the reservoir system.

4) Identify and monitor spawning migrations of rainbow and brown trout from the reservoirs into the lower reaches of perennial tributaries. Attempt to locate spawning sites of rainbow and brown trout by searching for redds in the tributaries. Determine the importance of the tributaries as rearing areas for juvenile rainbow and brown trout.

5) Monitor water temperature and streamflow in the lower reaches of perennial tributaries of the Missouri River between Canyon Ferry Dam and Cascade.

Progress was made on all of the objectives. Findings are presented in the appropriate sections of this report.

PROCEDURES

Water Temperature

Thirty-day continuous recording thermographs were used to monitor water temperature. The recorder box was positioned on the streambank as far above the high water mark as possible. A thermocouple lead, varying in length from 8 to 23 m, was extended into the water through flexible, plastic sewer pipe.

Stream Flow and Water Velocity

Stream flow and water velocity were measured with a Marsh-McBirney instantaneous current meter, except on the main stem of the Missouri River where stream flow was monitored by continuous recording U.S. Geological Survey gage stations.

Larval Fish

Larval fish located near the border of the stream channel were sampled with a hand-held rectangular framed 25 x 45 cm, conical shaped dip net with fine mesh (300 micron) pores. Since salmonidae larvae rarely are found in drift samples, this technique was utilized principally to collect Salmonidae.

After the net was retrieved from the river, its contents were thoroughly washed into a collecting jar containing an identifying label. Samples were preserved in a 10 percent solution of formaldehyde colored with phloxine-B dye, a deep pink coloring agent which penetrated the fish larvae and aided in separating them from aquatic vegetation and debris. Larvae were identified to the lowest taxon practical using keys by Hogue et. al., (1976) and May and Gasaway (1967). For purposes of this study, larval fish were defined as those fish exhibiting undeveloped pectoral, anal, and dorsal fin rays, essentially as suggested by May and Gasaway (1967).

Juvenile and Adult Fish

Boom-suspended Electrofishing System

A boom-suspended electrofishing system was used to sample fish populations on the mainstem of the Missouri River. The electrofishing system was adapted from Novotny and Priegel (1974) and is described by Berg (1981a). The electrofishing apparatus was mounted on a 4.5 m (14.6 foot) aluminum drift boat by a 9.9 horsepower outboard.

The boom-suspended electrofishing apparatus was the most effective technique for sampling fish in the Missouri River mainstem. Other procedures such as mobile electrofishing and seining were effective only in restricted habitat areas such as shorelines, backwaters and side channels.

Mobile Electrofishing System

A mobile electrofishing system was used to sample juvenile and forage fish in shoreline and side channel areas of the Missouri River. The system was also

used to sample adult, juvenile and forage fish in tributaries. The mobile electrofishing system consisted of a hand-held mobile positive electrode, a stationary negative electrode mounted on a 1.0 m^2 float attached to the boat, and a portable 1350-watt, 115 volt (60 Hz. single phase) alternating current generator. A Coffelt Model VVP-2C rectifying unit was used to change the alternating current to pulsed direct current. Output from the rectifying unit was adjustable from 0 to 300 volts half-wave 60 hz. in 25 and 50 volt increments. The eltrofishing system was carried in a 5.8 m (19 foot) aluminum freight canoe. In tributaries where the freight canoe could not be floated, electrofishing with this system was accomplished by bank shocking with 76.2 m (250 feet) of 16/2 electrical cord.

Seines

Juvenile and forage fish were collected from shoreline areas of the reservoirs with 15.2 x 1.2 m (150 x 4 feet) beach seines with 3.2 mm (1/8-inch) square mesh. Fish collected were identified and appropriate data were recorded.

Fish Sample Processing and Tagging

Fish captured by various methods were measured to the nearest mm in total length and weighed to the nearest 10 g. Sex and spawning condition (gravid, ripe or spawned) were recorded for fish captured during their spawning season. Several thousand catchable game fish were marked with individually numbered Floy t-tags to evaluate growth rate, movement and angler harvest. All fish were released near the capture site.

Fish Population Estimates

Population estimates were made using the Peterson mark-recapture formula as modified by Chapman (1951):

$$N = \frac{(M+1)\ (C+1)}{(R+1)} - 1$$

where: N = population estimates
M = the number of marked fish
C = the number of fish in the recapture sample
R = the number of marked fish in the recapture sample (C)

Multiple marking and recapture runs were needed to collect an adequate sample size. A partial fin clip or fin punch was used to mark the fish. A minimum of two weeks was allowed before recapture runs were made. Additional methods used for population and standing crop estimates are described by Vincent (1971 and 1974).

Fish Aging

Scales were collected from some fish for age determination. The scale samples were imprinted on an acetate slide, and the imprints were projected at 44X with a Bausch and Lomb optical projector. Annuli were identified and ages assigned following procedures described by Tesch (1971) and Lagler (1956).

FINDINGS - MISSOURI RIVER BELOW HOLTER DAM

PHYSICAL CHARACTERISTICS

Missouri River

Drainage Area and Stream Discharge

The drainage area of the middle Missouri River increases from 44,416 km^2 to 54,237 km^2, or by about 29 percent, between Holter Dam and the confluence of the Smith River (USGS 1979). The climate is characterized by moderately low rainfall, a dry atmosphere, hot summers, cold winters and a large proportion of sunny days.

Streamflow is monitored by the USGS at gages located 0.6 km downstream from Holter Dam (Holter Dam gage) and 14.6 km downstream from the confluence of the Smith River (Ulm gage). Mean annual discharge for a 33-year period of record at Holter Dam is 4.99 km^3/yr (4,051,000 acre-feet/year) compared to 6.09 km^3/yr (4,938,000 acre-feet/year) for a 21-year period of record at the Ulm Gage (USGS 1978). The maximum flow recorded at Holter Dam was 986 m^3/second (34,800 cfs) on June 8, 1948, while the maximum at Ulm was 779 m^3/second (27,500 cfs) on June 22, 1964.

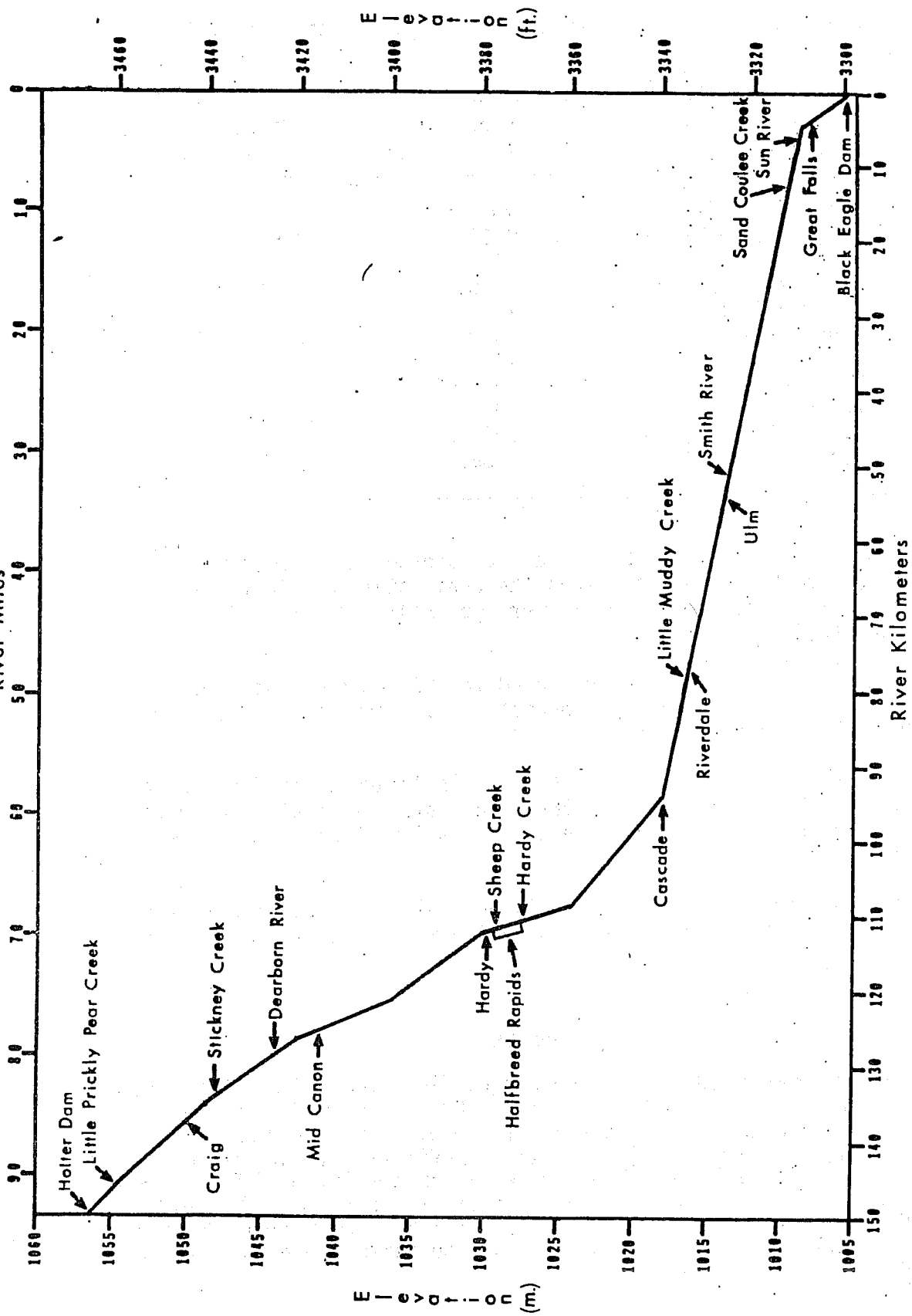
Present day flow regimens of the Missouri River are not natural because of regulation and storage at several dams in the drainage upstream from the study area. Flow is largely controlled by Canyon Ferry Reservoir, the largest of three consecutive upstream reservoirs. Canyon Ferry was completed in 1953, and it is operated by the U.S. Bureau of Reclamation for irrigation, hydropower, flood control, recreation and supplemental water supply for the City of Helena. Canyon Ferry has a surface area of 14,245 hectares (35,200 acres) and a storage capacity of 2.529 km^3 (2,051,000 acre-feet). Hauser and Holter reservoirs lie downstream of Canyon Ferry Dam and provide head for power generation (Figure 1). Hauser and Holter dams are owned and operated by Montana Power Company.

Stream Gradient

The Missouri River enters the study area immediately below Holter Dam at an elevation of 1056.1 m (3,465 feet) msl, dropping 44.2 m (145 feet) to an elevation of 1011.9 m (3,320 feet) msl near the confluence of the Smith River (Table 1). Stream gradient averages 0.39 m/km (2.04 feet/mile) and varies from 1.49 m/km (7.84 feet/mile) at Halfbreed Rapids to 0.10 m/km (0.52 feet/mile) near Ulm (Figure 2). Stream gradients were determined by measurements taken from USGS topographic maps.

Water Temperatures

Water temperatures in the Craig and Ulm study sections were monitored with continuous recording thermographs from April 2 through November 15, 1982. Five-day average maximum water temperatures recorded at each station are shown in



igure 2. Longitudinal profile of the Missouri River from Holter Dam to Black Eagle Dam near Great Falls.

Table 1. Stream gradients of the Missouri River from Holter Dam to Black Eagle Dam at Great Falls, MT.

River Kilometer	Approximate Location	Elevation (meters, msl)	Gradient (m/km)	Gradient (ft/mi)
0.0	Black Eagle Dam	1005.8	-	-
5.0	BN RR Bridge at Gt. Falls	1008.9	0.67	3.22
36.0	Ulm	1011.9	0.10	0.52
93.3	Cascade	1018.0	0.11	0.56
107.9	Finigan Creek	1024.1	0.42	2.21
112.0	Sheep Creek	1030.2	1.49	7.84
121.0	Andy Creek	1036.3	0.67	3.56
126.4	Mid-Canon	1042.4	1.14	6.01
135.1	Craig	1048.5	0.70	3.68
146.0	L.Prickly Pear Creek	1054.6	0.56	2.96
150.3	Holter Dam	1056.1	0.35	1.87

Figure 3. From April 10 through September 10, average maximum temperatures were generally warmer at the Ulm Station than the Craig station. In contrast, average maximum temperatures after September 10 were generally cooler at the Ulm station than the Craig station.

The maximum water temperatures recorded in 1982 at the Craig and Ulm stations were 20.6 and 22.2 c (69 and 72 F), respectively. These temperatures were recorded on July 31 at both stations.

Water temperature exceeded 19.4 c (67 F) on 4 days at the Craig station and on 26 days at the Ulm station in 1982. Mean diel fluctuation of water temperature was 1.15 c degree (2.07 F) at the Craig station compared to 1.33 c degree (2.39 F degrees) at the Ulm station.

The data indicate water temperature is optimal for trout survival from Holter Dam to Ulm. Water temperature monitoring will be continued in 1983.

Tributaries

Stream Discharge

Flows in the lower reaches of Sheep and Little Prickly Pear Creeks were monitored from April 30 through November 15, 1982. Hydrographs developed for these stations are presented in Figure 4. The maximum and minimum flows recorded for Sheep Creek were 2.09 m^3/sec (73.9 cfs) on April 13 and 0.12 m^3/sec (4.1 cfs) on August 27. For Little Prickly Pear Creek, a maximum flow of 11.45 m^3/sec (404.7 cfs) was recorded on April 27, while a minimum flow of 1.46 m^3/sec (51.6 cfs) was recorded on August 26. Maximum flows in April are attributable to runoff from snowmelt, while minimums in August are due to seasonal precipitation/runoff patterns and/or irrigation dewatering.

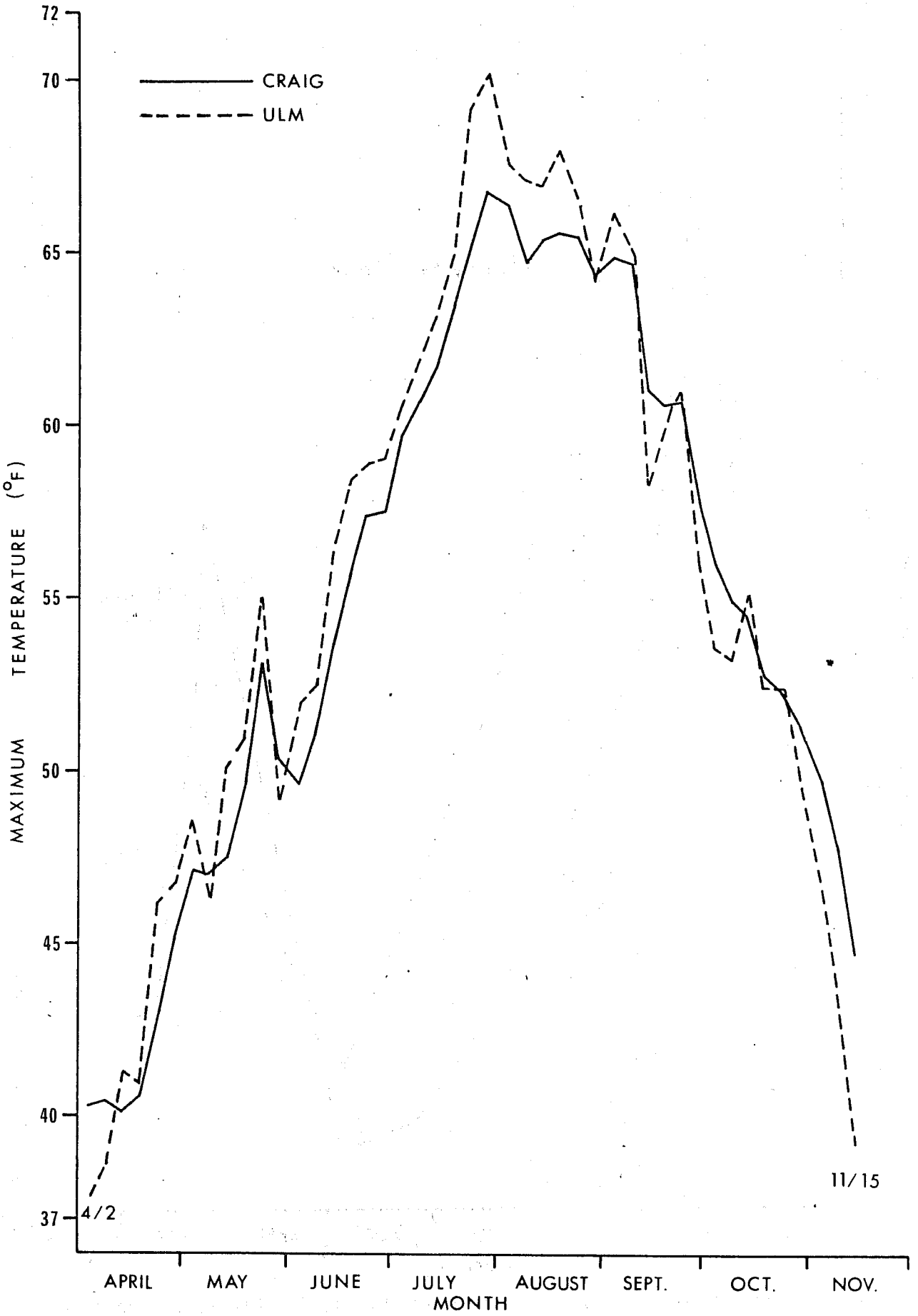


Figure 3. Five-day average maximum water temperatures for the Missouri River near Craig and Ulm in 1982.

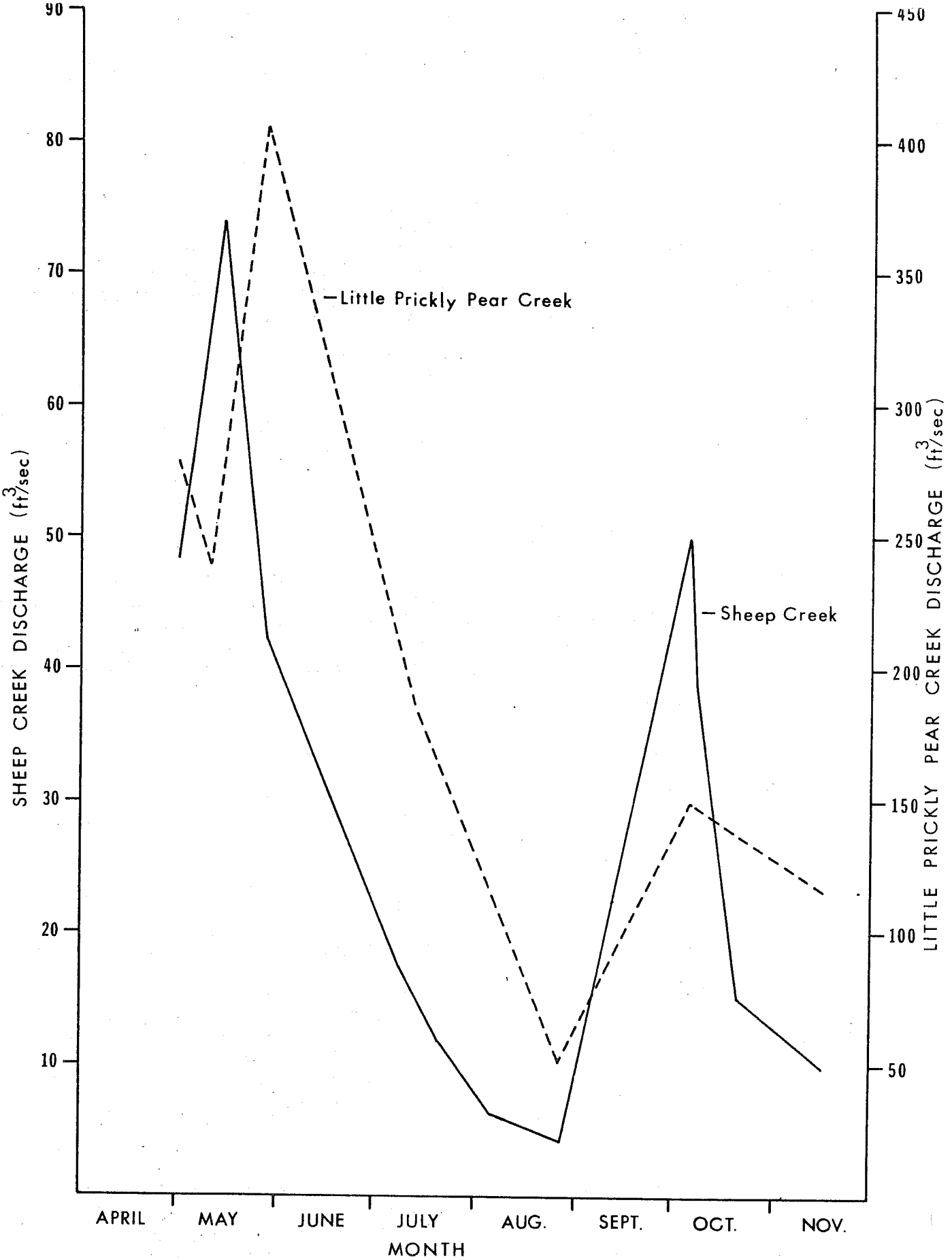


Figure 4. Discharge near the mouth of Sheep and Little Prickly Pear Creeks in 1982.

WATER TEMPERATURES

Water temperatures in the lower reaches of three tributaries of the Missouri River were monitored with maximum/minimum thermometers from April through November 15, 1982 (Figure 5). Maximum temperatures recorded on Sheep Creek, Dearborn River and Little Prickly Pear Creek were 20.0, 25.0 and 21.7 c (68, 77 and 71 F) respectively. The maximum temperatures were reached at these stations during a period from mid-July to late August.

Maximum summer temperatures appeared suitable for good survival of salmonids in Sheep and Little Prickly Pear Creeks in 1982, while the maximum summer temperature in the Dearborn River appeared marginal for salmonid survival. Abnormally warm summer water temperatures in the Dearborn River are apparently due to severe dewatering and/or warmed return flows resulting from irrigation.

FISH POPULATIONS

Species Composition

Twenty species representing eight families of fish, occur in the Missouri River between Holter Dam and the confluence of the Smith River (Table 2). Rainbow and brown trout and mountain whitefish are the most common game fish, and they comprise the bulk of the sport fishery. A few burbot and walleye are found in the river; however, they are not nearly as common as the former species. Longnose and white suckers, carp, longnose dace and mottled scuplin are the prevalent nongame species.

Trout Population Estimates

Trout populations were estimated in the Craig, Hardy and Cascade study sections. The Craig and Hardy study sections were each 9.000 km (5.594 mi.) in length, and the Cascade section was 6.650 km (4.132 mi.) in length. A summary of the population estimates is presented in Table 3.

Estimates of numbers of catchable trout and total trout biomass were highest for both rainbow and brown trout in the Craig section. In fall, 1982, 2528 seven-inch and larger (catchable) rainbow and brown trout per mile and a total standing crop of 2473.6 pounds of trout per mile were estimated in the Craig section. The catchable trout were 90.6 percent rainbow. A total of 99 trophy trout per mile were estimated for the Craig section in fall, 1982, of which 91.9 percent were brown trout. The fall, 1982 estimate is the only estimate presently available for the Craig section. Spring and fall estimates will be made in the Craig section in 1983, and data will be presented in the next progress report. The Craig study section is considered generally representative of trout populations in the Missouri River from Holter Dam to the confluence of the Dearborn River, a distance of 22.2 km (13.8 mi.).

The Hardy study section is considered generally representative of trout populations in the Missouri River from the confluence of the Dearborn River to Sheep Creek, a distance of 16.4 km (10.2 mi). Estimates completed to date indicate an average of about 1500 catchable rainbow and 150 catchable brown trout per

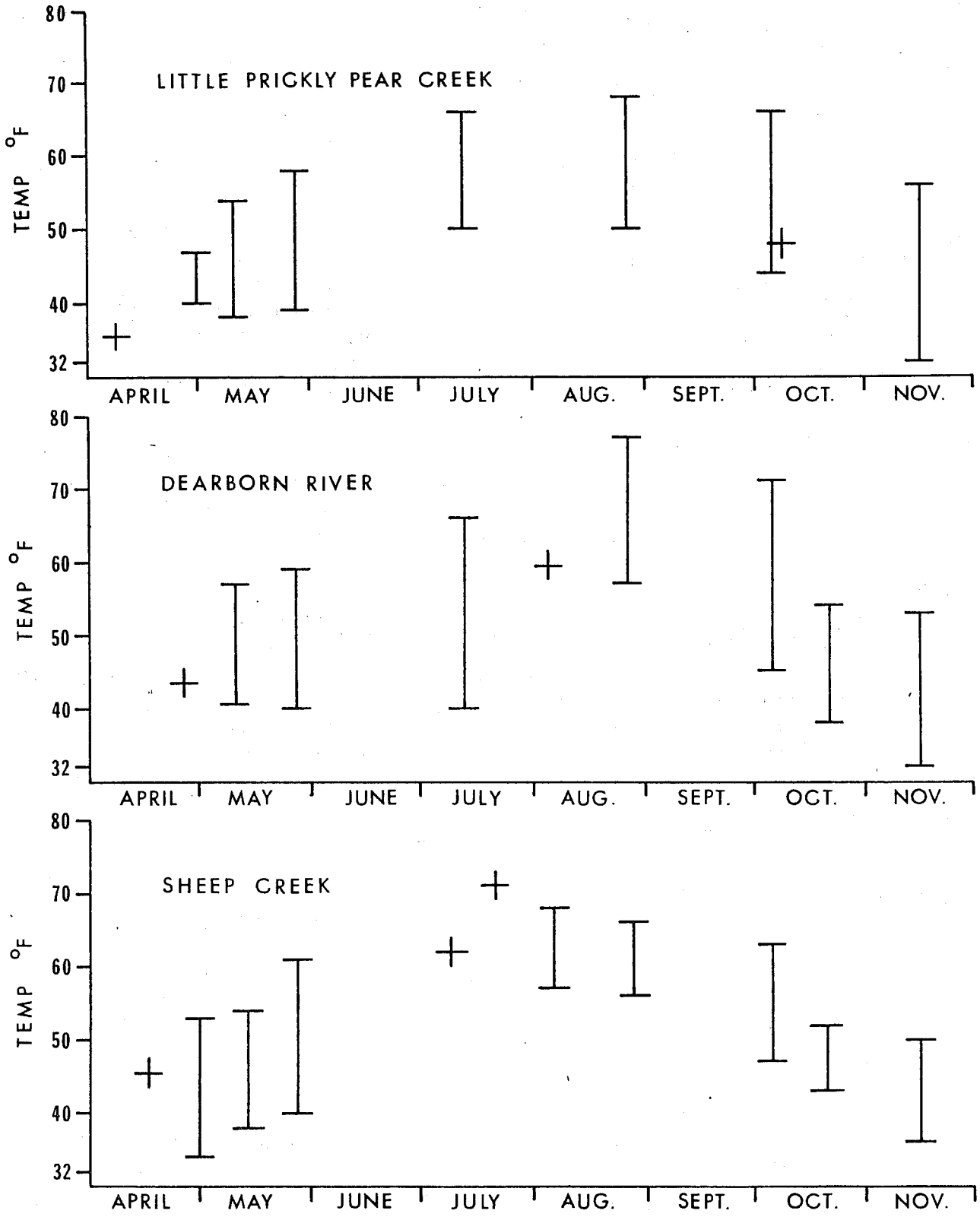


Figure 5. Maximum-minimum water temperatures of three tributaries of the Missouri River in 1982. Bars represent maximum-minimum thermometer readings. Plus signs represent individual spot temperature measurements.

Table 2. Fish species found in the Missouri River in Montana between Holter Dam and the confluence of the Smith River.

SALMONIDAE (Trout family)	
Prosopium williamsoni	Mountain whitefish (A)1
Oncorhynchus nerka	Kokanee (R)*
Salmo clarkii	Cutthroat trout (R)**
Salmo gairdneri	Rainbow trout (A)
Salmo trutta	Brown trout (A)
Salvelinus fontinalis	Brook trout (R)**
CYPRINIDAE (Minnow family)	
Cyprinus carpio	Carp (A)
Couesius plumbeus	Lake chub (C)
Pimephales promelas	Fathead minnow (C)
Rhinichthys cataractae	Longnose dace (A)
CATOSTOMIDAE (Sucker family)	
Catostomus catostomus	Longnose sucker (A)
Catostomus commersoni	White sucker (A)
ICTALURIDAE (Catfish family)	
Ictalurus melas	Black bullhead (R)
Noturus flavus	Stonecat (R)
GADIDAE (Codfish family)	
Lota lota	Burbot (C)
CENTRARCHIDAE (Sunfish family)	
Lepomis gibbosus	Pumpkinseed (R)
Micropterus salmoides	Largemouth bass (R)
PERCIDAE (Perch family)	
Perca falvescens	Yellow perch (C)
Stizostedion vitreum	Walleye (R)
COTTIDAE	
Cottus bairdi	Mottled sculpin (A)

1 Relative abundance - A=Abundant, C=Common, R=Rare.

* Rare transients found in the river, apparently from upstream reservoirs.

** Common in some tributaries of the Missouri in the study area.

Table 3. Estimated trout populations in three sections of the Missouri River.

Section Date	Fish Species[1]	Catchable Fish/Mile[2]	Trophy Fish/Mile[3]	Biomass Lbs/Mile[4]	Condition Factor[5]
Hardy	Rb	1080	NA[6]	986.1 ± 23.2%	36.17 ± 5.77
Spring 1980	LL	129	21	193.2 ± 25.5%	37.26 ± 4.43
Hardy	Rb	Data Analysis Incomplete			
Fall 1980	LL	152	17	172.6 ± 24.6%	39.53 ± 7.64
Hardy	RB	Data Analysis Incomplete			
Spring 1981	LL	125	24	171.4 ± 21.5%	37.28 ± 6.12
Hardy	RB	1598	5	1193.6 ± 9.9%	36.68 ± 5.41
Fall 1981	LL	160	25	197.4 ± 14.4%	37.07 ± 5.94
Hardy	Rb	1435	5	1099.7 ± 8.5%	34.81 ± 5.48
Spring 1982	LL	126	26	172.7 ± 6.5%	35.24 ± 4.86
Hardy	Rb	1493	4	1125.0 ± 9.5%	38.97 ± 5.60
Fall 1982	LL	198	33	242.6 ± 26.8%	38.82 ± 6.10
Craig	Rb	2290	8	2029.0 ± 9.0%	38.92 ± 6.70
Fall 1982	LL	238	91	444.6 ± 36.0%	38.65 ± 5.39
Cascade	Rb	1161	20	1318.1 ± 44.5%	34.89 ± 5.16
Spring 1980	LL	121	40	243.8 ± 34.5%	37.40 ± 4.72
Cascade	Rb	Data Analysis Incomplete			
Spring 1981	LL	Data Analysis Incomplete			
Cascade	Rb	1343	20	1067.5 ± 10.2%	36.72 ± 5.66
Fall 1981	LL	159	38	270.6 ± 19.7%	37.81 ± 5.68
Cascade	Rb	1268	7	887.2 ± 11.1%	41.25 ± 7.02
Fall 1982	LL	127	28	179.1 ± 16.1%	39.33 ± 5.03

1/ Abbreviations: Rb-rainbow trout; LL-brown trout.
2/ Catchable trout 7 inches or greater in length.
3/ Trophy trout 18 inches or greater in length.
4/ Total biomass including sub-catchable and catchable trout ± 80% confidence limits for total biomass expressed as a percentage.
5/ Condition factor of trout 5 inches or greater in total length ± 80% confidence limits.
6/ NA - No estimate available.

mile are found in the Hardy section. It appears the number of catchable rainbow increased slightly in this study section in 1981 and 1982 compared to 1980, while the number of catchable brown trout has remained essentially constant. The species composition of catchable trout in this section, averaging about 90 percent rainbow and 10 percent brown trout, is nearly identical to the Craig section.

Estimates of trophy trout numbers in the Hardy section include an average of about 5 rainbow and 25 brown trout per mile. Total trout biomass estimates in the Hardy section have ranged from 1179.3 to 1391.0 pounds per mile. Thus, catchable trout numbers, trophy trout numbers and total trout biomass per river mile are higher in the Craig section than in the Hardy section. The increased concentration of trophy trout in the Craig section is noticeably more significant than increased catchable trout numbers or total trout biomass.

The Cascade study section is considered generally representative of trout populations in the Missouri River from the confluence of Sheep Creek to the Cascade Bridge. a distance of 17.9 km (11.1 mi.). An average of about 1300 catchable rainbow and 140 catchable brown trout per mile have been estimated recently in the Cascade section. The species composition of catchable trout is about 90 percent rainbow and 10 percent brown trout, similar to the upstream study areas. Brown trout comprise about two-thirds of the trophy trout population in this section. Estimates range from 7 to 20 trophy rainbow and from 28 to 40 trophy brown trout per mile in the Cascade section. Total trout biomass estimates range from 1066.3 to 1561.9 pounds per mile.

Catchable trout numbers and total trout biomass per river mile are similar in the Hardy and Cascade sections, but densities of trophy rainbow and brown trout are notably higher in the Cascade section than in the Hardy section. While the Craig study area has considerably higher numbers of trophy brown trout per mile than the Hardy or Cascade study areas, it appears trophy rainbow trout may be slightly more abundant in the Cascade section than in the other study areas.

Discussion

Trout population estimates rank the Missouri River among the top blue ribbon trout streams in the state in terms of catchable and trophy trout densities per stream mile. The 38.6 km (24.0 mi.) reach of the Missouri River from Holter Dam to the confluence of Sheep Creek is rated by DFWP as a Class I (Blue Ribbon) trout fishery. The 60.3 km (37.5 mi.) reach of the river from the confluence of Sheep Creek to the confluence of the Smith River is rated as a Class II (Red Ribbon) trout fishery. Based on information gathered during this study it appears the 17.9 km reach of the Missouri River from the confluence of Sheep Creek to the Cascade Bridge should be upgraded to a Class I (Blue Ribbon) fishery. With re-classification, the Blue Ribbon segment from Holter Dam to the Cascade Bridge would be 56.5 km (35.1 mi.) in length. It is possible a portion of the 42.5 km reach of the Missouri River from the Cascade Bridge to the confluence of the Smith River may also qualify as a Blue Ribbon trout fishery . Additional fishery data is needed in this reach for determination of its value.

Trout Spawning

In an effort to evaluate spawning periodicity and sources of wild trout recruitment in the Missouri River, the main stem of the river and the lower reaches of several tributaries were electrofished during rainbow and brown trout spawning periods in 1982 to locate spawning fish. Sampling efforts during the spawning periods were limited. Numbers of spawners given in this report represent only a small portion of the total spawners present, since only selected days during the spawning period were sampled, and only one capture run was made on each day sampled. Also, the areas surveyed represent only a small portion of the total spawning area available in the river and its tributaries. Therefore, in the areas where spawning trout were captured, the data document only the presence of spawners and do not accurately define absolute abundance. Since spawning fish were collected at random from the various reaches of river, the data also do not accurately define relative abundance of spawners between reaches. The relative value of various habitats and reaches of the river for trout spawning and rearing was defined in previous reports (Berg 1981 and 1982).

Missouri River

Three electrofishing surveys were made on the Missouri River from Holter Dam to Cascade during April and May, 1982 to monitor the spawning activity of rainbow trout (Table 4). During each survey period, approximately 30 percent of all captured rainbow trout were in spawning condition. Ripe and spent female rainbow trout collected on the first survey run on April 14 indicated the spawning period began prior to initiation of our sampling effort. Spawning probably peaked in late April. Rainbow trout spawners ranged from 218-510 mm (8.6 - 20.1 in.) in total length and from 125 - 1355 gm (0.28 - 2.99 lbs.) in weight.

An electrofishing survey was made from Holter Dam to Cascade on October 18 - 20, 1982 to monitor the spawning activity of brown trout. Of the brown trout that were captured, 43.5 percent were in spawning condition (Table 5). A majority of the spawners were collected near redds located in side channels of the river. Spawning brown trout captured in the Missouri River ranged from 248-631 mm (9.8 - 24.8 in.) in total length and from 160-2730 gm (o.4 - 6.0 lbs) in weight.

Tributaries

Most members of the trout family migrate during the spawning season in search of suitable sites (Hubbs and Lagler 1970). Spawning movements of lake dwelling salmonid populations into inlet or outlet streams have been extensively documented for rainbow (Rayner 1942, Hartman el al. 1962, Calhoun 1966, Scott and Crossman 1973) and brown trout (Fenderson 1958, Stuart 1957) and mountain whitefish (Snyder 1918, Calhoun 1966).

Less information is available on spawning movements of river dwelling salmonid populations into feeder streams. Calhoun (1966) reports resident rainbow trout populations in streams tend to move upstream, and if possible into tributaries to spawn. River dwelling brown trout in Ontario normally seek

Table 4. Spawning condition and size composition of mature rainbow trout sampled randomly by electrofishing on the Missouri River from Holter Dam to Cascade during Spring 1982. Average total length of fish (mm) in parentheses and average weight [gm] in brackets.

River Section	Date	Number of Adult Rainbow Trout: Male Ripe	Male Spent	Female Gravid	Female Ripe	Female Spent	Not Ripe	Total
Holter Dam to Stickney Cr.	4/13/82	31 (372.0) [521.0]	1 (432.0) [590.0]	39 (395.6) [616.8]	0 --	1 (390.0) [490.0]	151 (326.1) [361.3]	223 (345.4) [429.8]
	4/27/82	7 (361.0) [500.0]	0 --	26 (377.7) [540.6]	4 (400.8) [615.0]	8 (406.4) [556.3]	86 (312.7) [330.2]	131 (336.6) [403.5]
	5/11/82	8 (350.9) [428.1]	0 --	7 (385.6) [617.9]	9 (386.0) [556.1]	5 (376.6) [453.0]	64 (325.7) [365.5]	93 (340.9) [413.0]
Stickney Cr. to Prewett Cr.	4/14/82	38 (347.1) [423.0]	0 --	72 (373.8) [530.6]	1 (358.0) [440.0]	0 --	246 (315.6) [321.1]	357 (330.8) [374.5]
	4/28/82	14 (346.9) [423.2]	0 --	54 (372.0) [525.2]	6 (405.0) [651.7]	12 (391.5) [537.9]	179 (320.2) [345.2]	265 (337.3) [401.7]
	5/12/82	13 (363.8) [463.1]	5 (381.0) [512.0]	7 (352.3) [456.4]	5 (356.8) [437.0]	16 (375.0) [462.8]	98 (325.6) [355.1]	144 (338.8) [390.0]
Prewett Cr. to Cascade	4/15/82	14 (363.1) [463.2]	0 --	22 (412.4) [693.9]	0 --	1 (445.0) [690.0]	88 (322.0) [344.0]	125 (343.4) [421.7]
	4/29/82	3 (391.3) [530.0]	0 --	14 (397.4) [580.0]	1 (413.0) [600.0]	8 (398.5) [523.8]	61 (326.6) [374.8]	87 (347.8) [429.5]
	5/13/82	5 (415.4) [606.0]	1 (395.0) [460.0]	2 (396.2) [635.0]	4 (378.5) [560.0]	4 (430.8) [661.3]	40 (349.0) [431.3]	56 (365.4) [480.3]
Cumulative Totals:								
	4/13 to 4/15/82	83	1	13	1	2	485	705
	% of Total	11.77	0.14	1.84	0.14	0.28	68.79	--
	4/27 to 4/29/82	24	0	94	11	28	326	483
	% of Total	4.97	0	19.46	2.28	5.80	67.49	--
	5/11 to 5/13/82	26	6	16	18	25	202	293
	% of Total	8.87	2.05	5.46	6.14	8.53	68.94	--

Table 5. Spawning condition and size composition of mature brown trout sampled randomly by electrofishing on the Missouri River from Holter Dam to Cascade during Fall 1982. Average total length of fish (mm) in parentheses and average weight [gm] in brackets.

River Section	Date	Number of Adult Brown Trout						
		Male		Female			Not	
		Ripe	Spent	Gravid	Ripe	Spent	Ripe	Total
Holter Dam to Craig	10/18/82	5 (481.4) [1174.0]	0 --	0 --	0 --	3 (424.3) [690.0]	26 (314.5) [331.9]	34 (348.7) [487.3]
% of Total		14.71	0	0	0	8.82	76.47	--
Craig to Prewett Cr.	10/19/82	12 (410.3) [905.8]	0 --	2 (570.5) [2180.0]	3 (458.3) [1416.7]	5 (460.8) [1020.0]	15 (326.0) [381.3]	37 (395.5) [818.9]
% of Total		32.43	0	5.41	8.11	13.51	40.54	--
Prewett Cr. to Cascade	10/20/82	4 (477.8) [1302.5]	0 --	3 (497.7) [1270.0]	2 (505.5) [1410.0]	1 (550.0) [1270.0]	11 (295.5) [269.1]	21 (391.2) [765.2]
% of Total		19.05	0	14.29	9.52	4.76	52.38	--
Total 10/18 to 10/20/82		21	0	5	5	9	52	92
% of Total		22.83	0	5.43	5.43	9.78	56.52	--

tributary streams for spawning purposes (MacKay 1963). Spawning movements of mountain whitefish from larger streams into some tributaries have been observed in Montana (Liebelt 1970, Brown 1971).

The lower reaches of several tributaries of the Missouri River were electrofished during the rainbow and brown trout spawning periods to document the possible presence of spawning runs. The tributaries were electrofished prior to the spawning runs to determine the size and abundance of resident salmonids. Fish captured in the tributaries during the spawning season were assumed to be from the Missouri River if they were in a ripe spawning condition and obviously oversize or overabundant for the habitat present. Also, some fish captured in tributaries had tags attached from fish population study sections on the Missouri River which confirmed the fish's origin.

The lower reaches of Sheep Creek, Dearborn River and Little Prickly Pear Creek were electrofished during April, 1982 to evaluate spawning periodicity

of rainbow trout in the tributaries and to document the possible presence of spawning runs of migrant fish from the Missouri River. Rainbow trout in spawning condition were found in all three tributaries. In Sheep Creek, all spawners appeared to be migrants from the river. These migrants ranged from 379-490 mm (14.9 - 19.3 in.) in total length and from 590-990 gm (1.3 - 2.2 lbs.) in weight (Table 6).

Table 6. Numbers of mature rainbow trout sampled by electrofishing in three tributaries of the Missouri River during Spring, 1982. Average total length of fish (mm) in parentheses and average weight [gm] in brackets.

Tributary	Date	Number of Adult Rainbow Trout						
		Male		Female			Not	
		Ripe	Spent	Gravid	Ripe	Spent	Ripe	Total
Sheep Creek	4/16/82	8 (425.9) [722.5]	0 --	1 (379.0) [590.0]	1 (478.0) [880.0]	2 (463.0) [855.0]	0 --	12 (432.5) [746.7]
% of Total		66.67	0	8.33	8.33	16.67	0	--
Dearborn R.	4/26/82	20 (364.0) [444.3]	0 --	18 (377.6) [515.3]	2 (388.5) [490.0]	13 (398.2) [521.9]	20 (254.8) [172.5]	73 (344.2) [402.4]
% of Total		27.40	0	24.66	2.74	17.81	27.40	--
Little Prickly Pear Cr.	4/08/82	25 (392.1) [563.6]	0 --	7 (404.1) [639.3]	4 (407.0) [601.3]	1 (405.0) [615.0]	19 (375.0) [503.2]	56 (389.1) [556.2]
% of Total		44.64	0	12.50	7.14	1.79	33.93	--

In the Dearborn River and Little Prickly Pear Creek, both resident and migrant spawning rainbow trout were collected. Spawners captured in the Dearborn River ranged from 309-468 mm (12.2 - 18.4 in.) in total length and from 260-870 gm (0.57 - 1.9 lbs.) in weight. In Little Prickly Pear Creek, spawners ranged from 317-485 mm (12.5 - 19.1 in.) in total length and from 270-1050 gm (0.6 - 2.3 lbs.) in weight.

The lower reaches of Sheep Creek, Dearborn River and Little Prickly Pear Creek were electrofished during October, 1982 to monitor the spawning activity of brown trout. Spawners were captured only in Sheep and Little Prickly Pear creeks. Spawning brown trout were not captured in the Dearborn River; however, additional sampling is needed on this stream to adequately confirm the pressure or absence of brown trout spawning runs.

In Sheep Creek, 64 percent of the captured brown trout were in spawning condition (Table 7). Most of the spawners appeared to be migrants from the river. Two spawning fish captured during the survey had been tagged previously in the Missouri River, verifying their status as migrants. Brown trout spawners sampled in Sheep Creek ranged from 292-515 mm (11.5 - 20.3 in.) in total length and from 270-1490 gm (0.6 - 3.3 lbs.) in weight.

Table 7. Numbers of mature brown trout sampled by electrofishing in three tributaries of the Missouri River during Fall, 1982. Average total length of fish (mm) in parentheses and average weight [gm] in brackets.

Tributary	Date	Number of Adult Brown Trout						
		Male		Female			Not	
		Ripe	Spent	Gravid	Ripe	Spent	Ripe	Total
Sheep Creek	10/07/82	5 (390.2) [740.0]	0 --	2 (423.0) [955.0]	1 (425.0) [770.0]	1 (460.0) [870.0]	5 (206.2) [122.0]	14 (336.6) [561.4]
% of Total		35.71	0	14.29	7.14	7.14	35.71	--
Dearborn R.	10/21/82	0 --	0 --	0 --	0 --	0 --	0 --	0 --
Little Prickly Pear Cr. (Mouth Section)	10/08/82	2 (448.0) [1205.0]	0 --	2 (429.5) [1035.0]	0 --	0 --	9 (277.6) [254.4]	13 (327.2) [520.7]
% of Total		15.38	0	15.38	0	0	69.23	--
(Wolf Cr. Sec.)	10/8/82	5 (480.8) [1202.0]	0 --	2 (563.0) [1715.0]	2 (496.5) [1115.0]	0 --	5 (358.2) [536.0]	14 (451.0) [1025.0]
% of Total		35.71	0	14.29	14.29	0	35.71	--

Forty-eight percent of the brown trout collected in Little Prickly Pear Creek were in spawning condition. Most of the spawners appeared to be river migrants. Four spawning fish captured during the survey had been tagged previously in the Missouri River, verifying their status as migrants. Brown trout spawners sampled in Little Prickly Pear Creek ranged from 340-591 mm (13.4 - 23.3 in.) in total length and from 410-1950 gm (0.9 - 4.3 lbs.) in weight.

Tag return evidence indicates some rainbow and brown trout move considerable distances in the Missouri River to reach a spawning tributary. Quantitative data on spawning movements defined by tag returns will be presented in the completion report for this project.

Trout Redds and Larval Fish

The Missouri River was searched from Holter Dam to Cascade during April and May, 1982 in an attempt to locate spawning sites (redds) of rainbow trout. Since the search was hindered by high turbid water, only one redd was located. Physical characteristics of this redd, found in a side channel of the Craig section, are shown in Table 8.

The lower reaches of Sheep Creek, Dearborn River and Little Prickly Pear Creek were searched for rainbow trout redds during April, 1982. Fourteen redds were located in Sheep Creek and seven were located in Little Prickly Pear Creek. Selected physical characteristics measured from the redds are shown in Table 8. Redds in Little Prickly Pear Creek were slightly larger in area and found in deeper water than those in Sheep Creek. Bottom water velocities at the redd sites were similar in both creeks.

The Missouri River was searched from Holter Dam to Cascade in October, 1982 for brown trout redds. A total of 24 redds were located. Twenty-three redds were found in side channels while only one redd was located in the main channel. The redds averaged 1.97 m^2 in area, 0.51 m in water depth, 0.42 m/sec in bottom velocity and 0.91 m/sec in mid-depth velocity (Table 9).

The lower reaches of Sheep Creek, Dearborn River and Little Prickly Pear Creek were searched for brown trout redds in October, 1982. Three redds were located in both Sheep and Little Prickly Pear Creeks. Selected physical characteristics of the redds are shown in Table 10.

Larval fish samples were collected from the Missouri River and the lower reaches of several tributaries during the report period. Findings will be presented in the completion report for the project.

Angler Harvest

A total of 7889 game fish has been marked with individually numbered Floy T-tags since the inception of this study on April 1, 1980. Of this total, 6883 have been tagged in the mainstem of the Missouri, and 1006 have been tagged in tributaries. The species tagged include 6100 rainbow, 1753 brown, 3 brook and 2 cutthroat trout, 17 burbot and 14 walleye.

An indication of angler harvest of rainbow and brown trout in the Missouri River and its tributaries is being provided by angler-returned fish tags. Since very few game fish other than rainbow and brown trout have been tagged, data for other species are not significant enough to warrant interpretation.

A total of 6.85 percent of the rainbow trout tagged in the mainstem of the Missouri River has been harvested by anglers (Table 11). In tributaries, anglers have harvested 2.90 % of the tagged rainbow trout. Harvest rates for brown trout are 6.97 and 3.43 percent in the mainstem and tributaries, respectively. In total, anglers have harvested 6.62 percent of the brown trout tagged in the Missouri River and its tributaries compared to 6.30 percent of the rainbow. It appears rainbow and brown trout are almost equally vulnerable

Table 8. Physical characteristics of rainbow trout redds located in the Missouri River and tributaries during Spring 1982.

MISSOURI RIVER

Section	Location T.	R.	S.	No. of Redds	Area of Redd (m^2) Mean	Range	Depth(m) Mean	Range	Bottom Vel(m/sec) Mean	Range	Mid-Depth Vel(m/sec) Mean	Range
Craig Side Channel 1	15N	3W	29	1	1.07	--	0.30	--	0.18	--	0.49	--

TRIBUTARIES

Tributary	Location T.	R.	S.	No. of Redds	Area of Redd (m^2) Mean	Range	Depth(m) Mean	Range	Bottom Vel(m/sec) Mean	Range	Mid-Depth Vel(m/sec) Mean	Range
Sheep Creek	16N	2W	1	14	0.97	0.53-1.52	0.15	0.06-0.23	0.18	0-0.43	0.27	0-0.55
Dearborn R.	16N	2&3W		0	--	--	--	--	--	--	--	--
Little Prickly Pear Creek	15N	3W	29,30, 31	7	1.16	0.65-2.01	0.28	0.14-0.61	0.18	0.03-0.35	0.53	0.21-0.85

Table 9. Physical characteristics of brown trout redds located in the Missouri River during Fall, 1982.

Section	Location T. R. S.	No. of Redds	Area of Redd (m^2) Mean	Area of Redd (m^2) Range	Depth(m) Mean	Depth(m) Range	Bottom Vel(m/sec) Mean	Bottom Vel(m/sec) Range	Mid-Depth Vel(m/sec) Mean	Mid-Depth Vel(m/sec) Range
Craig										
Side Channel 1	15N 3W 29	3	1.47	0.77-2.54	0.53	0.49-0.58	0.40	0.26-0.52	1.11	1.07-1.16
Side Channel 2	15N 3W 21	5	1.64	0.99-2.68	0.49	0.46-0.55	0.38	0.21-0.72	0.70	0.38-0.87
White Bridge Side Channel	15N 3W 15	2	3.33	2.71-3.95	0.57	0.52-0.61	0.49	0.30-0.67	0.95	0.94-0.96
Side Channel 11	15N 3W 2	1	2.17	--	0.18	--	0.43	--	0.75	--
Main Channel	15N 3W 2	1	3.07	--	0.52	--	0.20	--	0.24	--
Hardy										
Rhoda Isle Side Channel	16N 2W 29	4	1.58	0.74-2.24	0.51	0.29-0.79	0.26	0.11-0.41	0.94	0.61-1.34
Cascade										
Half Breed Side Channel	17N 2W 36	3	2.98	2.21-4.36	0.41	0.34-0.46	0.59	0.47-0.67	1.12	0.99-1.33
Cabin Side Channel	17N 1W 17	3	1.60	1.31-2.07	0.66	0.49-0.76	0.59	0.47-0.67	1.15	0.93-1.37
Brown Tank Side Channel	17N 1W 11	2	1.34	0.83-1.84	0.59	0.55-0.64	0.40	0.34-0.47	0.80	0.78-0.82
All Sites		24	1.97	0.74-4.36	0.51	0.29-0.79	0.42	0.11-0.72	0.91	0.38-1.37

Table 10. Physical characteristics of brown trout redds located in tributaries of the Missouri River during Fall, 1982.

Tributary	Location T.	R.	S.	No. of Redds	Area of Redd (m^2) Mean	Range	Depth(m) Mean	Range	Bottom Vel(m/sec) Mean	Range	Mid-Depth Vel(m/sec) Mean	Range
Sheep Creek	16N	2W	1	1*	0.57	--	0.27	--	0.21	--	0.35	--
Dearborn River	16N	2&3W		1	--	--	--	--	--	--	--	--
Little Prickly Pear Creek	14N	4W	2	3	3.16	1.31-4.67	0.28	0.24-0.34	0.33	0.27-0.40	0.76	0.61-0.87

* 2 others observed but not measured.

Table 11. Preliminary estimates of angler harvest of rainbow and brown trout as indicated by tag returns (updated to May 1, 1983).

Missouri River Study Area	Rainbow Trout			Brown Trout		
	Number Tagged	Number Harvested	Percent Harvested	Number Tagged	Number Harvested	Percent Harvested
Craig Section	1550	106	6.83	393	27	6.87
Hardy Section	2395	188	7.85	522	46	8.81
Cascade Section	820	43	5.24	450	27	6.00
Ulm Section	473	22	4.65	213	10	4.69
Sub-Total	5238	359	6.85	1578	110	6.97
Tributary Study Area:						
Sheep Creek	113	3	2.65	31	1	3.23
L. Prickly Pear	461	12	2.60	129	5	3.88
Dearborn River	250	7	2.80	11	0	0.00
Rock Creek	3	0	0.00	4	0	0.00
Wegner Creek	6	0	0.00	0	--	--
Hardy Creek	2	0	0.00	0	--	--
Stickney Creek	27	3	11.11	0	--	--
Sub-Total	862	25	2.90	175	6	3.43
Grand Total	6100	384	6.30	1753	116	6.62

to harvest in the Missouri River. This finding was not anticipated, since most anglers believe brown trout are more difficult to catch than rainbow trout.

Since large numbers of tagged trout are still at large in the study area, harvest rates presented in this report are preliminary. Angler harvest rate statisitics will be updated in the next progress report.

FINDINGS - HOLTER RESERVOIR, HAUSER RESERVOIR, LAKE HELENA AND TRIBUTARIES

Progress was made on all work objectives for this study area. Findings are reported in Berg and Lere (1983).

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Waters Referred to:

Dearborn River	17-2064
Hardy Creek	17-3328
Little Prickly Pear Creek	17-4224
Missouri River - Sec. 08	17-4880
Miisouri River - Sec. 09	17-4896
Rock Creek	17-6208
Sheep Creek	17-6560
Sheep Creek	17-6576
Stickney Creek	17-7344
Wegner Creek	17-8176

Key Words:

Trout population estimates
Trout spawning - Tributaries/mainstem
Trout redd measurements
Water temperature

Prepared By: Rodney K. Berg
September, 1983

MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION

JOB PROGRESS REPORT

State: Montana

Project No.: F-5-R-32 Title: Northcentral Montana Fisheries Study

Job No.: I-a Title: Inventory and Survey of Waters in the Western Half of Region Four

Period Covered: July 1, 1982 through June 30, 1983

Report Period: April 1, 1982 through March 31, 1983

ABSTRACT

Stocking densities, survival and growth of rainbow trout were evaluated in Bean Lake, Bynum, Eureka, Holter, Newlan Creek, Nilan and Willow Creek Reservoirs. Growth rates were fair to good in these waters. DeSmet strain of rainbow trout planted in Bean Lake exhibited good growth and survival. An excellent kokanee sport fishery is present in the Helena Valley Reservoir. The northern pike population in Pishkun Reservoir has increased over past years but is still below estimates made in the early 1970's. Angler harvest on northern pike is high. Information is presented on northern pike and walleye populations in Lake Frances and Lake Elwell. Netting in Priest Butte Lake revealed survival of black crappie introduced in 1981. Cutthroat trout were sampled from two mountain lakes in the Bob Marshall Wilderness area. Several small mountain streams were sampled to update management files. An introduction of grayling is proposed for Rock Creek in the Bob Marshall Wilderness area. Trout population estimates were conducted in the Smith River and North Fork Smith River. A total of 106 applications for proposed stream alternation projects were received and processed.

OBJECTIVES AND DEGREE OF ATTAINMENT

1. To inventory trout populations in five streams to update management files. Data from seven streams was collected and is included under Accomplishments.

2. To determine stocking densities, growth rates and angler success for rainbow trout in seven reservoirs and lakes. Data was collected on seven waters and the results are presented in this report. In addition, data was collected on an additional reservoir managed with kokanee.

3. To estimate the population and harvest of northern pike and to evaluate natural reproduction of kokanee in Pishkun Reservoir. This work was done and is included under Accomplishments.

4. To evaluate management of six farm ponds and to investigate the fishery potential of new ponds. Seven small ponds and lakes were surveyed and the information is presented.

5. To determine game fish population trends, fisherman harvest and food habits of northern pike, walleye and burbot and to determine composition and abundance of forage fish in Tiber Reservoir and Lake Frances. This was done and information is presented under Accomplishments.

6. To monitor stability of stream habitat and estimate brook trout populations on sections of the Teton River where flood debris was mechanically removed and where it was not removed. No work was done on this objective because significant changes did not occur in channel morphology and river habitat.

7. To take necessary action to protect stream habitat from hydraulic construction projects sponsored by government and private concerns. Action was taken and a summary is included under Accomplishments.

PROCEDURES

Fish were sampled with 3 X 4 foot and 4 X 6 foot frame net traps (¼, ½ and 1-inch mesh), 6X125 foot experimental gill nets (3/4 to 2-inch mesh), An 8X300 foot gill net (1¼ to 1 3/4-inch mesh), a 300-volt DC electrofish shocker and by hook and line. Measurements of fish include total lengths to the nearest tenth of an inch and weights to the nearest hundredth of a pound. Scale and otolith samples were collected for age and growth studies. Northern pike and walleye were tagged with Floy anchor tags. Harvest determinations were made through voluntary angler tag returns. Population estimates were made by mark and recapture techniques.

ACCOMPLISHMENTS

Lakes and Reservoirs

Gill net summaries for the lakes and reservoirs inventoried are presented in Table 1. Individual discussion of various waters follows:

Bean Lake

Fall (1982) and spring (1983) gill netting revealed good survival of Arlee and DeSmet rainbow trout planted in Bean Lake in 1982 (Table 1). Since the DeSmet strain were larger than the Arlee strain at planting, they were somewhat larger in the samples collected. The DeSmet rainbows were adipose fin clipped prior to planting to identify this fish in the future. Only a few of the wild rainbow collected from the Missouri River and planted in the lake in the fall, 1980, were still present. Gill net surveys conducted in 1981 revealed poor survival of both the spring planted Arlee and fall planted Missouri River strains. It is still unknown why stocking frequently fails in Bean Lake. We will continue to evaluate survival, growth and contribution to the creel of the DeSmet rainbow trout.

Table 1. Summary of gill netting in Lakes and Reservoirs, 1982

Water (Date Sampled)	Surface Acres	No. of Nets	Species	No. of Fish	Length Range (Average)	Weight Range (Average)
Bean Lake (Dec. 1)	200	2	Rb	24	9.6-12.3(10.4)	0.36-0.65(0.4
			DeSmet Rb	27	9.4-14.2(12.2)	0.30-1.08(0.7
			Wild Rb	2	16.3-17.0(16.7)	1.80-1.87(1.8
(Apr. 28, 1983)		2	Rb	1	(17.9)	(2.0
			Rb	40	9.9-13.6(11.1)	0.40-0.86(0.5
			DeSmet Rb	49	9.8-14.6(12.3)	0.36-1.10(0.7
			Wild Rb	2	14.5-17.2(15.8)	1.22-1.74(1.4
Bynum Reservoir (Oct. 15)	3000	2	Rb	21	8.0-10.0(9.4)	0.25-0.41(0.3
				21	12.0-15.9(13.1)	0.60-1.28(0.8
				2	17.0-18.6(17.8)	1.90-2.80(2.3
			KOK	19	15.6-18.9(17.8)	1.18-2.00(1.7
Eureka Reservoir (Oct. 20)	200	2	Rb	5	10.2-11.2(10.6)	0.42-0.53(0.4
			WSu	67		
Helena Valley Res. (Oct. 4)	560	3	KOK	1	(6.6)	(0.1
			KOK	51	9.9-14.3(11.9)	0.39-1.20(0.6
			KOK	31	15.5-18.1(16.6)	1.44-1.98(1.7
Holter Reservoir (Oct. 4)	4800	3	Rb	147	9.2-12.0(10.4)	0.32-0.69(0.4
			Rb	26	13.0-19.1(16.4)	0.92-3.04(1.8
			Ct	1	(16.4)	(1.6
			LL	1	(23.1)	(4.7
			KOK	2	11.6-16.5(14.1)	0.55-1.71(1.1
			Wf	3	13.7-15.3(14.6)	0.89-1.11(1.0
Lake Elwell (Tiber Res.) (Oct. 7,8)	11600	10	WE	8	7.4- 9.4(8.2)	0.10-0.28(0.1
				101	10.0-14.8(12.8)	0.30-1.36(0.7
				22	15.0-18.7(16.2)	1.18-2.55(1.6
				1	(25.0)	(5.2
			NP	28	11.7-15.2(13.1)	0.32-0.82(0.5
				2	26.6-30.2(28.4)	4.42-8.00(6.2
			Lt	3	24.2-27.5(26.2)	4.12-4.82(4.6
			C Cat	2	15.2-17.1(16.2)	0.98-1.70(1.3
			Rb	1	(15.7)	(1.6
			YP	14	6. 2- 7.9(6.6)	0.09-0.23(0.1
				3	9.0-11.2(10.3)	0.35-0.66(0.4
			WSu	4	(8.6)	(0.2
				34	14.1-18.8(17.2)	1.24-2.80(2.2
			LN Su	3	15.8-19.3(17.2)	1.64-2.70(2.0
Lake Frances (Oct. 1)	4500	4	WE	33	7.9-12.7(10.2)	0.12-0.64(0.3
				13	14.1-16.9(15.7)	0.94-1.59(1.3
				6	17.2-22.4(18.8)	1.80-3.55(2.3
				1	(27.0)	8 lbs. est
			NP	5	20.3-22.9(22.1)	2.23-2.95(2.6
				2	27.5-29.0(28.3)	7-8 lbs. est.
			YP	2	5.9- 8.6	0.08-0.29
			WSu	1	(18.3)	

Table 1. Cont'd.

Water (Date Sampled)	Surface Acres	No. of Nets	Species	No. of Fish	Length Range (Average)	Weight Range (Average)
Newlan Cr. Res. (Oct. 1)	300	2	Rb	40	7.6-12.1(9.7)	0.18-0.67(0.4
			Rb	7	12.7-15.4(14.0)	0.81-1.28(1.0
			Ct	2	17.7-18.9(18.3)	2.33-2.93(2.6
			Eb	1	(10.1)	(0.4
			Ln Su	21		
Nilan Reservoir (Oct. 14)	400	2	Rb	12	9.9-11.8(10.8)	0.40-0.68(0.5
				5	14.1-15.8(14.8)	1.09-1.52(1.2
Pishkun Res. (Aug. 10)	1400	3	KOK	16	7.2-12.3(9.2)	0.12-0.63(0.3
				7	14.2-17.6(15.5)	0.94-1.90(1.2
			NP	3	16.6-22.8(19.2)	1.28-3.50(2.2
			YP	13	6.0- 8.4(6.9)	0.09-0.33(0.2
			WSu	3	(6.3)	(0.7
				4	(15.0)	(1.7
Willow Cr. Res. (Oct. 13)	1300	4	Rb	36	9.5-10.8(10.3)	0.37-0.49(0.4
				16	13.4-15.8(14.1)	0.80-1.38(1.0

Species Abbreviations: Rb-rainbow trout; KOK-kokanee salmon; Lt-lake trout; WE-walleye; NP-northern pike; C Cat-channel catfish; YP-yellow perch; LnSu-longnose sucker; WSu-white sucker.

Helena Regulating Reservoir

This reservoir is managed exclusively with kokanee salmon. Good numbers of kokanee were sampled with gill nets and they exhibited excellent growth (Table 1). The current level of stocking, 40,000 kokanee per year, appears to be providing an excellent fishery.

The reservoir does not provide much of a snag fishery for mature kokanee because the inlet canal is turned off in September. Some of the early run salmon are snagged near the mouth of the canal. Most kokanee are harvested by trolling in May and June and by ice fishing in January and February.

Holter Reservoir

Loss of rainbow trout over Holter Dam was low in 1982 due to a short runoff period (Table 1). An excellent carry-over of trout planted in 1981 was found in gill net sampling in the fall of 1982. These fish averaged 1.8 pounds and were in good condition. Current year (1982) stocked trout exhibited good growth and averaged nearly one-half pound.

Newlan Creek Reservoir

Current year (1982) stocked rainbow trout exhibited good growth (Table 1). Physical condition of rainbow trout planted in 1981 was fair. Some cutthroat trout planted in 1977 and 1978 are still present in the lake and are of quality size. It appears cutthroat trout have excellent longevity and provide a quality fishery in this reservoir. We recommend converting this reservoir to a cutthroat trout fishery to provide a variety of fishing in the area. Two nearby reservoirs, North Fork Smith River and Bair, and several of the area farm ponds are currently managed with rainbow trout. It is recommended that 10,000 rainbow trout and 25,000 Yellowstone cutthroat be planted in 1983. A total of 30,000 cutthroat were recommended for stocking in the reservoir in 1984.

Lake Frances

A total of 10 trap days from May 6 through 14, 1982, captured 40 northern pike and 32 walleye. Two of the three traps were tampered with on various occasions and presumably affected the total catch. All fish taken were tagged and released. Fisherman harvest of walleye and northern pike is presented in Table 2, based on voluntary tag returns.

Four gill nets fished in October caught a good representative sample of walleye (Table 1). Several age groups were identified through scale analysis. Forage fish (yellow perch and white sucker) do not appear to be abundant, however, condition of walleye and pike remains good. Forage may become a problem in the future.

Table 2. Accumulative tag returns for northern pike and walleye from Lake Frances and Pishkun Reservoir, 1980-82

Area	Species	Year Tagged	No. Tagged	Accumulative Return (%) 1980	1981	1982
Lake Frances	N. pike	1981	58		20.7	25.9
		1982	40			25.0
	Walleye	1981	24		4.2	8.3
		1982	32			3.1
Pishkun Res.	N. pike	1980	93	22.6	25.8	26.9
		1981	122		16.4	21.3

Pishkun Reservoir

A total of 28 trap days from April 26 through May 2, 1982, caught 361 northern pike, 2 rainbow trout, 30 yellow perch and 98 white sucker (Table 1). The purpose of the spring netting is to monitor changes in population size of northern pike. The 1982 estimate of the northern pike population (for fish 16 inches and larger), is 705 fish which is an increase over the past several

years. If the population increases much beyond the 1982 estimate, it is recommended rainbow trout planting be discontinued. Harvest of northern pike continues fairly high, as shown in Table 2.

Gill nets were fished during August to sample kokanee salmon. Three age groups were represented in the sample. Angler success on kokanee has been only fair when compared to previous years. Kokanee spawners congregated in the inlet ditch in early November, but they were available to snaggers for only about a week while the ditch was flowing. Very few salmon were snagged in other areas of the lake. Mature males were aged as three and four years old while females were all four. Males averaged 17.0 inches in total length and 1.51 pounds, while females averaged 15.8 inches and 1.16 pounds.

It is unknown at the present time if stocked rainbow trout are contributing to the overall trout fishery. Earlier reports documented survival and growth of stocked trout based on fluorescent dye marking (Hill, 1982). The 1981 plant of rainbow trout were marked by an adipose fin clip and will be followed in future surveys to differentiate from wild trout entering Pishkun Reservoir via the supply canal from the Sun River.

Lake Elwell (Tiber Reservoir)

A total of 20 trap days in the Willow Creek Arm (from April 19 - 23, 1982) captured 73 northern pike, 56 walleye, 6 burbot, 95 white sucker, 19 black crappie and 17 carp. A total of 9 trap days from May 4 - 7, 1982 caught 22 northern pike, 17 walleye, 3 burbot, 1 rainbow trout, 27 white sucker, 1 black crappie and 3 carp in the Bootlegger Trail area. Due to the small number of fish taken in traps, neither northern pike nor walleye were tagged.

Ten gill nets fished in October collected 226 fish representing 8 species (Table 1). This survey indicates a good population of walleye and the possibility that the northern pike population is increasing. Scale analysis indicates that growth is improving for both species and that several of the northern pike taken in the sample were young-of-the-year fish ranging from 11.7 to 15.2 inches.

Forage fish and northern pike have not had good reproductive success for several years due to poor water levels. In the process of re-filling Lake Elwell, the Bureau of Reclamation agreed to manipulate water levels to inundate spawning habitat during the critical spawning period in 1982 and 1983. Although water levels flooded spawning habitat in the latter part of the critical period, northern pike, yellow perch and forage fish reproduction was limited. If water levels are again controlled in 1983, adequate northern pike and forage fish reproduction should be successful and provide an excellent fishery for northerns and walleyes for several years.

Small Lakes and Farm Ponds

Trap nets were fished in Priest Butte Lake in September to measure survival and reproductive success of black crappie that were introduced in 1981. Only two adult black crappie were collected. Other species taken include 176 adult white sucker, 94 brassy minnow, 16 lake chub and 1 adult carp.

Two mountain lakes in the Bob Marshall Wilderness Area were sampled by hook-and-line, and by creel checks. Yellowstone cutthroat trout in Unnamed Lake were 10.0 - 18.5 inches in length. Cutthroat were introduced in 1969 and have maintained a reproducing population. Yellowstone cutthroat trout sampled in Sock Lake ranged from 10.0 - 14.7 inches in length. This fishery is maintained by some natural reproduction and by planting every other year.

Fisherman creels were checked at Tunnel Lake and Fitzpatrick Lake. At Tunnel Lake, rainbow trout ranged from 10.8 - 14.7 inches and 0.49 - 1.24 pounds. Rainbow trout at Fitzpatrick Lake ranged from 9.0 inches and 0.34 pounds to 18.8 inches and 2.66 pounds.

Dissolved oxygen readings were taken at Dickens Lake on January 18, 1983. Concentrations ranged from 2.5 ppm at the surface to zero on the bottom. Several dead rainbow trout were observed floating under the ice. The lake did not completely winterkill, however, since fishermen reported catching trout after ice-out. Plans are being finalized to raise the level of the lake by constructing a three-foot fill in the outlet of this natural lake. Maintenance of higher water levels should reduce occurance of winterkill.

Furnell Pond in the Sweetgrass Hills is on property owned by the U. S. Fish and Wildlife Service. The ditch supplying water to the lake has not been cleaned in recent years, precluding the addition of fresh water to the lake. Water levels continue to drop and the lake will no longer support fish. The Fish and Wildlife Service has been asked to clean the ditch and also check into the possibility of diverting additional water from a nearby drainage.

Streams

Stream improvement structures installed by the U. S. Forest Service in 1981 in the West Fork Teton River were photographed and observed for changes (scouring or filling in of pools). Of the six log structures, pools have developed off the end or below three structures. Gravel has filled around the logs on the other three structures and a riffle is associated with the end of the deflectors.

Several streams in the North Fork Sun River drainage were sampled by hook-and-line to update management files. Samples include brook trout from Moose Creek, cutthroat from Gates Creek, cutthroat, rainbow and cutthroat-rainbow hybrids from the North Fork Sun River, and no fish from Rock Creek.

A proposal was made to introduce arctic grayling into Rock Creek. This stream is barren, although cutthroat eggs and fry have been introduced on three occasions. Forest Service approval is necessary since Rock Creek is within the Bob Marshall Wilderness. Grayling are native to the Sun River drainage below Gibson Dam. If grayling are introduced, they will be collected from the Sunny Slope Canal between Pishkun Reservoir and Fairfield.

Smith River

Trout population estimates were conducted in the Access Section in September, 1982, and data is presented in Table 3. The estimated number

of age II and older rainbow trout was comparable to prior years, but the number of yearling trout was 75% less than estimated in 1981. The estimated number of age II and older brown trout was also comparable to prior years but the number of yearlings increased about 100% when compared with 1981 estimates. The overall biomass of trout is comparable to prior years estimates.

Noticeable every other year fluctuations in yearling populations appear to occur since estimates were initiated in this section in 1978. Temperature and flow records have been monitored near this section since 1978 and will be evaluated and correlated with fish populations in the next progress report.

Table 3. Trout population estimates from Access Section, Smith River, September, 1982

Species	Age	Length (inches) Range	Average	Number	Weight (Pounds)
Rainbow trout	I	7.2- 8.8	7.9	40	7.96
	II	8.7-12.2	10.7	144	64.65
	III	10.1-13.1	11.7	111	62.12
	IV & older	12.2-15.6	13.7	64	58.84
				359 ± 109	193.57 ± 64
Brown trout	I	6.7- 9.8	8.6	155	37.45
	II	10.4-13.7	12.4	56	40.98
	III	12.5-17.5	15.7	18	26.63
	IV & older	15.9-28.0	18.6	28	76.55
				257 ± 84	181.61 ± 58
Grand Total				616	375.18
Standing crop/1000 feet				59	36.08
Standing crop/acre				52	31.53

North Fork Smith River

Trout populations were estimated in the Fowlie Section of the North Fork Smith River in September, 1982. This section was last inventoried in 1970 during the Smith River Drainage Inventory and Planning Investigation. Considerable beaver activity altered the lower 1,200 feet of the section (dams and ponds) so the section was shortened accordingly. Population estimate data is presented in Table 4.

Considerable change in the trout population had occurred since 1970. Brown trout comprised 51% of the total trout population in 1970 and estimates conducted in 1982 indicate brown trout now dominate the population as shown in the following table:

Species Yearlings & Older	% of Population 1970	% of Population 1982	Number/1,000 Ft. 1970	Number/1,000 Ft. 1982	Pounds/1,000 Ft. 1970	Pounds/1,000 Ft. 1982
Brown trout	51	93	135	163	76	76
Brook trout	37	5	97	9	28	3
Rainbow trout	12	2	30	3	18	1
Total	100	100	262	175	122	80

Even though yearling and older brown trout numbers have increased in the section, the decrease in numbers of brook trout and rainbow trout reveal a loss in total numbers and weight of trout per unit of areas in the stream. It is unknown why there was a large decrease in the population of brook and rainbow trout in this section. Demand for irrigation water has always been acute through this area, but observation through the years reveal the stream has never gone dry. An increase in fishing pressure may account for the decline of these more vulnerable species.

Table 4. Trout population estimates from Fowlie Section, North Fork Smith River

Species	Age	Length (inches) Range	Length (inches) Average	Number	Weight (Pounds)
Brown trout	I	6.1-10.0	8.0	307	59.43
	II	10.0-14.6	12.4	45	32.06
	III	12.0-16.7	14.9	63	76.55
	IV & Older	15.2-21.3	17.0	19	32.97
				$434^{+}_{-}79$	$201.01^{+}_{-}38$
Brook trout	-	8.0-13.0	9.6	$23^{+}_{-}7$	$9.0^{+}_{-}3$
Rainbow trout	-	6.0-12.9	9.4	9*	3.38
Grand Total				466	213.39
Standing crop/1,000 feet				176	80.52
Standing crop/acre				279	127.78

* Actual fish caught - too few for estimate.

Stream Habitat Preservation Activities

Legislation leading to passage of the Stream Preservation Act (SPA) in 1963 and the Natural Streambed and Land Preservation Act (NSLPA) in 1975 gives the Department involvement to protect, mitigate or enhance stream habitat from various hydraulic projects.

The SPA, administered by the Department, covers projects by agencies of state government, county, municipalities or other political subdivisions of the State of Montana. Federal agencies cooperate with the SPA through Memos of Understanding (MOU). Stream projects involving the private sector are covered by the NSLPA, which is administered by the County Soil and Water Conservation Districts.

A total of 106 notices of projects were received in the project area during the report period. Of these, 89 NSLPA project notices were received from 8 Conservation Districts, 13 SPA notices were received from county and city governments and 3 were received from the Montana Highway Department. Federal agencies (USGS and USFS) submitted four SPA notices.

Fishery personnel in the project area review all the applications for hydraulic projects and submit recommendations to the appropriate administrators. Copies of these project documents are submitted to Department Habitat Coordinators in our Helena offices.

LITERATURE CITED

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Wipperman, A. H. 1973. Smith River Drainage Inventory and Planning Investigation. Section I, Fisheries Inventory and Plan. Federal Aid to Fish and Wildlife Restoration Project. FW-1-R-3, Job Ia. pp. 7-74.

Prepared by: William J. Hill and Alfred H. Wipperman

Date: December 6, 1983

Waters referred to:

14-6480	W. Fork Teton River
14-7080	Bynum Reservoir
14-7320	Eureka Reservoir
14-7370	Fitzpatrick Lake
14-7440	Lake Frances
14-7450	Furnell Pond
14-8540	Priest Butte Lake
14-9240	Tiber Reservoir (Lake Elwell)
17-5472	N. Fork Smith River
17-6832	Smith River
17-8720	Bean Lake
17-9075	Helena Valley Reservoir
17-9136	Holter Lake
17-9330	Newlan Creek Reservoir
20-2350	Gates Creek
20-3900	Moose Creek
20-4400	N. Fork Sun River
20-5100	Rock Creek
20-7130	Dickens Lake
20-7900	Nilan Reservoir
20-7950	Pishkun Reservoir
20-8150	Sock Lake
20-8400	Tunnel Lake
20-8450	Unnamed Lake
20-8500	Willow Creek Reservoir

Key Words:

Rainbow trout - strain comparison

MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION

JOB PROGRESS REPORT

State: Montana

Project No.: F-5-R-32 Title: Northcentral Montana Fisheries Study

Job No.: I-b Title: Inventory and Survey of Waters in the Eastern Half of Region Four

Period Covered: July 1, 1982 through June 30, 1983

Report Period: April, 1982 through March 30, 1983

ABSTRACT

Netting surveys were conducted on 6 large reservoirs and 14 farm ponds located within the study area. Six BLM reservoirs and 12 farm ponds were investigated for fisheries potential. Streambank stabilization projects and habitat conditions were monitored and documented along Big Spring Creek and its tributaries. Invertebrate bottom samples were collected at the nine established stations along the stream and its tributaries. Trout population estimates were made in two sections of Big Spring Creek. Flow requirments for maintaining the aquatic community in Warm Spring Creek were determined in an area of potential de-watering by correlating discharge measurements with stream cross-section profile measurements. Fish populations, with particular emphasis on smallmouth bass, were sampled in Warm Spring Creek.

OBJECTIVES AND DEGREE OF ATTAINMENT

The objectives of this job were:

1. To obtain information on present management, survival and growth of rainbow trout, cutthroat trout, kokanee, largemouth bass, yellow perch, burbot and walleye in seven large reservoirs and fourteen farm ponds. This work was done in six reservoirs and fourteen farm ponds and the findings are included under Accomplishments.

2. To survey new ponds for possible addition to our management program. This work was done.

3. To monitor habitat changes and evaluate rainbow and brown trout populations in Big Spring Creek. This work was done for two stream sections and the findings are included under Accomplishments.

4. To determine the survival and growth of fingerling rainbow trout stocked in a section of Big Spring Creek. This work was done and the findings are included under Accomplishments.

5. To obtain baseline information on a smallmouth bass population and aquatic invertebrate populations in an area of Warm Springs Creek that may be impacted by a major water withdrawal. Work was done on fish populations but not aquatic invertebrates. Flow requirements for maintaining aquatic communities was determined and is included under Accomplishments.

6. To estimate fish populations in six streams to update information for management purposes. Work was done on one stream and is included under Accomplishments.

PROCEDURES

Fish were sampled with sinking and floating nylon experimental gill nets 125-foot by 6-foot (3/4 to 2-inch graduated mesh); 4-foot by 6-foot frame trap nets (1/2 and 1-inch mesh); 3 by 4-foot frame trap nets (1/4 inch mesh); a 300 volt D.C. electrofish shocker; a 0-500 variable voltage D.C. electrofish shocker; and by hook and line. Fish captured were measured to the nearest tenth of an inch (total length) and weighed to the nearest hundredth of a pound. Scales were collected for growth analysis. Occasional creel census and fishermen interviews were employed to check harvest, fishing pressure, and success of trout stocking in the more important reservoirs and streams. Invertebrate bottom samples were collected with a Surber Sampler. Population estimates for Big Spring Creek were made using the mark and recapture method described by Vincent (1971 and 1974). Electrofishing was employed to census smallmouth bass and fish populations in other streams. Erosion and habitat changes were measured from established transects and photo points. Determining possible impacts on aquatic life in Warm Spring Creek was done through correlating discharge measurements with stream cross-section measurements using the wetted perimeter computer program (Nelson 1980).

ACCOMPLISHMENTS

Large Reservoirs

Six of the seven larger Department of Natural Resources reservoirs located within the study area were sampled during 1982 and 1983. The results of this work are given in Table 1. War Horse Reservoir was not sampled because water levels were so low that it was impossible to launch a boat.

Ackley Lake - Netting surveys conducted during the report period indicate sucker numbers to be very high. A one-inch mesh trap net set overnight took an all time high of nearly 1600 suckers. Surveys indicate kokanee are relatively abundant but rainbow trout numbers and growth rates have continued to decline. If water levels are low enough, we may be able to chemically rehabilitate the lake during the fall of 1983.

Bair Reservoir - Netting surveys conducted on this reservoir indicate suckers are very abundant. Trout numbers, growth rates, fishing pressure and fishing success are all low. Success of a brown trout introduction made in 1981 appears to be questionable.

Martinsdale Reservoir - Rainbow trout numbers in the reservoir appear to be down although average size of fish is somewhat larger than normal. Fishing reports from the reservoir for 1983 are mediocre and there are indications that the 1982 plant of rainbow trout had poor survival.

Petrolia Reservoir - Rainbow trout, first planted into the reservoir in June of 1981, have been providing considerable fishing opportunity. Growth rates and survival of trout have been good but will undoubtedly decline as carp and sucker populations build. Perch numbers are increasing following several introductions. Northern pike were introduced in 1983 to help control undesireable fish species.

Smith River Reservoir - Netting surveys conducted in the reservoir indicate good growth and survival of stocked rainbow trout. Fishing success and harvests have reportedly been good.

Yellow Water Reservoir - Survival of rainbow trout from the 1982 plant appears very poor. Fishing pressure and fishing success have dropped off markedly. Although the number of trout present is below normal, the average size of fish from the reservoir is large. Carp numbers are increasing and it is only a matter of time until they take over the reservoir.

Table 1. Summary of netting data from large lakes and reservoirs, 1982-83

Location (Date Sampled)	Surface Acres	No. & Type of Nets	Species	No. of Fish	Length Range Inches (Average)	Weight Range Pounds (Average)
Ackley Lake						
(Sept. 30-Oct. 1/82)	247	1 Gill	KOK	75	7.8-17.1(12.3)	0.17-1.55(0.67)
			Rb	8	8.5-12.3(10.6)	0.22-0.63(0.42)
			WF	1	12.0	0.56
			CSu	4	--	--
(April 24,25,1983)		2 Gill	KOK	67	8.8-15.0(10.8)	0.20-1.07(0.41)
			Rb	4	11.5-12.8(12.2)	0.48-0.77(0.60)
			Wf	1	13.8	0.67
			CSu	107	--	--
			FSu	40	--	--
		1 Trap	KOK	3	11.8-17.0(15.2)	0.51-1.32(1.04)
			SCu	1265	--	--
			FSu	319	--	--
Bair Res.	272	1 Gill	Rb	6	8.7-10.7(9.7)	0.23-0.36(0.27)
(Sept 15-16, 1982)			Eb	3	7.6-10.5(9.4)	0.14-0.40(0.27)
			CSu	203	--	--
Martinsdale Res.	1000	2 Gill	Rb	23	13.1-16.3(13.7)	0.85-1.54(0.97)
Sept. 16-17, 1982			LL	1	11.7	0.51
			CSu	51	--	--
			FSu	6	--	--

Table 1. Continued.

Location (Date Sampled)	Surface Acres	No. & Type of Nets	Species	No. of Fish	Length Range Inches (Average)	Weight Range Pounds (Average)
Petrolia Res. (Oct. 19-20, 1982)	515	2 Gill	Rb	14	10.5-16.2(14.6)	0.40-1.55(1.26)
			WE	3	8.0- 9.0(8.5)	0.11-0.24(0.19)
			Bullhead	2	6.9- 7.0(6.9)	0.13
			CSu	80	--	--
			Carp	8	--	--
(May 2-3, 1983)		2 Gill	Rb	4	13.8-17.0(15.8)	1.22-2.12(1.61)
		1 Trap	YP	23	7.5-11.0(8.6)	0.17-0.55(0.25)
			Carp	34	--	--
			CSu	10	--	--
Smith River Res. (Sept. 15-16, 1982)	327	2 Gill	Rb	24	9.0-15.2(11.5)	0.26-1.22(0.55)
			Ling	1	16.5	0.81
			CSu	34	--	--
			FSu	11	--	--
Yellow Water Res. May 2-3, 1983	600	2 Gill	Rb	3	18.4-20.3(19.3)	3.21-3.50(3.34)
			Bullhead	1	9.0	0.37
			CSu	59	--	--
			Carp	1	--	--
		1 Trap	CSu	84	--	--
			Carp	10	--	--

Species Abbreviations: Rb-rainbow trout; LL-brown trout; Eb-brook trout; KOK-kokanee; CSu-white sucker; FSu-longnose sucker; WE-walleye; YP-yellow perch; Ling-burbot; MF-mountain whitefish.

Farm Ponds

Fourteen farm ponds and small reservoirs stocked by the Department were netted during the report period and the results are given in Table 2. Six BLM reservoirs and twelve private ponds were checked to determine their fisheries potential. A mild winter and good water level in most ponds contributed to excellent survival of fish populations. Yellow perch and largemouth bass were transplanted back into a number of ponds where they had winter killed in 1981.

Streams

Big Spring Creek - Flows in Big Spring Creek during the report period were about normal, although summer and fall flows are expected to be below average because of reduced mountain snow pack. Snow pack from the mild winter of 1982-1983 was only about 65% of normal and without a heavy snowstorm that occurred in

early May would have been even lower. Above average June rainfall and cool temperatures interacted to moderate stream flows and reduce flow peaks. Erosion rates and habitat destruction within the upper watershed were not severe because of the moderate stream flows and the dampening influence of the watershed dams.

Erosion and other naturally occurring stream channel stabilization processes are still very evident throughout much of the lower watershed. These processes are taking place even at normal and below stream flows. Habitat changes were monitored and documented with photos and measurements. The photos are used to update our erosion slide series which documents the effects of stream channelization.

Invertebrate bottom samples were collected at the nine established stations located along Big Spring Creek and its tributaries and the results are given in Table 3. The total number of invertebrates collected from all the sampling sites in 1982 (4563) was slightly lower than the total collected in 1981 (4708). These relatively low invertebrate numbers, two years following high water, closely parallel the pattern shown following the devastating flooding of 1975, when it also took two years for bottom invertebrates to reach pre-flood numbers. Bank full flow, with peaks near 1100 cfs for a six week period during May of 1981, and relatively high flow during May and June of 1982 have kept bottom invertebrate numbers depressed. Evidence continues to indicate that the flushing and scouring action of extended high flow, particularly in the spring, is the primary limiting factor for invertebrate production in Big Spring Creek.

Trout population estimates were made in two sections of Big Spring Creek during the fall of 1982. The results of these population estimates are summarized in Table 4.

Because of a gradual decline in the rainbow trout population in Section B, a study was started in 1979 to determine if the problem was related to spawning success and recruitment. Twenty thousand 4-6 inch rainbow trout were marked and planted in and near the section in 1979 and 1981. The fish planted in July of 1981 were marked by removal of the adipose fin. Two electrofishing trips through the section in 1982 took a total of 7 adipose fin clipped fish, indicating relatively poor survival and recruitment into the population of these hatchery fish. This was also confirmed by observing the relatively small number of fish in age group II which should contain these hatchery fish. As in 1979, predation by brown trout appeared to be a significant cause of mortality for these hatchery fish. The number of brown trout in section B has increased only slightly since the study was initiated, but the average weight of fish has increased by a half pound over that of pre-study fish (1978).

Rainbow trout estimates were down considerably in section B when compared to 1981 estimates, but the 1981 estimates are made up primarily of hatchery fish from age group I (93%). Most of these hatchery fish are gone from the stream before they reach age II. Rainbow trout in age groups III and IV increased 68% and 15%, respectively, over 1981 estimates.

Brown trout numbers in section B stayed about the same in 1981 and 1982 and the age structure of the population remained about the same. Most of the

Table 2. Results of sampling ponds and reservoirs, 1982-83

Pond	(Year)	No. of Gill Nets	Species	No. of Fish	Length Range Inches (Average)	Weight Range Pounds (Average)
Barta Pond	(1983)	1	Sculpin	1		
Buffalo Wallow	(1983)	1	Rb	6	14.9-20.3(16.8)	1.70-4.12(2.54)
C-1	(1983)	1	Rb	42	10.6-19.3(12.5)	0.52-2.74(0.84)
East Fork Res.	(1982)	2	Rb	21	8.4-10.6(9.4)	0.22-0.42(0.31)
			LL	2	9.0-12.5(10.7)	0.27-0.82(0.54)
			CSu	145	--	--
			FSu	9	--	--
Hassler Res.	(1983)	1	0	0	--	--
Holland Res.	(1983)	1	Rb	4	15.5-16.1(15.7)	1.99-2.54(2.19)
Lipke Res.	(1982)	1	CSu	40	--	--
Norman Res.	(1983)	1	Rb	17	10.3-18.0(13.2)	0.56-2.42(1.04)
Ridgeway Res.	(1983)	1	Rb	49	8.5-14.2(10.2)	0.28-1.00(0.48)
Rindal Res.	(1983)	1	Rb	18	7.1-13.3(10.2)	0.15-0.76(0.40)
Urs Res.	(1983)	1	Rb	27	10.0-14.1(12.1)	0.40-1.15(0.75)
Upper Wolf Coulee	(1983)	1	Rb	1	15.4	1.86
Lower Wolf Coulee	(1983)	1	YP	1	10.1	0.42
Culver Res.	(1983)	2 traps (¼" mesh)	YP	± 10,000	3"-11"	--

Species Abbreviations: Rb-rainbow trout; LL-brown trout; CSu-white sucker; FSu-longnose sucker; YP-yellow perch.

Table 3. Number and families of organisms collected in two one-square foot bottom samples from nine stations on Big Spring Creek and East Fork on August 9 and 10, 1982[1]

Organism	Hatchery	East Fork	Burleigh's	Montana Power	St. Leo's School	Above Sewer	Below Sewer	Trestle	Spring Cr. Colony
Trichoptera									
Brachycentridae	105	6	76	227	146	88	47	8	4
Leptoceridae	18		53	138	8	17	29	11	2
Rhyacophilidae	282		103	149	44	10	37	49	18
Hydropsychidae		4		2	2	2	2	18	25
Hydroptilidae		40	7	40	154	9	67	13	4
Psychomyidae						1			
Limniphilidae						1	5		
Helicopsychidae								11	1
Gastropoda									
Physidae				3		7	21	13	
Planorbidae		1	1	4		1	1		1
Diptera									
Tipulidae	7	5	11	10	44	30	42	19	5
Tendipedidae	108	3	45	30	35	97	147	178	81
Rhagionidae									
Empididae	1		1		1				
Simuliidae	10	10	61	13	2	19	1	6	3
Tabanidae									
Muscidae	1								
Tricladida									
Planariidae							3		
Ephemeroptera									
Baetidae	31	6	42	38	15	165	121	597	206
Heptageniidae		3	7	4	2	2	3	9	1

Table 3. Continued.

Organism	Hatchery	East Fork	Burleigh's	Montana Power	St. Leo's School	Above Sewer	Below Sewer	Trestle	Spring Cr. Colony
Plecoptera									
Perlodidae								6	
Perlidae									
Chloroperlidae			1						2
Oligochaeta									
Annelidae	4					9			
Pelecypoda									
Sphaeriidae				1		2			
Coleoptera									
Elmidae		1		8	7	1	1	6	
Hydracarina	5		1	9	5		53	4	7
Nematomorpha									
Chordodidae			1	4		1			
Nematoda				5					
Cladocera							1		
Station Totals	572	80	410	685	465	462	581	948	360
Org. No./Sq. Foot	286	40	205	342	232	231	290	474	180
No. of Families	11	10	14	17	13	18	17	15	14
Total 4563									

Table 4. Summary of trout population estimates for Big Spring Creek made in 1968, 1981 and 1982

Section	Year	Rainbow Trout		Brown Trout	
		No.	Weight (lbs.)	No.	Weight (lbs.)
B	1981	5598	787	73	166
B	1982	1317	528	71	144
C	1968	459	200	96	92
C	1982	811	255	53	85

Section (Year)	Age Group	Rainbow Trout No.	Rainbow Trout Size Range	Age Group	Brown Trout No.	Brown Trout Size Range
B (1981)	I	5229	5.0-10.4	III	13	13.9-16.0
	II	136	10.0-13.0	IV + older	58	15.8-20.8
	III	202	12.1-14.7			
B (1982)	I	857	5.3-11.4	II	7	11.5-14.3
	II	228	10.0-12.8	III	25	14.8-17.4
	III	232	12.3-14.0	IV + older	42	16.5-20.9
C (1968)	I	157	--	II	16	--
	II	245	--	III	40	--
	III	45	--	IV + older	40	--
	IV + older	12	--			
C (1982)	I	498	5.6- 9.2	II	5	13.8-14.2
	II	186	9.0-11.9	III	14	15.0-16.7
	III	106	11.2-13.9	IV + older	34	15.6-19.0
	IV + older	21	13.3-14.5			

brown trout sampled were age III and older. The average weight of brown trout declined about 14% which indicates the 1981 plant of hatchery rainbow trout were becoming scarse as a food source.

Population estimates made in section C were compared to estimates made in 1968 by Marcoux (1968). The total rainbow trout population estimate in section C was up 77% when compared to 1968 figures. The increase was in all age groups

except II. The largest increase (217%) was for age group I which indicates good spawning success. Inspection of the rainbow trout age structure for the section indicates a healthy population.

Brown trout population estimates for section C were down 49% when compared to 1968 estimates. The decrease was observed in all age groups. Brown trout numbers have declined from 23% of the total trout population within the section during 1967 and 1968 to only 7% of the trout within the section during 1982. This could be the result of expansion within the depressed rainbow trout population following the discontinuation of stocking catchable rainbow trout in 1974 in the creek or it could be a food related interaction.

Warm Spring Creek - An electrofishing run was made on a section of Warm Spring Creek during late August and the results are given in Table 5. Smallmouth bass planted into the stream in 1973, 1974 and 1977 have been difficult to collect on previous electrofishing trips. Fishermen reported catching bass quite frequently but the status of the population remained somewhat questionable. Although only six smallmouth bass were collected from within the shocking section, the size, condition and age of these fish indicated the population was healthy and reproducing. It appears that conductivity problems associated with the water in Warm Spring Creek make electrofishing difficult.

Table 5. Summary of elctrofishing results from a section of Warm Spring Creek, August 25, 1982

Species	No. of Fish	Length Range	(Average)	Weight Range	(Average)
Smallmouth Bass	6	6.5-12.9	(8.9)	0.15-1.21	(0.54)
Rainbow Trout	37	5.9-17.2	(8.8)	0.08-2.36	(0.39)
Yellow Perch	1		7.6		0.27

Electrofishing success on rainbow trout was better than for smallmouth bass but not enough fish were captured to make population estimates feasible. Data contained in Table 5 represents fish collected during one electrofishing trip through the section.

In 1981, a proposal was filed to construct a hydroelectric project, diverting 100 cfs of water from Warm Spring Creek in an existing irrigation ditch, to a power generating turbine about 3 miles downstream. Since recorded low flows in the stream are about 136 cfs, the diversion of 100 cfs would have a major impact upon the fishery, and potential impact upon other wildlife. Unfortunately, the area of potential dewatering was a 3 to 4 mile reach paralleled

by the highway and used heavily by recreationists. The Department fishing use survey for 1968 estimated 1082 fisherman days on Warm Spring Creek, the majority of which was concentrated within the area of potential dewatering. Since this proposed water withdrawal was so large and in an area where it would undoubtedly have a significant impact upon a long established fishery resource and related aquatic ecosystem, additional study of the potential impacts was justified.

During the summer of 1982, cross-section profile and stage discharge measurements were collected at several different flows. The method used was described by Nelson (1980) and relates wetted perimeter and discharge for selected channel cross-sections. This information was analyzed through the wetter perimeter (WETP) computer program for a number of different stream flows. Information from the WETP computer print-out for several representative cross-sections, including a riffle, deep run, and a composite encompassing all habitat types, was plotted and is presented in Figure 1.

The inflection point taken from the three cross sections is 90-95 cfs. The flow at which the inflection point occurs approximates the minimum flow needed to maintain fish populations at the existing level. Obviously, proposed reductions in flow approaching 75% in this stream reach will significantly reduce the standing crop of fish and adversely impact the existing aquatic community.

Louse Creek - A short section of Louse Creek was electrofished. This work is part of a continuing study to inventory and sample waters located within the project area. Electrofishing revealed an average of 48 brook trout per 400 feet of stream.

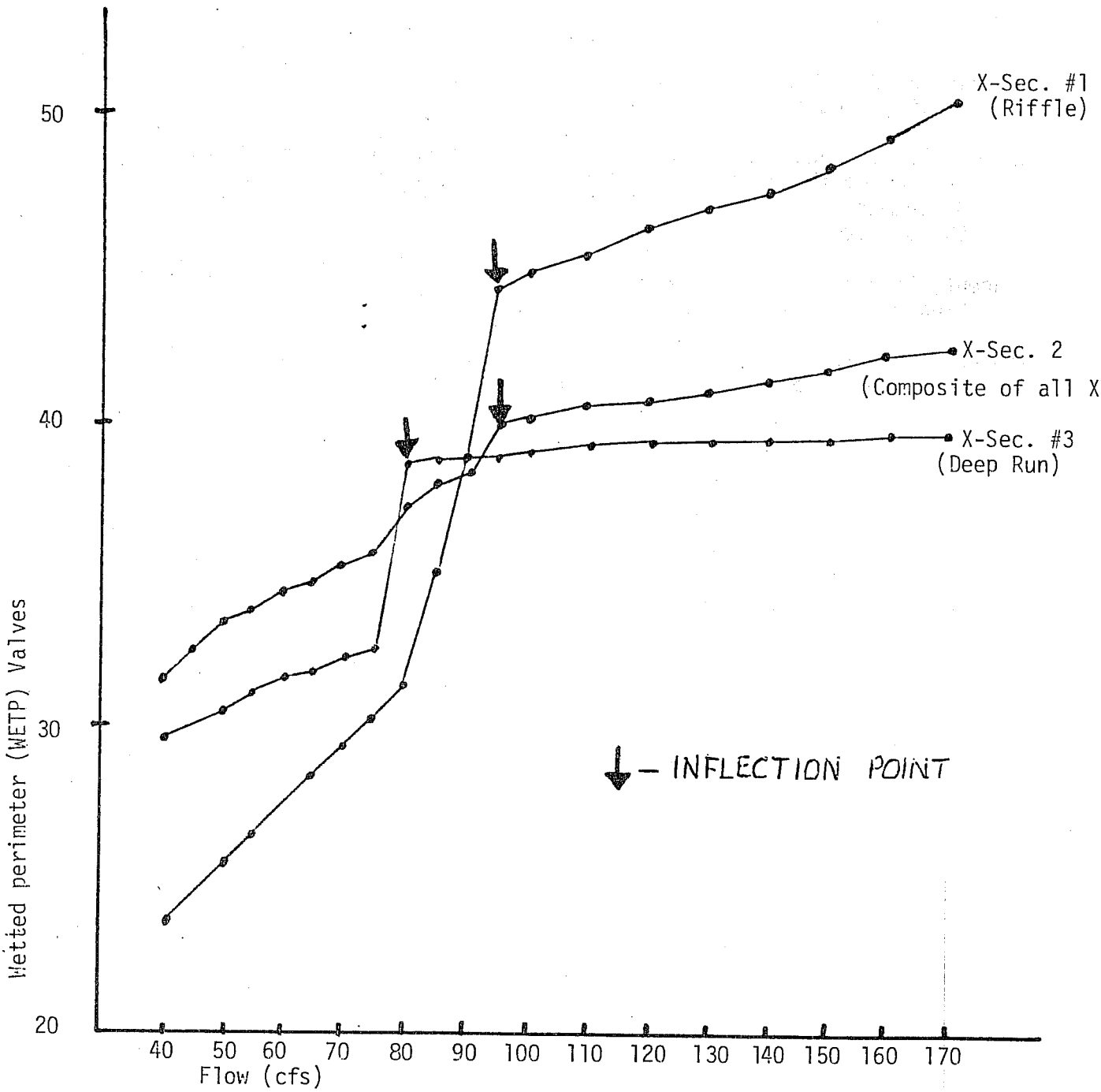

Figure 1. Wetted perimeter and discharge relationship for three cross-sections of Warm Spring Creek, 1982

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Code Numbers of Waters Referred to in this Report Are:

16-0300	Big Spring Creek Sec. 01
16-2160	Louse Creek
16-3920	Warm Spring Creek
16-4300	Ackley Lake
16-4400	Barta Pond
16-4590	C-1
16-4950	East Fork Spring Creek Reservoir
16-5700	Hassler Pond
16-6580	Lipke Pond
16-7286	Norman Pond #1
16-7949	Ridgeway Reservoir
16-7955	Rindal Reservoir
16-8660	Urs Reservoir
17-9616	Smith River Reservoir
18-7340	Buffalo Wallow Reservoir
18-7750	Bair Reservoir
18-7840	Holland Reservoir
18-8380	Martinsdale Reservoir
18-8720	Petrolia Reservoir
18-9440	War Horse Reservoir
18-9500	Yellow Water Reservoir