MONTANA DEPARTMENT OF FISH, WILDLIFE, & PARKS
ECOLOGICAL SERVICES DIVISION

JOB PROGRESS REPORT

STATE: Montana
PROJECT NO. FW-3-R-10
JOB NO. 1-a Fisheries

TITLE: Middle Missouri River Planning Project

PERIOD COVERED: July 1, 1981 through June 30, 1982

ABSTRACT

A fishery inventory and planning study was continued on the blue ribbon portion of the Missouri River from Holter Dam to the confluence of the Smith River. Twenty species representing eight families of fish occur in this study area. Rainbow and brown trout and mountain whitefish are the most common game fish, and they comprise the bulk of the sport fishery.

Electrofishing surveys indicate rainbow and brown trout and mountain whitefish utilize tributaries for spawning. Tag returns indicate some trout move considerable distances in the Missouri River to reach spawning tributaries. Tributaries provide important rearing habitat for trout. Trout and whitefish also use the mainstem of the Missouri for spawning and rearing. Tributaries are relatively more important for rainbow spawning and rearing, while side channels of the Missouri are relatively more important for brown trout.

Creel survey in 1981 indicated anglers caught 0.41 trout/hour in the Missouri River. Catch rates ranged from 0.16 trout/hour in May to 0.64 trout/hour in October. Brown trout comprised 18.6 percent of the catch at Cascade compared to only 1.5 percent at Holter. Boat fishermen caught 0.61 trout/hour, while bank fishermen caught 0.38 trout/hour. Anglers have harvested 5.49 and 5.70 percent of the rainbow and brown trout tagged in the study area.

Work was completed on an instream flow study for the Missouri River. In addition, data were collected on water temperatures, aquatic macroinvertebrates, fish larvae and forage fish.

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. For these reasons the Montana Department of Fish, Wildlife, and Parks (DFWP) initiated this study on April 1, 1980.

DESCRIPTION OF STUDY AREA

The 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 principal tributaries to the Missouri River in the study area. The tributaries add considerable flow to the Missouri during spring runoff, but they 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 north easterly 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 the mountain area and meanders through a wide and generally flat prairie zone. The upper portion of this zone, from 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.

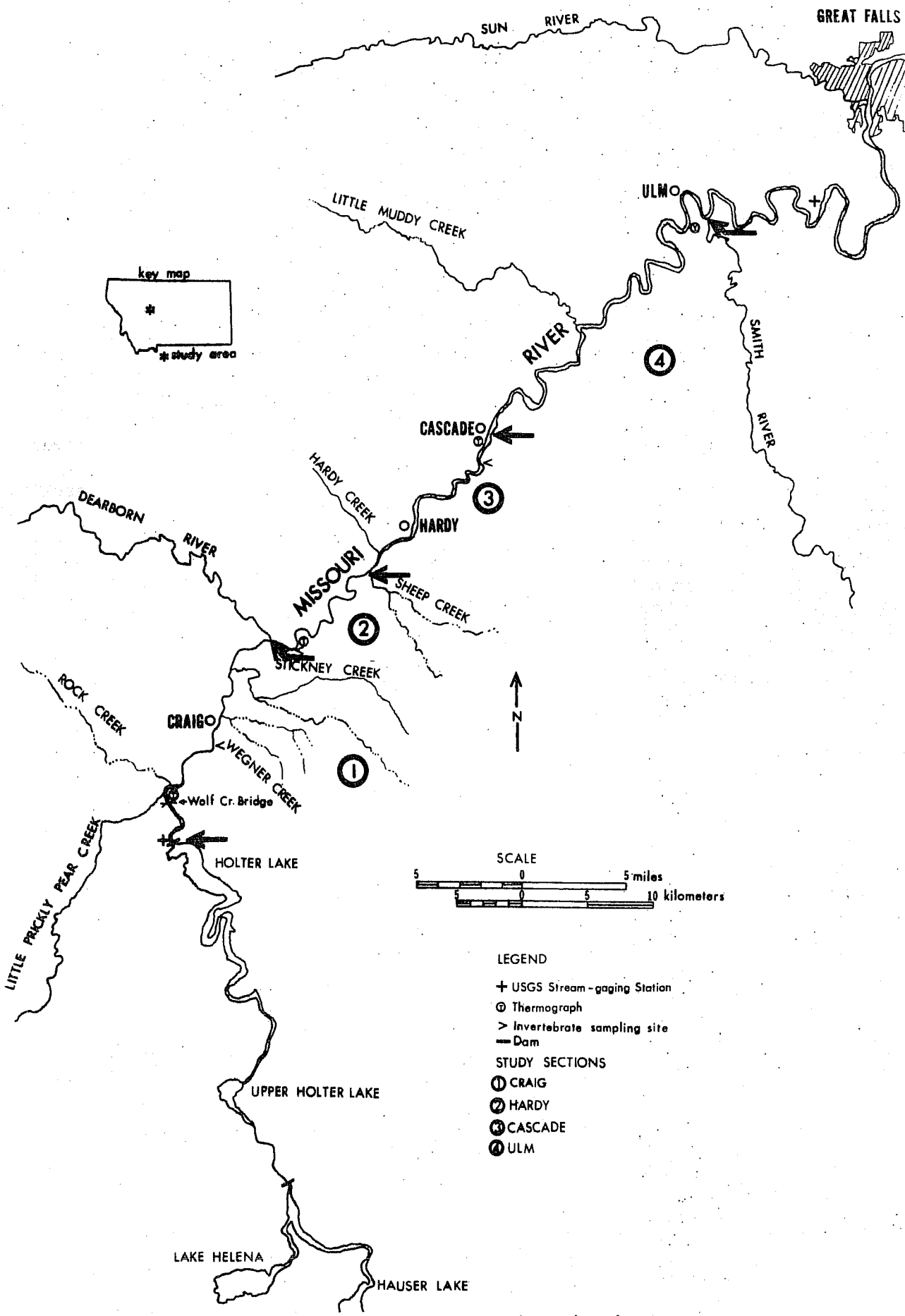

Figure 1. Map of Missouri River showing location of study sites.

The 99.0-km reach of the Missouri River from Holter Dam to the confluence of the Smith River is classified by the Montana Fish and Game Commission as a blue ribbon trout fishery (Brown et. al., 1959). This is one of the longest single reaches of blue ribbon trout stream in Montana, and it represents 14 percent of the state's 727 km (452 miles) of blue ribbon water. An excellent fishery exists in this area for trophy-sized rainbow and brown trout. Many trout from 2.3 to 4.5 kilograms (kg) (5 to 10 pounds [lb]) are taken each year as well as a good number of trout larger than 4.5 kg. Fish larger than 4.5 kg are predominantly brown trout. Mountain whitefish are several times more abundant than trout and provide an important winter fishery.

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 shore birds 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.

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 were:

(1) Continue to conduct baseline surveys of resident adult fish populations in four study sections of the Missouri River from Holter Dam to the confluence of the Smith River to determine species composition, longitudinal distribution, relative abundance and size composition of the populations. The four study sections are located on the Missouri River in the vicinities of Craig, Hardy, Cascade and Ulm.

(2) Obtain spring and fall estimates of rainbow and brown trout populations in the Hardy study section using a mark/recapture technique.

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

(4) Continue to attempt to locate spawning sites of rainbow and brown trout 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.

(5) Continue to tag key fish species in the Missouri River below Holter Dam with individually numbered tags to determine angler harvest, monitor movements of individual fish and establish home ranges.

(6) Continue to conduct a partial creel survey on the mainstem of the Missouri River to determine success rate, species composition and size composition of the catch.

(7) Continue to conduct baseline surveys in the lower reaches of the Dearborn River, Little Prickly Pear Creek, Sheep Creek and Rock Creek to determine the importance of these tributaries as rearing areas for juvenile rainbow and brown trout.

(8) Complete sampling for aquatic macroinvertebrates at four stations on the Missouri River to determine taxonomic composition and longitudinal distribution. The macroinvertebrate sampling stations are located in the Craig, Hardy, Cascade and Ulm study sections.

(9) Continue to collect forage fish samples in conjunction with adult fish population surveys to determine species composition and longitudinal distribution of forage fish.

(10) Complete analysis of wetted perimeter cross-section data gathered on the Missouri River in 1980. Attempt to derive instream flow recommendations from the data.

(11) Continue to conduct baseline surveys in side channels of the Missouri River to determine the amount of instream flow required to maintain trout rearing habitat.

(12) Locate a minimum of 10 viewpoint sites on the mainstem of the middle Missouri River and photograph the river at each of the sites at a variety of flow levels. Attempt to derive instream flow recommendations from the photo series.

(13) Maintain thermograph stations at four sites on the Missouri River below Holter Dam. The thermograph sites are located in the Craig, Hardy, Cascade and Ulm study sections.

(14) Continue to supervise BLM-funded instream flow study on the Missouri River from Morony Dam to Fort Peck Reservoir. Prepare annual study proposal and budget for this study and assist with preparation of annual report.

(15) Prepare instream flow applications for the Missouri River from Morony Dam to Fort Peck Reservoir and from Holter Dam to the mouth of the Smith River.

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.

Macroinvertebrates

Aquatic macroinvertebrate samples were collected using a rectangular framed 20 x 45 cm, conical net kick sampler with fine mesh (300 micron) pores. The net was positioned on the streambed so the current flowed into it. Macroinvertebrates were washed into the net by an operator standing in front of the net kicking into the substrate. A variety of habitat types (cobble, gravel, sand, submerged vegetation, etc.) were sampled at each station to obtain a representative sample. Samples were transferred to jars containing an identifying label and preserved with 10 percent formaldehyde.

Larval Fish

Drifting larval fish were sampled with a 0.5 m diameter by 1.6 m long Nitex plankton net (750 micron mesh) fitted with a threaded ring sewn at the distal end to accomodate a wide mouth, pint mason jar as the collecting bucket. The net was fished in a stationary position immediately below the surface of the water in main channel border areas of the river. The net was anchored in position in the current by a 4 m length of rope. The net was fished for a measured period of time, usually 30 to 60 minutes. On some occasions the net was fished for less than 30 minutes because of excessive amounts of debris collecting in the nets.

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 powered 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 of the Missouri. 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 electrofishing 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.

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 Petersen 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).

Missouri River Creel Survey

An angler creel survey was conducted on the sport fishery which exists on the Missouri River from Holter Dam to the confluence of the Smith River. The survey was a partial census in which interviews of fishermen were used to obtain estimates of angling data. With a postcard-sized survey form, partial trip data were obtained during interviews with individual anglers (Figure 2). The interview form was recorded in duplicate, with the original copy retained by the census taker and a carbon copy given to the angler. Upon completion of his/her fishing trip, the angler voluntarily recorded complete trip data and returned the postpaid carbon copy of the interview form.

FINDINGS - PHYSICAL CHARACTERISTICS

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 3). Stream gradients were determined by measurements taken from USGS topographic maps.

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 Gr. 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

MISSOURI RIVER CREEL CENSUS (Holter to Ulm)

Date _____ **Interview** _____

Location Holter, Craig, Hardy, Cascade, Ulm

No. Persons In Party _____ **Bank/Boat**

Where From _____

Type Of Tackle Artificial Lure, Bait, Flies _____ _____

Hrs. Fished _____ **After Interview** _____

		Fish Caught After Interview
No. Fish Kept _____	**Rainbow** _____	
	Brown _____	
	Whitefish _____	
	Other _____	
No. Fish Released _____	**Rainbow** _____	
	Brown _____	
	Whitefish _____	
	Other _____	

Completed Trip? Yes _____ **No** _____

Courier Printing

Figure 2. Forms used in Missouri River creel survey.

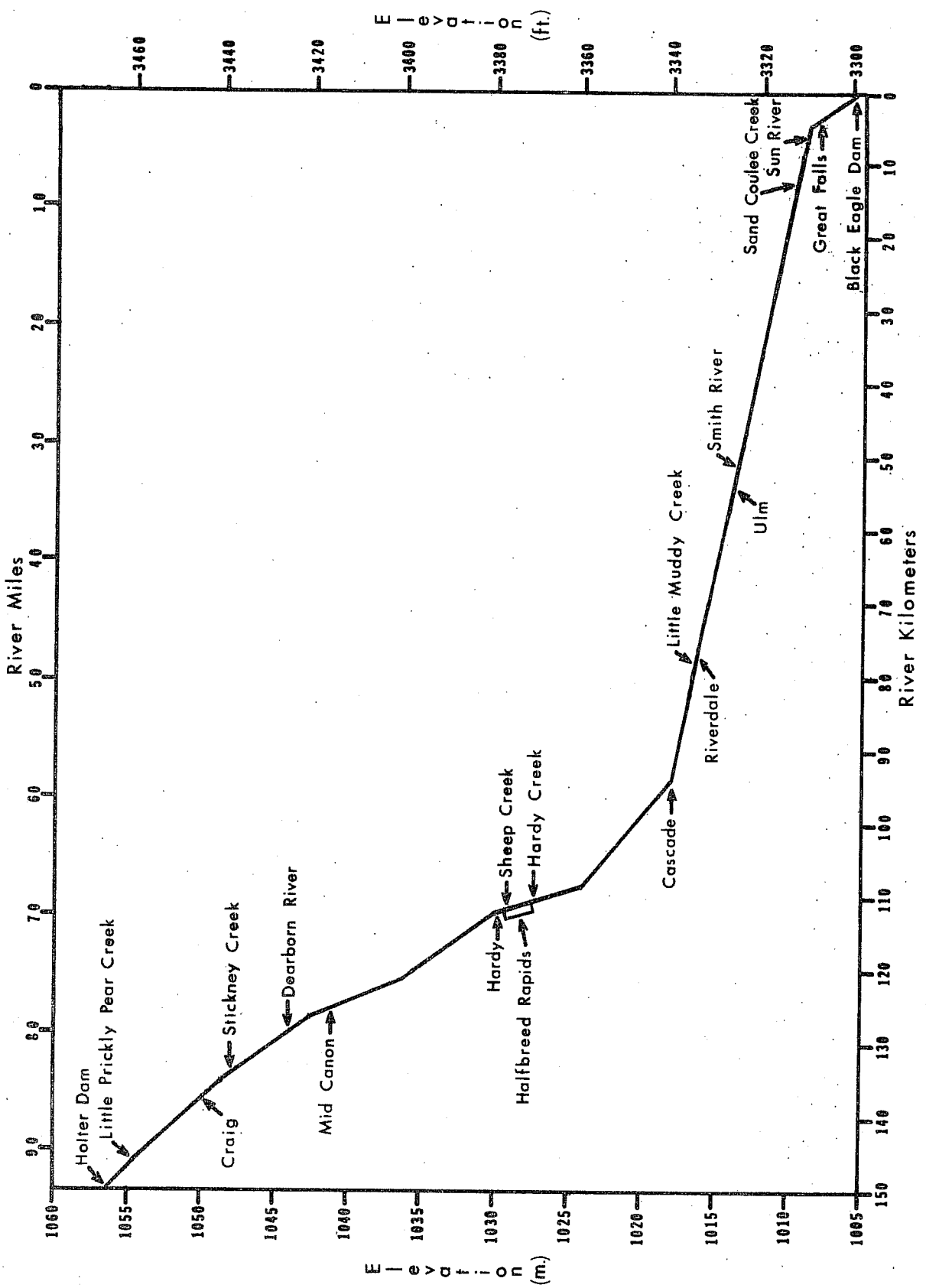

Figure 3. Longitudinal profile of the Missouri River from Holter Dam to Black Eagle Dam near Great Falls.

Water Temperatures

Water temperatures were monitored during the ice-free period by continuous recording thermographs located in the Craig, Hardy, Cascade and Ulm study sections (Figure 1). The thermographs were inoperative for a short period of time in late May and June due to unusually high runoff.

The maximum water temperatures recorded in 1981 at the Craig, Hardy, Cascade and Ulm stations were 21.7, 23.3, 21.7 and 22.2 degrees C (71, 74, 71 and 72 degrees F), respectively. These temperatures were achieved in late August (Figure 4).

Water temperature exceeded 21.1 C (70 F) on 1, 25, 3 and 7 days at the four stations, respectively, in 1981. The greater number of warm days at Hardy is related to a larger diurnal temperature fluctuation at this station, which, in turn, is probably related to the influence of the Dearborn River. Mean diurnal fluctuation of water temperature at the Hardy station was 2.79 C degrees (5.02 F degrees) compared to only 1.31, 1.06 and 1.30 C degrees (2.35, 1.90 and 2.34 F degrees) at the Craig, Cascade and Ulm stations, respectively. Diurnal fluctuations of water temperature are greater in the Dearborn River than in the Missouri River, and the Dearborn River enters the Missouri River only 3.4 km upstream from the Hardy station.

Since average minimum water temperatures at the Hardy station were consistently cooler than the other stations, mean temperatures at each of the thermograph stations follow a more logical sequence, generally warming in a downstream direction. However, the Hardy, Cascade and Ulm stations averaged only 0.43, 0.48 and 0.07 C degrees (0.78, 0.87 and 0.12 F degrees) warmer, respectively, than the Craig station.

The data essentially indicate that water temperature is optimal for trout survival from Holter Dam to Ulm. Water temperature monitoring will be continued in 1982.

MACROINVERTEBRATES

Aquatic macroinvertebrate sampling was completed during the report period. Samples have been sorted and identified, and interpretation of the data is in progress.

A total of 55,281 macroinvertebrates, representing at least 16 orders and 39 families, was collected during the study. Detailed findings will be presented in a future report.

FISH POPULATIONS

Species Composition, Distribution, and Relative Abundance

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 sculpin are the prevalent nongame species.

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 flavescens	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 Helena Regulating Reservoir.
** Common in some tributaries of the Missouri in the study area.

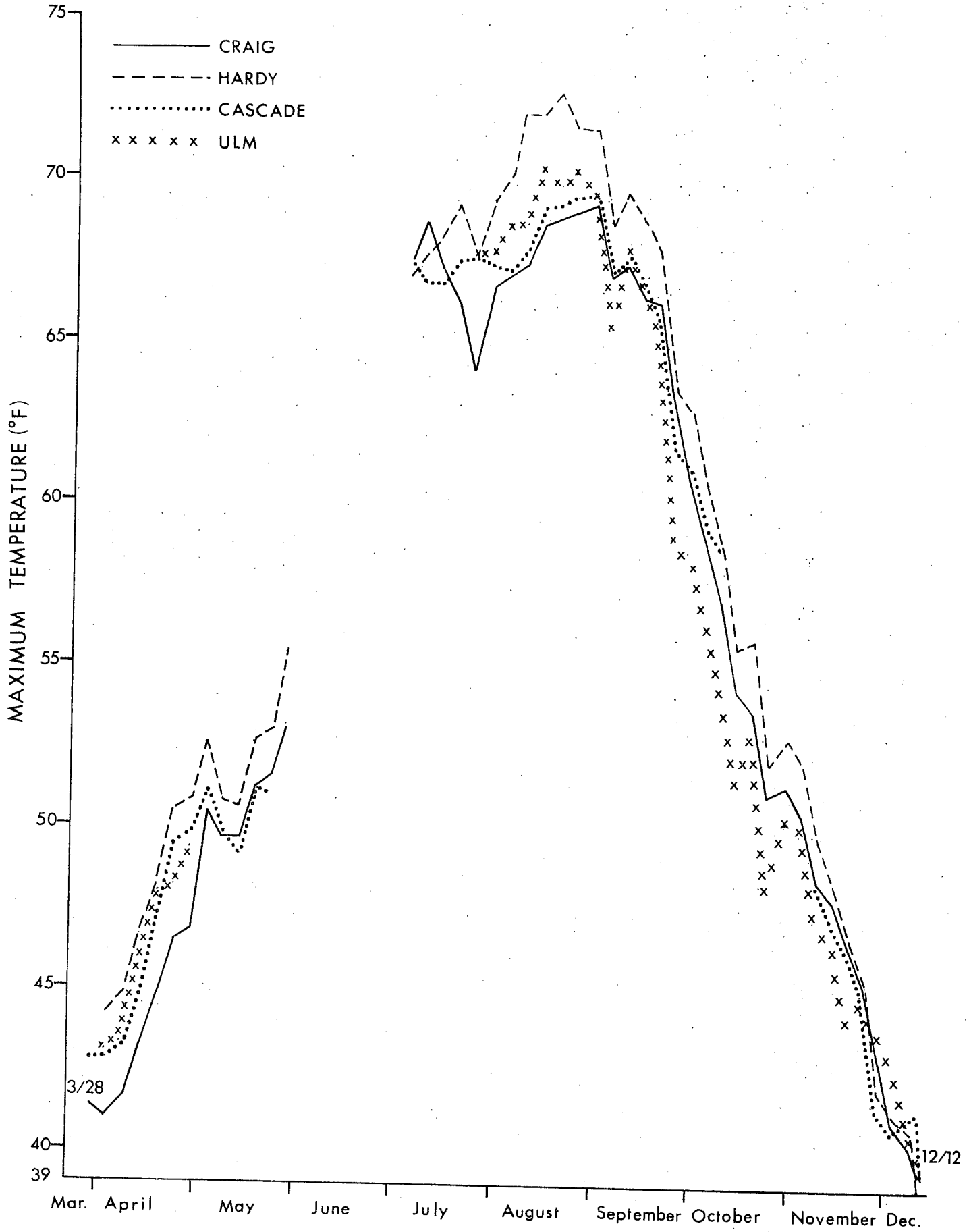

Figure 4. Five-day average maximum water temperatures for the Missouri River near Craig, Hardy, Cascade and Ulm in 1981.

No particular longitudinal distribution pattern has been found for most game or nongame fish species sampled during our study. Most species occurring in the river are found throughout the entire length of the study area from Holter Dam to the Smith River. Surveys are being continued to better define relative abundance, longitudinal distribution and species composition. Findings on these parameters will be presented in the completion report for this project.

Trout Population Estimates and Growth Rates

Trout populations were estimated in a 9.2 km reach of the Hardy section in fall 1981 and spring 1982. Trout populations were also estimated in a 6.2 km reach of the Cascade section in fall 1981.

All of the population estimates were successfully completed. The data have been keypunched and verified. Parameter cards have been prepared and sent to the Computer Sciences Center at Montana State University for computing the final estimates. Population estimate statistics will be presented in the next progress report. Age class assessments indicate spring population estimates can be made for at least two distinct age classes, while fall estimates can be made for at least three distinct age classes.

A comparison of the length-frequency distributions of rainbow trout sampled during the estimates indicates rainbow trout growth is better in the Cascade section than in the Hardy section (Figure 5). The sample of brown trout from the study sections was too small for a valid comparison.

Spawning and Recruitment Studies

Salmonid Spawning

Most members of the trout family migrate during the spawning season in search of suitable spawning 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 et 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 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).

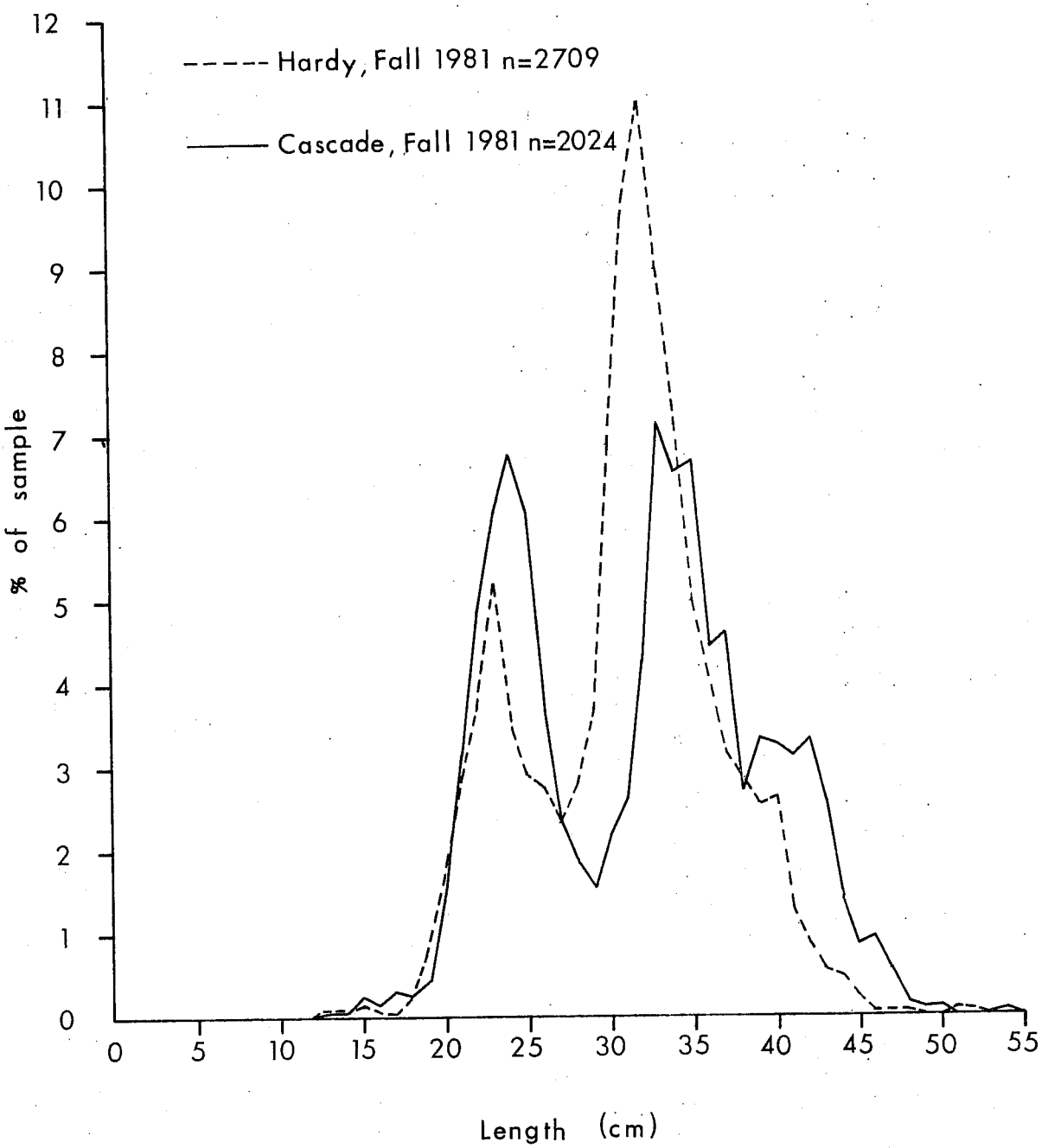

Figure 5. A comparison of the length-frequency distributions of rainbow trout sampled in t
Hardy and Cascade sections during fall 1981.

In an effort to better understand the relationship between the Missouri River and its feeder streams, the lower reaches of several tributaries were electrofished during brown trout and mountain whitefish spawning seasons 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.

Our sampling efforts on each tributary during the salmonid spawning migration periods were very limited. Numbers of spawners given in this report represent only a small portion of the total runs, since only selected days during the spawning period were sampled, and only one capture run was made on each day sampled. Also, the sections surveyed represent only a small portion of the total spawning area available on most tributaries. Therefore, in the tributary streams where migrant salmonids were captured, our data document only the presence of a run and do not necessarily reflect its magnitude. In tributary streams where no migratory fish were found, more intensive sampling is needed to definitely confirm the presence or absence of spawning runs.

The lower reaches of Little Prickly Pear, Sheep, Rock, Wegner, Hardy, Stickney and Prewett creeks and the Dearborn River were electrofished in 1981 to document the possible presence of rainbow and brown trout and mountain whitefish spawning runs. All of the tributaries contained enough flow to sustain spring spawning runs, but only Little Prickly Pear and Sheep creeks and the Dearborn River contained enough flow to sustain fall spawning runs. The Smith and Sun rivers also contained enough flow to sustain spring and fall spawning runs; however, these tributaries are located at and below the lower boundary of our study area and were not included in the survey.

Electrofishing evidence indicates rainbow and brown trout and mountain whitefish utilize tributaries for spawning if they contain enough flow to sustain spawning runs (Table 3). Tag return evidence indicates trout may move considerable distances in the Missouri River to reach a spawning tributary. Tabular data on spawning movements defined by tag returns will be presented in the completion report for this project.

In addition to tributary streams, rainbow and brown trout and mountain whitefish utilize the mainstem of the Missouri River for spawning. Side channels, in particular, provide an abundance of suitable spawning habitat. It appears tributaries are relatively more important for rainbow spawning, while side channels of the Missouri are relatively more important for brown trout. Mountain whitefish spawn abundantly in both areas.

Trout Redd and Larval Fish Studies

The Missouri River and the lower reaches of tributaries were searched extensively in the spring and fall of 1981 for rainbow and brown trout redds. Numerous redds were located. A variety of physical characteristics were measured at each of the redd sites to define conditions required for spawning.

Table 3. Numbers of mature rainbow and brown trout and mountain whitefish sampled in tributaries of the Missouri River during the spawning period in 1981.

Tributary	Date Sampled	Species	Not Ripe	Ripe Male	Female			Total
					Gravid	Ripe	Spent	
L. Prickly Pear Cr.	4/3/81	rainbow trout	2	17	10	3	2	34
	4/9/81	" "	15	13	42	3	7	80
	11/19/81	brown trout	7	6	2	2	8	25
	"	mountain whitefish	2	22	-	12	5	41
Dearborn River	4/7/81	rainbow trout	21	24	38	1	0	84
	4/22/81	" "	23	13	10	4	31	81
	10/23/81	brown trout	1	0	1	0	0	2
	"	mountain whitefish	14	19	0	1	0	34
	11/6/81	brown trout	0	1	1	0	0	2
	"	mountain whitefish	7	21	2	8	8	46
Sheep Creek	3/26/81	rainbow trout	10	36	40	3	0	89
	4/10/81	" "	6	39	24	6	5	80
	5/4/81	" "	5	9	2	0	6	22
	10/21/81	brown trout	1	2	1	1	0	5
	"	mountain whitefish	0	1	0	2	0	3
	11/20/81	brown trout	6	4	0	3	9	22
	"	mountain whitefish	1	12	0	0	0	13
Rock Creek	4/6/81	rainbow trout	3	2	0	0	0	5
Wegner Creek	4/6/81	" "	0	7	0	0	1	8
Hardy Creek	4/7/81	" "	0	3	0	0	0	3
Stickney Creek	4/8/81	" "	4	24	2	2	2	34
Prewett Creek	4/9/81	" "	None observed					

Larval fish samples were collected from the Missouri River and the lower reaches of its tributaries in 1981 to determine timing and location of hatching and emergence of important fish species. Brown trout and mountain whitefish emerged mainly in late April, rainbow trout peaked by mid-May, Catostominae hatched in late May and June, and Cyprinidae emergence peaked in July.

Detailed analysis and interpretation of trout redd and larval fish data are in progress. Tabular data and a complete write-up of findings will be presented in a future report.

Trout Rearing

Missouri River

Electrofishing surveys were made in side channels of the Missouri River in 1981 to aid in determining the amount of flow required to maintain trout rearing habitat. Juvenile trout habitat preferences were identified in 1980 (Berg 1981b). Flow requirements for trout rearing were incorporated into an instream flow claim filed on the Missouri River in December 1981. The instream flow claim will be discussed later in this report.

Tributaries

Electrofishing surveys were made on the lower reaches of the Dearborn River and Little Prickly Pear, Sheep and Rock creeks in 1981 to evaluate the importance of the tributaries as rearing areas for YOY and yearling trout. Scale samples were collected from a representative sample of the juvenile fish for age determination.

A composite average of 0.44 YOY rainbow trout per electrofishing minute (trout/min) was collected compared to only 0.26 brown trout/min (Table 4). For yearling fish, averages of 0.11 rainbow and 0.04 brown trout/min were sampled. Thus, tributaries appear to be more important as rearing areas for rainbow trout than brown trout. In addition, the data suggest that a significant percentage of rainbow trout rear in the tributaries as YOY and yearlings, while a greater percentage of brown trout yearlings emigrate from the tributaries to the Missouri River. These findings are consistent with tributary rearing observations in 1980 (Berg 1981b).

Forage Fish

Forage fish were collected by electrofishing and seining. The most common forage species collected in 1981 were YOY mountain whitefish, YOY longnose and white suckers, juvenile yellow perch, mottled sculpin and longnose dace. Forage fish were generally more abundant in the lower river (Cascade and Ulm sections) than in the upper river (Craig and Hardy sections). Similar observations were made in more detailed forage fish studies conducted in 1980 (Berg 1981b).

Angler Harvest as Indicated by Tag Returns

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

Table 4. Numbers of young-of-the-year (YOY) and yearling trout sampled in four tributaries of the Missouri River in 1981.

Tributary	Date Sampled	Minutes Electrofished	Section Length (m)	Rainbow Trout				Brown Trout			
				Number Sampled	Length Range (mm)	Average Length (mm)	CPUE[1]	Number Sampled	Length Range (mm)	Average Length (mm)	CPUE[1]
				YOY				YOY			
L.Prickly Pear Cr (Lahti Sec)	4/9	115	1500	0	-	-	0	0	-	-	0
	8/18*	100	210	33	56-105	75.6	0.33	118	68-112	87.9	1.18
	11/19	115	1500	3	83-89	86.0	0.03	10	94-127	114.5	0.09
L.Prickly Pear Cr (Sentinel Sec)	4/3	105	400	0	-	-	-	0	-	-	0
	8/17*	45	170	6	58-74	67.0	0.13	20	70-97	84.6	0.44
	11/19	30	120	0	-	-	0	0	-	-	0
L.Prickly Pear Cr (Quarry Sec)	8/17*	25	75	23	35-73	51.4	0.92	9	73-98	88.6	0.36
Sheep Cr	3/26	125	253	0	-	-	0	0	-	-	0
	4/10	60	320	0	-	-	0	0	-	-	0
	5/4	50	180	0	-	-	0	0	-	-	0
	8/13*	120	180	342	42-99	59.8	2.85	111	50-104	69.0	0.93
	10/21*	100	220	210	44-103	75.0	2.10	67	68-112	85.0	0.67
	11/20*	35	80	80	51-108	75.1	2.28	29	74-119	89.9	0.83
Dearborn R	4/7	200	7000	0	-	-	0	0	-	-	0
	4/22	200	7000	0	-	-	0	0	-	-	0
	8/12*	200	7000	2	49-67	58.0	0.01	41	62-100	78.9	0.21
	10/23*	200	7000	39	75-115	91.9	0.20	25	81-126	100.8	0.13
	11/6	200	7000	0	-	-	0	0	-	-	0
Rock Cr	4/6	50	240	0	-	-	0	0	-	-	0
	8/18*	20	60	0	-	-	0	9	60-107	88.7	0.45

Table 4. Continued

Tributary	Date Sampled	Minutes Electrofished	Section Length (m)	Rainbow Trout				Brown Trout			
				Number Sampled	Length Range (mm)	Average Length (mm)	CPUE[1]	Number Sampled	Length Range (mm)	Average Length (mm)	CPUE[1]
				Yearling				Yearling			
L. Prickly Pear Cr (Lahti Sec)	4/9	115	1500	1	185	185	0.01	1	155	155	0.01
	8/18*	100	210	38	136-197	169.9	0.38	3	161-187	169.7	0.03
	11/19	115	1500	0	-	-	0	7	132-153	138.1	0.06
L. Prickly Pear Cr (Sentinel Sec)	4/3	105	400	3	103-112	108.3	0.03	2	100-112	111.0	0.02
	8/17*	45	170	9	127-190	165.0	0.20	2	181-188	184.5	0.04
	11/19	30	120	1	192	192	0.03	0	-	-	0
L. Prickly Pear Cr (Quarry Sec)	8/17*	25	75	0	-	-	0	0	-	-	0
Sheep Cr	3/26	125	253	12	68-137	91.4	0.10	2	120-150	135.0	0.02
	4/10	60	320	3	77-101	86.0	0.05	0	-	-	0
	5/4	45	180	14	76-110	91.5	0.31	4	91-102	95.3	0.09
	8/13*	120	180	27	104-155	130.0	0.23	6	119-134	126.0	0.05
	10/21*	100	220	20	113-168	139.2	0.17	11	118-186	148.4	0.09
	11/20*	35	80	14	113-175	146.8	0.40	9	125-165	146.0	0.28
Dearborn R	4/7	200	7000	5	167-187	178.6	0.03	0	-	-	0
	4/22	200	7000	1	163	163	0.01	0	-	-	0
	8/12*	200	7000	3	161-187	170.6	0.02	0	-	-	0
	10/23*	200	7000	12	150-199	173.1	0.06	0	-	-	0
	11/6	200	7000	2	140-167	153.5	0.01	0	-	-	0
Rock Cr	4/6	50	240	6	95-143	122.7	0.12	4	125-153	135.5	0.08
	8/18*	20	60	0	-	-	0	2	184-197	190.5	0.10

1 - CPUE = No. fish sampled per electrofishing minute.
* - Sample date spent specifically searching for juvenile fish.

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 6.01% of the rainbow trout tagged in the mainstem of the Missouri River has been harvested by anglers (Table 5). In tributaries, anglers have harvested 2.32% of the tagged rainbow trout. Harvest rates for brown trout are 5.96 and 3.43% in the mainstem and tributaries, respectively. In total, anglers have harvested 5.70% of the brown trout tagged in the Missouri River and its tributaries compared to 5.49% of the rainbow. 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 statistics will be updated in the next progress report.

Missouri River Creel Survey

A creel survey was conducted from April through November 1981 on the sport fishery which exists in the blue ribbon segment of the Missouri River from Holter Dam to the confluence of the Smith River. The emphasis of the survey was to evaluate seasonal and longitudinal variation in catch and harvest rates of rainbow and brown trout. Study sections for the creel survey are identical to those shown in Figure 1, except the Craig section was divided into two creel survey sections. The Holter creel survey section extended from Holter Dam to the Wolf Creek Bridge, and the Craig creel survey section extended from the Wolf Creek Bridge to Craig.

The catch rate ranged from a low of 0.16 trout per man-hour (trout/hr) in May to a high of 0.64 trout/hr in October (Table 6). For all months combined, anglers caught 0.39 rainbow trout/hr compared to only 0.02 brown trout/hr. About 69% of the anglers interviewed in 1981 were from Great Falls.

The catch rate for rainbow trout was fairly uniform from Holter to Cascade, but dropped significantly at Ulm (Table 7). The catch rate for brown trout increased in a downstream direction from 0.01 fish/hr at Holter to 0.11 fish/hr at Cascade. The catch rate dropped to 0.01 brown trout/hr at Ulm.

The success rate was significantly higher in 1981 for lure and fly fishermen than for fishermen who used bait or a combination of various methods (Table 8). Lure and fly fishermen caught 0.62 and 0.84 trout/hr, respectively, compared to only 0.37 and 0.31 trout/hr for bait and combination anglers. Brown trout comprised slightly more than 10% of the catch for lure and fly fishermen. Boat fishermen caught 0.61 trout/hr compared to only 0.38 trout/hr for bank fishermen.

Table 5. Preliminary estimates of angler harvest of rainbow and brown trout as indicated by tag returns through August 1, 1982.

Missouri River Study Area	Rainbow Trout			Brown Trout		
	Number Tagged	Number Harvested	Percent Harvested	Number Tagged	Number Harvested	Percent Harvested
Craig Section	1550	92	5.94	393	22	5.60
Hardy Section	2395	168	7.01	522	44	8.43
Cascade Section	820	38	4.63	450	22	4.89
Ulm Section	473	17	3.59	213	6	2.82
Subtotal	5283	315	6.01	1578	94	5.96
Tributary Study Area						
Sheep Creek	113	3	2.65	31	1	3.23
L. Prickly Pear Cr	461	8	1.74	129	5	3.88
Dearborn River	250	6	2.40	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	-	-
Subtotal	862	20	2.32	175	6	3.43
Grand Total	6100	335	5.49	1753	100	5.70

Table 6. Monthly variation in catch and harvest rates of rainbow and brown trout as indicated by creel survey data collected from April through November 1981.

Creel Survey Statistics	Apr	May	June	July	Aug	Sept	Oct	Nov	Total
No. anglers interviewed	230	69	486	464	734	178	238	122	2521
Avg hrs fished/angler	2.95	3.51	4.12	3.79	3.97	3.88	3.92	2.77	3.79
Fish caught/man hour									
Rainbow trout	0.20	0.16	0.47	0.27	0.38	0.40	0.59	0.54	0.39
Brown trout	0.03	0	<0.01	0.01	0.02	0.02	0.04	0.05	0.02
Total trout	0.23	0.16	0.48	0.28	0.40	0.42	0.64	0.60	0.41
Fish harvested/man hour									
Rainbow trout	0.17	0.16	0.43	0.25	0.28	0.25	0.40	0.35	0.31
Brown trout	0.03	0	<0.01	0.01	0.01	<0.01	0.02	0.01	0.01
Total trout	0.19	0.16	0.43	0.25	0.29	0.26	0.42	0.36	0.32
Composition of Catch									
% Rainbow trout	87.7	100.0	99.5	96.1	95.1	94.8	93.3	91.0	95.6
% Brown trout	12.3	0	0.05	3.9	4.9	5.2	6.7	9.0	4.4
Angler Residency									
% Local[1/]	1.3	0	2.1	1.7	1.4	3.4	1.7	4.1	1.8
% Great Falls	83.0	62.3	77.6	66.8	63.9	59.0	64.3	73.0	68.9
% Helena	7.4	11.6	4.7	4.5	9.3	12.9	9.2	9.0	7.7
% Other Montana	5.7	26.1	9.9	8.4	12.4	14.0	13.4	9.8	11.0
% Out-of-State	2.6	0	5.8	18.5	13.1	10.7	11.3	4.1	10.6

1 - Local - Wolf Creek, Craig, Hardy, Cascade and Ulm.

Table 7. Longitudinal variation in catch and harvest rates of rainbow and brown trout as indicated by creel survey data collected from April through November 1981.

Creel Survey Statistic	Creel Survey Section					
	Holter	Craig	Hardy	Cascade	Ulm	Total
No. Anglers Interviewed	1374	581	410	55	101	2521
Avg. Hrs fished/angler	4.23	3.62	2.93	2.66	2.87	3.79
Fish caught/manhour						
Rainbow trout	0.41	0.39	0.37	0.48	0.09	0.39
Brown trout	0.01	0.03	0.04	0.11	0.01	0.02
Total trout	0.41	0.42	0.41	0.59	0.10	0.41
Fish harvested/manhour						
Rainbow trout	0.36	0.24	0.26	0.14	0.08	0.31
Brown trout	<0.01	0.01	0.02	0.01	0.01	0.01
Total trout	0.36	0.25	0.28	0.16	0.09	0.32
Composition of catch						
% rainbow trout	98.5	91.8	91.0	81.4	89.3	95.6
% brown trout	1.5	8.2	9.0	18.6	10.7	4.4

Table 8. A comparison of the success rates of anglers using various methods and modes of fishing in 1981.

	No. of Anglers	% of Anglers	Avg. Hrs Fished/ Angler	Fish caught/man hour			Composition of catch	
				Rainbow	Brown	Trout	% Rb	%LL
Method:								
Bait	1571	62.8	4.14	0.36	0.01	0.37	98.5	1.5
Lure	140	5.6	2.89	0.55	0.08	0.62	87.4	12.6
Fly	208	8.3	3.42	0.75	0.10	0.84	88.6	11.4
Comb.	583	23.3	3.21	0.30	0.02	0.31	94.7	5.3
Mode:								
Bank	305	12.1	3.81	0.37	0.01	0.38	97.1	2.9
Boat	2216	87.9	3.59	0.54	0.07	0.61	88.2	11.8

INSTREAM FLOW STUDY

Adequate instream flow is essential to maintain fish populations in lentic environments. The increasing demand for Montana's limited water supplies comprises a potential threat to fishery resources that is often apparent even to casual observers. To maintain the fishery resource of the Missouri River below Holter Dam, minimum flows must be established to provide adequate spawning areas for adult fish, rearing areas for juvenile fish and sufficient food producing and cover areas for fish of all sizes.

A 1969 state law (Section 89-801, RCM 1947), the so-called "Murphy's Law," authorized the Montana Department of Fish, Wildlife & Parks (DFWP) to appropriate water for instream uses on 12 high quality trout streams in the state. On the Missouri River between Holter Dam and the confluence of the Smith River, DFWP filed a claim for 84.96 m^3/sec (3,000 cfs) from January 1 through December 31. As a result of a decision concerning a contested water right on one of the 12 "Murphy's Right" streams, it was determined that DFWP had an instream right, but it was not adequately quantified. Consequently, fish and wildlife data supporting the instream flow claims on all "Murphy's Right" streams had to be gathered before the claims could become effective. Senate Bill 76, entitled "An Act to Adjudicate Claims of Existing Water Rights in Montana," was passed by the 1979 Montana Legislature. This act formally required quantification of DFWP's existing instream flow rights on the "Murphy's Right" streams and established January 1, 1982 as the deadline for refiling to confirm existing rights.

In 1981, studies were completed to determine the amount of flow required to maintain the fishery of the Missouri River from Holter Dam to the confluence of the Smith River. Our claim was filed with the Montana Department of Natural Resources prior to the January 1, 1982 deadline. A complete copy of this claim will be included in the completion report for this project.

LITERATURE CITED

Berg, R. K. 1975. Fish and game planning, Upper Yellowstone and Shields River drainages. Job Comp. Rept., Fed. Aid to Fish and Wildl. Rest. Proj. No. FW-3-R. Job 1-A. 92 pp.

_____. 1981a. Fish populations of the Wild and Scenic Missouri River, Montana. Job Comp. Rept., Fed. Aid to Fish and Wildl. Rest. Proj. No. FW-3-R. Job 1-A. 242 pp.

_____. 1981b. Middle Missouri River planning project. Job Prog. Rept., Fed. Aid to Fish and Wildl. Rest. Proj. No. FW-3-R-9. Job 1-A. 39 pp.

Brown, C. J. D. 1971. Fishes of Montana. Endowment and Res. Found., Mont. St. Univ., Bozeman. 207 pp.

Brown, C. J. D., J. M. Halterman, G. D. Holton and P. H. Nelson. 1959. A classification of Montana fishing streams - 1959.

Brown, H. P. 1972. Aquatic dryopoid beetles (Coleoptera) of the United States. US Env. Prot. Agency Proj. No. 18050 ELD. Washington, DC. 82 pp.

Calhoun, A. J. 1966. Inland fisheries management. Calif. Dept. of Fish & Game, Sacramento. 546 pp.

Chapman, D. G. 1951. Some properties of the hypergeometric distribution with applications to zoological sample censuses. Univ. of Calif. Pub. in Stat. 1(7): 131-160.

Fenderson, C. N. 1958. Brown trout, *Salmo trutta* Linnaeus. Fishes of Maine, 2nd Ed. Ed. W. H. Everhart. pp. 34-37.

Hartman, G. F., T. G. Northcote and C. C. Lindsey. 1962. Comparison of inlet and outlet spawning runs of rainbow trout in Loon Lake, British Columbia. J. Fish. Res. Bd. Can. 19(2):173-200.

Hooper, D. R. 1973. Evaluation of the effects of flows on trout stream ecology. Pacific Gas and Electric Co., Dept. of Eng. Res., Emeryville, Calif. 97 pp.

Hogue, J. J., R. Wallus and L. K. Kay. 1976. Preliminary guide to the identification of larval fishes in the Tennessee River. TVA, Norris, Tenn. 66 pp.

Hubbs, C. L. and K. F. Lagler. 1970. Fishes of the Great Lakes region. Univ. of Mich. Press, Ann Arbor. 213 pp.

Lagler, K. F. 1956. Freshwater fishery biology. Wm. C. Brown Publ. Co., Dubuque, Ia. 421 pp.

Liebelt, J. 1970. Studies on the behavior and life history of the mountain whitefish (*Prosopium williamsoni* - Girard). Ph.D. Thesis, Mont. St. Univ. 45 pp.

MacKay, H. H. 1963. Fishes of Ontario. The Bryant Press Ltd., Toronto, Ont. 300 pp.

May, E. B. and C. R. Gasaway. 1967. A preliminary key to the identification of larval fishes of Oklahoma with particular reference to Canton Reservoir, including a selected bibliography. Okla. Fish. Res. Lab., Bull. 5, Contr. No. 164. Okla. Dept. Wildl. and Cons., Norman. 42 pp.

Merritt, R. W. and K. W. Cummins. 1978. An introduction to the aquatic insects of North America. Kendall/Hunt Pub. Co., Dubuque, Ia. 441 pp.

Novotny, D. W. and G. R. Priegel. 1974. Electrofishing boats - improved designs and operational guidelines to increase the effectiveness of boom shockers. Wisc. Dept. Nat. Resc. Tech. Bull. No. 73. 48 pp.

Pennak, R. W. 1978. Fresh water invertebrates of the United States, 2nd Ed. The Ronald Press Co., NY, NY. 769 pp.

Rayner, H. J. 1942. The spawning migration of rainbow trout at Skaneateles Lake, New York. Trans. Am. Fish. Soc. 71:180-183.

Roemhild, G. 1976. The aquatic Heteroptera (true bugs) of Montana. Mont. Agr. Exp. Stat. Res. Rept. No. 102. 70 pp.

Scott, W. B. and E. J. Crossman. 1973. Freshwater fishes of Canada. Fish. Res. Bd. of Canada, Ottawa. 966 pp.

Snyder, J. O. 1918. The fishes of the Lahontan system of Nevada and northeastern California. Bull. US Bur. Fish. 35:31-86.

Stuart, T. A. 1957. The migrations and homing behavior of brown trout. Freshw. Salm. Fish. Res. Scot. 18:3-27.

Tesch, F. W. 1971. Age and growth. *In* Methods for assessment of fish production in fresh waters. IBP handbook No. 3. Blackwell Scientific Pub., Oxford and Edinburgh, England. 348 pp.

USGS. 1978. Water resources data for Montana. US Dept. of Interior. 824 pp.

_____. 1979. Water resources data for Montana. US Dept. of Interior. 842 pp.

Vincent, E. R. 1971. River electrofishing and fish population estimates. Prog. Fish. Cult. 33(3):163-167.

_____. 1974. Addendum to river electrofishing and fish population estimates. Prog. Fish. Cult. 36(3):182.

Ward, H. B. and G. C. Whipple. 1959. Fresh water biology. John Wiley and Sons, Inc., New York, NY. 1248 pp.

Wipperman, A. H. 1973. Smith River drainage inventory and planning investigation. Job Comp. Rept., Fed. Aid to Fish and Wildl. Rest. Proj. No. FW-1-R, Job 1a.

Prepared by: Rodney K. Berg
September 1982

MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION

JOB PROGRESS REPORT

State: Montana

Project No.: F-5-R-31 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, 1981 through June 30, 1982

ABSTRACT

A total of 25 waters were investigated during the report period. These included 9 streams, 6 farm ponds and small lakes and 10 larger lakes and reservoirs. Survival of rainbow trout planted into four irrigation storage reservoirs is fair to poor, while growth rates are considered average. Survival and growth of rainbow trout planted in Holter and Bean Lake and Newlan Creek Reservoir is discussed. Walleye and northern pike populations in Lake Elwell are depressed due to a shortage of forage fish and/or lack of suitable spawning areas. Lake Frances populations of walleye and northern pike appear healthy with good representative age classes. Population estimates of northern pike in Pishkun Reservoir indicate a slight increase over previous years. Mature snagged kokanee salmon in Pishkun Reservoir were comprised of 17, 49 and 34 percent of age 3, 4 and 5 fish respectively. The four year old fish represent natural reproduction. Survey electrofishing was conducted in several small streams along the Rocky Mountain Front. Information collected from the forks of the Sun River indicates average size of rainbow trout has increased slightly from 1979. Trout population estimates were estimated in the North Fork Smith River and in the access area in the Smith River. Notices for a total of 157 stream alteration projects were received in the project area.

OBJECTIVES AND DEGREE OF ATTAINMENT

1. To evaluate the effects of a two fish creel limit on trout populations in the North and South Forks of the Sun River. This work was done and information is included in the report.

2. To determine stocking densities, growth rates and angler success for rainbow trout in six reservoirs and lakes. Data was collected and appears in this report.

3. To estimate the northern pike population and fisherman harvest, to evaluate natural reproduction of kokanee salmon and to evaluate survival and growth of rainbow trout in Pishkun Reservoir. This work was done and is included in this report.

4. To evaluate management of four farm ponds and small lakes planted with rainbow and cutthroat trout, and to investigate fishery potential in new ponds. Information was gathered on four existing waters and for one potential pond. The data is included in the report. Data is also presented on one non-trout lake.

5. To inventory trout populations in six streams to update management files. Data was collected on nine streams and is included in this report.

6. To determine fish population trends, fisherman harvest and food habits of northern pike, walleye and burbot in Lake Elwell (Tiber Reservoir) and Lake Frances. Also to determine composition and abundance of indigenous forage species in these waters. This work was accomplished and the data appears in the report.

7. To monitor stability of stream habitat on the Teton River where flood debris was mechanically removed and where it was not removed and to estimate brook trout populations in these areas. This objective will be investigated only if significant changes occur in channel morphology and river habitat. No work was done on this segment during the report period.

8. To take necessary action to protect stream habitat from hydraulic construction projects sponsored by government and private concerns. These actions were monitored and are presented in this report.

PROCEDURES

Rainbow trout and kokanee salmon were sampled with gill nets in Bynum, Eureka, Nilan, Pishkun, Holter, Newlan and Willow Creek Reservoirs and Bean Lake to determine survival and growth. Trout sampled were examined with a black light to detect fish that were marked with fluorescent pigment in past years. Hatchery rainbow trout planted in Pishkun Reservoir were marked by an adipose fin clip. Gill nets, trap nets and seines were used to sample northern pike, walleye, burbot and forage fish in Pishkun Reservoir, Lake Frances and Lake Elwell (Tiber Reservoir). A population estimate of northern pike in Pishkun Reservoir was made by short term mark and recovery through use of trap nets. Northern pike and walleye in Lake Elwell and Lake Frances were marked with Floy T-tags and fin clips to determine movement and harvest. Age and growth studies in these reservoirs were conducted through the collection and analysis of scale samples. Harvest determinations were made through voluntary tag returns and limited creel census. Farm ponds and

small lakes were surveyed as outlined in the Department's Lake and Stream Survey Manual. Fish were sampled with gill nets, trap nets and hook and line. Trout populations in the Smith River were censused by employing electrofishing mark and recapture techniques described by Richard Vincent (Prog. Fish Cult. 33(3): 163-169, 1971). Trout in small streams were randomly sampled with electrofishing equipment. Trout populations in the Forks of the Sun River were sampled by hook and line and scale collections and length measurements taken. Inspections and recommendations were made upon receipt of notices to construct hydraulic projects influencing streams. The recommendations include protecting, mitigating or enhancing fish habitat as provided by the Stream Preservation Act and the Natural Streambed and Land Preservation Act.

ACCOMPLISHMENTS

Lakes and Reservoirs

Trout Reservoirs

Gill net summaries for the lakes inventoried are presented in Table 1. Rainbow trout planted in the spring of 1981 appear to have had fair to poor survival, even though the fish were stocked according to recommendations determined through previous studies. These recommendations involve stocking trout into these reservoirs approximately one month after ice-out and/or 50°F. water temperatures. Individual discussion of some of the waters follows:

Bean Lake

Sampling of the trout population with gill nets in the fall of 1981 revealed poor survival of 20,000 Arlee strain rainbow trout planted in the spring of 1981. Nearly twice as many wild trout (eggs collected from the Missouri River) from a plant of 16,300 fish in the fall of 1980 were represented in the catch. Average size of the two stocks were about the same, however, the Arlee trout averaged slightly more in weight. A fair sample of Arlee trout stocked in 1979 were present in the sample. These fish averaged over two pounds (Table 1). Nearly the same number of fish were sampled in the spring of 1982, except fewer large trout were present in the nets. Total sample size of the catch was considerably less than for those years when good survival was noted.

DeSmet rainbow trout were scheduled to be planted in Bean Lake in the fall of 1981. These fish were not planted until the spring of 1982 because of poor growth in the hatchery. The right pelvic fin was clipped on DeSmet trout for identification prior to stocking. At the time of stocking, these fish averaged 3.7 per pound and varied in length from about 3 to 11 inches. Spring and fall sampling will continue to evaluate the fishery provided by DeSmet rainbows compared to the Arlee rainbow.

Table 1. Gill net data from trout reservoirs, 1981

Area (Date Sampled)	Surface Acres 1/	No. of Nets	Species 2/	No. of Fish	Length Range (Average)	Weight Range (Average)
Bean Lake	200					
(Oct. 30, 1981)		2	Rb	5	11.9-14.2(13.2)	0.70-1.20(1.02)
			Rb	10	15.9-19.1(17.0)	1.74-2.91(2.19)
			Wild Rb	9	11.5-14.5(13.1)	0.77-1.19(0.91)
(Apr. 28, 1982)		2	Rb	5	12.2-14.2(13.0)	0.72-1.22(0.93)
			Rb	5	15.4-17.9(16.7)	1.62-2.52(2.11)
			Wild Rb	9	11.7-15.2(13.3)	0.66-1.45(0.95)
Bynum Reservoir	3,000					
(Oct. 6, 1981)		2	Rb	15	9.1-10.6(10.0)	0.28-0.47(0.37)
				10	13.2-15.0(14.1)	0.78-1.26(0.96)
			KOK	27	16.5-19.0(17.6)	1.35-2.11(1.73)
			LL	1	(7.8)	(0.17)
			Wf	1	(12.5)	(0.74)
Eureka Reservoir	100					
(Oct. 6, 1981)		3	Rb	2	10.2-10.5(10.4)	0.40-0.47(0.44)
				4	13.9-15.0(14.3)	0.88-1.32(1.05)
			LL	4	18.6-21.3(19.9)	2.36-3.66(2.83)
			LnSu	4	9.5-12.0(10.3)	0.30-0.62(0.40)
			WSu	42	9.0-11.3(10.4)	0.29-0.60(0.48)
				29	13.6-16.6(14.0)	1.06-1.94(1.26)
Holter Lake	4,800					
(Nov. 3, 1981)		3	Rb	97	9.0-12.1(10.6)	0.30-0.71(0.49)
			Rb	2	13.5-17.5(15.5)	0.91-2.06(1.49)
			Wf	3	14.9-16.9(15.7)	1.24-1.78(1.43)
			WE	2	20.8-21.8(21.3)	3.54-4.04(3.79)
Newlan Cr. Res.	300					
(Oct. 28, 1981)		2	Rb	43	8.3-11.5(9.8)	0.20-0.65(0.38)
			Rb	9	12.1-15.3(14.4)	0.67-1.35(1.06)
			Ct	10	14.2-18.5(16.0)	1.00-2.30(1.50)
			Eb	3	10.5-15.6(12.7)	0.35-1.30(0.73)
			LnSu	12		
Nilan Reservoir	175					
(Nov. 3, 1981)		2	Rb	7	9.8-11.3(10.7)	0.36-0.55(0.46)
				20	14.6-16.8(15.6)	1.11-1.72(1.37)
Willow Cr. Res.	1,300					
(Oct. 14, 1981)		4	Rb	14	9.4-10.2(9.8)	0.32-0.41(0.36)
				9	13.2-15.0(14.1)	0.74-1.19(0.98)
				1	(21.2)	(3.1

1/ Approximate surface acres at time of survey.
2/ Species abbreviations: Rb-rainbow trout; Ct-cutthroat trout; KOK-kokanee salmon; LL-brown trout; Wf-mountain whitefish; LnSu-longnose sucker; WSu-white sucker; WE-walleye.

Bynum Reservoir

Although kokanee salmon plants were discontinued in 1978 and the remaining salmon should have matured as four-year-olds in 1980, several mature five-year-olds were taken during the gill net survey in October. It is doubtful that any older year classes remain or that natural reproduction has occurred. A total of 7,515 four-inch brown trout were introduced into the reservoir on June 3, 1981. The larger brown trout should feed on the abundant sucker population and provide a trophy type fish for the angler.

Eureka Reservoir

An introduction of 3,510 four-inch brown trout was made on June 3, 1981. The introduction was also made in an attempt to produce some trophy trout. This reservoir is also heavily infested with suckers that should provide ample forage for the brown trout.

Holter Reservoir

Flood flow through Holter Reservoir in the spring of 1981 caused considerable loss of rainbow trout over the dam. Gill net sampling in early November, 1981 revealed poor carry-over of trout planted in the reservoir in 1980 (Table 1). Good survival of current year (July, 1981) stocked trout was noted. These fish averaged about one-half pound in weight.

Sampling is conducted with floating gill nets to prevent net tangling by the huge sucker population in the lake. Therefore, other species of fish found in Holter Lake are not represented in the catch.

Newlan Creek Reservoir

Description of this reservoir was described in the Job Progress Report last year (Hill and Wipperman, 1980). Gill net sampling revealed good survival of current year stocked rainbow trout (Table 1). A fair number of cutthroat trout planted in 1978 and 1979 were represented in the catch. Although slower growing than the rainbow trout, it appears cutthroat may have superior longevity in this reservoir than the Arlee strain of rainbow trout. None of the rainbow trout sampled were from 1978 and 1979 plants.

Multi-species Reservoirs

Gill net summaries for Lake Elwell, Lake Frances and Pishkun Reservoir appear in Table 2. These waters have a combination of trout, salmon and/or warm water species present. A brief discussion follows for each water.

Lake Elwell (Tiber Reservoir)

Trend information was gathered during 1981 for northern pike, walleye burbot, forage fish and other fish species found in the reservoir.

Table 2. Gill net summaries of multi-species reservoirs, 1981

Lake (Date Sampled)	Surface Acres[1/]	No. of Nets	Species[2/]	No. of Fish	Length Range Inches (Ave.)	Weight Range Pounds (Ave.)
Lake Elwell (Sept. 30 - Oct. 1)	11,000	16	WE	21	8.0-11.5(10.0)	0.13-0.40(0.27)
				20	12.0-15.0(13.1)	0.46-0.98(0.64)
				9	17.7-21.9(20.2)	2.00-2.98(2.50)
			NP	9	18.2-27.0(22.0)	1.33-4.32(2.47)
				2	30.7-35.1(32.9)	9.00-13.00(11.00
			Rb	2	15.1-20.3(17.7)	1.47-2.50(1.99)
			Lt	3	23.0-29.0(26.3)	4.00-5.50(4.67)
			Cat	1	(14.5)	(0.82)
			YP	2	(5.8)	0.10-0.21(0.11)
				13	7.1-11.3(8.6)	0.16-0.70(0.30)
			Carp	1	(20.7)	(4.52)
			WSu	34	(17.1)	(2.05)
			LnSu	4	7.7- 9.5(8.6)	0.18-0.33(0.25)
				5	12.6-16.7(13.4)	0.65-1.84(0.89)
Lake Frances (Sept. 29)	4,700	4	WE	3	7.9- 8.4(8.1)	0.14-0.17(0.16)
				4	11.5-12.5(11.9)	0.49-0.59(0.53)
				2	13.9-14.8(14.4)	0.92-0.98(0.95)
				9	16.0-21.2(17.4)	1.40-3.22(1.84)
			NP	6	20.4-26.2(22.9)	2.12-4.63(3.01)
			YP	1	(11.7)	(0.89)
			WSu	2	16.5-18.2(17.4)	2.02-2.43(2.23)
Pishkun Res. (Oct. 15)	1,350	3	KOK	8	7.8- 9.3(8.7)	0.18-0.30(0.25)
				8	11.8-14.2(13.0)	0.56-0.96(0.80)
				17	15.1-21.0(17.5)	1.18-2.56(1.76)
			Rb	1	(14.0)	(0.98)
			NP	3	18.6-21.5(20.0)	1.63-2.80(2.28)
			YP	2	6.0- 8.3(7.2)	0.08-0.25(0.17)
			WSu	5	12.9-14.1(13.9)	0.92-1.42(1.32)
				16	16.0-19.0(16.9)	1.85-3.10(2.27)

1/ Approximate surface acres at time of survey.

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

A total of 22 trap days in the Willow Creek Arm from April 3-10 captured 16 northern pike, 32 walleye, 4 burbot, 1 rainbow trout, 5 yellow perch, 93 white and longnose suckers and 6 black crappie. In the Bootlegger Trail area, 17 trap days took 7 northern pike, 40 walleye, 2 burbot, 1 rainbow trout, 19 white and longnose suckers, 2 carp and 1 lake trout, with traps fished from April 13-17.

Northern pike and walleye numbers appear to be considerably less compared to previous years. During April, only 20 northern pike were tagged. A total of 15.0 percent of these were returned by fishermen during 1981. Also, during April, a total of 64 walleye were tagged with 4.7 percent being returned to date. Table 3 summarizes tagging data for northern pike and walleye from 1977 through 1981. Tag loss ranges from 0 to 33.3 percent for northern pike and 28.6 to 100.0 percent for walleye.

Table 3. Northern pike and walleye tagging results, Lake Elwell, 1977-1981

Species	Year	Number Tagged	Accumulative Angler Returns to Date (%)		Annual Tag Loss Range %	Total Tags 1/ Accumulatively Removed (%)	
Northern Pike	1977	595	105	(27.0)	4.4-33.0	311	(52.3)
	1978	405	59	(15.2)	0- 4.7	76	(18.8)
	1979	300	50	(17.2)	0- 3.7	60	(20.0)
	1980	271	34	(12.5)	0-	34	(12.5)
	1981	20	3	(15.0)	-	-	
Walleye	1977	472	37	(100.0)	45.0-100.0	472	(100.0)
	1978	508	52	(94.5)	66.7- 85.7	505	(99.4)
	1979	500	52	(38.2)	51.9- 60.0	416	(83.2)
	1980	464	41	(12.0)	28.6-	164	(35.3)
	1981	64	3	(4.7)	-	-	

1/ Includes angler harvest plus tags lost from fish. (This data not determined for 1981).

At the present time, game fish populations in Lake Elwell are depressed due to a paucity of forage fish numbers. Northern pike numbers are also lower than normal due to absence of suitable spawning substrate during spawning season. The Bureau of Reclamation is planning to operate the reservoir at higher levels and will inundate terrestrial vegetation during the years 1982 and 1983. The Bureau has agreed to flood these areas during the northern pike spawning season. If water levels are adequate at the right time, several benefits will be realized. Primary food organisms will increase as will northern pike and forage fish numbers. Overall condition of the reservoir fishery should improve with increased food production. This improvement will be temporary at best due to normal fluctuations of approximately 15 feet. Suitable spawning substrate will be destroyed after being subjected to annual flooding. Future improvements to the fishery will require a low water year (to allow areas to revegetate), followed by a high water year (to flood established vegetation).

Lake Frances

Walleye are reproducing successfully and have provided quite a significant fishery, particularly during the summer months. Forage fish (yellow perch and small suckers) are thought to be limited and may result in poor growth rates for northern pike and walleye in future years.

During April of 1981, 58 northern pike and 24 walleye were tagged. Tag returns to date amount to 20.7 percent, and 4.2 percent, respectively.

Kokanee salmon planted in the lake in 1979 were not collected in either the spring or fall netting survey. Few salmon are thought to have survived predation by northern pike due to the overall shallowness of the lake (maximum depth - 44 feet).

Pishkun Reservoir

A total of 122 northern pike were tagged during April of 1981. Twenty or 16.4 percent have been harvested by fishermen. In addition, 3 northern pike were caught by anglers that were tagged in 1980, bringing the accumulative harvest to 25.8 percent for 1980. No tag loss has been observed on this group of fish.

Rainbow trout plants were discontinued in the early 1960's after northern pike were illegally introduced. Trout plants were reinstated in 1977 when it was determined the pike population was at low levels. The future of trout plants will depend on the size of the pike population and predation by pike. A population estimate of 447 northern pike (16 inches and larger) was made in 1981 using the Schnabel Method as described by Raunsefell and Everhart (1960) with the final estimate and confidence limits determined by formulas described by Chapman and Overton (1966). The pike population may be increasing slightly as evidenced by the smaller average size of fish taken (20.8) inches) during the spring survey. In past years, larger average size and fewer individuals were present in the population. Little or no predation by pike on trout was noticed.

Natural reproduction of kokanee salmon was again documented by analysis of scales and otoliths. Mature fish in the spawning run were represented by approximately 17 percent three year olds, 49 percent four year olds, (natural reproduction of the 1978 year class in which salmon were not planted), and 34 percent five year olds. Size of mature salmon ranged from 13.2 - 21.0 inches and 0.90 - 2.56 pounds.

Small Lakes and Farm Ponds

A gill net survey in Tunnel Lake on October 15, 1981, captured 8 rainbow trout averaging 10.6 inches and 0.47 pounds. One Yellowstone cutthroat trout (14.7 inches, 1.14 pounds) was also taken. Cutthroat plants were discontinued in 1980 and the lake is now managed with rainbow trout.

Dickens Lake, Ostle Reservoir and Furnell Pond were investigated from the standpoint of improving water levels. Preliminary plans have been made to increase water levels in Dickens Lake by constructing a dirt fill in the overflow area and to install a trickle tube to pass excess water. The spillway of Ostle Reservoir is eroding and it is proposed to close the spillway along with installing a trickle tube and control valve in the dam. Both Dickens and Ostle are on lands owned and administered by the Department. Dickens Lake presently has a rainbow trout fishery and a fishery would be developed in Ostle Reservoir once water levels were improved. Furnell Pond is owned and administered by the U. S. Fish and Wildlife Service. Through a series of dry years, water levels have decreased to a point where the fishery is considered marginal. The Federal agency has been requested to investigate their water rights that supply Furnell Pond in order to improve fish habitat. This pond has been managed with rainbow trout in the past.

A total of 300 black crappie and 30 yellow perch were introduced in Priest Butte Lake. These fish were of various sizes. Additional introductions of these species and possibly largemouth bass will be made when fish become available. A Preliminary Environmental Review (Hill, 1980) was prepared for these introductions.

Spring Meadow Lake is a gravel barrow pit that is fed by ground-water and spring water. The pit was excavated from 1936 to about 1965. The lake has a surface area of about 20 acres, a maximum depth of about 90 feet and a capacity of 553 acre-feet. It has an overflow outlet to Ten Mile Creek.

The Department assumed administration of a 55.8 acre area around the lake in August, 1981. When the lake was under private ownership, it had been stocked with rainbow trout, brook trout, largemouth bass, perch and pumpkinseed. The Department stocked about 1,500 rainbow trout in 1971 when the lake was open to public fishing for a short while.

Survey netting was conducted in the lake in early June, 1981, and the catch is presented in Table 4. No trout were collected or observed. Scales collected from largemouth bass revealed the following growth rates in inches

at the time of capture: Age II-5.9; III-8.0; IV-8.9; V-11.5. These growth rates are slightly faster when compared to other waters east of the Continental Divide in Montana. Larger bass, up to about two pounds, were observed during visual examinations of the lake shoreline.

A large, healthy yellow perch population appears to be present in the lake. Predation may be inhibiting survival of trout reproduction which apparently occurred prior to introduction of perch. Because this lake is close to a large metropolitan area, heavy fishing pressure was anticipated. Fishing regulations were proposed in an attempt to manage the lake to maintain the existing fishery. Creel limits of one bass or trout and unlimited perch were imposed. Future surveys will determine the effectiveness of these regulations.

Table 4. Netting summary from Spring Meadow Lake. June 2, 1981

Net Type	Species	Number	Length Range Inches (Avg.)	Weight Range Pounds (Avg.)
2 Trap	Largemouth bass	22	7.4-11.5(8.5)	0.18-0.82(0.34)
	Yellow Perch	232	7.1-12.5(8.9)	0.16-1.06(0.41)
	Pumpkinseed	1		
1 Gill	Longnose sucker	50	All adult	
	White sucker	4	All adult	

Streams

Species composition was investigated in Blackleaf, Box, Hall, Hyde and Spring Creeks, and the West Fork of the Teton River to update management files (Table 5). The areas sampled on the West Fork of the Teton River were done prior to installation of stream improvement structures constructed by the Forest Service. Future surveys will be conducted to measure the effectiveness of these structures.

Hook and line surveys were conducted on August 11 and 12, 1981 in the North and South Forks of the Sun River. Data was gathered to follow trends of trout populations in relation to the two-fish limit that has been in effect since 1975. As mentioned in a previous report (Hill and Wipperman, 1980), increases and decreases in the size of trout could be a result of normal fluctuations in the population and not be related to the two-fish limit. Data from 1981 shows the average size of rainbow trout in both forks to be increasing slightly from the lows reached in 1979.

Table 5. Streams sampled by electrofishing, 1981

Stream (Location)	Date	Length Sampled	Species[1/]	Number	Length Range	Weight Range
Blackleaf Cr. 26N-9W-13&14	7/22/81	[2/]	None			
Lower Box Cr. 30N-13W-13	9/17/81	75 Ft.	Eb	10	2.8- 8.3	0.02-0.27
			Ct	4	4.7- 7.6	0.05-0.17
			Rb	37	2.1-11.0	0.02-0.52
			RbxCt	4	4.6- 7.0	0.06-0.13
Upper Box Cr. 30N-13W-24	9/18/81	50 Ft.	Ct	1	10.1	0.41
			Eb	28	3.0- 8.5	0.03-0.28
Hall Creek 30N-13W-13	9/17/81	[3/]	Ct	9	1.5- 7.4	
			RbxCt	1	8.0	
Hyde Creek 30N-12W-18	9/18/81	300 Ft.	Eb	14	2.6- 9.5	0.02-0.42
Spring Cr. 24N-4W-30	10/08/81	100 Ft.	Eb	5	4.5- 9.9	0.04-0.36
			Rb	12	7.6-18.3	0.16-2.16
			Sculpins			
			WSu			
			LnDace			
W. Fk. Teton R. 25N-9W-6	7/27/81	800 Ft. [4/]	Eb	1	4.7	
			Ct	11	3.5-13.5	
			Sculpins			

1/ Species abbreviations: Eb-brook trout; Ct-cutthroat trout; Rb-rainbow trout; RbxCt-rainbow-cutthroat hybrid; WSu-white sucker; LnDace-longnose dace.

2/ Stream intermittent, no fish observed.

3/ Fish collected in pools of intermittent stream.

4/ Three areas sampled.

The length range for fish sampled in the forks of the Sun River is presented in Table 6. Also included in the table is a breakdown of age classes for rainbow trout.

Table 6. Length range and age class distribution of trout in the North and South Forks of the Sun River, Aug. 11-12, 1981

Stream	Species[1/]	No. of Fish	Length Range (Inches (Avg.)	Age Class	No. of Fish	Length Range
North Fork Sun River (Aug. 11)	Ct	11	6.8-12.5(9.6)			
	Eb	5	6.0-11.2(8.4)			
	RbxCt	5	7.7-13.2(11.2)			
	Rb	76	5.5-15.5(11.0)	I	5	5.5- 6.8
				II	17	7.4-11.0
				III + older	54	9.3-15.5
South Fork Sun River (Aug. 12)	Ct	2	10.7-13.2(12.0)			
	Eb	2	7.4-10.0(8.7)			
	RbxCt	1	(12.3)			
	Rb	57	8.0-15.3(12.0)	I	0	
				II	8	8.0-11.3
				III + older	49	9.8-15.3

1/ Species abbreviations: Ct-cutthroat trout; Eb-brook trout; RbxCt-rainbow-cutthroat hybrid; Rb-rainbow trout.

Smith River

Trout population estimates were conducted in two river sections in early September, 1981. The estimates are presented in Tables 7 and 8. The trout population estimates are within the range of estimates computed for the past four years. A 100-year flood ravaged the river in May but did not appear to have an overall adverse effect on Age II and older trout. The number of yearling trout in the Zieg Section was about a third lower than expected, but was about normal upstream in the Access Section.

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 governments, county, municipality or other subdivision of the State of Montana. Agencies of the government of the United States voluntarily

Table 7. Trout population estimates from Access Section, Smith River

Species	Age	Length (inches) Range	Average	Number	Weight (Pounds)
Rainbow trout	I	5.3- 9.6	8.2	158	35.54
	II	6.7-11.9	9.9	115	43.69
	III + older	9.7-15.9	12.4	224	161.32
				$497^{+}_{-}92$	$240.55^{+}_{-}52$
Brown trout	I	8.1-10.8	9.5	79	27.16
	II	10.0-15.3	12.7	57	47.56
	III + older	15.0-19.2	17.5	47	93.46
				$183^{+}_{-}73$	$168.18^{+}_{-}67$
Grand total				680	408.73
Standing crop/1,000 feet				65	39.30
Standing crop/acre				57	34.35

Table 8. Trout population estimates from Zieg Section, Smith River, 1981

Species	Age	Length (inches) Range	Average	Number	Weight (Pounds)
Rainbow trout	I	5.7- 8.3	7.1	867	120.01
	II	7.5-10.5	8.9	385	104.13
	III	8.7-13.5	11.0	632	296.34
	IV + older	10.9-15.9	12.4	315	206.73
				$2,199^{+}_{-}360$	$727.21^{+}_{-}135$
Brown trout	I	7.3- 9.0	8.6	88	22.35
	II	9.4-13.6	12.2	98	73.35
	III + older	12.7-23.0	16.0	122	206.27
				$308^{+}_{-}150$	$301.97^{+}_{-}147$
Grand total				2,507	1,029.18
Standing crop/1,000 feet				233	95.73
Standing crop/acre				120	49.17

cooperate with the SPA. 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 157 notices of projects were received in the project area during this report period. Of these, 125 NSLPA notices were received from 9 Conservation Districts and 32 SPA notices were received from 10 county and city governmental agencies and from 4 state and federal government agencies. Details concerning these projects are listed in Table 9.

The primary problem in the administration of both stream preservation acts is the failure of applicants to complete projects as recommended. Most Conservation Districts cooperate by submitting project notices, attending field inspections and issuing permits. Since the passage of NSLPA, the number of private projects involving inadvertent destruction of stream habitat has noticeably declined.

Table 9. Stream habitat preservation activities with the project area. Cascade County.

Project Name or Number	Applicant	Date Received	Name of Water	Inspected Yes	Inspected No	Type of Project (Rip-rap, Etc.)	Recommendations & Comments
Ca-07-81	Art Strain, Jr.	7/28/81	Belt Creek	X		Bank stabilization, rip-rap	Rip-rap or use log cribbing on eroded bank, 800-900 feet.
Ca-08-81 Emergency	Everett Carlson	8/19/81	Smith River		X	Repair of ford	Permit issued on Emergency basis
Ca-09-81	Jacob Parchen Jr.	7/28/81	Belt Creek	X		Bank stabilize, rip-rap	Place heavy rip-rap on bank only. No material removed from channel.
Ca-10-81	Joseph Mudd	7/28/81	Belt Creek	X		Channel Relocation	Flood damage. Relocate stream channel in the dry. Slope bank gently. Rip-rap head end of channel relocation.
Ca-11-81 Emergency	Johnny Marn	8/19/81	Belt Creek		X	Channel clearance and diking	Work done with SCS emergency funding. Severe flood damage.
Ca-12-81	Marilyn McEwen	7/29/81	Belt Creek	X		Channel clearance	Remove log and flood debris. Haul gravel deposits from area.
Ca-13-81	Jim Hasterlick	7/29/81	Belt Creek	X		Rip-rap	No relocation of channel. Fill eroded area with course gravel and use Properly sloped rip-rap.
Ca-14-81	Gladys Sutich	8/19/81	Belt Creek		X	Replace bridge and rip-rap	Permit issued without inspection. Objected through 404 process.
Ca-15-81 Emergency	Darvin Johnson	8/19/81	Belt Creek		X	Channel clearance	Applicant used bulldozer to push gravel out of stream during flood. Replaced his bridge.
Ca-16-81	Thomas Van Tighem	8/19/81	Belt Creek		X	Rip-rap and channel clearance	Permit issued without inspection (inspection in Nov., rip-rap only).
Ca-17-81	Lewis Holzheimer	8/19/81	Belt Creek		X	Replace bridge and rip-rap	Permit issued without inspection. Objected through 404 process.
Ca-18-81 Emergency	Thomas Van Tighem	8/19/81	Belt Creek		X	Channel clearance	Work done with SCS emergency funds during flood to protect cabin.
Ca-19-81	Harold Anderson	8/19/81	Otter Creek	X		Channel clearance bank shaping, rip-rap	Slope eroding banks, rip-rap toe of slopes, seed to grass and willow. Fence to exclude livestock.
Ca-20-81	George Marko	8/31/81	Smith River	X		Rip-rap repair	Remove debris, redistribute remains of rock jetty on eroding bank. Add rip-rap. Off stream dike upstream.

Table 9. Continued. Cascade County.

Project Name or Number	Applicant	Date Received	Name of Water	Inspected Yes	Inspected No	Type of Project (Rip-rap, Etc.)	Recommendations & Comments
Ca-21-81	Stone Paulson, Jr.	8/31/81	Belt Creek	X		Headgate & diking	Pull large gravel bar to form dike & rip-rap with heavy rock. No work in water.
Ca-22-81	Russell Goodman	8/31/81	Belt Creek	X		Bridge	Abutments should not constrict streamflow.
Ca-23-81	Ed Goodman	8/31/81	Belt Creek	X		Headgate & diking	See Ca-21-81.
Ca-24-81	Porter Fender	9/21/81	Belt Creek	X		Repair bridge	Clear out flood debris. Rebuild center pier of bridge. No gravel removal.
Ca-25-81 Violation	Lance Leffel	10/13/81	Andy Creek	X		Channel clearance & enlarge ponds	Construct overflow structures on ponds add rip-rap to streambanks.
Ca-26-81	Dale Schott	9/21/81	Belt Creek	X		Rip-rap	End dump rip-rap into eroding area on dike.
Ca-27-81	George Croff	9/04/81	Belt Creek	X		Channel clearance	Dike bulldozed up in middle of stream channel during flood should be pushed against dry bank and rip-rapped.
Ca-28-81	John Rohrer	9/21/81	Belt Creek	X		Rip-rap	Rip-rap about 200 ft. of bank. Placement with a front end loader across stream because of poor access.
Ca-29-81	Marjorie Richcreek	9/21/81	Belt Creek	X		Channel clearance	Remove large log jamb. Use logs to build up bank & stake down. No dozer activity in stream.
Ca-30-81 Violation	Continental Pipeline Co.	10/21/81	Belt Creek	X		Pipeline exposure repair	Stream bulldozed out & gravel pushed on eroding banks. Company claimed they put rip-rap on under gravel.
Ca-31-81	McIver Ranch	10/21/81	Sun River		X	Irrigation Pump	Not a project.
Ca-32-81	George Nilson	11-25-81	Missouri R.	X		Bank modification	Overflow channel should be closed at river to prior condition or construct flow control structure.
Ca-33-81	Dan Mortag	11/25/81	Smith River	X		Rechanneling	Construct overflow channel through large gravel deposition area. Cable logs to eroding bank.
Ca-34-81	Gilbert Stroop	11/25/81	Belt Creek	X		Channel clearance dike and rip-rap	Construct off stream dike & rip-rap with non-stream bed material.

Table 9. Continued. Cascade County.

Project Name or Number	Applicant	Date Received	Name of Water	Inspected Yes	Inspected No	Type of Project (Rip-rap, Etc.)	Recommendations & Comments
Ca-01-82	Dr. Harlan Lee	1/20/82	Missouri R.	X		Rip-rap	Seek engineering assistance. Project area about 600 ft. May not be needed.
Ca-02-82	Richard Dahlen	1/20/82	Sun River	X		Irrigation pump	Restore bank to conform to natural slope.
Ca-03-82	Thomas Van Tighem	3/08/82	Belt Creek	X		Rip-rap	Apply 150-feet of rip-rap to existing bank. Raise streambank.
Ca-04-82	Charles Steele	3/08/82	Missouri R.	X		Rip-rap	Slope bank 2:1. Rip-rap or use gabion blanket.
Ca-05-82	Ron Marko	3/25/82	Smith River	X		Rip-rap 150 Ft.	Rip-rap about 300 ft. of bank. Do work in the dry.
Ca-06-82	Leo M. Hertz	4/15/82	Belt Creek	X		Restore stream after-the-fact	Work done with SCS emergency funding. Severe flood damage.
Ca-1-82V Violation	Hidden Valley Ranch	6/18/82	Belt Creek	X		Channel clearance	Letter of instruction from C.D. Build up bank and rip-rap 200 feet at upper end of project.
Ca-7-82	James Carlile	6/18/82	Smith River		X	Plug old oxbow channel	Do not replace plug in oxbow on immediate river bank.
Chouteau County:							
CH-1-81	Harris Land & Cattle Company	10/9/81	Highwood Cr.	X		Debris and gravel removal	Restore stream to old channel, shape banks and rip-rap where necessary.
Glacier County:							
GL-1-81	Larry Whitford	9/25/81	Willow Cr. (Reservation)		X	Overflow channel dike	Anchor structure into stable banks, face dike with large rock & seed.
GL-2-81	Continental Pipeline	10/22/81	N. Fk. Cutbank Creek	X		Oil pipeline crossing	Modification - cover line with concret cap. If not possible, cover with large rock.
GL-1-82	BIA - Blackfeet Agency	1/21/82	Birch Creek	X		Channel change	Application revoked by BIA.

Table 9. Continued.

Project Name or Number	Applicant	Date Received	Name of Water	Inspected Yes	Inspected No	Type of Project (Rip-rap, Etc.)	Recommendations & Comments
Lewis & Clark County							
LC-16-81	Frank Gruber	6/18/81	Ten Mile Cr.	X		Channel clearance rip-rap banks	Pull trees from channel, slope and rip-rap existing banks. Applicant bulldozed stream straight after inspection (violation)
LC-17-81	Woods & Greenpole Cr. Landowners	7/01/81	Wolf Creek		X	Bridge	Good plan submitted by applicant. Construct approaches lower than bridge deck.
LC-18-81	Clinton Christianson	7/02/81	Beaver Cr.	X		Replace stream Channel	Add rip-rap to banks near buildings and irrigation structure.
LC-19-81	Green Meadow Country Club	7/26/81	Ten Mile Cr.	X		Channel clearance rebuild bridges restore banks	Do work in fall during low water. Install rip-rap, plant vegetation.
LC-20-81	Chevallier Ranch Co.	7/26/81	Little Prickly Pear Creek		X	Headgate Maintenance	Declared a non-project.
LC-21-81	J.H. Retz	7/26/81	Ten Mile Cr.	X		Store rip-rap rock on bank.	Accepted plan. Applicant later dug out streambed & placed gravel on rip-rap & built a dike (violation)
LC-23-81	Harry Nichols	8/18/81	Ten Mile Cr.	X		Channel clearance repair banks	Remove trash from channel. Fence stream to restore woody vegetation.
LC-25-81	Capital Music	9/15/81	Ten Mile Cr.	X		Bank repair & rip-rap	Approved as planned.
LC-26-81	Reinhold Isaak	9/15/81	Ten Mile Cr.	X		Field cleanup	Do not deposit trash on streambanks.
LC-27-81	Helena Nat'l Forest	9/15/81	Trout Creek		X	Not a 310 Project	
LC-28-81	Helena Nat'l Forest	9/15/81	Trout Creek		X	Not a 310 Project	
LC-30-81	C.W. Smallwood	9/15/81	Ten Mile Cr.	X		Channel clearance Rip-rap	Slope banks and rip-rap. Plant willows and grass. Some work being done before inspection. (Violation).
LC-31-81	George A. Johnson	9/15/81	Missouri R.		X	Suction dredging	Renewal of permit. No dredging in river portion above Hauser Lake.

Table 9. Continued.

Project Name or Number	Applicant	Date Received	Name of Water	Inspected Yes	Inspected No	Type of Project (Rip-rap, Etc.)	Recommendations & Comments
Lewis & Clark County. Cont'd.							
LC-32-81	Yellowstone Pipeline Co.	9/15/81	Big Prickly Pear Creek	X		Lower Pipeline crossing	Rip-rap trench cut to stop head-cutting. Key rock into banks.
LC-34-81	Champion Timberlands	10/21/81	Cadotte Cr.		X	Culvert crossing	Judged a non-project by C.D. because stream goes dry each year.
LC-35-81	Russell Brown	11/19/81	Ten Mile Cr.	X		Repair bridge. Rechannel stream	Redirect flow before repairing eroded area. Place fill and rip-rap.
LC-36-81	Don Burnham	11/19/81	Big Prickly Pear Creek	X		Stream restoration	Replace stream in old channels that were abandoned during flood. Rip-rap to keep stream in place.
LC-37-81	Darrell Himmesoette	11-19-81	Spokane Cr.		X	Irrigation sump	Install to SCS recommendations.
LC- 1-82	Joseph F. Duncan	2/25/82	Park Creek		X	Repair dam	Declared a non-project by C.D. Not a perennial stream.
LC- 2-81	Russell Weingartner	2/25/82	Canyon Cr.	X		Construct irrigation diversion	Restore disturbed area.
LC-3-82	Carl Kantorowicz	3/24/82	Little Prickly Pear Creek	X		Construct headgate	Minimize turbidity & sediment. Construct stream structure so not to impede fish passage.
LC-9-82	Jerry McGinnis	5/20/82	Missouri R.		X	Suction dredge placer mine	Denial - Arbitration hearing - panel denied application.
LC-11-82	Frank Gruber	5/26/82	Ten Mile Cr.			Slope banks	Applicant withdrew application.
LC-12-82	Frank Gruber	5/26/82	Ten Mile Cr.	X		Rip-rap, grass & shrub plantings	Construct to SCS specifications after-the-fact. Plant vegetation and rip-rap.
LC-13-82	Ballard Mining, Inc.	6/20/82	Grizzly Gulch	X		Placer Mine	Not a project, but inspected to determine if problems exist.

Table 9. Continued.

Project Name or Number	Applicant	Date Received	Name of Water	Inspected Yes	Inspected No	Type of Project (Rip-rap, Etc.)	Recommendations & Comments
Liberty County							
LB-1-81	So. Chester Water Users	7/09/81	Marias R.		X	Clean gravel filter bed for pump	Use dragline or backhoe. Dispose waste above high water mark. Declared a non-project by District.
Meagher County:							
Mr-2-81	James Teller	5/07/81	Elk Creek	X		Placer mine; relocate stream	Asked C.D. to deny project. Project was approved. Several stringent recommendations.
Mr-3-81	Harry Foster	6/24/81	Sheep Creek		X	Irrigation diversion Declared non-project	Disagreed with C.D. decision. Commented on project through 404 process.
Mr-4-81	Fred Scott	6/24/81	No. Fork Musselshell R.		X	Replace irrigation Diversion	Declared non-project by C.D. Agreed with decision.
Mr-5-81	Willard Leischer	6/24/81	Little Camas Creek	X		Placer mine	Protect water quality. Smooth over disturbed areas and reseed.
Mr-6-81	John Coleman	8/21/81	Beaver Cr.		X	Placer mine	Protect water quality. Smooth over disturbed areas and reseed.
Mr-7-81	Jim Higgins	8/21/81	Sixteen Mile Creek		X	Replace irrigation diversion. Declared non-project	Commented on project through 404 process.
Mr-8-81	Jack Galt	8/21/81	Rock Creek		X	Flood damage, move stream or original channel	Creek washed through corrals. Work done before C.D. review.
Mr-9-81	James Zelka	8/21/81	Little Camas Creek		X	Placer mine	See Mr-5-81
Mr-10-81	Louise Galt	10/08/81	So. Fork Musselshell R.		X	Declared non-project Replace irrig. Div.	Agreed with decision.

Table 9. Continued.

Project Name or Number	Applicant	Date Received	Name of Water	Inspected Yes	Inspected No	Type of Project (Rip-rap, Etc.)	Recommendations & Comments
Meagher County. Cont'd.							
Mr-11-81	Grande Ranch Co.	12/10/81	So. Fork Musselshell R.	X		Rip-rap	Apply rip-rap to eroding areas. Transplant willow to bank.
Mr-1-82	Jim Higgins	5/12/82	Sixteen Mile Creek		X	Replace irrigation headgate	Commented on project through 404 process.
Mr-2-82	Thomas E. Baker	5/12/82	Beaver Cr.	X		Placer mine	Not on stream. Protect water quality. Reclaim disturbed area.
Mr-3 to 12-82	Mountain Bell	5/21/82	Several Streams	X		Telephone cable crossing	Bury deep as possible, avoid brush disturbance. Follow-up inspection reveal little disturbance to streams.
Mr-13 to 25-82	Mountain Bell	6/11/82	Several Streams	Some		Telephone cable crossings	See recommendations Mr-3 to 12-82.
Pondera County:							
PN-1-81	Kingsbury Ditch Company	6/12/81	Birch Creek	X		Emergency work to get irrigation water	Recommend more premanent solution. Requested assistance from hydrologist.
PN-1 to 7-82	Mountain Bell	6/07/82	Pondera Coulee Spring Cr., Dry Fk Marias R.		X	Telephone cable crossing	Shape disturbed banks and seed.
Teton County:							
TE-1-82	Kenneth Mikesell	3/17/82	Teton River	X		Mine gravel	Approval with stipulations attached from team inspection of 6-3-81
TE-2-82	Teton Cooperative Res. Co.	3/16/82	Teton River	X		Channel clearance rip-rap Off-stream dike	Approve with modifications. Install culverts; Remove gravel from floodplain.
TE-3 to 12-82	Mountain Bell	3/17/82	Several Streams		X	Telephone cable crossings	Reshape disturbed areas and seed.
TE-2-81	Williams Exploration	5/06/81	Spring on Blackleaf Game Range		X	Culvert crossing	Application termed non-project by C.D. Board.

Table 9. Continued.

Project Name or Number	Applicant	Date Received	Name of Water	Inspected Yes	Inspected No	Type of Project (Rip-rap, Etc.)	Recommendations & Comments
Teton County. Cont'd.							
TE-3-81	Williams Exploration	5/06/81	Blackleaf Creek		X	Culvert crossing	Application termed non-project by C.D. Board.
TE-4-81	Williams Exploration	5/06/81	Cow Creek		X	Culvert crossing	Application termed non-project by C.D. Board. Decided it is a Project.
Toole County:							
TL-1-81	Charlie Lincoln		Marias River	X		Channel Change	Deny as proposed. Alternatives recommended.
Governmental - County:							
Bridge 245 Truly	Cascade Co.	7/17/81	Smith River	X		Replace portion of bridge & road, and rip-rap	No equipment in stream - remove debris with dragline.
Bridge 255 Orr	Cascade Co.	7/17/81	Smith River	X		Rip-rap	End-dump and push rip-rap into place under west abutment of bridge.
Bridge 260 Huntsberger	Cascade Co.	7/17/81	Smith River	X		Rebuild bridge	Remove temporary work bridge before high water. Remove gravel under West end of old bridge.
Bridge 2425 Marxer	Cascade Co.	8/14/81	Smith River	X		Rip-rap fill south abutment	No equipment in water.
Belt Cr. Old Highway 89	Cascade Co.	7/17/81	Belt Creek	X		Rip-rap shoulder of road	No equipment in stream.
FAS 331	Cascade Co.	7/17/81	Belt Creek		X	Channel-bank modifications	No action by county.
Bridge 544	Cascade Co.	7/17/81	Willow Cr.	X		Rip-rap of banks and channel	Work done by county without review.
Bridge 568 Johnson	Cascade Co.	7/17/81	Little Belt Creek	X		Channel modification and rip-rap	Move stream channel above bridge in the dry, slope bank & rip-rap. No work in channel below bridge.

Table 9. Continued.

Project Name or Number	Applicant	Date Received	Name of Water	Inspected Yes	Inspected No	Type of Project (Rip-rap, Etc.)	Recommendations & Comments
Governmental-County, Cont'd.							
MM 225-21 Ten Mile Rd. Flood Renov.	Lewis & Clark County	8/18/81	Ten Mile Cr.	X		Repair water line & road. Rip-rap several places	Verbal recommendations, 20-25 places on stream needing repair on road & water line. Keep work clean as possibl
Rock Cr. Bridge	Meagher Co.	7/14/81	Rock Creek	X		Rebuild bridge	No equipment in stream. Work to be completed by Sept. 15.
L-037-01	Lewis & Clark County	9/12/81	Willow Cr.	X		Rebuild bridge	Inspected by B. Hill. Minimize work in stream. Preserve woody vegetation.
Highwood Creek	Chouteau Co.	9/14/81	Highwood Cr.	X		Channel clearance	Remove gravel bar above bridge in the dry. Rip-rap east bank upstream for about 75 feet.
070230 Beaver Cr. Road	Lewis & Clark County	10/08/81	Beaver Cr.	X		Rebuild road & rip-rap	Reviewed by Boland. Minimize dozer activity.
ER-280-(7) 81 Culvert York Road	Lewis & Clark County	12/06/81	Trout Creek	X		Replace flood damaged culvert	Use large arch type culvert. Maintain stream gradient to allow fish passage.
ER 280-1(7) 081 Bridge	Lewis & Clark County	1/11/82	Trout Creek	X		Rebuild bridge	Channel work kept to a minimum. Eliminate excessive rip-rap below bridge.
	Teton County	7/07/81	Muddy Creek	X		Culverts, bank stabilization, construct overflow	Approval. (Modified by County 9/15/81 to replace bridge instead of culverts)
Cities, Towns and Miscellaneous Entities:							
E. Glacier Water Improvement	E. Glacier Water & Sewer Dist.	7/01/81	Midvale & Railroad Creeks		X	Pipeline crossings	Minimize sedimentation. Complete work as rapidly as possible. Reclaim disturbed areas.

Table 9. Continued.

Project Name or Number	Applicant	Date Received	Name of Water	Inspected Yes	Inspected No	Type of Project (Rip-rap, Etc.)	Recommendations & Comments
Cities, Towns and Miscellaneous Entities, Cont'd.							
Flood Damage Repair	Town of Neihart	8/25/81	Belt Creek	X		Channel clearance Rip-rap, repaid waterline	Remove debris, rip-rap bank (dike) behind school. Rock over pipeline crossing.
Gt. Falls, MT. Flood Protection project	Gt. Falls Flood Control Dist.	9/08/81	Sun River	X		Stilling basin on north bank	Reduce length of river bank to be disturbed.
Flood Damage Repair	Town of Belt	11/06/81	Belt Creek	X		Rip-rap	Key in rock properly; no equipment in stream channel.
Dutton Water Supply Protection	Town of Dutton	12/30/81	Teton River		X	Rip-rap 1,000 Ft.	Follow SCS Engineers recommendations.
Governmental - Federal:							
Wolf Cr. Boat Ramp	Fish, Wildlife & Parks	7/10/81	Missouri R.		X	Rip-rap	Rip-rap edge of ramp only.
Cable Line Erosion Repair	Malmstrom AFB	7/10/81	Dry Fork Belt Cr.	X		Rebury cable. Rip-rap	Modify rip-rap design. Prevent unnecessary sedimentation.
Wood Cr. Firewood Access	Lewis & Clark Nat'l Forest	7/16/81	Wood Creek	X		Bridge	Clear span bridge.
Jefferson Cr. Road Flood Repair	Lewis & Clark Nat'l Forest	7/30/81	Jefferson Creek	X		Road fill and rip-rap	Widen stream channel at wash-out. Fill washout with rip-rap.

LITERATURE CITED

Chapman, D. G. and W. S. Overton. 1966. Estimating and Testing Differences Between Population Levels by the Schnabel Estimation Method. J. Wildl. Mgmt. 30(1): 173-180.

Hill, William J. April, 1980. Preliminary Environmental Review. Yellow Perch, Black Crappie and Largemouth Bass Introduction, Priest Butte Lake. Montana Department of Fish, Wildlife and Parks. 4 pp.

Hill, William J. and A. H. Wipperman. 1980. Inventory and Survey of Waters in the Western Half of Region Four. Montana Department of Fish, Wildlife and Parks. Job Progress Report, F-5-R-29, Job I-a.

Rounsefell, George A. and W. Harry Everhart. 1960. Fishing Science, its Methods and Applications. John Wiley & Sons, Inc., New York.

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

Date: January 25, 1983

Table 9. Continued.

Project Name or Number	Applicant	Date Received	Name of Water	Inspected Yes	Inspected No	Type of Project (Rip-rap, Etc.)	Recommendations & Comments
Governmental - Federal, Cont'd.							
Cable Line Erosion Repair	Malmstrom AFB	8/04/81	Dearborn R.		X	Fill and rip-rap	Fill on eroded bank secured from outside the floodplain.
Muddy Cr. gage station	U.S. Geological Survey	8/13/81	Drain M	X		Install Parshall flume	None.
Cable line repair	Malmstrom AFB	8/14/81	Belt Creek	X		Trench & rip-rap	Stockpile trenched material outside live stream channel. Remove debris in area.
Cable line erosion repair	Malmstrom AFB	12/11/81	Smith River	X		Rip-rap 1,000 Ft.	No borrowing of material from stream channel. Use quarry rip-rap.
Green Gulch Timber Sale	Lewis & Clark Nat'l Forest	5/21/82	S. Fk. Teton and Green Gulch	X		Ford crossings	Log hauling restricted until stream flow becomes intermittent.
Benchmark Cr. Bridge	Lewis & Clark Nat'l Forest	5/21/82	Benchmark Creek		X	Repair bridge abutment	Project approved. Work is to be done by hand.
Ford Cr. Bridge	Lewis & Clark Nat'l Forest	6/25/82	Ford Creek	X		Replace bridge	Instream activities allowed July 1 - Sept. 15. Temp. diversions allowed. No streambed gravels. No channel changes. Settling ponds may be needed.

Waters referred to:

14-0320	Blackleaf Creek
14-0460	Box Creek
14-2280	Hall Creek
14-2520	Hyde Creek
14-5760	Spring Creek
14-6480	W. Fork Teton River
14-7080	Bynum Reservoir
14-7320	Eureka Reservoir
14-7440	Lake Frances
14-7450	Furnell Pond
14-8420	Ostle Reservoir
14-8540	Priest Butte Lake
14-9240	Tiber Reservoir (Lake Elwell)
17-6832	Smith River
17-8720	Bean Lake
17-9074	Spring Meadow Lake
17-9136	Holter Lake
17-9330	Newlan Creek Reservoir
20-4400	No. Fork Sun River
20-5600	So. Fork Sun River
20-7130	Dickens Lake
20-7900	Nilan Reservoir
20-7950	Pishkun Reservoir
20-8400	Tunnel 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-31 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, 1981 through June 30, 1982

ABSTRACT

Netting surveys were conducted on 7 large reservoirs and 12 farm ponds located within the study area. Fourteen BLM reservoirs and 10 farm ponds were investigated for fisheries potential. Streambed 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. Survival of fingerling rainbow trout stocked in one section was monitored. Limited sampling was done on Warm Spring Creek and Louse Creek. Erosion transects were measured and photographed along the Lost Fork of the Judith River. A summary of 10 stream habitat preservation projects is included. Flow requirements for maintaining aquatic life in Big Spring Creek using the WETP method were determined.

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 and walleye in seven reservoirs and twelve farm ponds. This work was done and the findings are included.

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

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

4. To determine survival of fingerling rainbow trout stocked in a section of Big Spring Creek. This work was done.

5. To determine the effects of land management practices on stream habitat along the Lost Fork of the Judith River. This work was done.

6. To determine the status of the smallmouth bass population in portions of Warm Spring Creek. This work was done and the findings are included.

7. To take necessary action to protect stream habitat from hydraulic construction projects sponsored by government and private concerns. This work was done and the results are included.

8. To determine flow requirements for maintaining aquatic life in Big Spring Creek. Data collection for this objective was done during the time period covered by F-5-R-30 but the data and recommendations are included in this report.

PROCEDURES

Fish were sampled with sinking and floating nylon gill nets 125 foot by 6 foot (with graduated mesh sizes from 3/4- to 2-inch); 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). Erosion and habitat changes were measured from established transects and photo points. Information gathered was compared to data from prior years to determine rates of bank erosion. Recruitment to the trout population was studied by stocking adipose clipped fingerlings into a section of stream followed by electrofishing to determine survival to yearling-age. Determining flow requirements for maintaining aquatic life in Big Spring Creek was done through correlating discharge measurements with stream cross-section measurements by using the wetted perimeter computer program (WETP) (Nelson 1980).

ACCOMPLISHMENTS

Large Reservoirs

Six of the seven larger Department of Natural Resources reservoirs located within the study area were sampled during 1981 and 1982. The results

of the work are given in Table 1. Smith River Reservoir was sampled but two nets were stolen before biological information could be obtained from the catch. A short narrative summary of findings on each of the other six reservoirs follows.

Ackley Lake - Netting surveys conducted during 1981 and 1982 showed suckers are very abundant in the reservoir. Kokanee made up the majority of the game fish in the surveys and contribute heavily to the creel as anglers have shifted their efforts towards harvesting this species. Few kokanee are harvested in the fall during spawning because of the fishermen's inability to locate fish concentrations. Lack of water clarity and significant inflow appear to be the major problems.

Bair Reservoir - Rainbow trout sampled from the lake are small and growth rates are below average. Only one brown trout from an introduction made in 1980 was taken, indicating a near failure for that plant. The reservoir still needs a predator fish capable of feeding on suckers.

Martinsdale Reservoir - Rainbow trout survival and growth remain good and the reservoir continues to receive very heavy recreational use.

Petrolia Reservoir - Rainbow trout introduced in 1981 have shown good growth and survival following draining of the reservoir in late 1980. Netting indicates the buildup of carp and suckers has been quite slow up to this time.

War Horse Reservoir - Netting conducted during 1982 failed to take any desirable species of fish. No yellow perch introduced in 1980 were caught.

Yellow Water Reservoir - Yellow Water continues to be one of the most heavily used waters in the area. Growth rates for rainbow trout are well above the average for other waters in the area. Carp, which first showed up in 1981, continued to increase and its only a matter of time until they take over the lake.

Farm Ponds

Twelve farm ponds and small reservoirs stocked by the Department were netted during the report period and the results are given in Table 2. Fourteen BLM reservoirs and ten private ponds were checked to determine their fisheries potential. Fish were introduced into several of these new ponds. A number of the ponds along the northern and eastern portions of the project area were dry or had water levels so low following several years of drought that the fish populations were lost. An abundance of moisture during the spring of 1982 filled nearly all the area's ponds and reservoirs, many for the first time in three or four years. Perch and bass were planted back into a number of ponds where they had previously been introduced, and into several new reservoirs.

Table 1. Summary of netting data from large lakes and reservoirs, 1981-82

Location (Date Sampled)	Surface Acres	No. & Type of Net	Species	No. of Fish	Length Range Inches (Average)	Weight Range Pounds (Average)
Ackley Lake						
(Oct. 21-22, 1981	247	2 Gill	KOK	88	6.0-16.4(14.6)	0.06-1.47(1.11)
			Rb	27	8.0-13.0(10.2)	0.19-0.80(0.44)
			Wf	1	12.5	0.64
			LL	1	15.1	1.38
			CSu	38	--	--
			FSu	18	--	--
(May 16-17, 1982)		2 Gill	KOK	53	6.6-15.7(10.5)	0.07-1.15(0.44)
			Rb	16	9.4-12.5(10.7)	0.28-0.70(0.45)
			CSu	76	--	--
			FSu	23	--	--
		1 Trap	CSu	501	--	--
			FSu	226	--	--
Bair Reservoir						
(Sept. 16-17, 1981)	272	2 Gill	Rb	50	6.1-11.5(9.4)	0.10-0.50(0.32)
			Eb	3	8.2-10.4(8.9)	0.20-0.32(0.24)
			LL	1	6.6	0.12
			CSu	266	--	--
Martinsdale Res.	1000					
(Sept.17-18, 1981)		2 Gill	Rb	46	8.7-15.8(10.3)	0.26-1.54(0.47)
			LL	2	14.7-17.0(15.8)	1.10-1.59(1.34)
			Wf	1	15.9	2.00
			CSu	26	--	--
			FSu	1	--	--
Petrolia Res.	515					
(Nov. 1-2, 1981)		2 Gill	Rb	24	8.0-10.1(9.2)	0.24-0.42(0.33)
			WE	2	15.1-19.0(17.0)	1.50-2.68(2.09)
			CSu	16	--	--
			FSu	1	--	--
War Horse Res.	1000					
(May 3-11, 1982		2 Trap	CSu	524	--	--
			Carp	141	--	--
Yellow Water Res.	600					
		2 Gill	Rb	21	13.0-14.5(13.8)	1.00-1.62(1.35)
			CSu	106	--	--
		2 Trap	Bullhead	1	12.5	1.35
			CSu	95	--	--
			Carp	11	--	--

Species Abbreviations: Rb-rainbow trout; LL-brown trout; Eb-brook trout; Wf-mountain whitefish; KOK-kokanee; CSu-white sucker; FSu-longnose sucker; WE-walleye

Table 2. Results of sampling ponds and reservoirs, 1981-1982

Pond (Year)	No. of Nets	Species	No. of Fish	Length Range Inches (Average)	Weight Range Pounds (Average)
Benes Pond (1982)	1	0	0	--	--
Berg Res. (1981)	1	Rb	36	6.2-15.7(11.3)	0.09-1.48(0.67)
		Eb	6	9.2-12.8(11.0)	0.30-0.78(0.58)
Box Elder Res.(1981)	1	Rb	10	8.3-10.5(9.6)	0.22-0.44(0.34)
Buffalo Wallow (Upper) (1982)		Rb	4	12.8-20.9(17.2)	1.22-4.60(2.79)
Buffalo Wallow (Lower) (1982)	1	0	0	--	--
Carters Pond (Lower)	1	0	0	--	--
Catfish Res. (1982)	1	0	0	--	--
East Fk. Res. (1981)	2	Rb	4	7.0- 8.3(7.6)	0.08-0.19(0.14)
		CSu	32	--	--
		FSu	10	--	--
Hanson Cr. Res(1982)	1	Rb	4	6.5-12.1(10.3)	0.10-0.63(0.45)
		COT	4	--	--
Holland Res. (1982)	1	0	0	--	--
Johnston Res. (1982)	1	0	0	--	--
Wolf Coulee Res. (1982)	1	LMB	2	14.8-15.0(14.9)	1.66-1.92(1.79)

Species abbreviations: Rb-rainbow trout; Eb-brook trout; CSu-white sucker; FSu-longnose sucker; LMB-largemouth bass; COT-mottled sculpin.

Streams

Big Spring Creek - Flows in Big Spring Creek during the report period were about normal during the first few months of 1982, although mountain snow pack was below normal. Heavy snow and rain during April, May and June brought precipitation totals above average in most areas. Watershed dams filled and Big Spring Creek ran bank full for several weeks. Erosion rates and habitat destruction in the upper watershed were not too severe because below average flows for several years had allowed vegetation in the riparian

zone to heal and federally funded (216) projects protected other areas. Erosion rates and habitat destruction downstream from Lewistown were more pronounced. High flows coupled with old channel alterations and unstable banks contributed to the problem.

Erosion and other naturally occurring stream channel stabilization processes are still very evident throughout much of the Tresch-County Farm properties in spite of the extensive "216" projects completed in 1977. Bedload movements and severe erosion around the ends of rip-rap sections continues even at normal and below normal stream flows. Erosion and sedimentation problems increase in severity as one proceeds downstream from Lewistown. Habitat changes were monitored and documented with photos and measurements. The photos are used to update the 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 1981 (4708) was less than half the total number collected in 1980 (9488). This reduction is probably the result of scouring action from extended high stream that occurred in 1981. It appears that there is an inverse relationship between stream discharge and invertebrate populations for that year. It appears that the flushing and scouring action of extended high flows is the primary limiting factor for invertebrate populations in Big Spring Creek.

Trout population estimates were made in two sections of Big Spring Creek during the fall of 1981. The results of population estimates for 1980 and 1981 are summarized in Table 4.

Because of a gradual decline in the rainbow trout population in Section B, a study was initiated in 1979 to determine if the problem was related to spawning success and recruitment. Twenty thousand 4-6 inch rainbow trout were dye marked and planted in and near the section in 1979. Mark retention proved to be a major problem with the study, so an additional twenty thousand 4-6 inch rainbow trout with the adipose fin clipped were planted in the study section during July of 1981. Fin clipped fish should be much easier to identify when making subsequent electrofishing trips over the next several years of the study.

Rainbow trout estimates were up considerably in Section B when compared to 1980 estimates but the 1981 estimates are made up primarily of hatchery fish from age group I (94%). The number of fish from the estimates in age group II and III are about the same for both years. As in 1980, we again saw a significant increase in the number of fish in age group III over the previous years estimates, indicating possible movement of fish from other areas of the stream into the section. The number of fish IV and older declined 57% from 1980 to 1981, indicating that these older fish are possibly being harvested by fishermen. Recruitment into the population of hatchery fish from the 1979 plant appears to be low.

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 July 30 and 31

Organism	Hatchery	East Fork	Burleigh's	Montana Power	St. Leo's School	Above Sewer	Below Sewer	Trestle	Spring Cr. Colony
Trichoptera									
Brachycentridae	78	1	425	272	85	71	128	50	
Leptoceridae	15		94	44	15	33	5	3	1
Rhyacophilidae	205	3	76	89	87	14	28	51	8
Hydropsychidae				2	1	5	4	19	21
Hydroptilidae		20	4	15	181	118	1	28	
Psychomyidae						3			
Helicopsychidae								3	
Amphipoda									
Gammaridae							1		
Gastropoda									
Physidae	18				7			6	
Planorbidae	7	1		1				1	
Diptera									
Tipulidae	7		4	17	69	12	5	7	2
Tendipedidae	18	9	25	36	253	60	101	80	7
Rhagionidae	1	2							
Empididae			1	1	4				
Simuliidae	7	61	1	104	4	120	48	6	16
Tabanidae								2	
Tricladida									
Planariidae						2			
Ephemeroptera									
Baetidae	16	85	21	54	20	75	36	288	324
Heptageniidae		6	5	3	1	2	1	8	6

Table 3. Continued.

Organisms	Hatchery	East Fork	Burleigh's	Montana Power	St. Leo's School	Above Sewer	Below Sewer	Trestle	Spring Cr. Colony
Plecoptera									
Perlodidae			2					4	
Perlidae					1				
Chloroperlidae			1						
Annelidae									
Oligochaeta	4				5		1		
Pelecypoda									
Sphaeriidae		2							
Coleoptera									
Elmidae		2	2	5	58	4	7	21	
Hydracarina	1	2		7	156	16	4		12
Station Totals	377	194	661	650	947	535	370	577	397
Org. No./Sq. Foot	189	97	331	325	474	268	185	289	199
No. of Families	12	12	13	14	16	14	14	16	9

Table 4. Summary of trout population estimates for Big Spring Creek, late August, 1980 and 1981

Section	Year	Rainbow Trout		Brown Trout	
		No.	Weight (lbs.)	No.	Weight (lbs.)
B	1980	495	382	95	178
B	1981	5598	787	73	166
D	1980	1577	1099	559	449
D	1981	2311	1071	438	386

Section	(Year)	Rainbow Trout Age Group	No.	Size Range	Brown Trout Age Group	No.	Size Range
B	1980	I	84	5.8-12.4	III	7	14.3-15.7
		II	147	10.5-12.8	IV	35	15.0-17.0
		III	196	12.2-13.7	V + older	53	16.4-19.5
		IV + older	68	13.4-16.5			
D	1980	I	662	5.0-10.0	I	208	5.0-11.0
		II	159	9.8-12.4	II	201	9.8-13.9
		III	366	11.8-14.4	III	63	13.8-15.4
		IV + older	390	13.5-17.6	IV + older	87	15.1-19.6
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			
		IV + older	29	14.5-16.8			
D	1981	I	1343	5.0-10.1	I	14	5.5- 9.4
		II	449	9.6-12.8	II	173	9.5-12.8
		III	259	12.6-14.9	III	112	12.2-14.9
		IV + older	259	14.3-18.1	IV + older	111	14.1-24.0

Brown trout numbers declined by 25% between 1980 and 1981 but the total number of fish involved is rather small (24). No young-of-the-year or yearling brown trout were taken, indicating continuing problems with spawning success and recruitment within this section of stream.

Rainbow and brown trout population estimates in Section D were up 47% and down 22%, respectively, when compared to 1980 figures. Total weight estimates for rainbow trout declined slightly indicating a decline in the average size of the rainbows in the section. This also appears in the age structure of the population, with major increases in age group I (101%) and II (182%) and declines in age group III (29%) and IV and older (33%). Harvest is considered to be relatively light within this section, so movement probably accounts for much of this change. Most of the decline in brown trout numbers is from age group I, indicating poor recruitment from the 1979 fall spawning season. The combined total trout population estimates within this section is the highest it has been since the project was initiated.

Warm Spring Creek - A two and one half mile section of Warm Spring Creek was electrofished in August, 1981 as part of a continuing study to inventory and sample water located within the project area. Table 5 summarizes the findings of this survey. The primary purpose of this project was to check on the success of three smallmouth bass introductions into the stream. Fishermen regularly reported taking the species from several locations along the stream. No smallmouth bass were sampled within the section but plans for 1982 include additional electrofishing further upstream where habitat is much more stable and appears to be better suited for the species. A number of small rainbow trout were sampled, leading to the theory that some successful natural reproduction may be occurring within the stream. A few larger brown trout were sampled. The complete absence of small brown trout indicates that adult fish are probably moving up into Warm Spring Creek from the Judith River.

Table 5. Summary of electrofishing results from a section of Warm Spring Creek, August 26, 1981

Barney'section (2½ Miles)			
Salmonid Species	Number	Length Range (Average)	Weight Range (Average)
Rb	139	3.9-12.7(8.0)	0.03-0.73(0.24)
LL	6	14.5-19.7(16.8)	1.21-2.95(1.80)

Louse Creek - A short section of stream on Louse Creek was electrofished. This work is part of a continuing study to inventory and sample waters located within the project area. Sampling captured 26 brook trout ranging in length from 5.0 to 11.0 inches in length.

Lost Fork - Erosion transects were measured along the Lost Fork of the Judith River during 1982 and photos were taken at established photo points. Bank erosion at all three transect locations was insignificant.

Stream Habitat Preservation Activities

During fiscal year 1981, ten "310" projects were inspected and processed. A summary of these activities is given in Table 6.

Aquatic Life Flow Requirements

To determine flow requirments for maintaining aquatic life in Big Spring Creek was an objective in Job Progress Report F-5-R-30, Job I-b. Computer data was not received in time to include the findings in that report. The data was analyzed and is included in this report.

The Montana Department of Fish, Wildlife and Parks under provisions of an act passed by the 1969 Montana Legislature, filed for instream water rights for the purposes of maintaining aquatic life in the 31-mile length of Big Spring Creek from the mouth to the State Fish Hatchery. The DFWP filed on December 21, 1970 for the amounts following:

	C.F.S.
Reach 1 - Mouth to Mouth of Cottonwood Creek	150
Reach 2 - Mouth of Cottonwood Creek to State Fish Hatchery	120

Much of Big Spring Creek is classified as a high priority fishery resource in recognition of its high recreational values. Big Spring Creek is the largest spring fed stream in Montana and the stable year round flows have contributed greatly to the excellent fishery. For its size, the stream is rated as one of Montana's finest fishing waters.

Recent advances in the development of instream flow methodologies and river electrofishing techniques have enabled the DFWP to more accurately define those flows needed to maintain the high quality trout fishery of Big Spring Creek at the existing level. The wetted perimeter inflection point method (WETP) was applied to two riffle areas along the stream, one section immediately downstream from the mouth of Cottonwood Creek (T16N, R17E, Sec. 28) and one section upstream from Lewistown (T15N, R18E, Sec. 25).

In the section below Cottonwood Creek, the WETP program was calibrated to field data collected at flows of 159, 385 and 564 cfs. The inflection

Table 6. Summary of stream habitat preservation activities for fiscal year 1981

Project Name or No.	Applicant	Date Received	Name of Water	Inspected Yes	Inspected No	Type of Project	Recommendations
FR-2-81	Julius R. Tresch	9/14/81	Big Spring Cr.	X		Rip-rap stream	Use clean rock rip-rap
FR-3-81	Bernard Grenaux	9/14/81	Warm Spring Cr.	X		Rip-rap; install concrete box for irrigation pump station	Project should be done to SCS standards; use clean quarry rock for rip-rap
FR-1-82	Lloyd Bowen	1/05/82	East Fork Big Spring Creek	X		Install prefabricated check to divert water into irrigation ditch	Provision should be made for fish passage; project should be built to SCS standards
FR-2/82	Julius R. Tresch	3/01/82	Big Spring Cr.	X		Bank shaping; rip-rap; rock diversion	Project should be designed to SCS standards & specifications; Use clean quarry rock
FR-3-82	D.N.McKinlay	3/28/82	Big Spring Cr.	X		Rip-rap project	Approved if applicant can get an SCS approved project design for permanent placement of rip-rap
FR-4-82	Mountain States Telephone	4/14/82	Numerous streams	X		Stream crossings with buried telephone cable	Make crossings on bridges where-ever possible
FR-5-82	Burlington Northern R.R.	6/01/82	East Fork Big Spring Creek	X		Rip-rap streambank	Use clean quarry rock for rip-rap
FR-6-82	Fuel Resources Development Corp.	9/12/82	Missouri River	X		Gas pipeline crossing of river	Work to be done during low flow period (Sept-Oct); line should be buried as deep as possible, particularly on both banks
JB-3-81	Keith Whitfield	11/03/81	Coyote Creek	X		Level land in old creek channel; alter creek channel entrance	Project should be done to SCS standards; existing channel should not be shortened
JB-1-82	Henry Wertheimer	4/25/82	Judith River		X	Debris removal	Minimize work in channel; remove material so it won't end up back in channel

point of the wetted perimeter-discharge relationship (Figure 1) occurs at a flow of about 110 cfs. The inflection point shows up at the same flow on a riffle composite curve and on a riffle-run-hole composite curve.

The WETP program was calibrated to field data collected at flows of 131, 217 and 314 cfs in the section above Lewistown. The inflection points on the wetted perimeter-discharge relationship (Figure 2) occurs at a flow of about 110 cfs.

The WETP method revealed that a flow of 110 cfs year round is needed to maintain the high quality wild trout fishery at the existing level. This 110 cfs flow represents the base flow of record measured below the Big Spring plus the average flows of Castle Creek and Hanson Creek, both small tributaries. Additional water flowing into Big Spring Creek from the East Fork of Big Spring Creek and from other tributaries nearly doubles the flow recorded near the Big Spring.

The final claim amounts to 79,617 acre-feet of water per year or about 56 percent of the annual flow that was recorded below the mouth of Cottonwood Creek in 1968. This final claim amounts to a net reduction of 36,190 acre-feet from the original instream filing made on December 21, 1970.

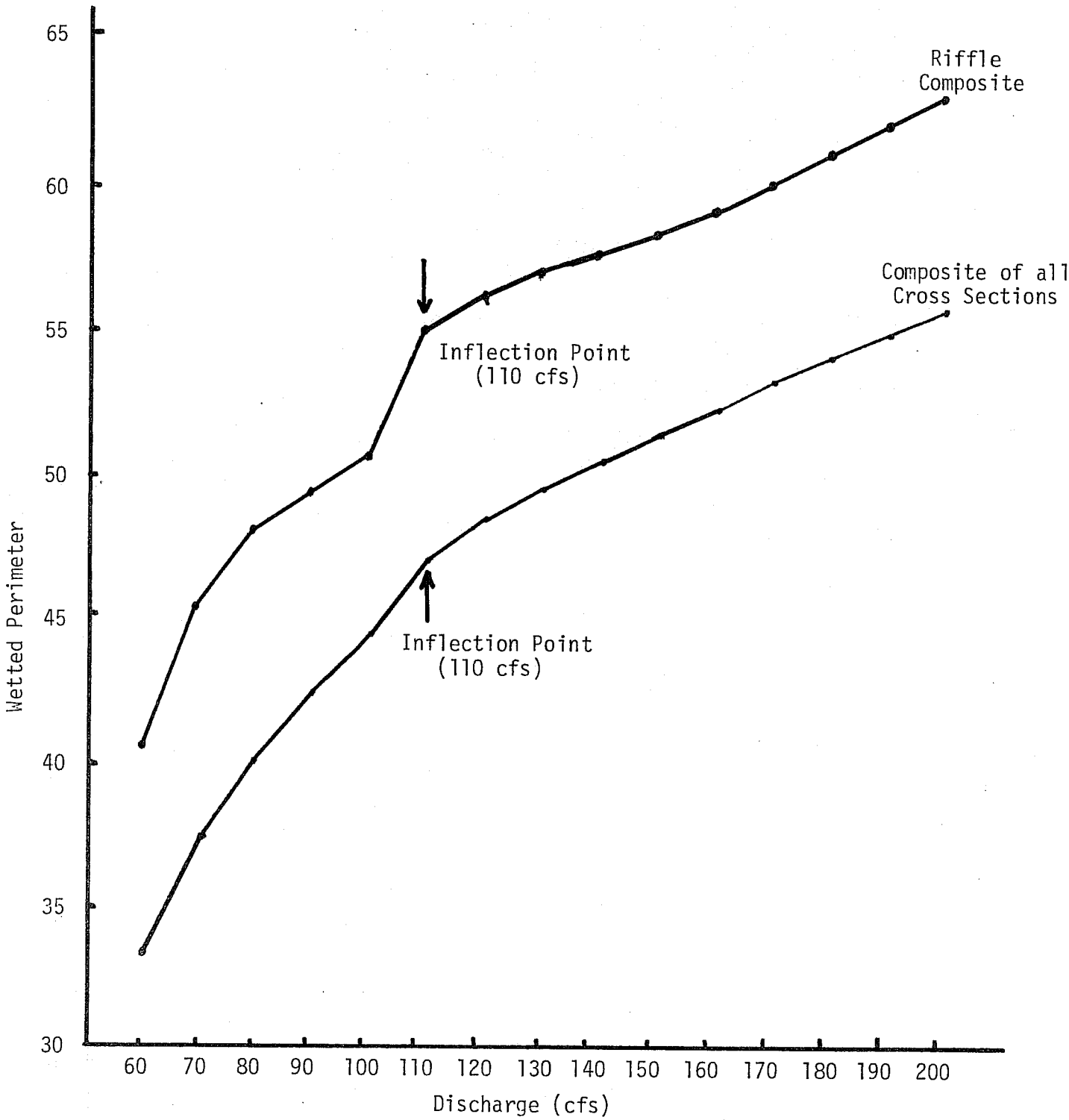

Figure 1. Wetted Perimeter-discharge relationship for Big Spring Creek below Mouth of Cottonwood Creek (T16N, R17E, S28)

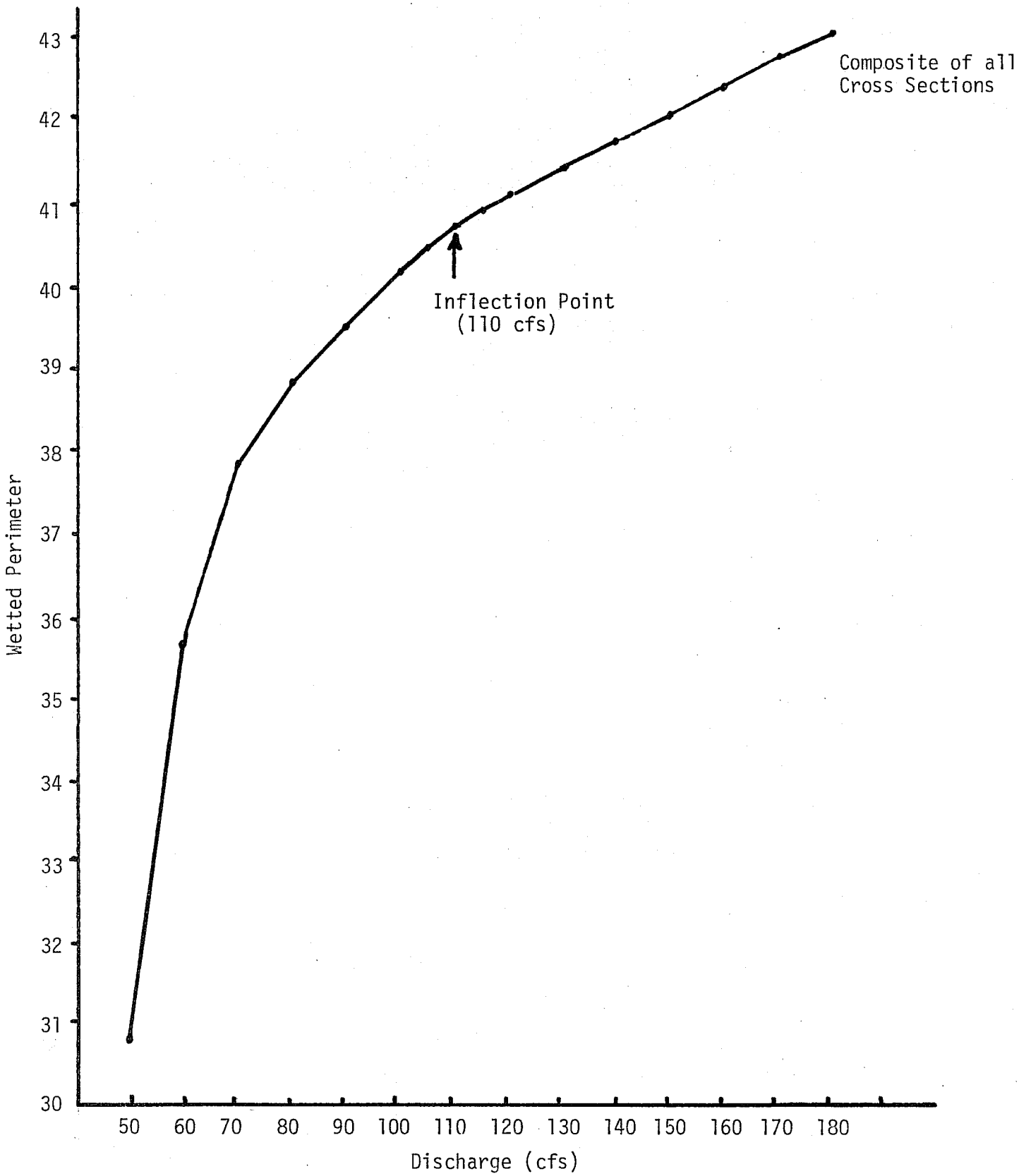

Figure 2. Wetted Perimeter-discharge relationship for Big Spring Creek above Lewistown (T15N, R18E, S25)

LITERATURE CITED

Nelson, F.A. 1980. Guidelines for using the Wetted Perimeter (WETP) Computer Program of the Montana Department of Fish, Wildlife and Parks. Montana Department of Fish, Wildlife and Parks, 8695 Huffine Lane, Bozeman, MT 59715. 12 pp.

Vincent, Richard. 1971. River Electrofishing and Fish Population Estimates. Progressive Fish-Culturist, Volume 33, No. 3. pp. 163-169.

Vincent, Richard. 1974. Addendum to River Electrofishing and Fish Population Estimates, Progressive Fish-Culturist, Volume 36, No. 3, pp. 182.

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Code Numbers of Waters referred to in this report are:

16-0300	Big Spring Creek Sec. 01
16-0310	Big Spring Creek Sec. 02
16-2140	Lost Fork Judith River
16-2160	Louse Creek
16-3920	Warm Spring Creek
16-4300	Ackley Lake
16-4463	Benes Reservoir
16-6420	Carters Pond (Lower)
16-4950	East Fork Spring Creek Reservoir
16-5535	Hanson Creek Reservoir
17-9616	Smith River Reservoir
18-7180	Berg Reservoir
18-7220	Box Elder Reservoir
18-7340	Buffalo Wallow Reservoir (Upper)
18-7341	Buffalo Wallow Reservoir (Lower)
18-7395	Catfish 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

Key Words:

Rainbow trout - age - growth
Brown trout - age - growth
Trout - population dynamics
Invertebrate survey
Instream flow needs

Region Four Index:

Introduction - smallmouth bass
Introduction - carp