MONTANA DEPARTMENT OF FISH AND GAME
ENVIRONMENT AND INFORMATION DIVISION

JOB PROGRESS REPORT
RESEARCH PROJECT STATEMENT

State: Montana Title: Middle Missouri River

Project No.: FW-3-R-4 Planning Project

Job No.: I-a Fisheries

Period Covered: October 1, 1975 through June 30, 1976

ABSTRACT

Field inventory of the aquatic resources and factors influencing the resources will be the basis for an aquatic resource management plan for the middle Missouri River. The study area consists of a 184-mile reach of the mainstem of the river in northcentral Montana from Morony Dam to Robinson Bridge. The project was initiated October 1, 1975.

Forty-nine species representing 14 families of fish are known to occur in the middle Missouri River drainage. Fish populations were surveyed in three study areas during spring 1976. Experimental gill net and frame trap sampling produced a total catch of 324 fish representing 18 species in the Fort Benton section, 651 fish representing 16 species in the Loma ferry section and 180 fish representing 17 species in the Marias River section. Forage fish samples were collected by drag seines and mobile electrofishing apparatus.

Water temperature monitoring stations were established on the Missouri River at Fort Benton, Coal Banks Landing and Robinson Bridge. Aquatic macroinvertebrate sampling was initiated at Morony Dam, Fort Benton, Coal Banks Landing, Judith Landing and Robinson Bridge.

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 middle Missouri River in Montana supports a significant fishery and basic inventory data on the aquatic resources of this area are lacking.

The aquatic resources of Montana are becoming increasingly threatened by an expanding population. Not only is more recreational use being placed on the resources, but human activities are encroaching on the aquatic habitat at an alarming rate. Man's activities on the floodplain, streambanks and headwaters have altered many of our streams beyond the point at which they can naturally adjust.

Because of the increasing human demand for Montana's limited water supplies for industrial, agricultural and domestic uses, the prospect for water resource development plans on streams such as the middle Missouri River in Montana appears likely. Projects which remove or impound substantial amounts of streamflow will undoubtedly alter the existing flow regimens and associated aquatic communities. Unless basic inventory data are collected and present and future problems are identified, little can be done to evaluate conflicting resource demands and minimize adverse impacts on the aquatic resource.

OBJECTIVES

The long-range objective of the study is to follow the inventory procedures developed on the Smith River (Wipperman 1973) and the upper Yellowstone-Shields River (Berg 1975) drainages to prepare recommendations for aquatic resource management on the middle Missouri River. Basic inventory data will be collected from the middle Missouri River to formulate the plan. Physical, chemical and biological characteristics of the waters of importance, or potential importance, to the recreational fishery of the study area will be determined. Immediate and future problems affecting the aquatic resource will be identified, and some recommendations to alleviate the problems will be proposed. The study was initiated on October 1, 1975.

DESCRIPTION OF THE STUDY AREA

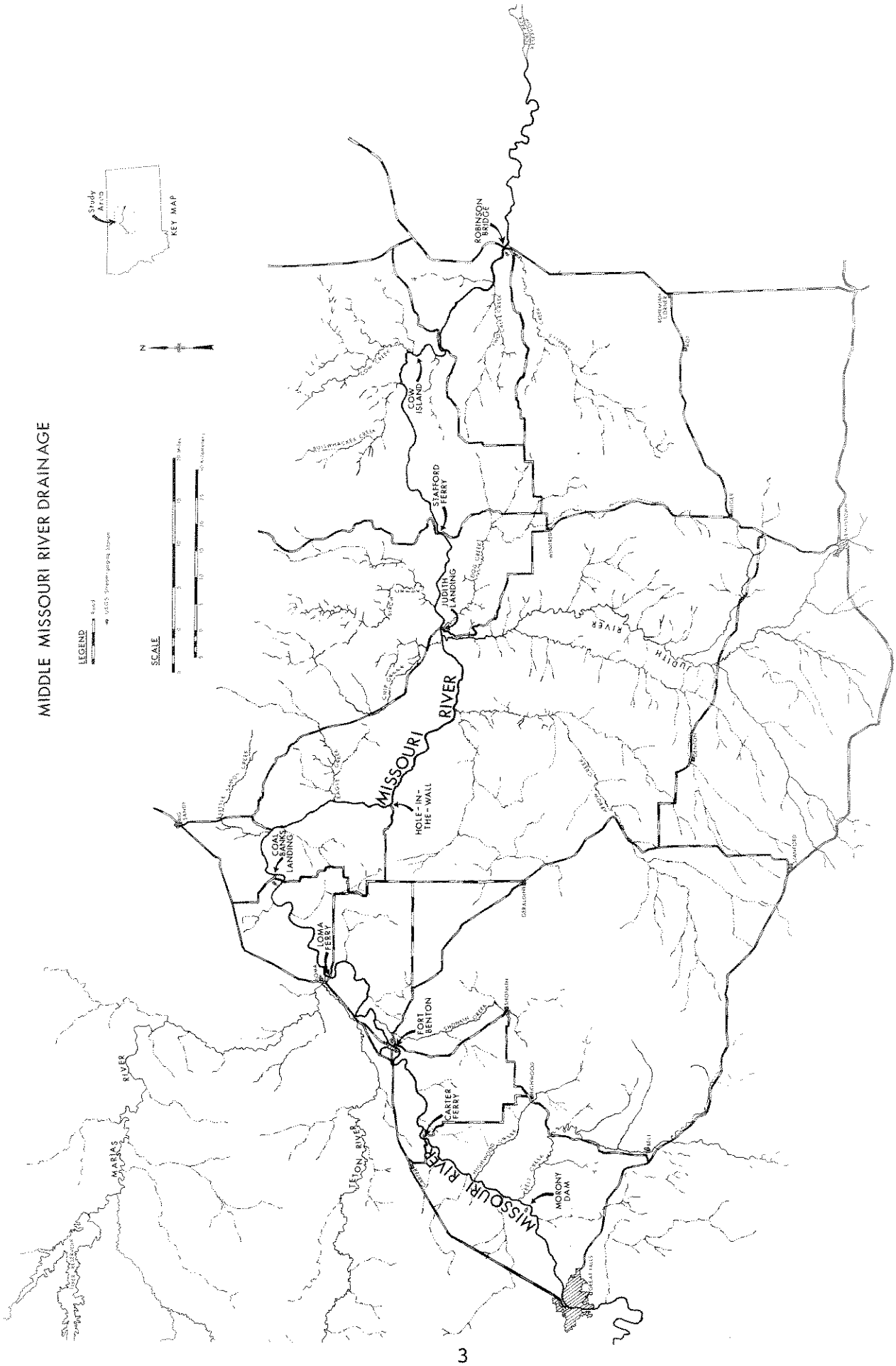
The study area consists of a 184-mile reach of the mainstem of the middle Missouri River in northcentral Montana from Morony Dam near Great Falls, Montana, to Fred Robinson Bridge near Landusky, Montana (Figure 1). The Missouri River forms at the confluence of the Gallatin, Jefferson, and Madison rivers near Three Forks in southwestern Montana. It drains the greater part of the eastern slopes of the Rocky Mountains in the state before entering the study area at Morony Dam.

The Missouri is the nation's longest river. The 184-mile reach covered by this study represents the last major free-flowing portion of the entire 2475-mile-long river. From Three Forks to Great Falls, the Missouri is characterized by several dams and intensive bottomland cultivation. From Fort Peck to its junction with the Mississippi, the river has been heavily engineered with channel pilings, flood walls, dams and reservoirs which have impaired the river's natural values.

The land contiguous to the Missouri River in the study area has retained most of its primitive characteristics. It consists primarily of rolling plains, interrupted at considerable distances from the river by isolated areas of mountain uplift (Missouri River Joint Study 1963). The gorge-like river valley, which lies 500 to 1000 feet below the average elevation of the adjacent upland plains, is comprised largely of spectacular, varied and highly scenic badlands and breaks areas ranging from 2 to 10 miles in width.

Because of its extraordinary historical, recreational, scenic and natural values, a 149-mile segment of the Missouri River in the study area

Figure 1. Map of middle Missouri River drainage in Montana.



from Fort Benton to Robinson Bridge has been designated as part of the National Wild and Scenic Rivers System (U. S. Congress 1975a). This inclusion, signed into law on October 13, 1976, affords considerable protection for the last major free-flowing portion of the Missouri River. Under provisions of the legislation, no dams may be built on any of the protected waters and specific protective regulations would be imposed on any new commercial development in designated areas surrounding the protected waters (U. S. Congress 1975b). The law does allow minor diversion and pumping of water from the protected area for agricultural uses. Private landowners in the area can continue with traditional grazing, farming, recreational and residential uses.

The Marias River from the north, including its tributary the Teton River, and the Judith River from the south are the principal tributaries entering the Missouri River in the study area. Other tributary drainages entering the Missouri River from the north in the study area include Little Sandy, Eagle, Chip, Birch, Bullwhacker and Cow creeks. Belt, Highwood, Shonkin, Arrow, Dog, Two Calf, and Armells creeks enter from the south.

TECHNIQUES AND EQUIPMENT DEVELOPMENT

Water Temperature

Thirty-day continuous recording thermographs were used to monitor water temperature regimes. The recorder box was positioned on the streambank as far above the high water mark as possible. A thermocouple lead, varying in length from 25 to 50 feet, was extended into the water through flexible plastic sewer pipe.

Macroinvertebrates

Aquatic macroinvertebrate samples were taken using a rectangular framed, conical net kick sampler with fine mesh (300 micron) pores. The net was positioned on the streambottom so that the current flowed into it. Macroinvertebrates were washed into the net by an operator standing in front of the net kicking downwards into the substrate. A variety of habitat types (gravel, sand, mud, submerged vegetation, etc.) were sampled at each station to obtain a representative sample. Samples were transferred to jars with watertight lids and preserved with 70 percent isopropyl alcohol.

Kick sampling by this technique ensures collection of most of the macroinvertebrate genera (Newell 1975). Data gathered from kick samples can be used in diversity calculations, percent composition and comparisons between stations.

Fish Populations

The middle Missouri River is a substantially larger stream than the Smith or upper Yellowstone River drainages where the previous inventory and planning investigations were conducted. The Missouri has a greater diversity of aquatic habitat types and a larger variety of fish species. Natural turbidity, deep water and deceptive current velocities present problems for survey operations in many areas.

Because of these problems, many of the fish population sampling procedures developed during the previous inventory and planning studies cannot be used on the Missouri River. A basic objective of this study is to become familiar with proven sampling methods on large rivers and develop sampling equipment and techniques adaptable to the Missouri River. The following sections describe fishery sampling gear and methods which were tested and utilized during this report period.

Frame Traps

Fish populations were sampled in some areas with 3-foot high by 4-foot long frame traps. The traps were constructed from 1-inch square mesh chicken wire and 1/2-inch diameter reinforcing rod material. Similar traps had been used successfully by Posewitz (1963) to capture fish in the middle Missouri River and the lower reaches of its tributaries.

In areas of the river with any significant amount of current, the frame traps were set in the stream with the open throat facing downstream. Two fish net or chicken wire leads, 3 to 6 feet high with 1-inch square mesh, and from 10 to 50 feet long, were stretched at various angles downstream from the trap. The angle depended on the force of the current at the trap site.

In areas of the river with little or no current, the traps were set with the open throat facing the shoreline. The trap was positioned as far away from the shoreline as practical, and a single lead was stretched from the trap to the shoreline.

Although catch rates on individual days and at individual trap sites were erratic, the frame traps were successful in taking a good total catch of fish. The traps appeared to be somewhat selective toward capture of adult game fish species. Posewitz (1962) believed the traps were selective for sauger in the lower Marias River. Selectivity toward adult fish was probably due to the relatively large 1-inch square mesh size of the traps and leads. Ricker (1971) reported that underwater frame traps are selective by species, and have been selective for the larger fish of a size class above the minimum imposed by the physical dimensions of the net (mesh). Traps and leads of a mesh size smaller than 1 inch cannot be fished in the Missouri River because they impede streamflow, trap debris and are washed out much more easily than the large mesh.

The primary value of frame traps in this study appears to be for monitoring spawning movements of adult game fish species from the mainstem of the Missouri River into tributary systems or restricted mainstem habitat areas, such as side channels and backwaters. Catches were considerably higher for most species during their spawning season, undoubtedly due to increased movement rates of sexually mature fish.

A future attempt with frame traps will be directed toward the use of bait in some of the sets. For some fishes, efficiency is improved by baiting (Ricker 1971). Elser (1976) used baited frame traps successfully to capture channel catfish in the Tongue River in southeastern Montana.

Gill Nets

Fish were also captured with standard experimental sinking nylon gill nets (125x6-foot with graduated mesh size from 3/4 to 2-inch square measure). Overnight stationary sets with these nets in areas of the river with little or no current generally produced good catches of a wide variety of fish species. Stationary gill net sets in areas of the river with any significant amount of current were largely unsuccessful because the nets usually became badly fouled with debris and, in some cases, were washed downstream by the current. The primary value of stationary gill net sets in the middle Missouri River appears to be for sampling selected slow water habitats, such as backwaters, slack water behind the downstream edge of larger islands or large, quiet pools in the mainstem.

During 1977 an attempt will be made to drift heavy duty large mesh sinking gill nets in main channel areas of the river with moderate current. This method was effective for capturing shovelnose sturgeon, channel catfish and blue suckers in the lower Tongue and Yellowstone Rivers (Peterman and Haddix 1975). The technique also showed promise for sampling paddlefish.

Electrofishing

An attempt was made to sample fish populations with electrofishing gear in the mainstem of the Missouri River and in the lower reaches of the Marias River. The electrofishing unit consisted of a 14-foot fiberglass boat containing a hand-held mobile positive electrode, a stationary negative electrode (fastened to the bottom of the boat) and a portable 2500-watt alternating current generator. A Fisher Model FS-103 rectifying unit was used to change the alternating current to various forms of pulsed or continuous direct current. The direct current output was adjustable from 0 to 500 volts. A 40-horsepower jet outboard was used for mobility of the electrofishing boat.

The mobile electrode unit was effective for sampling fish populations in the lower Marias River and in shallow areas of the Missouri River, such as backwaters and side channels. Maneuverability of the relatively small boat in these confined areas proved to be highly advantageous.

Attempts to obtain fish samples with the mobile unit in main channel areas of the Missouri River were largely unsuccessful, especially when water depths exceeded 4 to 5 feet. Peterman and Haddix (1975) reported similar problems with mobile electrode systems on the mainstem of the lower Yellowstone River, a stream comparable in size and conductivity to the middle Missouri. They concluded that the chief value of mobile electrodes on the Yellowstone mainstem was to probe riprap, brush piles, and other confined areas in search of forage fish and age 0 sport fish.

It is apparent that an electrofishing boat with a substantially greater range and capacity than the mobile unit will be required for sampling fish populations in the mainstem of the Missouri River. AC-DC

shockers with electrodes suspended from fixed booms have been relatively successful for sampling fish populations in the lower Yellowstone River (Peterman and Haddix 1975), in freshwater lakes and rivers in Wisconsin (Novotny and Priegel 1974), and in other lakes and large rivers (FAO 1975). A boom shocker will be constructed for use on the middle Missouri River during the next report period.

Seines

A 50x4-foot nylon drag seine with 1/4-inch square mesh was used to collect forage fish samples. Most of the seining sites were in confined areas of the river, such as backwaters and side channels, where the presence of forage fish was considered to be likely. Some forage fish were also taken in selected unconfined portions of the open river, such as shoreline and shallow riffle areas.

Setlines

Baited setlines were occasionally used to capture fish. They were used primarily during time periods when physical conditions on the river, such as high water and ice, precluded the use of other survey methods. The setlines were assembled with 25 to 50 hooks, ranging in size from No. 6 to 3/0.

Fish Sample Processing and Tagging

Fish captured by the various techniques were anesthetized with MS-222, measured to the nearest 0.1 inch in total length, and weighed to the nearest 0.01 pound. Sex and spawning condition (gravid, ripe or spawned) were recorded for fish captured during their spawning season. All fish were released near the capture site.

In addition to the above, a number of fish species was marked with individually numbered tags. Tag return data will be used to provide an indication of fisherman harvest rates and to determine movement patterns of individual fish, particularly spawners, and establish their home ranges.

Individually numbered plastic cinch-up spaghetti tags anchored near the base of the dorsal fin were used to mark channel catfish and black bullheads. Shovelnose sturgeon were tagged with individually numbered monel wing band tags clipped over the anterior fin rays of the pectoral fin or with individually numbered plastic cinch-up spaghetti tags inserted through the posterior portion of the fleshy keel at the base of the dorsal fin. All other game fish species and several nongame species, including blue suckers, bigmouth buffalo, and freshwater drum, were tagged with individually numbered Floy T-tags inserted near the base of the dorsal fin. Information signs were placed at accessible points along the river in the study area in an effort to encourage anglers to provide information about tagged fish in their creel.

AQUATIC HABITAT PARAMETERS

Drainge Area and Stream Discharge

The drainage area of the middle Missouri River increases from 23,292 square miles to 40,987 square miles, or by about 75 percent, between Morony Dam and Robinson Bridge (USGS 1974). However, due to the semi-arid nature of the area's climate, the increase in mean annual streamflow is only about 18 percent. The climate is characterized by moderately low rainfall, a dry atmosphere, hot summers, cold winters and a large proportion of sunny days (Gieseker 1931). Precipitation averages about 13 inches annually, of which about 8.5 inches occurs during the months of May through September (Missouri River Joint Study 1963).

Streamflow regimens are being monitored by the U. S. Geological Survey at four locations on the mainstem of the middle Missouri River. The stations are located at Morony Dam, Fort Benton, Coal Banks Landing and Robinson Bridge. Mean annual discharges for an 18-year period of record at Morony Dam, an 84-year period of record at Fort Benton, a 39-year period of record at Coal Banks Landing and a 40-year period of record at Robinson Bridge were 5.569 million acre feet (MAF) (7,687 cfs), 5.572 MAF (7,691 cfs), 6.079 MAF (8,391 cfs), and 6.593 MAF (9,100 cfs), respectively (USGS 1974). The maximum flows recorded at the four stations, respectively, were 72,000 cfs (June 10, 1964), 140,000 cfs (June 6, 1908), 122,000 cfs (June 5, 1953) and 137,000 cfs (June 6, 1953). The recorded minimums were 1 cfs (Sept. 16, 1962, powerplant shutdown) at Morony Dam, 627 cfs (July 5, 1936) at Fort Benton, 638 cfs (July 5, 1936) at Coal Banks Landing and 1,120 cfs (July 8, 1936) at Robinson Bridge. The present-day flow regimens are not entirely natural because of regulation and storage at several dams in the drainage upstream from the study area.

Stream Gradient and Velocity

The Missouri River enters the study area immediately below Morony Dam at an elevation of 2809 feet msl, dropping 550 feet to an elevation of 2259 feet msl at Robinson Bridge. Stream gradient averages 2.99 ft/mile and varies from over 10 ft/mile in the extreme upper reaches to less than 2 ft/mile in some sections (Table 1). A longitudinal profile of the Missouri River from Morony Dam to Fort Peck Reservoir is shown in Figure 2. Stream gradients were determined by measurements taken from U. S. Geological Survey topographic maps (1:24,000 scale). A river mileage chart for the middle Missouri, also taken from the topographic maps, is presented in Appendix Table 1.

Velocity of the middle Missouri River is closely associated with stream width, discharge and gradient. Mean velocities vary from about 3.5 to 2.0 feet per second at a discharge of 6000 cubic feet per second (USDI 1975).

Water Temperature

Water temperatures are being monitored during the ice-free period by continuous recording thermograph stations located on the Missouri River at Fort Benton, Coal Banks Landing and Robinson Bridge. The

Table 1. Stream gradients of the middle Missouri River from Morony Dam to Fort Peck Lake. Confluence of the Missouri River with the normal pool of Fort Peck Lake is mile 0.0.

River Mile	Elevation (feet)	Gradient (ft/mile)
207.0 (Morony Dam)	2809	
206.3	2800	16.41
205.2	2780	18.69
203.1	2760	9.34
201.2	2740	10.81
196.5	2720	4.19
192.2	2700	4.66
189.1	2680	6.41
185.0	2660	4.88
179.9	2640	3.95
175.4	2620	4.45
168.4	2600	2.84
162.5	2580	3.41
158.4	2560	4.88
149.4	2540	2.20
140.0	2520	2.13
126.6	2500	1.49
117.3	2480	2.13
107.5	2460	2.05
98.7	2440	2.30
92.1	2420	3.01
83.0	2400	2.20
70.4	2360	3.17
56.3	2320	2.82
40.8	2280	2.59
23.2 (Robinson Bridge)	2259	2.08
0.0 (Fort Peck Lake)	2246	0.83

stations were established on April 15, July 23 and May 24, 1976, respectively The Coal Banks Landing station is operated by the U. S. Geological Survey and the others are maintained by the Fish and Game Department. An additional thermograph station will be installed next year on the Missouri River at Morony Dam. The four stations will provide longitudinal temperature data for the entire study reach.

Water Quality

Basic water quality parameters are being monitored by the U. S. Geological Survey at two stations on the middle Missouri River. The stations are located at Coal Banks Landing and Robinson Bridge. Three additional water quality stations will be established next year to augment

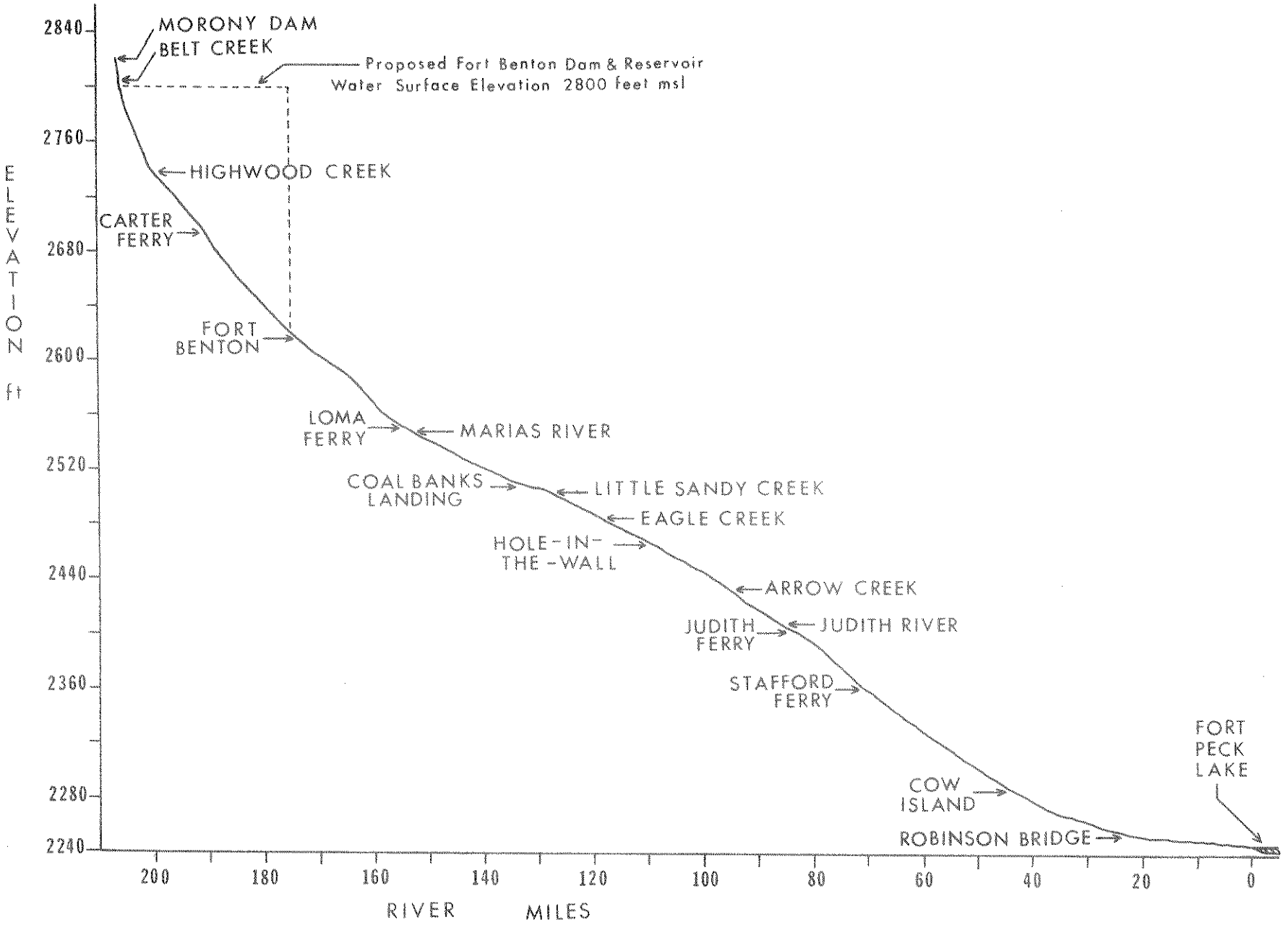


Figure 2. Longitudinal profile of the Missouri River from Morony Dam to Fort Peck Reservoir.

the existing data. These stations will be located at Morony Dam, Fort Benton and Judith Landing. The five stations (combined total) will correlate with existing study sites for aquatic macroinvertebrate and fish populations.

MACROINVERTEBRATES

Macroinvertebrate sampling was initiated at five stations on the middle Missouri River during the spring of 1976. The stations are located at Morony Dam, Fort Benton, Coal Banks Landing, Judith Landing and Robinson Bridge. Periodic samples have been taken at each station since May, but the collections have not been analyzed. Findings will be presented in a later progress report when the number of samples and data accumulation become substantial enough to warrant interpretation.

FISH POPULATIONS

Forty-nine species representing 14 families of fish are known to occur in the middle Missouri River drainage between Morony and Fort Peck dams (Table 2). Thirty-four species are found in the mainstem of the Missouri River in the present study area from Morony Dam to Robinson Bridge. Known distribution of the remaining 15 species is limited to Fort Peck Reservoir or tributaries to the middle Missouri River. However, it is likely that most of the latter species occur at least as transients in the mainstem study area. Additional species will probably be added to the list during the course of the present investigation.

Fish population surveys were initiated on the middle Missouri River study area during this report period. A basic objective of the initial effort was to test a variety of fish population sampling methods and determine the most suitable equipment and techniques for this study. An evaluation of several methods tested during this report period is presented in the TECHNIQUES section. A continuing effort will be made to refine sampling techniques already in use and to develop new techniques.

Fishery survey data collected during this report period will be presented in tabular form by study section and method. Specific analysis of numerical abundance, size-frequency distribution, or life history aspects of individual species is unwarranted at this time because of the limited amount of data. These interpretations will be presented in future reports.

Fish populations were sampled by experimental gill netting and frame trapping in two study sections on the Missouri River and one study section on the lower Marias River during the spring of 1976. The Missouri River sections were located at Fort Benton and Loma ferry (Figure 1). The Marias River study section included the lower 2-1/2 miles of that river.

Thirty overnight frame trap sets and 7 overnight gill net sets produced a total catch of 324 fish representing 18 species in the Fort Benton study section. A total of 651 fish representing 16 species was taken in the Loma ferry study section by 47 overnight frame trap sets and

Table 2. Fish species recorded for the middle Missouri River drainage in Montana between Morony and Fort Peck Dams (family, scientific, and common names).

ACIPENSERIDAE (Sturgeon family)
Scaphirhynchus albus - Pallid sturgeon
Scaphirhynchus platorynchus - Shovelnose sturgeon

POLYODONTIDAE (Paddlefish family)
Polyodon spathula - Paddlefish

HIODONTIDAE (Mooneye family)
Hiodon alosoides - Goldeye

SALMONIDAE (Trout family)
Prosopium williamsoni - Mountain whitefish
Onocorhynchus kisutch - Coho salmon*
Onocorhynchus nerka - Kokanee*
Salmo clarkii - Cutthroat trout*
Salmo gairdneri - Rainbow trout
Salmo trutta - Brown trout
Salvelinus fontinalis - Brook trout
Salvelinus namaycush - Lake trout*

ESOCIDAE (Pike family)
Esox lucius - Northern pike

CYPRINIDAE (Minnow family)
Cyprinus carpio - Carp
Carassius auratus - Goldfish
Notemigonus crysoleucas - Golden shiner*
Phoxinus eos - Northern redbelly dace*
Phoxinus neogaeus - Finescale dace*
Hybopsis gracilis - Flathead chub
Couesius plumbeus - Lake chub*
Notropis atherinoides - Emerald shiner
Hybognathus hankinsoni - Brassy minnow
Hybognathus placitus - Plains minnow*
Hybognathus nuchalis - Silvery minnow*
Pimephales promelas - Fathead minnow
Rhinichthys cataractae - Longnose dace

CATOSTOMIDAE (Sucker family)
Carpoides carpio - River carpsucker
Cycleptus elongatus - Blue sucker
Ictiobus bubalus - Smallmouth buffalo
Ictiobus cyprinellus - Bigmouth buffalo
Moxostoma macrolepidotum - Shorthead redhorse
Catostomus catostomus - Longnose sucker
Catostomus commersoni - White sucker
Catostomus platyrhynchus - Mountain sucker

Table 2. Fish species recorded for the middle Missouri River drainage in Montana between Morony and Fort Peck Dams (family, scientific, and common names). (Continued)

ICTALURIDAE (Catfish family)
Ictalurus melas - Black bullhead
Ictalurus punctatus - Channel catfish
Noturus flavus - Stonecat

GADIDAE (Codfish family)
Lota lota - Burbot

GASTEROSTEIDAE (Stickleback family)
Culaea inconstans - Brook stickleback*

CENTRARCHIDAE (Sunfish family)
Lepomis macrochirus - Bluegill*
Micropterus salmoides - Largemouth bass*
Pomoxis annularis - White crappie
Pomoxis nigromaculatus - Black crappie*

PERCIDAE (Perch family)
Perca flavescens - Yellow perch
Stizostedion canadense - Sauger
Stizostedion vitreum - Walleye
Etheostoma exile - Iowa darter*

SCIAENIDAE (Drum family)
Aplodinotus grunniens - Freshwater drum

COTTIDAE (Sculpin family)
Cottus bairdi - Mottled sculpin

* Known distribution is limited to Fort Peck Reservoir or tributaries to the middle Missouri River.

5 overnight gill net sets. Eleven overnight frame trap sets and 3 overnight gill net sets in the Marias River study section captured 180 fish representing 17 species. A catch rate summary for each study section, expressed in numbers of fish per overnight gill net or frame trap set, is presented in Table 3. Total catch, average size and size range for individual species are shown in Tables 4 through 9.

Table 3. Catch rate summary of frame trap and gill net surveys in the middle Missouri River drainage in spring 1976, expressed as number of fish per overnight set.

Fish Species	Frame Traps			Experimental Gill Nets		
	Ft. Benton Section	Loma Ferry Section	Marias R. Section	Ft. Benton Section	Loma Ferry Section	Marias R. Section
Shovelnose sturgeon	-	0.02	-	0.43	9.40	1.33
Goldeye	0.53	0.53	0.45	12.57	50.20	17.33
Brown trout	-	-	-	0.14	-	-
Mountain whitefish	-	-	2.09	-	-	-
Northern pike	-	-	0.09	-	-	-
Carp	0.13	0.49	0.18	2.43	1.80	2.33
Flathead chub	0.03	0.17	0.09	0.57	0.80	0.67
River carpsucker	0.10	0.21	0.09	0.86	1.40	3.33
Blue sucker	0.07	0.02	-	0.71	-	-
Smallmouth buffalo	0.03	0.06	0.09	0.29	0.40	1.33
Bigmouth buffalo	-	-	0.09	0.57	-	0.67
Shorthead redhorse	0.77	0.96	0.36	2.57	1.80	2.67
Longnose sucker	0.20	0.83	0.82	5.14	3.60	3.00
White sucker	0.07	0.01	-	0.71	-	0.33
Mountain sucker	-	-	-	0.43	-	-
Black bullhead	-	-	-	-	0.40	-
Stonecat	-	-	-	0.29	0.20	1.00
Burbot	0.10	0.32	0.18	0.29	0.20	0.33
Sauger	1.03	2.47	1.73	2.86	1.60	2.00
Walleye	0.03	0.02	0.09	0.14	-	-
Freshwater drum	0.03	0.04	0.09	1.86	0.40	-
Total	3.12	6.15	6.44	32.86	72.20	36.32

Table 4. Catch statistics of 30 overnight frame trap sets in the Fort Benton study section of the middle Missouri River, April 21-May 6, 1976.

Fish Species	Total No. Caught	Ave. Length (Inches)	Length Range (Inches)	Ave. Weight (Pounds)	Weight Range (Pounds)
Goldeye	16	12.3	11.4 -15.0	0.60	0.40 - 1.04
Carp	4	18.4	16.0 -21.4	3.24	2.36 - 4.84
Flathead chub	1	7.0	-	0.16	-
River carpsucker	3	15.9	15.0 -17.0	1.92	1.43 - 2.52
Blue sucker	2	26.8	26.5 -27.0	5.9	5.8 - 5.9
Smallmouth buffalo	1	23.6	-	7.5	-
Shorthead redhorse	23	16.5	11.7 -19.7	1.86	0.58 - 3.25
Longnose sucker	6	12.7	10.5 -15.2	0.87	0.42 - 1.42
White sucker	2	15.4	13.7 -17.0	1.59	1.16 - 2.01
Burbot	3	20.3	14.6 -24.6	1.69	0.98 - 2.42
Sauger	31	13.1	8.8 -18.4	0.71	0.18 - 2.56
Walleye	1	16.2	-	1.27	-
Freshwater drum	1	12.5	-	1.03	-
Total	94				

Table 5. Catch statistics of 7 overnight experimental gill net sets in the Fort Benton study section of the middle Missouri River, June 10-16, 1976.

Fish Species	Total No. Caught	Ave. Length (Inches)	Length Range (Inches)	Ave. Weight (Pounds)	Weight Range (Pounds)
Shovelnose sturgeon	3	36.1	34.1 -38.0	7.2	6.2 - 8.6
Goldeye	88	12.3	11.3 -15.1	0.59	0.40- 1.06
Brown trout	1	18.6	-	4.24	-
Carp	17	20.0	17.4 -22.6	3.87	2.64- 5.30
Flathead chub	4	5.8	4.0 - 7.4	0.10	0.04- 0.18
River carpsucker	6	16.3	14.8 -17.8	1.98	1.26- 2.80
Blue sucker	5	26.9	25.8 -27.6	6.0	5.0 - 6.8
Smallmouth buffalo	2	23.7	23.0 -24.4	7.5	7.4 - 7.6
Bigmouth buffalo	4	24.1	18.5 -28.4	9.2	4.0 -13.8
Shorthead redhorse	18	16.8	11.2 -19.3	1.95	0.60- 2.60
Longnose sucker	36	13.3	7.6 -17.6	1.10	0.18- 2.88
White sucker	5	13.8	8.8 -17.2	1.26	0.30- 2.05
Mountain sucker	3	4.0	3.3 - 5.4	0.05	0.04- 0.07
Stonecat	2	5.6	5.4 - 5.8	0.09	0.08- 0.10
Burbot	2	19.0	15.0 -23.0	1.56	1.04- 2.08
Sauger	20	12.4	9.7 -16.9	0.57	0.23- 1.20
Walleye	1	24.4	-	6.2	-
Freshwater drum	13	12.3	10.4 -14.4	0.97	0.56- 1.62
Total	230				

Table 6. Catch statistics of 47 overnight frame trap sets in the Loma ferry study section of the middle Missouri River, May 4-21, 1976.

Fish Species	Total No. Caught	Ave. Length (Inches)	Length Range (Inches)	Ave. Weight (Pounds)	Weight Range (Pounds)
Shovelnose sturgeon	1	30.2	-	4.19	-
Goldeye	25	12.7	11.3 -14.9	0.64	0.46 - 0.88
Carp	23	17.5	15.2 -20.3	2.59	1.62 - 3.89
Flathead Chub	8	8.2	7.1 - 9.4	0.22	0.18 - 0.28
River carpsucker	10	16.1	14.2 -17.4	2.19	1.58 - 3.04
Blue sucker	1	26.2	-	5.6	-
Smallmouth buffalo	3	21.0	20.2 -21.7	5.4	4.9 - 5.8
Shorthead redhorse	45	16.6	8.3 -19.4	2.01	0.22 - 3.26
Longnose sucker	39	16.2	11.8 -18.4	1.93	0.58 - 3.04
White sucker	1	10.8	-	0.57	-
Burbot	15	20.5	16.2 -25.6	1.47	0.81 - 2.72
Sauger	116	12.8	7.0 -19.0	0.76	0.10 - 3.01
Walleye	1	15.2	-	1.04	-
Freshwater drum	2	11.5	11.3 -11.7	0.66	0.60 - 0.72
Total	290				

Table 7. Catch statistics of 5 overnight gill net sets in the Loma ferry study section of the middle Missouri River, May 6-11, 1976.

Fish Species	Total No. Caught	Ave. Length (Inches)	Length Range (Inches)	Ave. Weight (Pounds)	Weight Range (Pounds)
Shovelnose sturgeon	47	31.0	23.2 -35.8	4.54	1.84 - 7.80
Goldeye	251	12.1	7.6 -14.0	0.58	0.11 - 1.01
Carp	9	17.2	15.3 -22.5	2.84	1.72 - 7.34
Flathead chub	4	7.4	6.5 - 8.1	0.15	0.11 - 0.19
River carpsucker	7	16.0	14.5 -16.8	1.92	1.48 - 2.34
Smallmouth buffalo	2	22.3	21.2 -23.4	6.0	5.2 - 6.7
Shorthead redhorse	9	17.5	14.0 -19.3	2.31	1.10 - 2.96
Longnose sucker	18	16.6	13.9 -19.5	2.03	1.28 - 2.90
Black bullhead	2	7.9	7.5 - 8.2	0.17	0.13 - 0.20
Stonecat	1	7.9	-	0.22	-
Burbot	1	14.2	-	0.71	-
Sauger	8	11.6	9.8 -15.7	0.47	0.26 - 1.06
Freshwater drum	2	13.0	12.0 -14.0	0.99	0.78 - 1.20
Total	361				

Table 8. Catch statistics of 11 overnight frame trap sets in the lower Marias River study section, May 11-21, 1976.

Fish Species	Total No. Caught	Ave. Length (Inches)	Length Range (Inches)	Ave. Weight (Pounds)	Weight Range (Pounds)
Goldeye	5	12.5	11.5 -13.2	0.60	0.45 - 0.70
Mountain whitefish	23	12.8	10.4 -15.9	0.69	0.36 - 1.31
Northern pike	1	22.0	-	3.17	-
Carp	2	16.2	15.3 -17.0	2.12	1.74 - 2.49
Flathead chub	1	8.6	-	0.20	-
River carpsucker	1	15.6	-	1.89	-
Smallmouth buffalo	1	23.6	-	6.5	-
Bigmouth buffalo	1	28.2	-	12.8	-
Shorthead redhorse	4	17.1	15.8 -18.2	2.07	1.81 - 2.21
Longnose sucker	9	16.8	14.0 -18.4	2.16	1.12 - 2.88
Burbot	2	21.7	18.5 -24.8	1.76	1.03 - 2.49
Sauger	19	13.4	10.1 -18.6	0.78	0.28 - 2.60
Walleye	1	14.2	-	0.88	-
Freshwater drum	1	11.5	-	0.70	-
Total	71				

Table 9. Catch statistics of 3 overnight gill net sets in the lower Marias River study section, May 17-19, 1976.

Fish Species	Total No. Caught	Ave. Length (Inches)	Length Range (Inches)	Ave. Weight (Pounds)	Weight Range (Pounds)
Shovelnose sturgeon	4	32.1	29.0 -34.6	4.61	3.27 - 6.20
Goldeye	52	12.1	9.1 -14.5	0.58	0.25 - 0.84
Carp	7	18.7	16.6 -21.6	3.02	2.04 - 3.82
Flathead chub	2	7.2	6.9 - 7.4	0.19	0.17 - 0.20
River carpsucker	10	16.2	14.7 -17.5	1.97	1.54 - 2.32
Smallmouth buffalo	4	21.6	19.1 -23.8	5.7	4.8 - 6.6
Bigmouth buffalo	2	28.6	26.8 -30.3	13.4	11.2 -15.6
Shorthead redhorse	8	15.7	10.9 -17.6	1.71	0.71 - 2.14
Longnose sucker	9	16.7	15.5 -18.3	2.16	1.58 - 2.86
White sucker	1	14.9	-	1.47	-
Stonecat	3	8.6	7.8 - 9.6	0.17	0.13 - 0.23
Burbot	1	23.4	-	2.42	-
Sauger	6	11.9	10.2 -17.0	0.57	0.36 - 1.54
Total	109				

A forage fish is defined as any fish that is used as a source of food by other fish (Newell 1975). In conjunction with the gill net and frame trap surveys in the above study sections, forage fish samples were taken by drag seines and mobile electrofishing apparatus. The main objective of this sampling is to determine taxonomic composition and longitudinal distribution of forage fish populations in the study area under existing habitat conditions. A food habits study will be initiated to identify the species which are important as a food source by other fish species. Specific habitat requirements (i.e., preferences) of the important forage fish species will then be identified. Forage fish study findings will be presented in a later progress report when data accumulation becomes substantial enough to warrant interpretation.

RECOMMENDATIONS

Field inventory of the aquatic resources and factors influencing these resources will be the basis for an aquatic resource management plan for the middle Missouri River. Baseline surveys of fish populations and existing habitat conditions should continue to complete the inventory. Spawning migrations of paddlefish and other key species should be identified and monitored.

Paddlefish and other species should be tagged to monitor movement patterns of individual fish and establish home ranges. An attempt should be made to use radio telemetry gear to follow paddlefish movements, locate spawning areas and evaluate spawning success. Macroinvertebrate and forage fish samples should be collected to determine taxonomic composition and longitudinal distribution of these organisms under existing streamflow and water quality conditions. A partial creel survey should be coordinated with the BLM recreation survey on the middle Missouri River. Thermograph stations should be maintained at Morony Dam, Fort Benton and Robinson Bridge. All other necessary streamflow, water quality or water temperature monitoring should be coordinated with the U. S. Geological Survey or the Montana Department of Health and Environmental Sciences.

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Appendix Table 1. River mileage chart for the middle Missouri River study area. Confluence of the Missouri River with the normal flood pool of Fort Peck Lake is river mile 0.0.

Location	River Mile
Morony Dam	207.0
Belt Creek	205.8
Highwood Creek	199.4
Carter Ferry	190.6
Fort Benton	174.7
Loma Ferry	154.2
Marias River	152.4
Spanish Island	146.2
Virgelle Ferry	135.2
Coal Banks Landing	132.1
Little Sandy Creek	127.2
Eagle Creek	118.0
Hole-in-the-Wall	110.0
Arrow Creek	95.8
Judith River	85.8
Judith Ferry	84.3
Stafford Ferry	70.8
Sturgeon Island	53.1
Cow Island	43.6
Grand Island	31.4
Robinson Bridge	23.2
Fort Peck Lake	0.0

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