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MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
ECOLOGICAL SERVICES DIVISION

JOB PROGRESS REPORT

State Montana Title Lower Missouri River Basin

Project Number FW-2-R-9 Investigations

Job Number I-b Title Planning Inventory, Fisheries

Period Covered July 1, 1979 through June 30, 1980

ABSTRACT

A fisheries survey and inventory study of the Missouri River from Fort Peck Dam to North Dakota, (lower Missouri River) a 185 mile river section, was begun in 1979. Cold water releases from Fort Peck Dam affect the river downstream to at least Culbertson. Average monthly temperatures 8 miles downstream from Fort Peck Dam do not exceed 54 F. One hundred and fifty-one miles downstream from Fort Peck Dam summer water temperatures do not warm sufficiently to reach equilibrium with ambient air temperatures. The relatively warm and turbid Milk River forms a "two rivers" situation when it enters the Missouri channel, with a warm, turbid "river" on the north side of the channel and a cold, clear "river" on the south side. The river gradient over the study area averages 0.91 feet per mile, considerably less than the Missouri River upstream of Fort Peck Dam or the lower Yellowstone River.

A total of 3,067 fish was sampled in the study area in 1979, of which 1,606 were game fish. The sauger is probably the most abundant game species. Goldeye, river carpsucker and flathead chub are abundant nongame species. Thirty-four fish species are known to occur in the study area. The rainbow smelt was collected for the first time in Montana.

Larval fish were sampled to locate spawning areas. Some larval game species were collected. Larval sauger were more abundant in tributary streams than in the Missouri River. Sauger and paddlefish concentrated in the warm "river" downstream of the Milk River. Sauger apparently spawned in this area. Sauger also concentrated in the lower Milk River. Concentrations of shovelnose sturgeon were found in the dredge cuts-tailwater area.

Shovelnose sturgeon were much smaller, and northern pike more abundant than in the middle Missouri River or Yellowstone River. Burbot were larger than in their other areas. Sauger and walleye are highly migratory in the study area.

BACKGROUND

The aquatic biology in general and especially fish populations of the lower (downstream of Fort Peck Reservoir) Missouri River in Montana have received only scant study. The only exception is work done by the Montana Department of Fish, Wildlife and Parks in the Fort Peck Dam tailwaters and dredge cuts. This work has been done in only a few miles of the 185 miles of river between Fort Peck Dam and the Montana-North Dakota border. Fisheries studies begun in 1979 on the entire 185 mile river reach are reported in the paper.

However, much remains to be learned concerning the status and habitat requirements of fish species in the river. Also, little is known concerning vulnerability of various fish species to various water development options, importance of tributaries and particular river reaches, or physical, hydrological and biological factors of importance to fish populations.

Water withdrawals, which will affect fish populations, are likely to occur in the near future from the lower Missouri River or from Ft. Peck Reservoir. Reservoir withdrawals would leave less water available for release to the river. Large amounts of coal are present on the south side of the river in McCone County. Various developments using the coal have been proposed, most of which require large amounts of water. Recently the State of Montana has reserved much of the streamflow in the Yellowstone basin for instream uses. At the same time the U.S. Congress designated a major portion of the Missouri River upstream of Fort Peck Reservoir as a Wild and Scenic river. These two actions may direct future industrial water consumption to Fort Peck Reservoir or to the Missouri River downstream.

A reregulation dam to be located approximately eight miles downstream from Fort Peck Dam may be built to dampen flow fluctuations caused by increased power production at Fort Peck Dam. Several thousand paddlefish known to use the dredge cuts (Needham 1979b) would no longer have access because the dredge cuts are located upstream of the proposed reregulation dam.

OBJECTIVES

Overall project objectives consist of the inventory of game and nongame fish populations, determination of important factors upon which game fish depend, location of critical river reaches or tributary streams for the game species and formulation of instream flow recommendations to protect game fish populations.

More specific objectives for the report period included the following: testing various types of fish sampling gear to determine efficacy and suitability; determination of game and nongame fish species composition and distribution in space and time; locating spawning concentrations and other key areas where game species congregate; tagging of game species to determine movements; locating game fish eggs and measuring associated physical parameters; sampling of larval fish in spring and young-of-the-year game fish in fall to determine reproductive success; sampling and tagging channel catfish using baited hoop traps; determining seasonal distribution of

paddlefish.

Progress was made toward all of these objectives with the exception of locating game fish eggs. Activities related to other objectives during the spring season filled available time. Attempts to locate game fish eggs and measure associated physical parameters will be made at a later time.

DESCRIPTION OF THE STUDY AREA

The study area consists of 185 miles of the Missouri River from Fort Peck dam near Glasgow, Montana to the Montana-North Dakota border and the lower several miles of tributary streams within the reach, (Figure 1). The Yellowstone river enters the Missouri River two miles downstream from the Montana-North Dakota border. The headwaters of Garrison Reservoir, a mainstem Missouri River impoundment, are located approximately 25 miles downstream from the mouth of the Yellowstone River.

Major tributary streams in the study area are the Milk River, Poplar River and Big Muddy Creek from the north and the Redwater River from the south. Other tributary streams are intermittent.

Streamflows are measured by the U.S. Geological Survey on the Missouri River 8 miles downstream from Fort Peck Dam, near the town of Wolf Point and near the town of Culbertson. Streamflows are also measured on the Milk River, Poplar River and Redwater River. Measurements on the downstream portion of the Redwater River have begun only recently so long term averages are not available. Below Fort Peck dam the drainage area is 57,556 square miles with a mean annual discharge of 9,816 cubic feet per second (cfs) or 7.11 million acre feet (maf). Near the town of Culbertson the drainage area is 91,557 square miles and the mean annual discharge is 10,710 cfs or 7.76 maf. These numbers show a 59% increase in drainage area but only a 9.1% increase in mean annual discharge at the downstream point. This is due to the semi-arid nature of northeastern Montana and greater precipitation in the Missouri River headwater areas of southwestern Montana and northwestern Wyoming. The mean streamflows are based on 34 years of record below Fort Peck Dam and 27 years near Culbertson. Both periods of record began after Fort Peck Dam reached operational level.

The Milk River which reaches the Missouri River 10 miles downstream from Fort Peck Dam, has a drainage area of 22,332 square miles and a mean annual discharge of 694 cfs or 0.50 maf (38 year period of record). Corresponding figures for the Poplar River are 3,174 square miles, 134 cfs or 0.1 maf (40 year period of record). While data are lacking for the Redwater River, its discharge is smaller than that of the Poplar River.

River gradients for the study reach of the Missouri River are shown in Table 1. The data are shown in Figure 2 in the form of a horizontal profile. River gradients are low compared to the Missouri River farther upstream and to the Yellowstone River. The average gradient is 0.91 feet per mile. The range is 0.65 to 1.92 feet per mile, calculated over distances of 5 to 15 miles. Berg (1978) reported an average gradient of 2.99 feet per mile in a 184 mile reach of the Missouri River in northcentral Montana. Peterman and Haddix (1975) found average gradients of 8.1 feet per mile in the middle Yellowstone River in southcentral Montana, and 2.8

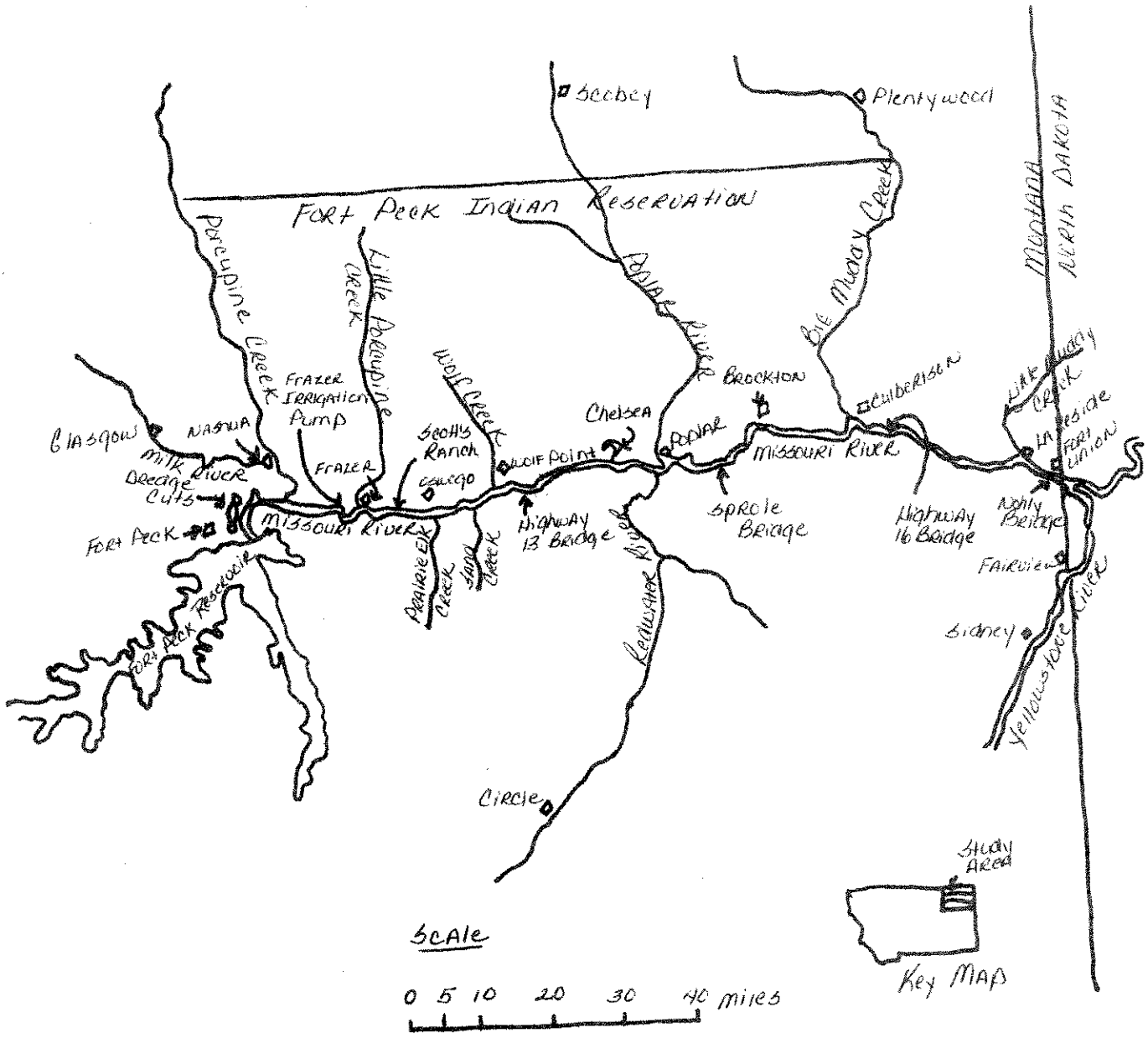

Figure 1. Map of lower Missouri River drainage in Montana.

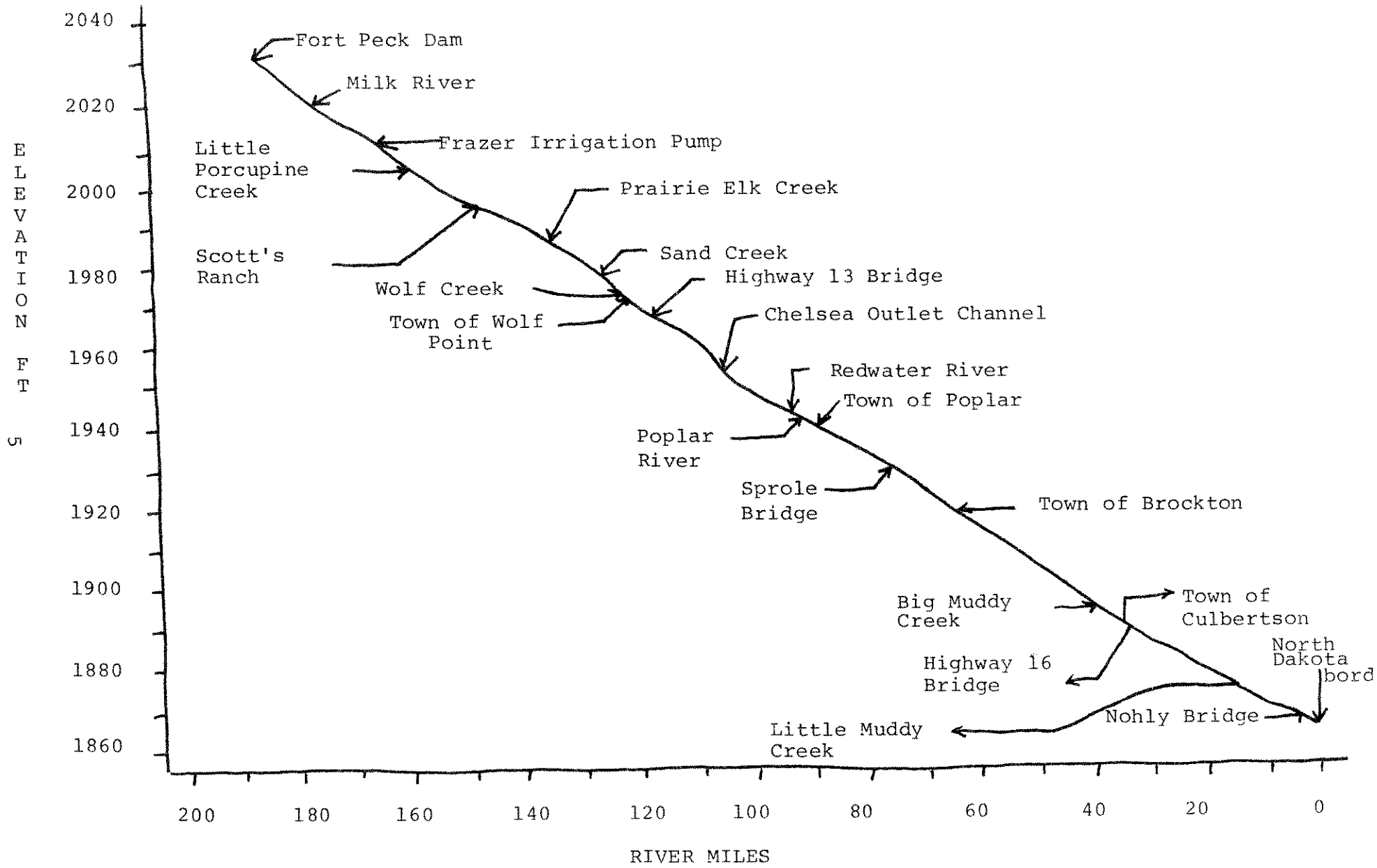

Figure 2. Horizontal profile of the Missouri River from Fort Peck Dam to the Montana-North Dakota border.

Table 1. River gradients for the Missouri River from Fort Peck Dam to the Montana-North Dakota border.

River Mile	Description	Elevation (feet)	Gradient (feet/mile)
185.0	Fort Peck Dam	2033	-
182.8	2.25 Miles downstream from Fort Peck Dam	2030	-
174.7	Near Milk River	2020	1.24
165.4	9.5 Miles downstream from Milk River	2010	1.08
154.3	3.0 Miles downstream from Little Porcupine Creek	2000	0.90
139.5	4.0 Miles upstream from Prairie Elk Creek	1990	0.68
131.0	4.5 Miles downstream from Prairie Elk Creek	1980	1.18
121.4	0.3 Miles downstream from Wolf Creek	1970	1.04
109.8	5.1 Miles downstream from highway 13 bridge	1960	0.86
104.6	Near Chelsea outlet channel	1950	1.92
89.3	2.75 Miles downstream from Poplar River	1940	0.65
77.3	0.5 Miles upstream from Deep Creek	1930	0.84
65.8	11.0 Miles downstream from Deep Creek	1920	0.87
45.8	1.1 Miles downstream from Two Mile Creek	1900	1.00
33.2	1.1 Miles downstream from highway 16 bridge	1890	0.79
20.0	Near Otis Creek	1880	0.76
7.25	5.75 Miles downstream from Little Muddy Creek	1870	0.78
2.25	2.25 Miles upstream from Montana-North Dakota border	1865	1.00
0	Montana-North Dakota border	1863	-

feet per mile for the lower Yellowstone River in eastern Montana.

Elevations above sea level vary from 2030 feet just below Fort Peck Dam to 1863 feet at the Montana-North Dakota border.

The land adjacent to the study area has a variety of forms and uses. Where the land rises slowly away from the river, stands of deciduous trees with a sometimes dense understory of shrubs are common. Irrigated fields of corn and alfalfa are common. Water is supplied to these crops by pumping from the river. This irrigation probably constitutes the major consumptive use of water from the river. Dryland grains are also common. Prairie vegetation reaches close to the river banks where land rises

rapidly away from the river. Cattle and sheep grazing is the major use of these areas. Steep badland formations and other steep hills often rise away from the river. Scrubby evergreen vegetation is abundant on these landforms, of which junipers are abundant.

The study reach of the Missouri River is meandering, often 300-800 feet wide, and typically 10-15 feet deep near eroding banks. Sand and silt are the most common bed and bank materials. Gravel is common only in the tributaries and in the Missouri River from Fort Peck Dam to the Milk River. Scattered boulders and rock bottom materials are common where steep hillsides are adjacent to the river. Islands and side channels are abundant. Side channels often become isolated backwaters at lower streamflows. High eroding banks occur over much of the study reach of the main river.

The Fort Peck Indian Reservation occupies the north side of the river from Porcupine Creek to Big Muddy Creek (map, Figure 1).

PROCEDURES

Physical Features

Distances between points on the Missouri River were calculated using a river mile index compiled by the Montana Department of Natural Resources and Conservation (1979). This publication and topographic maps from the U.S. Geological Survey were used to calculate river gradients.

All data on temperature and turbidity were taken from U.S. Geological Survey publications.

Larval Fish

Drifting larval fish were sampled with nylon plankton nets towed upstream at the side of a boat at a speed, relative to shore, of 3.65 feet per second. Nets were 6 feet long with a 0.5 meter diameter opening and 760 micron mesh. A removable plankton bucket was attached to the net to allow removal of larval fish and debris.

Nets were towed for periods of 10 to 20 minutes or until the net began to backwash because of plugged mesh. Field samples were preserved in 10% formalin to which a biological stain had been added to make larval fish more visible. Larval fish were identified using keys by Hogue, Wallus and Kay (1976) and May and Gasaway (1967).

Fish Processing

Fish captured by various methods were weighed to the nearest 0.01 pound if less than five pounds. Fish over five pounds were weighed to the nearest 0.1 pound, except paddlefish which were weighed to the nearest pound. Only total length was measured. Fish were measured to the nearest 0.1 inch if less then three feet total length, or to the nearest inch if over three feet.

Sauger, walleye, northern pike and trout were tagged with individually numbered Floy "T-tags" inserted with a tagging gun. Tags were placed just under the dorsal fin. Floy "cinch-up" tags were used for tagging

channel catfish, shovelnose sturgeon and burbot. The tag was placed under the posterior part of the dorsal fin on sturgeon and burbot, and under the adipose fin for channel catfish. A 0.5 inch, individually numbered, metal band was clamped on the lower jaw of paddlefish.

Fish Aging

Fish were aged from plastic scale impressions. No attempt was made to age fish which lack scales or lack scales suitable for aging. Scales were collected during fish processing.

Electrofishing Apparatus

The electrofishing system used was adapted from the system described by Novotny and Priegal (1976), and is similar, except for boat and motor size, to that described by Berg (1978).

The electrofishing apparatus was mounted on a 14-foot fiberglass boat powered by a 25-horsepower outboard.

Power was supplied by a 3500 watt AC generator. The alternating current was delivered to a Coffelt Model VVP-10 rectifying unit which changes the alternating current to pulsed or continuous direct current. The positive electrode consisted of a spherical array of copper tubing or stainless steel "droppers." These electrodes were supported by fiberglass booms and were positioned about six feet in front of the boat. The negative electrodes were two to four feet lengths of flexible steel conduit suspended from the side of the boat.

The unit was typically operated at 10-15 amps, 125-175 volts, 50% pulse width and a pulse frequency of 50-100 pulses per second.

Gill Nets

Gill nets were successfully fished in areas with little or no current. Most were set in backwaters. Nets set in significant current became fouled with drifting filamentous algae and caught no fish. Nets used were 125x 6 feet with graduated mesh size from 3/4 to 2-inch square mesh. Attempts were made to drift 3-inch square mesh nets in current for shovelnose sturgeon. This met with little success and was abandoned because of the high frequency that nets became entangled on snags.

Baited Hoop Nets

Baited hoop nets were set to capture channel catfish. The nets used are described in detail by Berg (1978). Basically, they consisted of four wooden hoops of 2.5 feet diameter, covered with 1.25-inch square tarred nylon mesh. Each net had two throats and was anchored by 70 pounds of weight. A perforated rubber bait bag was attached to the upstream hoop inside the net and filled with one to two pounds of rotten cheese. A rope with a float was attached to the downstream hoop to mark the net's location.

Nets were set in a variety of water depths and current velocities to determine the type of physical location giving the largest catches.

Frame Trap Nets

Frame trap nets were fished at various locations to determine their utility for fish sampling. Nets consisted of two rectangular frames of lightweight conduit 4-feet high and 6.5-feet wide. Behind these were two 4-feet diameter wood hoops. Frames and hoops were covered with 1-inch square mesh tarred nylon netting. A 4-feet high and 50-feet long lead was attached to the front hoop. This also had 1-inch square mesh.

Nets were set in areas of no current and in current with the lead placed upstream and downstream. The lead was sufficiently weighted so that both trap and lead sank in water deeper than the net. Sets made in the river current were not successful and this type of set was soon abandoned.

FINDINGS

Physical Features

The entire length of the Missouri River from Fort Peck Dam to the North Dakota border is affected by discharge to the river of relatively cold reservoir water. Monthly average water temperatures below the dam reach a maximum of 54 F in late summer and early fall (Table 2). No temperature data are available before construction of Fort Peck Dam, but an examination of temperature data for the Missouri River near Culbertson (151 river miles downstream of Fort Peck Dam) and for the Missouri River near Virgelle (approximately 135 river miles upstream of Fort Peck Reservoir) shows that river temperatures average 3.5 F colder at the downstream point (64.5 vs. 61.0 F) for the months of June through September, the months of rapid fish growth. The average temperature for the same period below Fort Peck Dam is 52.5 F (Table 2).

Table 2. Average monthly temperatures (F) from October 1974 to September 1977 for the Milk and Missouri Rivers. [a/]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Missouri River near Virgelle	32	32	37	46	55	62	69	67	60	49	40	34
Missouri R. 8 miles below Fort Peck Dam	35	35	37	40	46	50	52	54	54	54	49	40
Milk River near Nashua	32	32	32	45	60	67	73	69	60	46	35	32
Missouri River near Culbertson	32	32	34	43	54	60	65	62	57	48	40	32

a/ Data from USGS (1975, 1976, 1977)

A somewhat more valid comparison can be made using Missouri River temperature measurements at the Robinson Bridge (23 miles upstream of Fort

Peck Reservoir), a point much closer to Fort Peck Reservoir than Virgelle, to compare to measurements made near Culbertson. Only measurements for part of 1977 are available for the Robinson Bridge location. The average temperatures for the upstream and downstream locations for the period June 19 to September 30, 1977 are 67.2 and 62.1 F, respectively (data derived from Table 3).

Table 3. Average temperatures (F) for comparable portions of 1977 for the Milk River and three locations on the Missouri River.

	Apr 19-30	May	Jun 19-30	Jul	Aug	Sep
Missouri River near Robinson Bridge a/	57.0	60.6	71.4	70.1	66.7	60.6
Missouri River 8 miles below Ft. Peck Dam b/	43.8	48.2	51.8	50.9	52.7	52.7
Milk River near Nashua b/	55.4	63.5	69.4	70.7	65.3	57.2
Missouri River near Culbertson b/	51.7	59.9	65.1	65.3	60.8	57.2

a/ Data from Berg (1978).
b/ Data from USGS (1977).

Without Fort Peck Dam mean summer river temperatures near Culbertson should be slightly higher than at Virgelle or Robinson Bridge, as the downstream location is several hundred feet lower in elevation. It is evident that the Missouri River fails to completely equilibrate with ambient summer air temperatures through the 151 Missouri River miles from Fort Peck Dam to Culbertson.

The Milk River enters the Missouri River 10 river miles downstream from Fort Peck Dam. It is at least as warm or somewhat warmer then the Missouri River upstream of Fort Peck (Tables 2 and 3).

Fort Peck Dam greatly alters turbidity in the Missouri River (Table 4). Turbidities average in the single digits below the dam and the spring peaks are eliminated. Unlike temperature, turbidity returns to values typical of locations upstream of Fort Peck Dam at some point upstream of Culbertson (Table 4). The Milk River has average turbidities greater than any of the points shown on the Missouri River shown in Table 4.

The Milk River is the largest of the tributary streams in the study reach of the Missouri River. It has a mean annual discharge of 694 cfs compared to 134 cfs for the Poplar River, the second largest tributary. Natural springtime peak flows in the Missouri River are stored in Fort Peck Dam. As a result during the spring the discharge of the Milk River is often a significant fraction of the flow of the Missouri River. For example in May 1979 the average flows in the Milk River near Nashua and in the Missouri River below Fort Peck Dam were 3810 cfs and 16,660 cfs, respectively. During this month the Milk River added an average of 23% to the flow of the Missouri River.

Table 4. Average monthly turbidities (JTU) from October 1974 to September 1977 for the Milk and Missouri Rivers.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Average
Missouri River near Virgelle	7	4	8	112	112	45	32	12	6	7	6	7	33
Missouri R. 8 miles below Ft. Peck Dam	2	2	1	2	5	6	3	5	3	7	3	2	3
Milk River near Nashua	4	61	370	76	255	200	311	127	16	38	12	6	123
Missouri River near Culbertson	14	22	136	110	77	73	67	44	48	42	28	10	56

During the spring and early summer, when the flow of the Milk River is relatively large, the warm turbid water from the Milk River mixes very slowly with the cold, clear water of the Missouri River. This results in a "two rivers" situation downstream of the Milk River, with a warm, turbid "river" on the north side of the channel and a cold, clear "river" on the south side.

On May 22, 1979 two miles downstream of the Milk River the water temperature was 56 F near the north bank and 38 F near the south bank. The "two rivers" could be easily distinguished by eye, because of the turbidity difference, for at least 10 miles downstream for all of the spring and the early part of summer in 1979.

Gravel is abundant downstream of the Milk River for several miles, but uncommon at points farther downstream. The combination of suitable spawning substrate and warm water on the north side of the river downstream of the Milk River caused concentration of sauger in this area. This will be discussed in a later section.

Fish Populations

Species Composition and Relative Abundance

A total of 34 species in 15 families were observed in the study area in 1979 or are otherwise known to occur (Table 5). Brown (1971) reports that the brassy minnow is present in the study area, but it was not observed in 1979. No backwater seining has been done outside of the Fort Peck dredge cuts-tailwaters area, so the likelihood of collecting additional species is high when seining is done over the remainder of the study area. Berg (1978) reported 49 species in 14 families in the middle Missouri River from Robinson bridge to Morony dam, or in tributary streams in that reach. Most of the additional species he reported are in the families Salmonidae and Cyprinidae. A total of 30 species are present in both reaches of the Missouri River. Four species (shortnose gar, rainbow smelt, white bass and small mouth bass) were not reported from the middle Missouri River by Berg (1978).

The paddlefish is largely seasonal in the river, although at least a few are known to overwinter in the dredge cuts. Most individuals winter in Garrison Reservoir, enter the river in spring and return to the reservoir later in the year. The small mouth bass was introduced in the Poplar River in the late 1960's. It is common in the lower Poplar River but has not been observed in the Missouri River.

The shortnose gar is native to Montana but until 1979 it had been collected only in the dredge cuts. In 1979 a single individual was caught in a gill net in the mouth of Little Porcupine Creek.

The white bass and rainbow smelt have been introduced in Garrison Reservoir. A single white bass was captured in the dredge cuts. This is the only record of this species in Montana. The rainbow smelt was first noted in Montana in 1979. Several individuals were seen and two were captured near the North Dakota border.

Table 5. Fish species captured in the Missouri River in Montana from Fort Peck Dam to the North Dakota border.

ACIPENSERIDAE (Sturgeon family)
Scaphirhynchus platorynchus a/ - Shovelnose sturgeon (A) i/
Scaphirhynchus albus a/ - Pallid sturgeon (R)
Polyodontidae (Paddlefish family)
Polyodon spathula a/ - Paddlefish (A)

LEPISOSTEIDAE (Gar family)
Lepisosteus platostomus a/ b/ - Shortnose gar (R)

HIDONTIDAE (mooneye family)
Hiodon alosoides a/ - Goldeye (A)

SALMONIDAE (Trout family)
Salmo gairdneri - Rainbow trout (C)
Salmo trutta c/ - Brown trout (R)
Salvelinus namaycush d/ - Lake trout (C)

OSMERIDAE (Smelt family)
Osmerus mordax e/ - Rainbow smelt (R)

ESOCIDAE (Pike family)
Esox lucius - Northern pike (A)

CYPRINIDAE (Minnow family)
Cyprinus carpio - carp (A)
Hybopsis gracilis a/ - Flathead chub (A)
Couesius plumbeus a/ - Lake chub (C)
Notropis atherinoides a/ - Emerald shiner (A)
Hybognathus nuchalis a/ - Silvery minnow (C)
Pimephales promelas a/ - Flathead minnow (C)

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

ICTALURIDAE (Catfish family)
Ictaluras melas - Black bullhead (C)
Ictaluras punctatus a/ - Channel catfish (C)
Noturas flavus a/ - Stonecat (C)

GADIDAE (Codfish family)
Lota lota a/ - Burbot (A)
Percichthyidae (Sea bass family)
Morone chrysops h/ - White bass (R)

Table 5. (continued) Fish species captured in the Missouri River in Montana from Fort Peck Dam to the North Dakota border.

CENTRARCHIDAE (Sunfish family)
Micropterus dolomieui f/ - Smallmouth bass (C)
Pomoxis annularis f/ - White crappie (R)
Perchidae (Perch family)
Perca flavescens - Yellow perch (C)
Stizostedion canadense a/ - Sauger (A)
Stizostedion vitreum - Walleye (A)
SCIAENIDAE (Drum family)
Aplodinotus grunniens a/ - Freshwater drum (C)

a/ Native to the Missouri River drainage
b/ Found only in the dredge cuts and mouth of Little Porcupine Creek
c/ Single individual captured near town of Poplar
d/ Found only in the Fort Peck tailwaters and dredge cuts area
e/ First Montana record. Found only near North Dakota
f/ Found only in lower Poplar River
h/ Single individual captured in dredge cuts
i/ A = abundant; C = common; R = rare

Results of Field Sampling

Electrofishing

Catch rates by electrofishing are shown for game fish species in Tables 6 and 7. Numbers captured and fish lengths and weights are in Appendix Tables A and B. A total of 810 game fish were captured by electrofishing in the Missouri River. Two hundred and fifty-three were captured in the lower portions of tributary streams. Species of nongame fish seen while electrofishing were not counted nor retained for weighing and measuring, but species seen were recorded as being present.

Sauger made up 76% of the total number of fish captured in the Missouri River electrofishing surveys. Percentages for other species were northern pike 7%, paddlefish 5%, walleye 4%, burbot 3%, shovelnose sturgeon 2% and other species 1%. Percentages were considerably different in the downstream portions of tributary streams (Table 7). Walleye were most abundant in Poplar River electrofishing catches. With very limited time spent electrofishing in the mouths of Little Porcupine Creek and Big Muddy Creek, northern pike were the most abundant game species.

Attempts were made to electrofish the entire 185 mile study reach, rather than choosing study sections so that any concentrations of fish would not be

Table 6. Electrofishing catch rate (number of fish per day) summary for game fish species in the Missouri River in 1979.

Season	River Section: Milk River to Frazer Pump	to Scott's Ranch	to Sand Creek	to Highway 13 Bridge	to Chelsea	to Poplar River	to Sprole Bridge	to Brockton	to Big Muddy Creek	to Highway 16 Bridge	to Little Muddy Creek	to N. D. border
Sauger												
Spring	48	10	8	12	-	-	23	18	22	7	24	14
Summer	43	-	12	16	-	-	-	15	-	13	11	8
Fall	4	1	14	21	9	8	46	27	10	24	17	39
Walleye												
Spring	2	2	0	1	-	-	0	0	2	2	3	2
Summer	1	-	0	2	-	-	-	0	-	0	1	0
Fall	0	0	0	1	0	1	1	2	0	0	1	7
Northern Pike												
Spring	5	2	1	2	-	-	4	0	0	2	1	2
Summer	1	-	0	1	-	-	-	3	-	3	0	0
Fall	1	2	2	0	6	2	7	1	1	1	0	0
Burbot												
Spring	3	3	0	1	-	-	0	0	5	0	1	0
Summer	0	-	1	0	-	-	-	1	-	2	2	6
Fall	0	1	0	0	0	1	0	0	0	1	0	1
Shovelnose Sturgeon												
Spring	1	3	0	1	-	-	1	2	0	0	0	1
Summer	1	-	1	0	-	-	-	1	-	0	1	4
Fall	0	0	0	1	0	0	0	1	0	0	0	0
Paddlefish-captured												
Spring	6	2	1	3	-	-	4	1	3	0	0	4
Summer	8	-	1	0	-	-	-	0	-	0	0	0
Fall	0	1	0	0	0	0	0	0	0	0	0	0
Paddlefish-observed but not captured												
Spring	11	5	2	10	-	-	8	6	1	3	0	11
Summer	33	-	2	3	-	-	-	8	-	1	0	0
Fall	1	1	0	0	0	0	0	0	0	0	0	0

Table 7. Electrofishing catch rate (number of fish per day) summary for game fish species in Missouri River tributaries in 1979.

Species	Milk River (3.5)[a]	Little Porcupine Creek (0.2)	Poplar River (6.0)	Big Muddy Creek (0.1)
Sauger	16.9	20.0	9.5	0.0
Walleye	0.9	5.0	11.1	0.0
Northern pike	1.4	25.0	5.5	100.0
Burbot	0.3	0.0	0.7	0.0
Channel catfish	0.6	0.0	0.0	0.0
Smallmouth bass	0.0	0.0	0.2	0.0

a/ Number of days of electrofishing.

Table 8. Frame trap netting catch rate summary (fish captured per net day) for the Missouri River and mouths of tributary streams in summer 1979.

Species	Milk R. near mouth (7)[a]	Missouri R. near Milk R. (7)	Poplar River near mouth (2)	Redwater R. near mouth (3)	Missouri R. near Poplar R. (1)	Missouri R. near Big Muddy Creek (14)	Missouri R near Little Muddy Creek (14)
Shovelnose sturgeon						0.1	
Goldeye	31.0		0.5	0.3	1.0	0.4	1.5
Northern pike	2.1		4.0	0.3		0.7	0.6
Carp	2.9		3.5		1.0	0.4	0.1
River carpsucker	23.1		4.5	11.0		1.6	4.5
Blue sucker	0.6						
Smallmouth buffalo	2.4		0.5	0.7			0.2
Bigmouth buffalo	0.1						
Shorthead redhorse	0.7		0.5				0.1
White sucker	0.3						
Channel catfish	0.3			2.7		0.4	
Sauger	26.9	0.3	1.0	2.3	1.0	0.3	0.2
Walleye	1.3		1.0			0.2	
Totals	91.7	0.3	15.5	17.3	3.0	4.1	7.2

a/ Number of net days.

missed. This goal was met only for fall electrofishing sampling (Table 6). Discussion of game fish concentration is found under headings for the various game species.

Frame Trap Netting

Frame trap nets were set in the Missouri River and in the mouths of tributary streams in summer, 1979. Results are shown in Table 8 and Appendix C. Nets were not fished in the mouths of tributary streams in spring, when this gear should be most efficient, but this activity is planned for spring in future years. Both game and nongame species were weighed and measured from frame trap nets.

A total of 891 fish were caught, of which 280 were game fish. Of the game fish, sauger made up 74%, northern pike 15%, channel catfish 6% and walleye 5%. Goldeye and river carpsucker were the most abundant nongame species.

Catch rates in the mouths of tributary streams were much higher than in the Missouri River. Average numbers of fish caught per net-day were 41.5 for the mouths of tributaries and 3.6 for main river locations. Catch rates in the mouth of the Milk River were especially high (Table 8). Goldeye, river carpsucker, and sauger were each caught at rates exceeding 20 fish per net day. At other locations catch rates for individuals were generally less than five fish per net day.

Gill Netting

Gill nets were set in the Missouri River and in the mouths of tributary streams in summer, 1979. A catch rate summary by locations is shown in Table 9. Appendix D contains numbers, lengths and weights of species captured in gill nets. Gill nets proved to be a very efficient method for sampling fish. A total of 1,088 fish were caught in gill nets of which 238 were game fish. Gill nets, however, have the disadvantage of killing most of the fish captured so that only a few are available for tagging and study of fish movement.

A large number of shovelnose sturgeon was captured in the dredge cuts - tailwater complex. Of 144 shovelnose sturgeon caught in gill nets, 137 were caught in the dredge cuts - tailwaters area. No other large differences in proportion of species captured are evident among the areas sampled.

Overall catch rates were higher in the mouths of the tributaries than in the main river, but differences were not as great as with frame trap nets. An average of 58.8 fish per overnight set were caught with gill nets set in the mouths of tributary streams, while the average for sets in the main river was 29.6.

The shortnose gar caught in the mouth of Little Porcupine Creek is the only record of this species in Montana apart from the Fort Peck Dam dredge cuts.

Of the 238 game fish caught in gill nets shovelnose sturgeon made up 61%, sauger 13%, northern pike 12%, channel catfish 8% and walleye 5%. If the dredge cuts area is ignored, the northern pike is numerically dominant, making up 38% of the game fish catch. Percentages for other game species are sauger 36%, shovelnose sturgeon 10%, walleye 7%, channel catfish 7%, and yellow perch 1%.

Table 9. Gill netting catch rate summary (fish captured per overnight net set) for the Missouri River and mouths of tributary streams in 1979.

Species	Ft. Peck Tailwaters and Dredge Cuts (12)[a]	Near Little Porcupine Creek (5)	Mouth of Little Porcupine Creek (1)	Highway 13 Bridge (6)	Mouth of Redwater R. (1)	Mouth of Poplar R. (2)	Near Poplar R. (2)	Near Little Muddy Creek (5)
Shovelnose sturgeon	11.4			1.0				0.2
Shortnose gar			1.0					
Goldeye	14.2	2.4	28.0	38.7	25.0	14.5	39.5	16.2
Northern pike	0.2		9.0	1.0		2.5	0.5	1.0
Carp	0.8	0.4		0.3	4.0	1.0	1.0	0.6
Flathead chub				0.3				0.2
River carp-sucker	2.7	1.4	16.0	0.3	33.0	1.0	0.5	4.0
Blue sucker	0.4							
Smallmouth buffalo	0.2	0.2	3.0	0.2	2.0	2.5		
Shorthead redhorse				0.2	16.0	1.0	0.5	0.4
Longnose sucker				0.2				
White sucker	0.5							
Black bullhead					2.0			0.2
Channel catfish	1.2				1.0	1.0		0.4
Yellow perch				0.2				
Sauger	0.6	0.2	4.0	0.8	6.0	1.5	0.5	1.0
Walleye	0.7			0.2	1.0	0.5		0.4
Totals	32.9	4.6	61.0	43.4	90.0	25.5	42.5	24.6

a/ Number of overnight gill net sets.

Larval Fish Sampling

Larval fish were sampled with towed nets from late May to early July so that the larval season of most species present would be covered. Both the main river and tributary streams were sampled. Results are found in Table 10.

Many larval fish could not be identified to species. Taxonomic groups sampled were : *Stizostedion* sp. (sauger or walleye), Catostomidae (sucker family), Cyprinidae (minnow family), *Ictiobus* sp. (smallmouth buffalo or bigmouth buffalo), emerald shiner, carp, yellow perch, blue sucker, Iowa darter and burbot. Yellow perch and burbot larvae were found only in Big Muddy Creek, Iowa darter only in the Poplar River and Big Muddy Creek, *Ictiobus* sp. only in the Milk River and in the Missouri River 1.5 miles downstream of the Milk River (Table 10). Other taxonomic groups were sampled at more locations. No larval fish were captured in the Missouri River upstream of the Milk River, indicating that the cold water area is not utilized for spawning.

Stizostedion sp. were the only game fish captured at several locations. A total of 33 were captured, 16 in the mouths of tributary streams and 17 in the Missouri River. Larval sauger/walleye per volume of water sampled were five times more abundant in tributary streams than in the Missouri River, suggesting that tributaries are relatively more important for spawning. In the main river larval sauger/walleye were most abundant just below the Milk River and from Big Muddy Creek to the North Dakota border. Greatest abundance for the main river was at the Nohly bridge, 2.5 miles upstream of the North Dakota border (Table 10). No walleye/sauger larvae were caught on the Missouri River from the Frazer pump downstream to the Poplar River. Temperature differences are a likely explanation.

Sauger

The sauger is native to the Missouri River and is probably the most abundant game fish in the study area. This species is probably the most abundant game fish in the middle Missouri River (Berg 1978) and in the lower Yellowstone River (Peterman and Haddix 1975). Of 1,606 game fish captured in the study area in 1979, 975 (61%) were sauger. All of these except for approximately 30 individuals were tagged and released for movement studies.

Sauger were distributed over the length of the study area, but were most abundant downstream of the Milk River along the north bank (Table 6). This concentration persisted into the summer. Gravel suitable for spawning is abundant in this area but rare farther downstream, and water temperatures are much warmer on the north bank, because of the Milk River, than on the south bank. Two or three miles of the south bank were electrofished in May, but no sauger were seen, although suitable spawning gravel is present along the south bank.

Table 10. Larval fish captured in towed nets in the Missouri River and in t mouths of tributary streams in 1979.

Sampling Period	Number of Samples	Total Water Volume Sampled (M^3)	*Stizostedion* sp.	Catostomidae	Cyprinidae	*Ictiobus* sp.	Emerald Shiner	Carp	Yellow Perch	Blue Sucker	Other
Milk River near mouth											
6-5-7-10	6	2227		10	152	20	6	6			
Redwater River near mouth											
6-6-6-20	4	1205		35	8			1			
Poplar River near mouth											
5-30-7-10	9	2423	10(4.1)[a]	1443	1						16[b]
Big Muddy Creek near mouth											
5-31-7-9	8	2227	6(2.7)	52	36			1	14	11	2[b]
Missouri River-upstream of Milk River											
5-30-7-10	9	3170	No Larval Fish Captured								
Missouri River-1.5 miles downstream of Milk River											
5-30-7-10	10	4103	5(1.2)	45	225	4		1			
Missouri River-near Frazer Pump											
6-5-7-10	8	3668			5						
Missouri River-Upstream of Wolf Creek											
6-5-7-10	8	3956		2	7						
Missouri River-Highway 13 Bridge											
5-30-7-10	10	4244		5	4						
Missouri River-Upstream of Poplar River											
5-30-7-10	10	2489			4						
Missouri River-2 miles downstream of Poplar River											
5-30-7-10	9	2358	1(0.4)	3	2						
Missouri River-Sprole Bridge											
6-8-7-9	8	3013		5			1				
Missouri River-Brockton											
5-31-7-9	8	3774		6							

Table 10 (continued). Larval fish captured in towed nets in the Missouri River and in the mouths of tributary streams in 1979.

Sampling Period	Number of Samples	Total Water Volume Sampled (M^3)	*Stizostedion* sp.	Catostomidae	Cyprinidae	*Ictiobus* sp.	Emerald Shiner	Carp	Yellow Perch	Blue Sucker	Other
Missouri River-upstream of Big Muddy Creek											
5-31-7-9	9	2227	1(0.4)	1	5						
Missouri River-0.5 miles downstream of Big Muddy Creek											
5-31-7-0	9	2489	2(0.8)	2	5						
Missouri River-Highway 16 Bridge											
5-31-7-0	9	3747	1(0.3)	1	1						1[c]
Missouri River-Nohly Bridge											
5-31-7-9	9	3511	7(2.0)	4	5						

a/ Number per 1000 M^3 of water volume sampled.

b/ Iowa darter

c/ Burbot

No walleye/sauger larvae were caught on the Missouri River from the Frazer pump downstream to the Poplar River. Temperature differences are a likely explanation.

Considerable sauger spawning probably occurred downstream of the Milk River. A total of 13 spent females were captured in this area on May 22, 23 and 24 (Table 11). No electrofishing was done in this area prior to May 22 and spawning probably occurred a few days previous to electrofishing. One ripe and one spent female sauger were caught in the Milk River (Table 11). Sauger and walleye spawning is known to occur in the Milk River through capture of larval fish (Needham 1979a). Only one other spent female was captured in the study area (Table 11). Isolated small patches of gravel may be used by sauger in the downstream part of the study area.

Table 11. Summary of ripe and freshly spent female spawners captured by electrofishing in 1979.

Number of ripe females	Number of spent females	Date	Location
		Sauger	
	1	5- 2-79	Missouri River-near Fort Union
	8	5-22-79	Missouri River-below Milk River
	1	5-23-79	" " " " "
	3	5-24-79	" " " " "
1	1	5-23-79	Milk River near mouth
		Walleye	
	1	5- 2-79	Missouri River-near Fort Union
	1	5-21-79	Missouri River-near Big Muddy Creek
		Northern Pike	
2		4-16-79	Poplar River near mouth
1		4-19-79	" " " "
2		4-27-79	" " " "
2		5- 3-79	" " " "
	2	5-15-79	" " " "

In spite of the evidence for sauger spawning in the Missouri River only three age 0+ sauger were caught in fall 1979. One age I sauger was caught in spring 1979. These fish were caught by electrofishing. Seining in backwater and other slow-water areas has not been done. This technique would be more likely to sample young-of-the-year sauger if they are present in significant numbers.

For the Missouri River and for tributary streams (Table 12), sauger captured in spring and fall were aged from scales. These fish grew at rates similar to other locations in Montana and very close to the rates given by Brown (1971). Growth rates are found in Table 12. Sauger from the lower Poplar and Milk Rivers grew at rates similar to Missouri River fish. No differences were found in growth of fish from the upstream and downstream portions of the study area (Table 12). Movement of fish may mask any differences in growth rate between the colder upstream areas and the warmer downstream areas.

Movements of many miles appear to be common in Missouri River sauger (Table 13). Of 24 total sauger tag returns in 1978 and 1979, 16 (58%) had moved at least 10 river miles from the tagging location (Table 13). Six moved over 100 river miles, five moved between the Yellowstone and Missouri Rivers, and one moved from the Missouri River to Garrison Reservoir. One sauger moved over 400 river miles from the Missouri River near

the Milk River to the Yellowstone River near Forsyth. It is possible that sauger in the Missouri and Yellowstone Rivers and in Garrison Reservoir constitute a single, highly mobile population. Much larger numbers of tag returns would be required to make a strong case for this hypothesis.

Table 12. Age and growth of sauger in the Missouri River and tributary streams.

Age	Number of Fish	Mean Length	Length Range	Location	Time
I	0(1)	-(5.5)	- (-)	Upper River[a/] (Lower River)[b/]	Spring 1979
II	6(12)	10.3(10.2)	9.7-11.0(8.7-11.0)		
III	31(38)	11.3(11.8)	9.2-13.0(9.8-14.0)		
IV	34(21)	13.9(14.0)	12.0-16.8(13.0-16.3)		
V & older	18(15)	16.7(17.6)	14.3-20.1(15.4-20.3)		
0+	1(2)	7.2(6.1)	- (5.5-6.7)	Upper River (Lower River)	Fall 1979
I+	13(35)	9.9(9.4)	8.9-11.0(7.1-11.2)		
II+	17(60)	10.7(10.8)	8.9-12.6(8.4-13.2)		
III+	2(16)	13.0(13.2)	11.7-14.4(11.4-14.5)		
IV+	3(10)	16.2(14.8)	15.3-17.2(13.0-16.8)		
V+ & older	2(14)	18.0(18.1)	15.8-20.2(14.6-23.3)		
I	0(0)	-(-)	- (-)	Milk River[c/] (Poplar River)[c/]	Spring 1979
II	1(2)	10.7(10.8)	- (10.2-11.5)		
III	8(24)	11.6(12.1)	9.7-12.6(10.2-13.9)		
IV	15(14)	13.5(13.6)	12.5-14.8(11.2-14.9)		
V & older	3(8)	18.2(16.3)	15.8-22.5(14.5-17.9)		

a/ Missouri River from the Milk River to Chelsea
b/ Missouri River from Chelsea to North Dakota
c/ Fish collected near the mouth

Walleye

The walleye is not native to Montana, but the western edge of the native distribution is not far to the east in North Dakota (Brown 1971). A total of 131 walleye were captured in 1979 in the study area. Of this number 67 (51%) were caught in the Poplar River, where this species appears to make up a larger fraction of the game fish. Walleye are distributed over the length of the study area, but are not as abundant as the sauger.

At least some walleye spawning probably occurs in the Missouri River. Two freshly spent female walleye were captured in May in the lower portion of the study area (Table 11). Spawning by walleye in the lower Poplar River is well recognized (Stewart 1979). Walleye spawning is also probably common in the lower Milk River (Needham 1979a).

At least some walleye rearing occurs in the Missouri River. Six walleye young of the year were captured electrofishing in fall 1979.

Walleye age and growth are shown in Table 14. Although the sample

Table 13. Miscellaneous information related to fish tag returns and movement in the Missouri River and lower portions of tributary streams in 1978 and 1979.

Category	Fish Species					
	Sauger	Walleye	Paddlefish	Rainbow Trout	Northern Pike	Total
Number of tag returns[a]	24	7	2	1	2	36
Moving over 10 miles	14	6	2	0	1	22(64%)[b]
Not moving as much as 10 miles	10	1	0	1	1	13(36%)
Moving over 100 miles	6	3	2	0	0	11(31%)
Moving between Missouri[c] and Yellowstone Rivers	5	0	2	0	0	7(19%)
Moving from Missouri[c] River to Garrison Reservoir	1	2	0	0	0	3(8%)

a/ Does not include fish tagged and recaptured in the Poplar River.
b/ Percentage of total number of fish recaptured.
c/ On Missouri River tributary.

size is not large, this species appears to grow at rates that are about average for Montana.

Only seven tagged walleye were recaptured in 1979. Six of these were recaptured at least 10 miles from the tagging location (Table 13). Three had moved over 100 miles. Two were recaptured in Garrison Reservoir. Both of these were spawners tagged in spring in the lower Poplar River. The walleye appears to be high mobile in the Missouri River.

Northern Pike

The northern pike is native to Montana, but probably not in the Missouri River drainage (Brown 1971). It is distributed throughout the study area. Considering the game species, the northern pike appears to be second in abundance to the sauger. A total of 179 northern pike were sampled in the study area in 1979. Of 113 sampled in the spring, 33 were caught in the Poplar River. Northern pike appear to be more abundant in the lower Missouri River than in the Middle Missouri River. Berg (1977, 1978) reported only 13 northern pike captured in the middle Missouri River by electrofishing and gill-netting over a two year period. Peterman and Haddix (1975) found very few northern pike in the Lower Yellowstone River. This species avoids strong currents (Pfliegar 1975) and in rivers is primarily a fish of backwaters. This habitat type is probably more abundant in the Lower Missouri River than in the Middle Missouri or lower Yellowstone Rivers.

Larger numbers of age I (in spring) and age 0+ (in fall) northern pike were sampled than were these ages of sauger and walleye. Of 50 northern pike captured in spring 32, (64%) were age I. Of 38 northern pike captured by electrofishing in fall, 6 (16%) were age 0+. The Missouri River and tributary streams may rear significant numbers of northern pike.

Concentrations were found in the mouths of some tributary streams (Table 7) This was true for Little Porcupine Creek and Big Muddy Creek. Ten northern pike were captured in the mouth of Big Muddy Creek in October in approximately 0.5 hours of electrofishing. This species may be attracted by warmer water in tributary streams.

Female spawners were captured only in the Poplar River (Table 11). From April 16 to May 15, 1979, seven ripe females and two recently spent females were captured. No female spawners were captured in other areas, but it cannot be said with any degree of certainty that the Poplar River is the only significant spawning area.

Age and growth of northern pike captured in the study area are shown in Table 15. This species grows somewhat faster in the lower Missouri River than at other locations in the state reported by Brown (1971). Individuals of large size are common in the study area. Northern pike weighing 10 to 20 pounds are not uncommon.

Channel Catfish

The channel catfish is native to Montana. Its status in the lower Missouri River is poorly understood because relatively few individuals have been captured Brown (1971) indicated that the species spawns after water temperatures exceed 75 F. This temperature is not reached in the lower Missouri River. Annual

Table 14. Age and growth of walleye in the Missouri River and Poplar River near the mouth.

Age	Numbers of Fish	Mean Length	Length Range	Location	Time
I	2(9)	6.6(6.1)	6.2- 7.1(4.8- 7.3)		
II	0(20)	- (9.8)	- (7.5-11.8)	Missouri River	Spring
III	0(5)	- (13.5)	- (12.6-15.1)	(Poplar River)	1979
IV	4(5)	14.2(14.1)	13.4-15.4(12.0-15.5)		
V and older	2(10)	19.0(20.7)	18.6-19.3(14.2-26.9)		
0+	6	5.6	4.3- 6.8	Missouri River	Fall
I+	4	9.5	7.2-11.5		1979
II+	2	14.0	12.5-15.6		
III+	1	15.4	-		
IV+	1	17.4	-		

Table 15. Age and growth of northern pike in the Missouri River and mouths of tributary streams.

Age	Numbers of Fish	Mean Length	Length Range	Location	Time
I	19(13)	11.0(11.8)	8.2-14.3(8.9-14.3)	Missouri River	Spring
II	1(7)	13.1(18.9)	- (13.1-23.0)	(Poplar River near mouth)	1979
III and older	3(7)	25.3(25.6)	23.0-26.7(21.5-31.7)		
Age 0+	6	9.5	8.3-11.2	Missouri River	Fall
Age I+	12	17.3	12.4-25.7	and mouths of	1979
Age II+	3	23.3	22.6-23.8	Tributary Streams	
Age III+	5	27.9	23.9-30.1		
Age IV+ and older	12	30.4	23.8-39.5		

maximum temperatures in the Missouri River near Culbertson approximately 70 F. Upstream maxima are lower.

Baited hoop nets are recognized to be very selective for channel catfish. These nets were fished for 60 net days in the study area. Results are shown in Table 16. A total of 29 channel catfish were captured, giving an average of 0.48 fish per net day. Berg (1978) fished these nets for 106 days in the middle Missouri River and caught 815 channel catfish, yielding an average of 7.7 fish per net day. Berg (1978) also caught individuals exceeding 20 pounds, while the largest individual caught in the lower Missouri River weighed only 6.7 pounds (Appendix D).

The largest catches in the study area in baited hoop nets were made in the lower Milk River and in the Missouri River near the Poplar River (Table 16).

Channel catfish were also captured in gill nets and frame trap nets. A total of 16 were caught by the latter method (Appendix Table C) and 19 by the former (Appendix Table D). No channel catfish were caught in the cold water upstream portions of the Missouri River using baited hoop nets, frame trap nets or gill nets, with the exception of 14 caught in gill nets in the dredge-cuts-tailwater area.

Table 16. Summary of channel catfish captured in baited hoop nets in 1979.

Location	Net Days	Number of Catfish Captured	Number per Net Day	Mean Length (Inches)	Length Range (Inches)	Mean Weight (pounds)	Weight Range (pounds)
Milk River near mouth	14	11	0.79	18.2	15.6-22.7	1.86	1.04-3.80
Missouri River near Milk R.	14	0	0	-	-	-	-
Missouri River near Frazer Pump	2	0	0	-	-	-	-
Missouri R. near Highway 13 Bridge	2	1	0. 5	17.0	-	1.54	-
Missouri River near Poplar R.	8	14	1.75	16.7	14.4-21.8	1.43	0.81-3.21
Poplar R. near mouth	1	1	1.00	12.4	-	0.74	-
Redwater R. near mouth	1	0	-	-	-	-	-
Missouri R. near Big Muddy Creek	8	0	-	-	-	-	-
Missouri R. near Little Muddy Creek	2	0	-	-	-	-	-
Missouri R. near N. Dakota border	8	2	0.25	16.6	14.8-18.4	1.34	1.01-1.67
Overall	60	29	0.48	17.1	12.4-22.7	1.57	0.74-3.80

Shovelnose Sturgeon

The shovelnose sturgeon is also native to Montana in the Missouri and Yellowstone River drainages. This species was captured only infrequently while electrofishing. A total of 18 were captured in 1979 by electrofishing, one in frame traps and 144 in gill net sets. Drifted gill nets often used by others successfully for sampling shovelnose sturgeon (Peterman and Haddix 1975) frequently became fouled on submerged snags and were largely unsuccessful in capturing shovelnose sturgeon in the study area.

Of the 144 individuals sampled in gill nets, 137 were caught in the Fort Peck dredge cuts-tailwater area (Appendix D). Catch rates were 11.4 shovelnose sturgeon per overnight net set in the dredge-cuts-tailwater area and 0.32 per overnight set in the remainder of the study area. Sampling with gill nets was done in summer only. No particular explanation can be given at this time for the apparent concentration of shovelnose sturgeon below Fort Peck dam.

The majority of shovelnose in the study area weighed between one and two pounds. The largest weighed 4.2 pounds. This is much smaller than individuals reported for the middle Missouri River (Berg 1978) or for the lower Yellowstone River (Peterman and Haddix 1975). A sample of 342 shovelnose sturgeon from the middle Missouri averaged 5.22 pounds, with a maximum of approximately 10 pounds. Lower Yellowstone shovelnose sturgeon reached a maximum weight of 15.5 pounds, with significant numbers weighing 10-15 pounds.

Examination of data from Carlander (1969) for shovelnose sturgeon populations south and east of Montana shows that lower Missouri River shovelnose are typical in size. The middle Missouri River and lower Yellowstone River populations are composed of individuals of unusually large size and lower Missouri River individuals are quite average. The Montana populations have not yet been compared on the basis of age.

Paddlefish

Lower Missouri River paddlefish are seasonal migrants. This species winters in Garrison reservoir, although at least a few are known to winter in the dredge cuts (R.G. Needham, personal communication). Paddlefish migrating out of Garrison reservoir in the spring travel up both the Yellowstone and Missouri Rivers. Individual fish may change rivers from one year to the next. Two paddlefish tagged in the Yellowstone River were captured in the Missouri River in 1979 (Table 13). Most fish leave the river during summer, and by fall few paddlefish remain in the Missouri River (Table 6). Paddlefish are known to spawn in the spring in the lower Milk River (Needham 1979a). They may also spawn in other portions of the study area, but this has yet to be demonstrated.

Paddlefish were first observed in the lower portion of the study area near Fort Union on May 2 in 1979. Nine days later paddlefish were seen approximately 140 river miles upstream near Prairie Elk Creek. Paddlefish reached upstream points within a few days.

Paddlefish are easily seen using electrofishing gear, but are not easily dip-netted while in the electrical field. In 1979 a total of 197 were observed in the study area, exclusive of the dredge cuts. Of these, 45 were captured, tagged, weighed and measured. Paddlefish remained abundant in the river

through July, but few were present by October (Table 6). Concentrations were observed between the Milk River and the Frazer pump, but data from 1979 are not sufficient to determine location of other concentrations. The Milk River is the only tributary where paddlefish were observed. Here they were observed only downstream of the first rapids four miles upstream from the mouth. Numbers captured at the vatious locations are shown in Appendices A and B.

Paddlefish captured were 50 to 69 inches total lenth and weighed from 16 to over 63 pounds. The scale used had a capacity of only 63 pounds. Sex could not be determined externally and no ripe fish were captured.

Paddlefish in the dredge cuts have received considerable study. A population estimate made by Needham (1979b) indicated the presence of over 3,000 paddlefish in the Fort Peck dredge cuts in summer 1978.

Burbot

The burbot is native to Montana. It is a predator preferring cool water. Little is known concerning the status and life history of this species in the study area. They appear to be distributed over all of the study area, including some of the tributary streams (Tables 6 and 7). Burbot were captured in the study area only by electrofishing. Numbers, lengths and weights of individuals captured are shown in Appendix Tables A and B.

A total of 34 burbot were captured in the study area in 1979. The average weight of fish in this sample was 2.34 pounds with a maximum of 16.5 pounds. Eight fish weighed over three pounds. Burbot in the study area may reach a larger size than in other rivers in the state. Peterman and Haddix (1975) reported that in a sample of 220 burbot from the Yellowstone River none weighed as much as three pounds. In the middle Missouri River the largest individual in a sample of 37 burbot weighed only 5.6 pounds (Berg 1977 and Berg 1978). Considering weights of burbot in North America (Carlander 1969), those captured in the study area are not unusually large.

Rainbow Trout

Only a few rainbow trout were captured during field sampling in 1979 (Appendix Table A); however, a spawning run was observed in the Fort Peck tailwaters in spring. Large catches by anglers were noted in this area in spring of rainbow trout weighing up to several pounds. These fish may have originated in Garrison Reservoir in North Dakota where this species was stocked over a period of years in the early 1970's.

Reproduction was apparently successful as live sac fry were dug from redds. Efforts will be made in future years to sample this spawning run by electrofishing.

RECOMMENDATIONS

The lower Missouri River survey and inventory project should continue. Emphasis for the next year should remain on determining the status, habitat types used, relative abundance, concentration locations and movements of game fish. The importance of tributary streams to Missouri River fish

populations should continue to receive attention.

Fish population size and reproductive success in the East and Middle Forks of the Poplar River should continue to be measured, as power plant operation begins in late 1980. If reproduction of walleye and northern pike fails in the East Fork, reservoir releases can be recommended to insure reproduction.

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LIST OF WATERS REFERRED TO

6-15-2680-02 - Milk River
6-16-0280-02 - Big Muddy Creek
6-16-2420-02 - Missouri River - section 1
6-16-2460-01 - Missouri River - section 3
6-16-2500-01 - Missouri River - section 5
6-16-2940-02 - Redwater River
6-16-2820-02 - Poplar River - section 1

Appendix Table A. Summary of game fish captured by electrofishing in the Missouri River in 1979.

Species	Number captured	Average Length (Inches)	Length Range (Inches)	Average Weight (Pounds)	Weight Range (Pounds)
Milk River to Frazer Irrigation Pump-4.5 days of electrofishing					
Sauger	164	13.4	7.2-22.2	0.65	0.11-2.51
Walleye	5	13.3	6.2-21.1	0.99	0.06-2.60
Northern Pike	13	12.0	9.2-18.1	0.46	0.15-0.78
Burbot	5	15.5	10.3-20.5	0.85	0.25-1.50
Channel Catfish	2	21.2	18.8-23.6	3.28	1.72-4.83
Shovelnose Stugeon	2	26.8	23.9-29.7	2.65	1.70-3.60
Yellow Perch	2	5.8	5.3- 6.2	0.08	0.06-0.10
Paddlefish	24	58.9	51.0-69.0	41.3	16.0 -63.0+
Total	217				
Frazer Irrigation Pump to Scott's Ranch-2.0 days of electrofishing					
Sauger	11	13.7	9.6-18.2	0.80	0.20-1.69
Walleye	2	13.6	13.4-13.8	0.67	0.64-0.70
Northern Pike	4	11.9	8.2-16.5	0.43	0.08-0.97
Burbot	4	21.8	14.8-37.5	3.94	0.76-12.50
Shovelnose Sturgeon	3	25.8	24.0-27.1	1.80	1.68-1.96
Paddlefish	3	55.0	54.0-56.0	30.0	22.0-36.0
Total	27				
Scott's Ranch to Sand Creek-3.0 days of electrofishing					
Sauger	45	12.7	8.9-19.7	0.61	0.16-2.17
Northern Pike	3	14.5	8.4-23.8	1.36	0.12-3.60
Burbot	1	8.4	-	0.15	-
Shovelnose Sturgeon	2	27.6	23.5-26.8	1.87	1.43-2.32
Paddlefish	2	55.5	55.0-56.0	25.5	25.0-26.0
Total	53				
Sand Creek to Highway 13 Bridge-4.0 days of electrofishing					
Sauger	64	11.6	8.9-16.2	0.41	0.16-1.16
Walleye	4	14.7	6.0-22.0	1.55	0.05-3.57
Northern Pike	5	26.0	23.0-29.7	3.89	2.39-5.75
Burbot	2	28.0	20.8-35.2	5.84	2.08-9.60
Shovelnose Sturgeon	2	25.0	24.5-25.5	1.57	1.30-1.84
Yellow Perch	1	5.5	-	0.08	-
Rainbow Trout	2	16.8	16.1-17.4	1.46	1.33-1.59
Paddlefish	3	56.0	53.0-61.0	32.50	18.0-51.0
Total	83				

Appendix Table A (continued). Summary of game fish captured by electrofishing in the Missouri River in 1979.

Species	Number captured	Average Length (Inches)	Length Range (Inches)	Average Weight (Pounds)	Weight Range (Pounds)
Highway 13 Bridge to Chelsea-1.0 days of electrofishing					
Sauger	9	10.3	9.2-11.4	0.27	0.18-0.35
Northern Pike	6	30.5	24.2-39.5	7.85	3.05-17.60
Total	15				
Chelsea to Poplar River-1.0 days of electrofishing					
Sauger	8	11.4	9.1-15.5	0.39	0.18-0.97
Walleye	1	6.8	-	0.10	-
Northern Pike	2	30.7	29.6-31.8	7.10	6.50-7.70
Burbot	1	19.8	-	1.28	-
Total	11				
Poplar River to Sprole Bridge-2.0 days of electrofishing					
Sauger	70	11.9	8.5-20.3	0.49	0.14-2.20
Walleye	1	5.0	-	0.03	-
Northern Pike	12	13.8	7.9-26.7	1.07	0.10-4.63
Shovelnose Sturgeon	1	25.2	-	1.42	-
Rainbow Trout	1	14.1	-	0.86	-
Brown Trout	1	19.5	-	2.10	-
Paddlefish	4	54.0	51.0-56.0	26.80	21.5 -31.5
Total	90				
Sprole Bridge to Brockton-3.0 days of electrofishing					
Sauger	60	11.7	8.2-23.3	0.55	0.13-3.64
Walleye	2	4.4	4.3- 4.6	0.02	0.01-0.02
Northern Pike	4	25.3	19.4-30.7	4.15	1.31-7.00
Burbot	1	17.5	-	1.05	-
Shovelnose Sturgeon	4	21.0	14.5-24.5	1.02	0.14-1.63
Rainbow Trout	1	13.1	-	0.74	-
Paddlefish	1	63.0	-	60.0+	-
Total	73				
Brockton to Big Muddy Creek-2.0 days of electrofishing					
Sauger	32	13.3	8.3-19.7	0.70	0.13-2.54
Walleye	2	14.2	13.6-14.8	0.91	0.73-1.10
Northern Pike	1	12.4	-	0.37	-
Burbot	5	15.8	6.6-23.1	1.46	0.05-3.62
Channel Catfish	1	20.1	-	2.70	-
Paddlefish	3	54.0	53.0-57.0	31.0	26.0 -38.0
Total	63				

Appendix Table A (continued). Summary of game fish captured by electrofishing in the Missouri River in 1979.

Species	Number captured	Average Length (Inches)	Length Range (Inches)	Average Weight (Pounds)	Weight Range (Pounds)
Big Muddy Creek to Highway 16 Bridge-3.0 days of electrofishing					
Sauger	44	11.4	5.5-18.1	0.44	0.04-1.92
Walleye	2	18.0	15.4-20.5	1.76	1.o9-2.44
Northern Pike	6	17.2	11.7-25.1	1.37	0.32-3.98
Burbot	3	13.1	10.8-17.1	0.54	0.26-1.03
Total	55				
Highway 16 Bridge to Little Muddy Creek-3.0 days of electrofishing					
Suager	52	12.8	5.5-21.1	0.67	0.05-3.14
Walleye	5	18.1	14.6-21.6	2.24	1.02-3.28
Northern Pike	2	13.6	11.6-15.7	0.61	0.41-0.81
Burbot	3	13.0	7.3-24.3	1.22	0.07-3.51
Shovelnose Sturgeon	1	23.0	-	1.29	-
Total	63				
Little Muddy Creek to North Dakota Border-2.5 days of electrofishin					
Sauger	57	12.7	7.1-20.2	0.65	0.17-2.44
Walleye	9	13.4	5.5-29.2	1.64	0.03-8.50
Northern Pike	2	14.4	12.7-16.1	0.66	0.42-0.90
Burbot	4	8.4	6.8-10.4	0.11	0.06-0.22
Shovelnose Sturgeon	3	23.7	22.6-24.5	1.46	1.37-1.60
Paddlefish	4	52.5	50.0-56.0	22.0	18.0 -25.0
Total	79				

Appendix Table B. Summary of game fish captured by electrofishing near the mouths of Missouri River tributary streams in 1979.

Species	Number captured	Average Length (Inches)	Length Range (Inches)	Average Weight (Pounds)	Weight Range (Pounds)
Milk River-3.5 days of electrofishing					
Sauger	59	13.2	9.7-22.5	0.63	0.21-2.90
Walleye	3	12.0	8.8-15.3	0.52	0.16-1.00
Northern Pike	5	18.9	4.6-33.0	3.59	0.02-8.70
Burbot	1	21.6	-	2.04	-
Channel Catfish	2	17.8	15.8-19.9	1.94	1.19-2.69
Paddlefish	1	51.0	-	18.50	-
Total	71				
Little Porcupine Creek-0.2 days of electrofishing					
Sauger	4	14.3	11.0-19.9	0.84	0.34-1.87
Walleye	1	5.6	-	0.05	-
Northern Pike	5	27.2	12.8-31.7	5.88	0.49-8.00
Total	10				
Poplar River-6.0 days of electrofishing					
Sauger	57	13.4	10.2-17.9	0.61	0.25-1.49
Walleye	67	12.6	4.8-26.9	0.98	0.04-8.35
Northern Pike	33	17.6	7.6-31.7	1.64	0.10-7.60
Burbot	4	29.3	22.9-42.0	7.45	3.10-16.50
Smallmouth Bass	1	13.2	-	1.16	-
Total	162				
Big Muddy Creek-0.1 days of electrofishing					
Northern Pike	10	21.8	18.8-29.8	2.41	1.30-6.10

Appendix Table C. Summary of fish captured in frame trap nets in the Missouri River and mouths of tributary streams in 1979.

Species	Number captured	Average Length (Inches)	Length Range (Inches)	Average Weight (Pounds)	Weight Range (Pounds)
Milk River near mouth-7 net days					
Goldeye	217	12.0	10.5-13.5	0.47	0.32-0.70
Northern pike	15	27.2	23.4-33.4	4.51	2.45-9.60
Carp	20	-	-	-	-
River carpsucker	162	15.7	12.4-20.2	1.99	0.88-4.56
Blue sucker	4	22.8	21.5-24.3	3.15	2.73-3.50
Smallmouth buffalo	17	21.5	15.5-25.4	5.06	1.84-11.30
Bigmouth buffalo	1	23.0	-	6.50	-
Shorthead redhorse	5	16.2	13.6-18.8	1.62	0.80-2.51
White sucker	2	14.2	10.5-17.9	1.39	0.48-2.30
Channel catfish	2	20.2	20.2-20.2	2.52	2.40-2.64
Sauger	188	13.7	11.0-19.5	0.71	0.34-1.63
Walleye	9	17.7	13.0-26.5	2.06	0.83-7.00
Total	642				
Missouri River ½ mile downstream of Milk River-7 net days					
Sauger	2	11.9	11.6-12.2	0.43	0.37-0.49
Poplar River near mouth-2 net days					
Goldeye	1	-	-	-	-
Northern pike	8	32.4	25.1-42.5	9.12	3.32-22.00
Carp	7	21.1	16.3-27.6	4.50	1.84- 9.50
River carpsucker	9	16.6	14.7-18.9	2.14	1.44- 3.04
Smallmouth buffalo	1	17.9	-	2.55	-
Shorthead redhorse	1	9.0	-	0.28	-
Sauger	2	13.6	12.1-15.1	0.73	0.41-1.05
Walleye	2	20.2	18.2-22.1	2.52	1.93-3.10
Total	31				
Redwater River near mouth-3 net days					
Goldeye	1	12.0	-	0.57	-
Northern pike	1	19.7	-	1.68	-
River carpsucker	33	14.5	11.0-19.3	1.44	0.58-3.40
Smallmouth buffalo	2	19.2	17.2-21.3	3.02	1.54-4.51
Channel catfish	8	12.4	9.4-26.2	1.05	0.20-6.30
Sauger	7	11.0	9.9-11.8	0.33	0.21-0.47
Total	52				

Appendix Table C (continued). Summary of fish captured in frame trap nets in the Missouri River and mouths of tributary streams in 1979.

Species	Number captured	Average Length (Inches)	Length Range (Inches)	Average Weight (Pounds)	Weight Range (Pounds)
Missouri River near Poplar River-1 net day					
Goldeye	1	8.2	-	0.15	-
Carp	1	16.5	-	2.20	-
Sauger	1	11.5	-	0.34	-
Total	3				
Missouri River near Big Muddy Creek-14 net days					
Shovelnose Sturgeon	1	22.5	-	1.10	-
Goldeye	6	10.7	9.1-11.8	0.36	0.27-0.42
Northern pike	10	24.1	14.0-37.5	4.14	0.62-13.90
Carp	6	22.3	21.3-23.7	3.56	2.79-4.44
River carpsucker	23	15.6	13.6-19.4	1.84	1.16-3.54
Channel catfish	6	22.3	21.3-23.7	3.56	2.79-4.44
Sauger	4	12.9	10.3-19.8	0.75	0.27-2.10
Walleye	3	18.2	17.9-18.6	1.83	1.70-2.05
Total	60				
Missouri River near Little Muddy Creek-14 net days					
Goldeye	21	9.1	7.1-12.0	0.36	0.11-0.47
Northern pike	9	22.0	11.9-31.0	3.13	0.37-7.80
Carp	1	19.0	-	3.10	-
River carpsucker	63	14.3	8.9-18.4	1.42	0.32-2.55
Smallmouth buffalo	3	19.3	17.3-21.2	3.64	2.91-4.47
Shorthead redhorse	1	7.2	-	0.15	-
Sauger	3	12.7	10.1-16.2	0.58	0.33-1.13
Total	101				

Appendix Table D. Summary of fish captured in overnight experimental gill net sets in the Missouri River and mouths of tributary streams in 1979.

Species	Number captured	Average Length (Inches)	Length Range (Inches)	Average Weight (Pounds)	Weight Range (Pounds)
Fort Peck Dam tailwaters and Dredge Cuts (12) [a]					
Shovelnose sturgeon	137	25.1	19.8-32.1	1.94	0.86-4.20
Goldeye	171	12.4	10.2-13.9	0.55	0.22-0.87
Northern pike	3	26.8	23.5-32.3	4.33	2.46-7.80
Carp	10	17.3	14.3-21.4	2.44	1.11-4.84
River carpsucker	32	15.2	13.9-19.8	1.62	1.03-4.48
Blue sucker	5	23.2	18.0-25.3	4.05	2.63-5.25
Smallmouth buffalo	2	22.9	18.3-27.5	7.53	2.86-12.20
White sucker	6	14.9	9.6-17.6	1.79	0.37-2.31
Channel catfish	14	17.8	16.1-21.0	1.75	1.17-3.59
Sauger	7	15.3	12.8-20.1	0.96	0.55-2.08
Walleye	8	16.4	11.7-21.0	1.48	0.40-2.61
Total	395				
Missouri River near Little Porcupine Creek (5)					
Goldeye	12	12.5	11.9-13.7	0.63	0.54-0.84
Carp	2	18.9	17.3-20.5	3.93	2.64-5.22
River carpsucker	7	18.0	14.9-19.9	2.92	1.32-4.50
Smallmouth buffalo	1	19.1	-	3.33	-
Sauger	1	12.8	-	0.54	-
Total	23				
Mouth of Little Porcupine Creek (1)					
Shortnose gar	1	24.4	-	1.76	-
Goldeye	28	11.6	5.9-13.2	0.53	0.07-0.72
Northern pike	9	30.3	26.6-35.7	7.53	3.66-13.90
River carpsucker	16	16.7	14.7-19.0	2.34	1.41-3.75
Smallmouth buffalo	3	21.1	19.5-23.2	3.83	3.80-5.60
Sauger	4	12.5	10.9-14.6	0.50	0.32-0.74
Total	61				
Missouri River near Highway 13 Bridge (6)					
Shovelnose sturgeon	6	23.9	21.8-25.8	1.34	1.00-1.63
Goldeye	232	11.5	6.0-13.5	0.49	0.06-0.80
Northern pike	6	26.8	9.9-39.1	7.01	0.20-18.20
Carp	2	17.8	13.6-22.0	2.98	1.25-4.70
Flathead chub	2	7.4	6.4- 8.4	0.15	0.10-0.20
River carpsucker	2	14.1	13.4-14.9	1.34	1.16-1.5
Smallmouth buffalo	1	18.7	-	3.35	-
Shorthead redhorse	1	8.1	-	0.24	-

Appendix Table D (continued). Summary of fish captured in overnight experimental gill net sets in the Missouri River and mouths of tributary streams in 1979.

Species	Number captured	Average Length (Inches)	Length Range (Inches)	Average Weight (Pounds)	Weight Range (Pounds)
Longnose sucker	1	11.5	-	0.71	-
Yellow perch	1	5.8	-	0.09	-
Sauger	5	11.5	0.26-0.67	0.39	10.2-13.5
Walleye	1	13.4	-	0.68	-
Total	260				
Mouth of Redwater River (1)					
Goldeye	25	9.0	6.1-11.5	0.25	0.09-0.49
Carp	4	16.4	16.2-16.8	1.64	0.99-2.04
River carpsucker	33	15.2	10.2-19.8	1.78	0.53-3.60
Smallmouth buffalo	2	20.6	17.7-23.4	3.90	2.50-5.30
Shorthead redhorse	16	10.6	6.4-17.4	0.62	0.09-2.04
Black bullhead	2	6.7	6.1-7.3	0.10	0.09-0.12
Channel catfish	1	13.4	-	0.64	-
Sauger	6	10.4	9.7-11.1	0.29	0.21-0.36
Walleye	1	10.6	-	0.36	-
Total	90				
Mouth of Poplar River (2)					
Goldeye	29	10.6	6.9-13.1	0.46	0.10-0.98
Northern pike	5	27.3	21.0-32.7	5.33	2.15-8.40
Carp	2	17.3	9.9-24.7	3.34	0.47-6.20
River carpsucker	2	14.5	14.0-15.0	1.30	1.19-1.41
Smallmouth buffalo	5	19.9	17.6-23.4	4.41	2.72-7.50
Shorthead redhorse	2	11.1	9.3-12.8	0.58	0.30-0.81
Channel catfish	2	20.6	16.3-24.9	3.98	1.26-6.70
Sauger	3	11.1	9.0-12.4	0.38	0.19-0.48
Walleye	1	16.2	-	1.20	-
Total	51				
Missouri River near Poplar River (2)					
Goldeye	79	10.3	7.4-13.6	0.40	0.13-0.75
Northern pike	1	25.6	-	5.12	-
Carp	2	11.6	9.6-13.5	0.84	0.40-1.27
River carpsucker	1	14.7	-	1.44	-
Shorthead redhorse	1	8.5	-	0.24	-
Sauger	1	11.2	-	0.35	-
Total	85				

Appendix Table D (continued). Summary of fish captured in overnight experimental gill net sets in the Missouri River and mouths of tributary streams in 1979.

Species	Number captured	Average Length (Inches)	Length Range (Inches)	Average Weight (Pounds)	Weight Range (Pounds)
Missouri River near Little Muddy Creek (5)					
Shovelnose sturgeon	1	26.1	-	1.96	-
Goldeye	81	9.0	5.9-13.4	0.32	0.06-0.75
Northern pike	5	27.3	16.7-36.2	5.74	1.01-10.70
Carp	3	17.2	15.0-20.9	2.59	1.66-4.25
Flathead chub	1	12.3	-	0.69	-
River carpsucker	20	12.9	8.5-17.7	1.22	0.35-2.90
Shorthead redhorse	2	6.5	6.5-6.5	0.11	0.11-0.11
Black bullhead	1	6.0	-	0.09	-
Channel catfish	2	23.1	23.1-23.1	4.62	4.48-4.76
Sauger	5	11.5	8.1-15.9	0.51	0.14-1.21
Walleye	2	10.7	9.9-11.6	0.38	0.29-0.46
Total	123				

a/ Number of overnight gill net sets.