Ref#85608
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MONTANA DEPARTMENT OF FISH, WILDLIFE & PARKS
ECOLOGICAL SERVICES DIVISION

JOB PROGRESS REPORT

STATE: Montana
PROJECT NO. FW-2-R-10
JOB NO. 1-b

TITLE: Lower Missouri River Basin Investigations
TITLE: Planning Inventory, Fisheries

PERIOD COVERED: July 1, 1980 through June 30, 1981

ABSTRACT

The second year of a survey and inventory study on the Missouri River from Fort Peck Dam to North Dakota was continued in 1980. Spring runoff was high in 1979 and low in 1980, giving an opportunity to determine effects of greatly differing flows. Upstream-downstream temperature differences were largest in spring, with water temperatures up to 16 F colder below Fort Peck Dam than near the North Dakota border. Drifting macroinvertebrates were sampled incidentally to sampling for larval fish.

Fish were sampled by electrofishing, gill nets, baited hoop nets, seining and towed plankton nets. Thirty-five species in 15 families have been sampled. A total of 4,510 fish was sampled in 1980, of which 2,378 were game fish. Sauger are the most abundant game fish, but goldeye are most abundant overall. All fish species were more abundant in downstream locations of the Missouri River, except for the shovelnose sturgeon. Relatively few fish may winter in the Missouri River.

Fewer larval fish were sampled in 1980 than in 1979. Game fish spawning was relatively less successful in 1980. Paddlefish concentrated in the Wolf Point area, rather than the Milk River area as in 1979.

Sauger were concentrated in the lower 2 miles of the Milk River rather than downstream of the Milk River as in 1979. They were much more abundant downstream of Brockton than at upstream locations. Sauger were much larger in the Missouri River in fall 1980 than previously. In October 1980, the average weight was over 1 pound, and 20 percent of the sauger sampled weighed over 2 pounds. Sauger YOY were found to rear in downstream areas.

Walleye were much less abundant than sauger. No evidence of northern pike reproduction was found in 1980. Northern pike are abundant in the study area, reach a large size, and are sedentary. Channel catfish were almost lacking in the Missouri River upstream of Wolf Point. Some channel catfish of yearling size were sampled in the lower river. Shovelnose sturgeon concentrations were found, but no spawners were observed. This species was not found in tributaries. There was a spawning run of large rainbow trout below Fort Peck Dam. These fish may be resident in Garrison Reservoir, North Dakota. A large spawning run of rainbow smelt entered the river in April 1980 from Garrison Reservoir. These fish traveled upstream to Fort Peck Dam and appear to have become resident in the dredge cuts.

BACKGROUND

Results of aquatic studies on the Missouri River from Fort Peck Dam to the Montana-North Dakota border (lower Missouri River) in 1980 are reported in this paper. Work on the lower Missouri River was begun in 1979, and results of this work were reported earlier (Stewart 1980). Prior to 1979, aquatic work in the study area was confined to the tailwaters and dredge cuts immediately downstream from Fort Peck Dam (see map, Figure 1).

1980 was a year of low streamflow in the study area, while streamflows were much larger in 1979. This has given, to some extent, an opportunity to observe fish populations under differing hydrological conditions. Because 1979 was the first year of the study, much work was not done that year that was needed to make comparisons to 1980.

Considerable progress has been made in clarifying the status of the important game fish species. However, much remains to be learned concerning habitat requirements, spawning locations, reproductive success and general life history aspects of fish species in the study area. Also, little is known concerning vulnerability of various fish species to various water development options.

Water withdrawals, which will affect fish populations, are likely to occur in the near future from the lower Missouri River or from Fort 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 US 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 downstream to the Missouri River.

A reregulation dam to be located approximately 8 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 game species, and formulation of instream flow recommendations to protect game fish populations.

More specific objectives for the report period included the following: obtain and summarize hydrological data related to fish populations, test large mesh drifted gill nets for sampling paddlefish, tag all game fish captured for movement studies, make paddlefish counts over the length of the river, sample game species in the lower

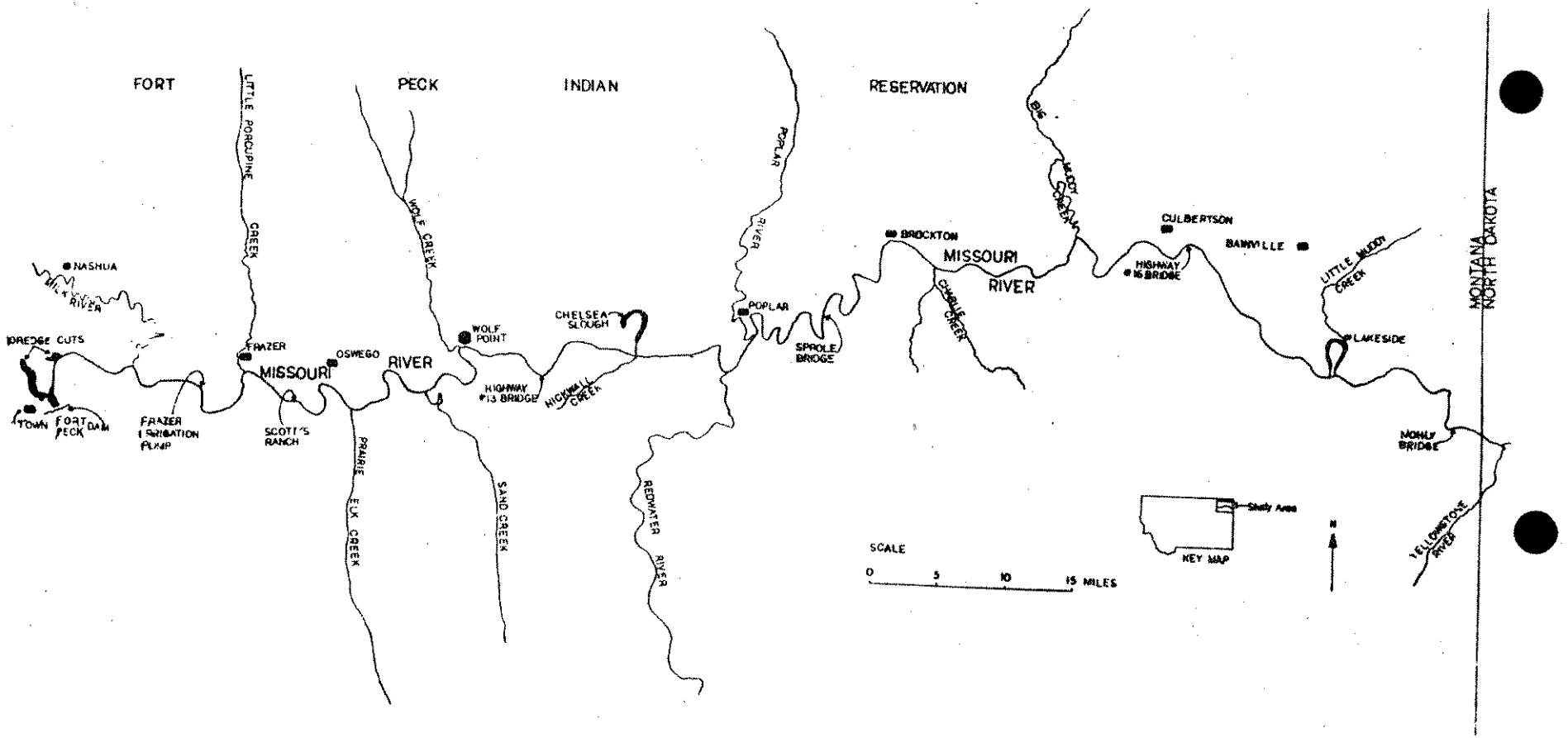

Figure 1. Map of lower Missouri River drainage in Montana.

portions of tributaries during spring migrations, sample game species over the length of the river in spring, summer and fall, locate concentrations of game species, sample walleye and sauger eggs on the river bottom to determine spawning locations, sample drifting larval fish, sample nongame fish species over the length of the river, sample young-of-the-year game fish, if present.

Substantial progress was made toward all of the above objectives.

DESCRIPTION OF THE STUDY AREA

The study area is described in a previous report (Stewart 1980).

PROCEDURES

Most of the equipment and procedures used were described in a previous report (Stewart 1980). Only new techniques and equipment will be described here.

Fish eggs were collected using an egg basket described by Priegal (1970). The basket consists of a metal framework covered with small mesh nylon cloth. A length of wood handle is attached to the metal frame for holding the basket in position. The river-bottom substrate was agitated upstream of the basket using a wide-toothed garden rake to free eggs from the riverbottom and allow them to be washed into the basket.

Fish were sampled from backwaters and channel margin areas of low velocity water using a drag seine. The seine used was of 0.25 inch mesh, 100 feet long and 10 feet deep.

Hoop nets were fished as in 1979, except that bait bags were attached to the bottom of the upstream hoop instead of to the top as was done in 1979. Two types of hoop nets were used, one with 0.5 inch square mesh and the other with 1.25 inch mesh.

Floating gill nets of 4 and 5 inches square mesh, 100 feet long and 6 feet deep were drifted downstream in areas of paddlefish concentration.

In 1979, paddlefish were captured and counted during electrofishing runs in which other species were also collected, weighed, measured and tagged. In 1980, two separate counting runs were made for paddlefish so that electrofishing could be done exclusively in the habitat usually favored by this species. Separate electrofishing runs were also made to capture paddlefish for length and weight measurements and tagging.

FINDINGS

River Temperature and Streamflow

Streamflows in the lower Missouri River drainage area were much lower in 1980 than in 1979. The differences were largest on the tributary streams and less on the Missouri River because Fort Peck Dam regulates the flow. Differences between the 2 years were

greatest in spring because of the large snowmelt runoff in 1979. On the Missouri River, for example, the average May 1979 streamflow near Culbertson was 32,840 cfs; the value for May 1980 was 6,998 cfs. The comparable May values for the Milk River near Nashua were 3,810 cfs and 44 cfs.

In a previous report, data were presented to indicate that water temperatures in the Missouri River were much colder near Fort Peck Dam (Stewart 1980) and that equilibration with ambient summer air temperatures was not reached 151 river miles downstream of Fort Peck Dam near Culbertson. Increases in water temperature with distance downstream from the dam are shown in Figure 2. In April, water temperatures were approximately 16 F colder near the dam than near the North Dakota border. Differences became less later in the year (Figure 2). Upstream and downstream differences became less in fall as downstream waters cool due to lowering air temperatures.

Aquatic Macroinvertebrates

Macroinvertebrates were collected incidentally to sampling for drifting larval fish with towed nets. No systematic sampling of the riverbottom for macroinvertebrates has been done yet, so data in Table 1 show only the composition, by various taxonomic groups, of drifting organisms.

Several groups of organisms are absent at upstream locations or make up only a small percentage of the drifting macroinvertebrates at upstream sampling points. No stoneflies (Order Plecoptera) were sampled upstream of the Frazer pump (Table 1). Stoneflies made up a large percentage of the drifting macroinvertebrates only in the lower half of the study area. The distribution of caddisfly larvae (Order Trichoptera) is similar.

Diptera made up a large fraction of organisms sampled at upstream locations, but became increasingly less important at downstream points.

Upstream-downstream differences in temperature, and probably to a lesser extent turbidity, probably cause the observed distributions of drifting macroinvertebrates.

Fish Populations

Species Composition, Distribution and Relative Abundance

A total of 35 species in 15 families was observed in the study area in 1979 and/or 1980 or are otherwise known to occur (Table 2). The brassy minnow (Hybognathus hankinsoni) is reported to be present in the lower Missouri River (Brown 1971), but none were observed in 1979 or 1980. The pallid sturgeon is known only from a few angler catches. The Iowa darter is listed in Table 2 because a single larval fish was captured in a towed net in 1980. This species may not be resident in the Missouri River. The Iowa darter is common in tributary streams and may have originated there.

The paddlefish is largely seasonal in the river. Most individuals winter in Garrison Reservoir, enter the river in spring and return to the reservoir later in the year.

The shortnose gar is native to Montana, but until 1979 it had been collected only from the dredge cuts. In 1979, one fish was captured in the mouth of Little Porcupine Creek.

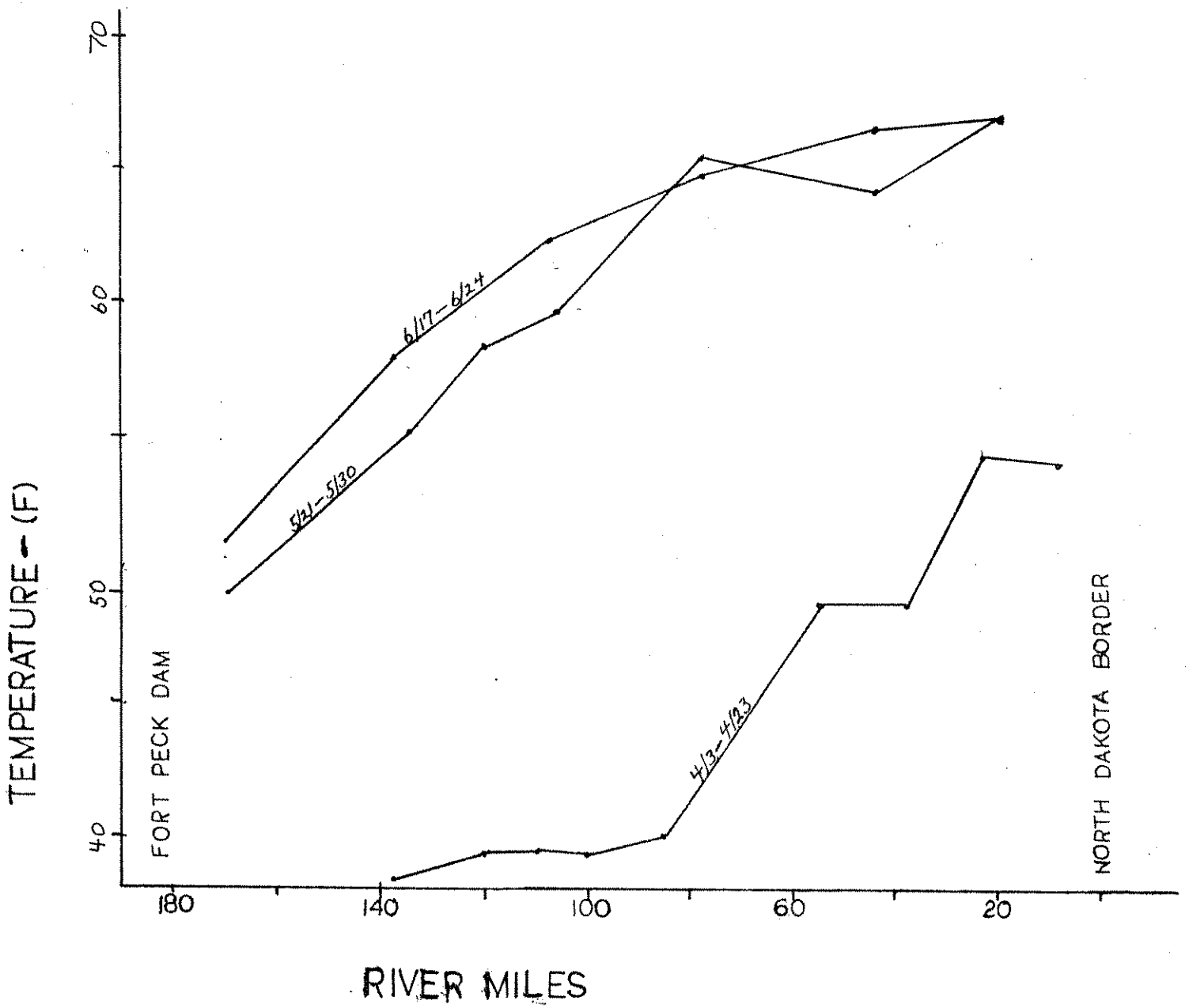

Figure 2. Longitudinal profile of temperatures in the Missouri River, 1980.

Table 1. Percentage composition of various taxonomic groups of aquatic macroinvertebrates in Missouri River towed net samples collected in spring and summer 1979 and 1980.

Location	Total Number Captured	Plecoptera	Ephemeroptera	Hemiptera	Trichoptera	Diptera	Annelida	Nematoda	Other[a]
Above Milk River	39	0	0	3	0	92	5	0	0
Below Milk River	50	0	12	0	2	84	0	2	0
Frazer Pump	44	2	9	2	0	80	0	5	2
Near Wolf Cr	29	7	17	34	0	34	0	0	7
Highway 13 Bridge	42	10	52	2	0	33	0	2	0
Above Poplar R	58	3	55	0	0	28	9	5	0
Below Poplar R	49	6	51	2	8	24	6	0	2
Sprole Bridge	31	32	26	0	16	19	0	6	0
Brockton	44	20	9	2	45	11	7	2	2
Above Big Muddy Cr	44	30	9	0	43	18	0	0	0
Below Big Muddy Cr	55	35	22	4	29	9	2	0	0
Highway 16 Bridge	66	26	36	0	30	5	0	2	2
Nohly Bridge	76	35	18	1	34	8	1	0	1
Total or Average	627	16	24	4	16	34	2	2	1

a - Other includes Coleoptera, Amphipoda and Gordiodia.

Table 2. Fish species captured in the Missouri River in Montana from Fort Peck Dam to the North Dakota border.

ACIPENSERIDAE (Sturgeon family)	
Scaphirhynchus albus[a, d]	Pallid sturgeon (R)[b]
Scaphirhynchus platorynchus[a]	Shovelnose sturgeon (A)
POLYODONTIDAE (Paddlefish family)	
Polyodon spathula[a]	Paddlefish (A)
LEPISOSTEIDAE (Gar family)	
Lepisosteus platostomus[a]	Shortnose gar (R)
HIODONTIDAE (Mooneye family)	
Hiodon alosoides[a]	Goldeye (A)
SALMONIDAE (Trout family)	
Salmo gairdneri	Rainbow trout (U)
Salmo trutta	Brown trout (R)
Salvelinus namaycush	Lake trout (U)
OSMERIDAE (Smelt family)	
Osmerus mordax	Rainbow smelt (A)
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 (U)
Notropis atherinoides[a]	Emerald shiner (C)
Hybognathus nuchalis[a]	Silvery minnow (U)
Pimephales promelas[a]	Fathead minnow (U)
CATOSTOMIDAE (Sucker family)	
Carpoides carpio[a]	River carpsucker (A)
Cycleptus elongatus[a]	Blue sucker (C)
Ictiobus bubalus[a]	Smallmouth buffalo (C)
Ictiobus cyprinellus[a]	Bigmouth buffalo (C)
Moxostoma macrolepidotum[a]	Shorthead redhorse (C)
Catostomus catostomus[a]	Longnose sucker (U)
Catostomus commersoni[a]	White sucker (U)
ICTALURIDAE (Catfish family)	
Ictaluras melas	Black bullhead (U)
Ictaluras punctatus[a]	Channel catfish (C)
Noturas flavus[a]	Stonecat (U)
GADIDAE (Codfish family)	
Lota lota[a]	Burbot (A)

Table 2 continued.

PERCICHTHYIDAE (Sea bass family)	
Morone chrysops	White bass (R)
CENTRARCHIDAE (Sunfish family)	
Micropterus dolomieui[c]	Smallmouth bass (C)
Pomoxis annularis	White crappie (C)
PERCIDAE (Perch family)	
Perca flavescens	Yellow perch (C)
Stizostedion canadense[a]	Sauger (A)
Stizostedion vitreum	Walleye (A)
Etheostoma exile	Iowa darter (R)
SCIAENIDAE (Drum family)	
Aplodinotus grunniens[d]	Freshwater drum (U)

a - Native to the Missouri River in Montana.
b - A=abundant, C=common, U=uncommon, R=rare.
c - Found only in the Poplar River.
d - Known only from angler catches in the Ft. Peck tailwaters.

The white bass and rainbow smelt have been introduced in Garrison Reservoir. Only two white bass have been captured in the study area, one from the dredge cuts and one near the Nohly bridge. The rainbow smelt was first noted in the study area in 1979. In spring 1980 there was a large run of rainbow smelt up the Missouri River from Garrison reservoir.

The smallmouth 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.

Table 2 contains a subjective indication of the relative abundance of each species. Eleven species were judged abundant, nine common, ten uncommon and five rare.

Brown (1971) lists six additional species as being present in the lower portion of one or more of the tributary streams in the study reach of the Missouri River. These are pearl dace *(Semotilus margarita)*, northern redbelly dace *(Phoxinus eos)*, finescale dace *(Phoxinus neogaeus)*, plains minnow *(Hybognathus placitus)*, longnose dace *(Rhinichthys cataractae)* and the pumpkinseed *(Leopomis gibbosus)*.

Table 3 shows the longitudinal distribution of fish species in the lower Missouri River. Thirteen species were captured throughout the length of the study area. These are shovelnose sturgeon, paddlefish, goldeye, northern pike, carp, river carpsucker, blue sucker, smallmouth buffalo, bigmouth buffalo, shorthead redhorse, white sucker, sauger and walleye. An additional nine species have not been observed

Table 3. Longitudinal distribution of fish species captured in the lower Missouri River in 1979 and 1980.

	Ft Pk Dr Cts/ Tailwaters	vic. Milk R	Frazer Pump	Scott's Ranch	vic. Sand Cr	Highway 13 Br	Chelsea	vic. Poplar R	Sprole Br	Brockton	vic. Big Muddy Cr	Highway 16 Br	Lakeside	Nohly Br
Shovelnose sturgeon	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Paddlefish	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Shortnose gar	x													
Goldeye	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Rainbow trout	x		x	x	x	x		x	x	x				
Brown trout								x						
Lake trout	x													
Rainbow smelt	x	x		x	x	x	x			x	x	x	x	x
Northern pike	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Carp	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Flathead chub		x	x	x	x	x	x	x	x	x	x	x	x	x
Lake chub	x											x		
Emerald shiner	x	x	x	x	x	x		x	x	x	x	x	x	x
Silvery minnow	x													
Fathead minnow	x		x	x				x						
River carpsucker	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Blue sucker	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Smallmouth buffalo	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Bigmouth buffalo	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Shorthead redhorse	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Longnose sucker	x	x	x	x	x	x	x	x	x	x	x		x	x
White sucker	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Black bullhead						x							x	
Channel catfish	x		x			x	x	x			x		x	x
Stonecat											x		x	x
Burbot		x	x	x	x	x	x	x	x	x	x	x	x	x
White bass	x													x
White crappie								x			x		x	x
Yellow perch	x	x	x			x		x			x		x	x
Sauger	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Walleye	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Iowa darter												x		
Freshwater drum		x	x	x	x	x				x	x		x	x

at one or more sampling locations, but are considered to probably be present at least seasonally in the entire study area. These species are rainbow trout, rainbow smelt, flathead chub, emerald shiner, longnose sucker, channel catfish, burbot, yellow perch and freshwater drum. The flathead chub is noticeably less abundant upstream of Sand Creek than at downstream points. Channel catfish are mostly absent from Wolf Creek upstream to the Milk River, but are common in the dredge cuts.

Most fish species appear to be less abundant in the colder upstream portion of the Missouri River. The shovelnose sturgeon is an exception. Noticeably greater numbers of this species were found at upstream locations.

Results of Field Sampling Techniques

Electrofishing Surveys

Electrofishing was done over the entire length of river from the Milk River to North Dakota, rather than using only isolated sections. By this procedure, any concentrations of fish would probably not be missed. The Missouri River was divided into 12 segments from the Milk River to North Dakota. Each of these segments could be electrofished in approximately 1 day. Each segment was sampled by electrofishing at least three times in 1980, in the months of April, July and October. Only game fish were retained for tagging, weighing and measuring, but the presence of other species was noted.

Number and size of game fish captured in the Missouri River are shown in Table 4. The same information is found in Table 5 for tributary streams. In the main river, 754 fish were captured in electrofishing runs (exclusive of paddlefish). Of these, sauger made up 61.4 percent, shovelnose sturgeon 15.1 percent, northern pike 10.5 percent, walleye 7.8 percent, burbot 4.8 percent and channel catfish 0.3 percent. In tributary streams, 730 game fish were captured by electrofishing, of which sauger made up 92.9 percent, walleye 3.8 percent, northern pike 1.5 percent, channel catfish 1.1 percent and burbot 0.7 percent. No shovelnose sturgeon were captured by electrofishing in tributary streams. Large numbers of sauger captured in the lower Milk River overshadowed the small numbers of other species captured in tributary streams.

Numbers and sizes of game fish captured by river segments in electrofishing runs are shown in Appendix Table A.

A catch rate summary for the various game species captured in the main river is given in Table 6. Numbers of game fish were fewest in the spring, and in the upper river in all seasons. Only shovelnose sturgeon were common in the upper river in April.

In the first 10 days of April from the Milk River to Brockton, very few game fish were found (Table 6). Numbers became somewhat larger from Brockton to North Dakota, but were still less than in summer or fall. The same is also true of nongame species, although not shown in Table 6.

Much larger numbers of game fish were found in the main river in spring 1979 (Stewart 1980), when large amounts of relatively warm runoff entered the Missouri River from tributary streams. The same is true for nongame fish species. The relatively warm tributary runoff was lacking in spring 1980.

Table 4. Number and size of game fish captured by electrofishing in the Missouri River in 1980.

Species	Number captured	Average length (inches)	Length range (inches)	Average weight (pounds)	Weight range (pounds)
Sauger	463	12.8	5.6 -24.0	0.80	0.04 - 5.22
Walleye	59	14.3	5.6 -25.7	1.63	0.04 - 8.30
Northern pike	79	24.5	9.7 -42.0	4.65	0.22 -19.00
Burbot	36	17.2	4.6 -32.7	1.88	0.01 - 7.30
Shovelnose sturgeon	114	26.0	21.5 -33.5	2.12	1.06 - 4.38
Channel catfish	2	24.2	23.4 -25.1	6.72	5.24 - 8.20
Yellow perch	1	6.5	-	0.11	-
Paddlefish[a]	28	57.8	51 -69	35.1	19 -65
	782				

a - Includes one fish captured in a drifted gill net.

Table 5. Number and size of game fish captured by electrofishing near the mouth of Missouri River tributary streams in 1980.

Species	Number captured	Average length (inches)	Length range (inches)	Average weight (pounds)	Weight range (pounds)
Milk River - 9.5 days of electrofishing					
Sauger	677	13.2	8.4 -21.5	0.67	0.15 - 3.04
Walleye	21	14.0	8.6 -23.5	1.07	0.16 - 4.10
Northern pike	6	24.6	15.1 -33.0	4.18	0.71 -10.20
Burbot	4	23.6	12.5 -40.2	4.92	0.43 -13.50
Channel catfish	8	22.4	16.1 -27.4	5.28	1.33 -11.20
Poplar River - 2 days of electrofishing					
Sauger	1	9.8	-	0.20	-
Walleye	5	16.9	9.0 -23.3	2.31	0.18 - 5.80
Northern pike	1	19.8	-	1.76	-
Big Muddy Creek - 1 day of electrofishing					
Walleye	4	7.3	2.7 -20.7	0.74	0.01 - 2.93
Northern pike	4	21.2	14.6 -29.0	3.04	0.71 - 7.00
Burbot	1	9.8	-	0.19	-

Table 6. Electrofishing catch rate (number of fish per day) summary for game fish species in the Missouri River in 1980.

Season	River Section: Milk River to Frazer pump	to Scott's Ranch	to Sand Creek	to Highway 13 Br	to Chelsea	to Poplar River	to Sprole Bridge	to Brockton	to Big Muddy Cr	to Highway 16 Br	to Lakeside	to ND Border	Season Totals
Sauger													
Spring	2	1	0	6	4	0	0	1	23	2	12	8	59
Summer	9	2	14	6	13	24	18	15	25	25	40	30	221
Fall	1	10	13	5	17	7	8	11	20	17	21	28	158
Location totals	12	13	27	17	34	31	26	27	68	44	73	66	438
Walleye													
Spring	0	0	0	0	0	0	1	1	7	3	2	2	16
Summer	0	0	4	3	0	2	3	1	2	5	3	1	24
Fall	0	1	2	0	2	1	0	2	1	3	0	3	15
Location totals	0	1	6	3	2	3	4	4	10	10	5	6	55
Northern pike													
Spring	0	0	0	4	2	2	3	1	0	0	0	2	14
Summer	0	0	1	1	6	5	3	2	7	3	2	2	32
Fall	0	0	2	3	2	2	3	1	8	5	0	3	29
Location totals	0	0	3	8	10	9	9	4	15	8	2	7	75
Burbot													
Spring	0	1	0	0	0	0	0	0	0	1	1	0	3
Summer	0	0	0	0	0	1	1	0	1	0	4	0	7
Fall	0	1	1	0	1	1	2	3	2	0	6	9	26
Location totals	0	2	1	0	1	2	3	3	3	1	11	9	36
Shovelnose sturgeon													
Spring	10	7	0	0	0	0	0	1	1	1	1	0	21
Summer	22	12	5	28	2	1	1	4	1	0	0	1	77
Fall	2	3	0	0	0	0	0	1	0	0	0	0	6
Location totals	34	22	5	28	2	1	1	6	2	1	1	1	104
Totals of above Species													
Spring	12	9	0	10	6	2	4	4	31	7	16	12	113
Summer	31	14	24	38	21	33	26	22	36	33	49	34	361
Fall	3	15	18	8	22	11	13	18	31	25	27	43	234

The available data suggest that few fish winter in the main river and that fish are slow to reenter the main river in years when large amounts of warm water from tributary streams are absent in spring.

Relatively few game fish were found in the downstream portions of tributary streams, with the exception of the Milk River (Table 7). Concentrations of sauger persisted in the Milk River through most of 1980.

Table 7. Electrofishing catch rate (number of fish per day) summary for game fish species in Missouri River tributaries in 1980.

Species	Milk River (9.5)[a]	Poplar River (2)	Big Muddy Creek (1)
Sauger	72	<1	0
Walleye	2	3	4
Northern pike	<1	<1	4
Burbot	<1	0	1
Channel catfish	<1	0	0

a - Number of days of electrofishing.

Frame Trap Netting

Frame trap nets were set in the mouths of the Milk, Poplar and Redwater rivers as soon as ice was out in April 1980. The Redwater River net was stolen before fish could be worked from it. The Poplar River net was stolen after fish were worked once. The same happened to the frame trap net in the mouth of the Milk River after 13 net days. As a result, relatively few fish were captured in frame trap nets in the mouths of tributary streams (Table 8). From the net in the mouth of the Milk River, it was evident that a concentration of sauger was present. Electrofishing was used to sample these fish after the theft of the frame trap net, and proved to be more efficient with time.

Gill Netting Surveys

Complete number and size data for fish collected in gill nets are shown by sampling location in Appendix Table B. Table 9 contains number and size data for fish species sampled on the main river. Corresponding data for gill nets set in the mouths of tributary streams are given in Table 10. Gill nets were an effective method of fish sampling. A total of 2190 fish was caught in 52 experimental gill net sets. Of these, 1474 were caught at main river sampling locations and 716 were caught in the mouths of tributary

Table 8. Summary of game fish captured in frame trap nets in the mouths of Missouri River tributary streams in April 1980.

Species	Number Captured	Average length (inches)	Length range (inches)	Average weight (pounds)	Weight range (pounds)
	Milk River near mouth - 13 net days				
Sauger	139	13.5	10.1 -20.8	0.66	0.23 - 2.56
Walleye	3	21.3	20.1 -22.9	3.52	2.92 - 4.17
Northern pike	11	24.6	15.6 -30.0	3.82	0.76 - 7.50
Burbot	1	38.0	-	12.70	-
Channel catfish	4	23.7	20.8 -27.2	5.34	2.70 - 7.60
	Poplar River near mouth - 4 net days				
Sauger	9	12.8	11.1 -15.2	0.54	0.32 - 0.90
Walleye	4	14.3	10.8 -16.2	1.02	0.38 - 1.43
Northern pike	3	23.7	20.0 -30.2	3.30	1.67 - 6.50

Table 9. Number and size of fish captured in 42 overnight experimental gill net sets at seven locations on the Missouri River in 1980.

Species	Number Captured	Average length (inches)	Length range (inches)	Average weight (pounds)	Weight range (pounds)
Shovelnose sturgeon	76	25.3	20.7 -29.5	2.11	0.96 - 3.62
Goldeye	925	10.1	5.9 -14.9	0.40	0.06 - 1.27
Rainbow smelt	29	6.9	6.4 - 7.4	0.08	0.07 - 0.10
Northern pike	59	25.5	17.4 -40.6	4.60	1.20 -18.80
Carp	28	17.0	11.8 -21.2	2.40	0.81 - 4.10
Flathead chub	3	7.2	6.5 - 8.0	0.11	0.08 - 0.17
River carpsucker	91	14.9	9.3 -20.5	1.68	0.48 - 4.92
Blue sucker	3	24.3	23.8 -25.1	4.15	3.74 - 4.46
Smallmouth buffalo	1	20.6	-	5.42	-
Shorthead redhorse	33	12.1	7.9 -17.0	0.84	0.21 - 1.90
Longhose sucker	9	14.5	7.2 -19.9	1.87	0.13 - 3.84
White sucker	9	13.8	6.7 -17.9	1.45	0.13 - 2.84
Channel catfish	5	20.6	18.1 -21.5	2.68	1.60 - 3.06
White bass	1	6.9	-	0.15	-
White crappie	5	6.2	5.3 - 7.6	0.12	0.07 - 0.22
Sauger	131	13.9	8.1 -21.0	0.89	0.14 - 2.70
Walleye	66	16.6	8.1 -23.2	1.76	0.11 - 4.52
	1,474				

Table 10. Number and size of fish captured in 10 overnight experimental gill net sets in the mouths of Missouri River tributary streams[a] in 1980.

Species	Number Captured	Average length (inches)	Length range (inches)	Average weight (pounds)	Weight range (pounds)
Shovelnose sturgeon	4	26.8	24.7 -30.0	2.21	1.85 - 2.80
Goldeye	477	10.6	6.6 -14.0	0.40	0.08 - 1.02
Northern pike	19	23.7	17.0 -32.5	3.46	1.10 - 6.90
Carp	18	14.3	10.3 -21.1	1.53	0.53 - 4.40
River carpsucker	62	15.0	9.7 -18.8	1.52	0.41 - 2.93
Blue sucker	3	24.5	23.4 -25.2	4.52	4.30 - 4.82
Smallmouth buffalo	3	18.9	16.6 -20.2	3.75	2.82 - 4.66
Shorthead redhorse	50	13.2	7.0 -17.5	1.01	0.10 - 2.68
Channel catfish	11	14.7	10.6 -22.7	1.23	0.32 - 3.98
Burbot	1	22.0	-	2.58	-
Sauger	48	13.6	9.4 -19.7	0.75	0.18 - 2.40
Walleye	19	16.5	10.3 -21.6	1.82	0.36 - 3.98
Freshwater drum	1	14.7	-	1.83	-
	716				

a - Milk River, Little Porcupine Creek, Redwater River, Poplar River, Big Muddy Creek.

streams. Game fish made up 23 percent of the fish sampled from the main river and 14 percent of the fish from mouths of tributaries.

Numbers of fish caught per overnight net set by sampling location are found in Table 11 (Missouri River locations) and Table 12 (tributary stream locations). For all sampling locations and for all species, catch rates were approximately twice as high in the mouths of tributary streams as compared to the Missouri River. Catch rates on the main river were lowest in the vicinity of the Milk River (Table 1) in the cold water area. Catch rates were highest in the dredge cuts and near the North Dakota border. On the tributary streams, catch rates were highest in the mouth of the Milk River where goldeye and sauger made up most of the gill net catch.

Catch rates of walleye and sauger in gill nets were higher in 1980 than in 1979. Data for 1979 are found in Stewart (1980). Differences between the 2 years were especially large in the dredge cuts where the 1980 sauger catch rate was 6.8 in 1980 and 0.6 in 1979. The presence of rainbow smelt in the dredge cuts in 1980 may be responsible for the difference.

Percentage composition of the various species is shown in Table 13 (Missouri River locations) and Table 14 (tributary stream locations). Goldeye was the most abundant species, making up 64 percent of the catch at main river stations and 68 percent at

Table 11. Gill netting catch rate summary (fish captured per overnight net set) for the Missouri River in 1980.

Species	Ft.Peck Tailwaters and dredge cuts(10)[a]	Near Milk River(4)	Near Little Porcupine Cr (3)	Near Wolf Creek(7)	Near Poplar River(5)	Near Big Muddy Creek(7)	Below Lakeside (6)	Average All Locations
Shovelnose sturgeon	6.6			0.1	0.4	0.4		1.7
Goldeye	25.5	1.8	18.0	29.0	11.0	17.9	37.7	22.0
Rainbow smelt	2.9							0.7
Northern pike	0.1		2.3	1.4	0.8	0.6	5.5	1.4
Carp	0.9	0.2		1.6	0.2	0.3	0.7	0.7
Flathead chub					0.2	0.1	0.2	0.1
River carpsucker	2.3		2.0	3.9	1.2	0.3	4.5	2.2
Blue sucker	0.1	0.2				0.1		0.1
Smallmouth buffalo				0.1				0.0
Shorthead redhorse	0.6	0.5		0.9	0.2	2.1	0.5	0.8
Longnose sucker	0.7	0.2	0.3					0.2
White sucker	0.7	0.2			0.2			0.2
Channel catfish	0.5							0.1
White bass							0.2	0.0
White crappie							0.8	0.1
Sauger	6.8	1.0	1.0	4.0	0.4	2.4	1.5	3.1
Walleye	2.7		0.3	1.1	0.2	0.7	4.0	1.6
Location totals	50.4	4.1	23.9	42.1	14.8	24.9	55.6	35.0

a - Number of overnight gill net sets.

Table 12. Gill netting catch rate summary (fish captured per overnight net set) for nets set in the mouths of Missouri River tributary streams in 1980.

Species	Milk River(2)[a]	Little Porcupine Creek(1)	Redwater River(2)	Poplar River(2)	Big Muddy Creek(3)	Average All Locations
Shovelnose sturgeon	2.0					0.4
Goldeye	74.0	44.0	43.5	22.0	51.3	47.7
Northern pike	0.5	1.0	3.0		3.7	1.9
Carp	0.5		4.0	0.5	2.7	1.8
River carpsucker	6.5	7.0	18.5	1.0	1.0	6.2
Blue sucker	1.0				1.0	0.3
Smallmouth buffalo		3.0				0.3
Shorthead redhorse	8.0	1.0	12.5	4.0	0.7	5.0
Channel catfish			1.5	3.5	0.3	1.1
Burbot					0.3	0.1
Sauger	15.0		2.0		4.7	4.8
Walleye	2.0	1.0	1.0		4.0	1.9
Freshwater drum					0.3	0.1
Location Totals	109.5	57.0	86.0	31.0	70.0	71.6

a - Number of overnight gill net sets.

Table 13. Species composition percentages for gill net catches in the Missouri River 1980.

Species	Ft. Peck Tailwaters and dredge cuts(10)[a]	Near Milk River(4)	Near Little Porcupine Cr (3)	Near Wolf Creek(7)	Near Poplar River(5)	Near Big Muddy Creek(7)	Below Lakeside (6)	Average All Locations
Shovelnose sturgeon	13.1			0.3	2.7	1.7		2.5
Goldeye	50.6	41.2	75.0	68.8	74.3	71.4	67.9	64.2
Rainbow smelt	5.8							0.8
Northern pike	0.2		9.7	3.4	5.4	2.3	9.9	4.4
Carp	1.8	5.9		3.7	1.4	1.1	1.2	2.2
Flathead chub					1.4	0.6	0.3	0.3
River carpsucker	4.6		8.3	9.2	8.1	1.1	8.1	5.6
Blue sucker	0.2	5.9				0.6		1.0
Smallmouth buffalo				0.3				0.1
Shorthead redhorse	1.2	11.8		2.0	1.4	8.6	0.9	3.7
Longnose sucker	1.4	5.9	1.4					1.2
White sucker	1.4	5.9			1.4			1.2
Channel catfish	1.0							0.1
White bass							0.3	0.1
White crappie							1.5	0.2
Sauger	13.5	23.5	4.2	9.5	2.7	9.7	2.7	9.4
Walleye	5.4		1.4	2.7	1.4	2.9	7.2	3.0
Totals	100.2	100.1	100.0	99.9	100.2	100.0	100.0	100.0

a - Number of overnight gill net sets.

Table 14. Species composition percentages for gill net catches in Missouri River tributary streams 1980.

Species	Milk River(2)[a]	Little Porcupine Creek(1)	Redwater River(2)	Poplar River(2)	Big Muddy Creek(3)	Average All Locations
Shovelnose sturgeon	1.8					0.3
Goldeye	67.6	77.2	51.2	71.0	74.0	68.2
Northern pike	0.5	1.8	3.5		5.3	2.2
Carp	0.5		4.7	1.6	3.8	2.1
River carpsucker	5.9	12.3	21.8	3.2	1.4	8.9
Blue sucker	0.9				0.5	0.3
Smallmouth buffalo		5.3				1.0
Shorthead redhorse	7.3	1.8	13.5	12.9	1.0	7.3
Channel catfish			1.8	11.3	0.5	2.7
Burbot					0.5	0.1
Sauger	13.7		2.4		6.7	4.6
Walleye	1.8	1.8	1.2		5.8	2.1
Freshwater drum					0.5	0.1
Totals	100.0	100.2	100.1	100.0	100.0	99.9

a - Number of overnight gill net sets.

tributary sampling stations. Considering only the game fish, the following are percentages on the main river with percentages for tributary sampling locations in parentheses: sauger 39%(48%), walleye 19%(19%), shovelnose sturgeon 21%(4%), northern pike 17%(19%), channel catfish 1%(11%), other species 1%(1%).

Hoop Netting Surveys

Baited hoop nets were set for the purpose of sampling channel catfish, but nearly as many flathead chubs were sampled as catfish (Table 15). Only small numbers of other species were captured. As with other sampling methods, few fish were caught in the upstream cold water area. Hoop nets tended to sink into the substrate in the study area, because bottom types are almost entirely sand or silt in the locations where depth and velocity are suitable for hoop nets. These nets would probably capture more fish if gravel were available for net placement.

More detailed results for channel catfish will be given in a later section.

Table 15. Species composition and numbers of fish captured in baited hoop nets in the Missouri River 1980.

Fish Species	Location					
	Near Milk River	Near Upper Frazer Pump	Near Wolf Point	Near Poplar River	Near Big Muddy Creek	Near Lakeside
Channel catfish	0	1	5	34	41	23
Flathead chub	0	0	20	25	23	24
Burbot	0	0	1	2	1	2
Shorthead redhorse	0	0	2	0	3	2
Stonecat	0	0	0	0	1	3
Sauger	0	0	0	2	1	1
River carpsucker	0	1	0	0	0	3
Shovelnose sturgeon	0	0	0	1	0	0

Seining Surveys

Backwater and channel margin seine hauls were made over the length of the study area from the last week of July through the first week of September 1980. This type of sampling could be done only where current velocity was very low. It was done to locate previously uncollected species and young-of-the-year (YOY) fish. Results are in Table 16.

The fathead minnow, which had previously been found only in the dredge cuts, was sampled at downstream locations. YOY of the following species were captured by seining: longnose sucker, white sucker, white crappie, yellow perch, sauger and freshwater drum. The numbers of freshwater drum YOU found in seine hauls were somewhat surprising because adults of this species are uncommon. The white crappie in Table 16 could be yearlings rather than YOY, as scales were not collected. The finding of sauger YOY indicates that this species does rear in the main river.

Larval Fish and Egg Sampling

Attempts were made to locate fish eggs on likely spawning locations so that areas important for spawning could be identified. Parts of four different days (May 7, 8, 9 and 13, 1980) were spent sampling gravels in the Milk River near the mouth, Missouri River near the highway 13 bridge and the Missouri River near the Nohly bridge. Eggs were found in only a single sample near the Nohly bridge. These were approximately 1 mm diameter, the egg size of several species of cyprinids, but also of rainbow smelt. The eggs appeared to be mostly dead and beginning to decay. For these reasons, the eggs were not identified.

Table 16. Results of backwater and channel margin seining at six locations on the Missouri River 1980.

Location	Species	Number captured	Average length (inches)	Length range (inches)	Average weight (pounds)	Weight range (pounds)
Near Milk River (5)[a]	Unidentified *Catostomus*	15	1.8	1.6 - 2.0		
	Carp	1	adult	-		
Near Little Porcupine Cr (4)	Carp	2	adult			
	Fathead minnow	2	2.0	1.9 - 2.0		
	River carpsucker	5	adult			
	Smallmouth buffalo	3	adult			
	Bigmouth buffalo	1	adult			
	Longnose sucker	6	1.9	1.8 - 2.1		
	Freshwater drum	1	2.5			
Near Wolf Cr (6)	Goldeye	46	9.1	2.7 -13.2	0.29	0.01 - 0.68
	Northern pike	4	24.3	11.5 -31.1	4.92	0.31 - 9.40
	Carp	1	11.3		0.70	
	Flathead chub	1	3.3			
	Emerald shiner	5	3.9	3.7 - 4.3		
	Unidentified cyprinidae	3	1.9	1.8 - 2.0		
	River carpsucker	38	11.9	1.6 -17.9	1.12	0.01 - 3.24
	Smallmouth buffalo	6	17.1	14.0 -20.2	2.95	1.78 - 4.50
	Bigmouth buffalo	5	19.0	17.0 -21.1	4.42	2.96 - 5.84
	Shorthead redhorse	1	5.6		0.06	
	Longnose sucker	4	2.3	2.1 - 2.5		
	White sucker	4	2.4	2.2 - 2.5		
	Unidentified *Catostomus*	15	2.1	1.7 - 2.3		
	Yellow perch	2	2.2	1.9 - 2.5		
	Sauger	1	3.8		0.01	
	Walleye	1	13.8		0.83	
	Freshwater drum	9	2.4	1.7 - 3.1		

Table 16 continued.

Location	Species	Number Captured	Average length (inches)	Length range (inches)	Average weight (pounds)	Weight range (pounds)
Near Poplar River (5)	Goldeye	6	adult			
	Northern pike	1	24.7		3.44	
	Carp	5	adult			
	Flathead chub	9	adult			
	Emerald shiner	7	3.5	3.0 - 4.3		
	Fathead minnow	1	2.0			
	River carpsucker	6		4.0 -18.0		
	Shorthead redhorse	8		3.2 -12.0		
	Longnose sucker	4	2.8	20. - 5.0		
	White sucker	1	adult			
	White crappie	25	1.8	1.5 - 2.1		
	Yellow perch	1	6.0			
	Sauger	2		2.7 -adult		
	Walleye	1	adult			
Near Big Muddy Creek (4)	Goldeye	10	8.4	6.1 - 9.5	0.18	0.07 - 0.26
	Flathead chub	2	adult			
	Emerald shiner	7	4.1	3.8 - 4.4	0.03	0.02 - 0.04
	River carpsucker	6	9.2	5.1 -14.6	0.54	0.07 - 1.48
	Smallmouth buffalo	1	12.5		1.19	
	Shorthead redhorse	3	3	3.9 -16.0		
	Longnose sucker	5	2.2	1.7 - 2.8		
	White sucker	1	5.1			
	White crappie	15	1.8	1.5 - 2.3		
	Yellow perch	1	5.5		0.10	
	Sauger (adult)	3	9.9	9.2 -10.5	0.24	0.19 - 0.28
	Sauger (YOY)	9	2.7	2.0 - 4.2		
	Freshwater drum	5	2.3	2.0 - 2.7		

Table 16 continued.

Location	Species	Number Captured	Average length (inches)	Length range (inches)	Average weight (pounds)	Weight range (pounds)
Below Lakeside (6)	Goldeye	4	7.2	5.9 - 8.9	0.11	0.06 - 0.20
	Carp	2	adult			
	Emerald shiner	2	3.8	3.7 - 3.8		
	River carpsucker	10	6.6	1.6 -14.9	0.38	0.01 - 1.85
	Smallmouth buffalo	1	adult			
	Bigmouth buffalo	1	adult			
	Shorthead redhorse	7	4.6	2.1 - 5.6	0.04	0.01 - 0.06
	Unidentified *Catostomus*	1	1.7			
	White crappie	33	2.0	1.3 - 3.3		
	Yellow perch	9	3.0	2.3 - 5.0		
	Sauger (YOY)	5	3.4	2.3 - 4.6		
	Sauger	1	6.2		0.05	
	Walleye	1	6.9		0.08	
	Freshwater drum	3	2.9	2.4 - 3.2		

a - Number of seine hauls.

Large concentrations of sauger spawners were sampled in the lowest 2 miles of the Milk River (discussed in a later section), but no fish eggs were found in this area. Flows were too low to produce current velocity over spotty shore gravels.

Larval fish were sampled with towed nets from early May to late June 1980, so that the larval period of most species present would be covered. Results are shown in Table 17 (Missouri River stations) and Table 18 (tributary stations). Many larval fish could not be identified to species, but the lowest taxonomic category that could be recognized is shown in Tables 17 and 18.

Several relationships of significance are recognizable using larval data for 1979 and 1980. Data for 1979 are from an earlier report (Stewart 1980). Streamflows were large in spring 1979, but considerably below average in 1980. Average numbers of larval fish captured on the Missouri River in 1979 were 8.4 per 1000 M^3 and 1.8 in 1980, a factor of 4.5 difference. For tributary stations in 1979, an average of 226 larval fish per 1000 M^3 was sampled, but only 35 in 1980, a difference factor of 6.5. It appears that the magnitude of sprintime streamflows may largely determine the magnitude of larval fish production.

Production of larval fish in tributary streams was much larger than in the Missouri River in both 1979 and 1980. Comparing numbers of larval fish sampled per 1000 M^3 of water filtered through towed nets, larval fish were 20 and 27 times more abundant in tributary streams than in the Missouri River in 1979 and 1980, respectively. Differences between the tributaries and the Missouri River in larval fish production may be even greater than would appear on the basis of relative numbers captured because many of the larval fish captured in the Missouri River may have originated in the tributaries.

Species Data and Discussions

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 pers. com.). 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 (Stewart 1980). One of these had been at large 15 years, the other 7 years. Paddlefish tagged in the Missouri River have also been recaptured in later years in the Yellowstone River (Rehwinkel 1978). Most fish leave the river during summer, and by fall, few paddlefish remain in the Missouri River (Table 19 and Stewart 1980). Paddlefish are known to spawn 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 in the dredge cuts have received considerable study, but little is known concerning paddlefish in the remainder of the study area. A population estimate made by Needham (1979b) indicated the presence of over 3,000 paddlefish in the Fort Peck dredge cuts in summer 1978.

Table 17. Larval fish captured in towed nets in the Missouri River from 5/9 to 6/28/80.

Location	Total Water Volume Sampled (M^3)	Carp	Blue sucker	*Ictiobus* sp.	White sucker	Unidentified Catostomidae	Freshwater Drum	Other
Above Milk R	1280	No larval fish captured						
Below Milk R	1408			1	1	1	1	
Frazer pump	1280	1			1		8	
Near Wolf Cr	1408	No larval fish captured						
Highway 13 br	1408				1			
Agove Poplar R	1280	No larval fish captured						
Below Poplar R	1280		1					
Sprole bridge	1408	1	1		1	2		
Brockton	1408					1		
Above Big Muddy Cr	1280		1	2				
Below Big Muddy Cr	1280			1				1[a]
Highway 16	1408					1		1[b]
Nohly bridge	1408	1						1[c]

a - Shorthead redhorse.
b - Iowa darter - first record in Missouri River.
c - *Stizostedion* sp.

Table 18. Larval fish captured in towed nets in the mouths of Missouri River tributary streams from 5/9 to 6/27/81.

Stream	Total Water Volume Sampled (M^3)	*Stizostedion* sp.	*Pomoxis* sp.	Yellow perch	Freshwater drum	Catostomidae		
						River carpsucker	*Ictiobus* sp.	White sucker
Milk River	2304				100		3	2
Poplar River	1728	13	19	32				25
Big Muddy Cr	1613					1	2	

Table 19. Number of paddlefish counted during electrofishing on the lower Missouri River in 1980.

River Section	Electrofishing Dates 4/1-4/23	5/21-5/30	6/17-6/23	7/7-7/23	10/7-10/31	Location Totals
Milk River (174.9)[a] to Upper Frazer Pump (164.8)	28	1	4	6	0	39
Upper Frazer Pump (164.8) to Scott's Ranch (147.0)	0	4	0	1	0	5
Scott's Ranch (147.0) to Prairie Elk Creek (135.5)	0	3	1	0	0	4
Prairie Elk Creek (135.5) to Sand Creek (126.9)	0	4	1	1	0	6
Sand Creek (126.9) to Highway 13 Bridge (114.9)	1	103	11	21	9	145
Highway 13 Bridge (114.9) to Chelsea Slough (104.6)	2	13	6	4	1	26
Chelsea Slough (104.6) to Poplar River (92.0)	0	10	20	1	0	31
Poplar River (92.0) to Sprole Bridge (75.8)	1	6	12	0	0	19
Sprole Bridge (75.8) to Brockton (63.1)	1	2	2	0	0	5
Brockton (63.1) to Big Muddy Creek (43.8)	0	8	2	0	0	10
Big Muddy Creek (43.8) to Highway 16 Bridge (35.1)	1	2	0	0	0	3
Highway 16 Bridge (35.1) to Lakeside (13.0)	34	5	3	0	0	42
Lakeside (13.0) to Nohly Bridge (2.4)	11	2	1	1	0	15
Totals	79	163	62	35	10	350

a - River miles upstream from the Montana-North Dakota border.

Paddlefish work in 1980 consisted of determination of migration timing, counting of paddlefish over the length of the study area to find concentrations, and sampling to determine sizes. Large mesh drifted gill nets captured very few fish, so paddlefish were captured by electrofishing.

Paddlefish were first noted in the Missouri River on the first day of field work for 1980 - April 1. Twenty-eight paddlefish were counted in a small area approximately 3/4 mile upstream of the upper Frazer Pump (Table 19). These fish had probably wintered in the river. It is doubtful that they were migrants because river temperatures on April 1 were in the 35-40 F range, well below temperatures required to initiate migration in paddlefish.

The 34 paddlefish counted between the highway 16 bridge and Lakeside (Table 19) on April 22, 1980 were probably the first migrants noted. On that date, the noon river temperature was 55 F. Many of these fish were in relatively shallow water thought to be used by migrating paddlefish, but not by fish having taken up temporary residency.

Numbers of paddlefish counted in various river sections are shown in Table 19. Electrofishing in April, July and October was done principally to capture other species, and the deep water paddlefish habitat was poorly sampled. For these reasons, a smaller percentage of the paddlefish present in the river were probably counted in April, July and October than in May and June, when electrofishing was done specifically to count paddlefish. As a result, May and June 1980 paddlefish counts in Table 19 may not be fully comparable to other months.

Paddlefish congregated in the Sand Creek to Highway 13 bridge section in 1980 (Table 19). Counts for May and June are shown in more detail in Figure 3. Largest paddlefish concentrations were in May near the town of Wolf Point, where approximately 100 paddlefish were counted in 10 river miles on May 20. This concentration did not persist, and was largely dispersed by June 20 (Figure 3). By the second half of June, a smaller concentration had developed in the Chelsea slough area. Numbers of paddlefish shown in Table 19 and Figure 3 are only a fraction of the total numbers present in the river. Due to the volume of the Missouri River and limitations of the electrofishing gear, only part of the paddlefish present can be counted during an electrofishing run.

Paddlefish concentrations observed in the Missouri River just downstream from the Milk River in 1979 (Stewart 1980) were absent in 1980. The same is true for concentrations in the lowest 3 miles of the Milk in 1979. These differences are probably due to the differences in Milk River streamflows, which were large in spring 1979, but very small in spring 1980.

A total of 45 paddlefish was captured in 1979 for weighing, measuring for length and tagging. The sample size for these purposes in 1980 was 28. Average lengths in 1979 and 1980 were 57.0 and 57.8 inches; average weights were 35.5 and 35.1 pounds. Maximum weight in 1980 was 65 pounds. These fish are very similar in size to Yellowstone River paddlefish reported by Rehwinkel (1978). He reported average lengths for two different years of 54.2 inches and 55.1 inches. Average weights were 32.8 pounds and 35.6 pounds, with a maximum weight of 78 pounds. The similarity in sizes would suggest that paddlefish in the two rivers are a single breeding population. This conclusion is also supported by a limited amount of tag return and movement data previously discussed in this section.

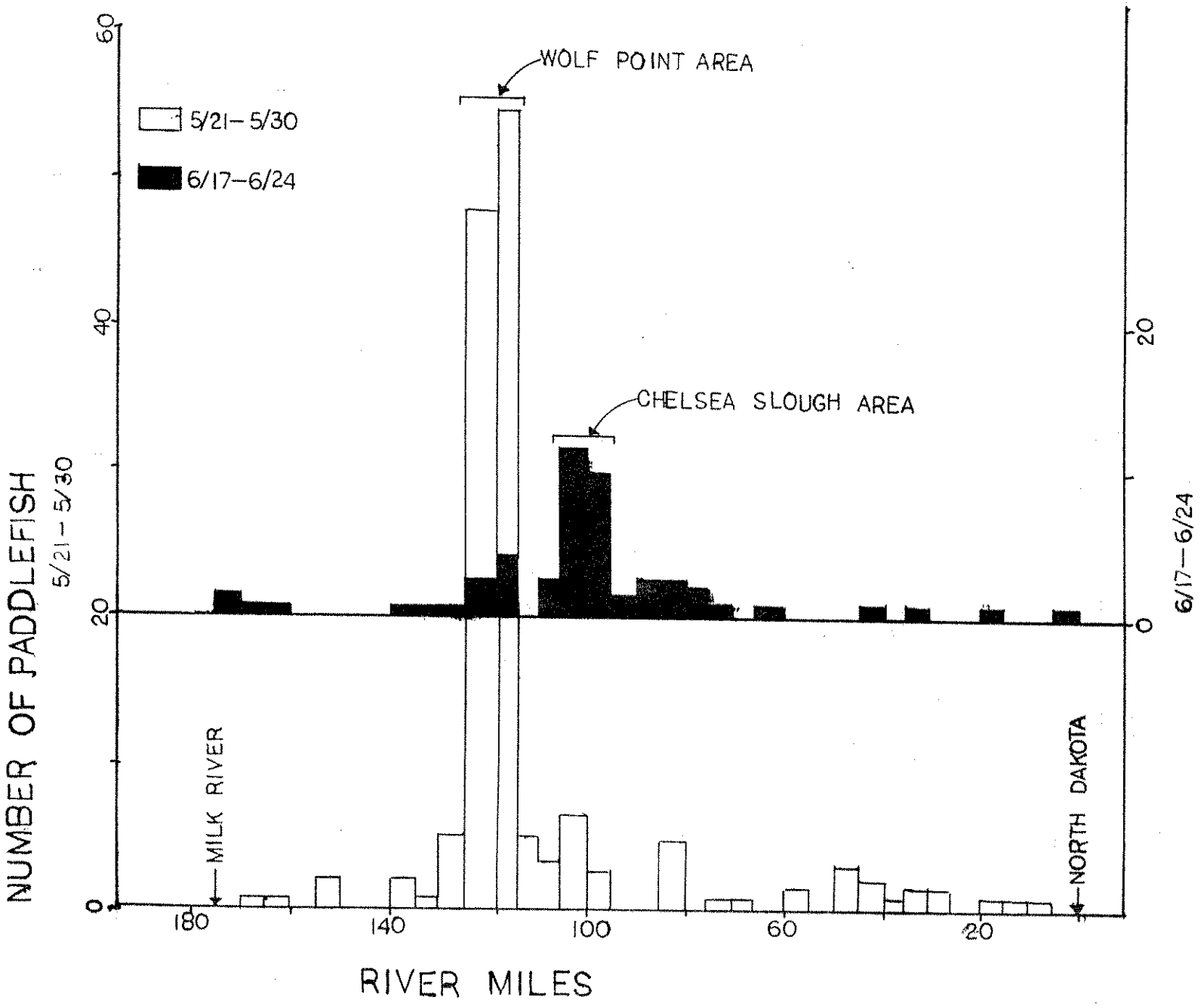

Figure 3. Number of paddlefish counted per 5-mile section in the Missouri River during two electrofishing runs (5/21/80-5/30/80 and 6/17/80-6/24/80).

Paddlefish farther upstream in the Missouri River are considerably larger than lower Missouri River or Yellowstone River paddlefish. These fish are resident in Fort Peck Reservoir and migrate up the Missouri River each spring. Berg (1977) reported the following for a sample of 231 of these paddlefish: average length 61 inches, average weight 56 pounds, and maximum weight 111 pounds.

To date there is no evidence of paddlefish spawning in the Missouri River. No ripe fish were found in 1979 or 1980.

Sauger

The sauger is probably the most abundant game fish in the study area. It usually predominates in electrofishing catches. The northern pike is sometimes more abundant in gill net catches, but gill nets are set mostly in backwaters, habitat favored by northern pike. In 1980, sauger made up 61 percent in the Missouri River and 93 percent in tributary streams of game fish captured by electrofishing. A total of 619 sauger was captured in the Missouri River; 874 were captured in the lower few miles of tributary streams. All but approximately 50 of these were tagged and released for movement studies.

Sauger electrofishing catch rates for 1980 are in Table 6. Numbers caught in spring were low compared to numbers caught later in the year, and especially low compared to spring 1979 (Stewart 1980). An average of 5 sauger per day was caught in spring 1980 compared to 19 per day in spring 1979. Again, the differences in spring streamflow between the two years are probably responsible. Low streamflows and relatively cold water probably caused fewer fish to move from Garrison Reservoir to the Missouri River in 1980 than in 1979. The spring electrofishing in 1980 was done in April. Four of the sections in Table 6 were electrofished again in May. Sauger numbers had not increased over those found the previous month.

Catch rates increased considerably for sauger in summer and fall 1980 (Table 6). Catch rates were nearly four times as large in summer and three times as large in fall as in spring. Many sauger that were present in summer and fall may have been in Garrison Reservoir earlier in the year. Large amounts of relatively warm water from tributary streams may be needed in spring to cause sauger to enter the Missouri River from Garrison Reservoir. The warm inflow from tributary streams was absent in 1980.

A sharp increase in the number of sauger captured per day was noted at Brockton in 1980 (Table 6). Numbers of sauger caught per day by electrofishing are averaged in Table 20 for locations upstream and downstream of Brockton. As indicated by electrofishing, sauger were 6.2 times more abundant in spring in the lower area than the upper. The difference between upper and lower in summer and fall was a factor of 2.4 (Table 20). Warmer water temperatures in the lower river (Figure 2) may have much to do with the observed sauger distribution.

Largest concentrations of sauger observed in the Missouri River in 1979 were found immediately downstream of the Milk River (Stewart 1980). These fish were near the north bank in warm water that entered the Missouri from the Milk River. Sauger numbers in this location were low in 1980. Streamflows in the Milk River were too low to affect temperature at points downstream in the Missouri River in 1980.

Table 20. Average number of sauger sampled per day by electrofishing in 1980 in the upper[a] and lower portions of the study area.

Season	Upper	Lower	Difference Factor
Spring	1.8	11.2	6.2
Summer	12.6	30.0	2.4
Fall	9.0	21.5	2.4
Total	23.4	62.8	2.7

a - Upper = Milk River to Brockton; lower = Brockton to North Dakota border.

Large numbers of sauger were present from spring to fall 1980 in the Milk River from the mouth to a point approximately 2 miles upstream. Upstream from the point, very few sauger were captured. An average of 72 sauger per day was captured here (Table 7) in 9.5 days of electrofishing, with a maximum of 118 in 1 day. These catch rates far exceed those for sauger on the Missouri River (Table 6). A total of 816 sauger was captured in the lowermost 2 miles of the Milk River in 1980 by electrofishing and frame trap netting. Electrofishing proved to be more efficient with time than frame trap netting. Only 619 sauger were captured by all methods in the Missouri River. Average catch rates by electrofishing were a factor of six greater on the Milk River than on the Missouri River. Gill net catch rates were greater on the Milk River by a factor of five. These concentrations in the Milk River are not well understood. The Milk River is much warmer than the Missouri River (Stewart 1980), but the same is true for the Poplar River and Big Muddy Creek where sauger were not concentrated in 1980.

Number and size of sauger captured in the Milk River in 1980 are in Table 21. The average size of these sauger decreased in September and October, possibly in response to movements of larger sauger out of the Milk River and into the dredge cuts (discussed later). Milk River sauger were approximately the same size as those caught in the Missouri River, except that almost no "giant" (over 3 pounds) sauger were found in the Milk River. Eleven sauger weighing over 3 pounds each were sampled in the Missouri River in 1980.

Ripe or freshly spent female sauger were found only in the Milk River (Table 22); none were found in other tributaries or in the Missouri River. In spite of considerable sampling for eggs, none were found in the Milk River. It is unknown where the spent female sauger in the Milk River spawned. No larval sauger/walleye were sampled in the Milk River (Table 18), nor were any young-of-the-year seen during electrofishing in September or October. Data indicate that no young-of-the-year sauger were produced in the Milk River in 1981.

Table 21. Number and size of sauger captured by electrofishing and frame trap netting in the lower Milk River in 1980.

Date[a]	Number of Fish	Average length (inches)	Length Range	Average weight (Pounds)	Weight Range
4/11-4/24	139	13.5	10.1 -20.8	0.66	0.23 - 2.56
4/29	48	13.1	9.8 -18.8	0.71	0.22 - 2.08
5/2	90	13.8	10.3 -20.5	0.74	0.25 - 2.52
5/5	105	14.7	9.2 -19.9	0.72	0.18 - 2.21
5/7	43	14.2	10.2 -20.1	0.82	0.23 - 2.79
6/10	59	12.8	9.1 -19.9	0.74	0.19 - 2.68
6/16	93	13.0	9.4 -19.4	0.66	0.20 - 2.09
6/25	37	13.3	8.7 -21.5	0.74	0.15 - 3.04
7/25	118	12.1	8.4 -20.3	0.60	0.15 - 2.54
9/9	63	11.8	9.5 -17.5	0.44	0.22 - 1.61
10/3	21	12.3	10.2 -16.9	0.52	0.23 - 1.40
Total or Average	816	13.2	8.4 -21.5	0.67	0.15 - 3.04

a - Sampling by frame trap net from 4/11-4/24, electrofishing on other dates.

Table 22. Ripe and freshly spent female spawners captured in frame trap nets and by electrofishing in 1980.

Number of Ripe Females	Number of Spent Females	Date	Location
	Sauger		
2	0	4/15	Milk River near mouth
1	0	4/29	"
0	2	5/2	"
6	1	5/5	"
5	0	5/7	"
	Walleye		
1		5/7	Milk River near mouth
	Northern Pike		
1		4/15	Poplar River near mouth
	Rainbow Smelt		
2		4/17	Missouri River near Big Muddy Cr

Larval sauger/walleye were captured only in the Poplar River (Table 18) and at the extreme lower end of the study area in the Missouri River near the Nohly bridge (Table 17). It is questionable that larval sauger/walleye entered the Missouri River in significant numbers from the Poplar River, because none were captured at the sampling station in the Missouri River immediately downstream from the Poplar River (Table 17).

Nevertheless, some degree of successful spawning must have taken place in the Missouri River or lower portions of tributaries, because significant numbers of YOY sauger were found during backwater and channel margin seining in the Missouri River (Table 16). Due to the small size of the fish, some of the fish labeled sauger in Table 16 may have actually been walleye. Almost certainly, however, the majority of these fish were sauger. YOY sauger were found only from the Wolf Creek vicinity downstream. From Wolf Creek downstream, the number of sauger YOY captured in 4-6 seine hauls were: Wolf Creek vicinity - 1, near Poplar River - 1, near Big Muddy Creek - 9, near Lakeside - 5.

In conclusion, sauger spawning and rearing in 1980 probably took place only from Wolf Creek downstream, and numbers produced were greater from Big Muddy Creek downstream.

The distribution of yearling sauger in July 1980 was similar to that of YOY. Only 1 was found upstream of Wolf Creek, 7 from Chelsea to Big Muddy Creek, and 15 from Big Muddy Creek to North Dakota.

The average size of sauger in the Missouri River increased considerably from spring to fall. Whether or not this size increase is related to entry of large numbers of rainbow smelt into the river for the first time in 1980 is unknown. Average length (and weights) of sauger sampled were 11.1 (0.50) in spring, 12.1 (0.64) in summer and 14.8 (1.18) in fall. Most of the increase in size was due to greater numbers of sauger weighing more than 2 pounds. Percentages of the total sauger catch weighing more than 2 pounds were 3.6 percent in spring, 6.3 percent in summer and 19.6 percent in fall. These larger fish probably entered the Missouri River from Garrison Reservoir. Spring, summer and fall samples of sauger in 1979 all consisted of less than 2.5 percent of sauger weighing more than 2 pounds.

There was a total of 94 sauger tag returns in 1980 (Table 23). This number included tag returns from both anglers and field sampling. An unknown number of tags from fish caught by anglers was not returned.

Sauger in the study area are highly mobile. Of 11 sauger tagged and recaptured in the Missouri River, only 1 had moved less than 10 miles from the tagging location. There was also considerable movement between the Missouri River and tributary streams, especially the Milk River. Of the 61 sauger tagged and recaptured in the Milk River, most were recaptured only a few days or weeks after tagging. Fourteen tagged sauger were caught by anglers in the Ft. Peck dredge cuts and tailwater areas (Table 23). Most of these were caught in the lower dredge cut. No sauger were tagged upstream of the Milk River. These fish moved to the lower dredge cut almost exclusively from the lower 2 miles of the Milk River. Angler-caught sauger that moved to the lower dredge cut from the Milk River were considerably larger than tagged sauger remaining in the Milk River and caught there by anglers. Tagged Milk River sauger caught by anglers in the dredge cut averaged 16.7 inches and 1.41 pounds. Sauger tagged in the Milk River and caught there by anglers averaged 14.3 inches and 0.86 pounds. The latter size is only slightly larger than the average size of sauger tagged in the lower Milk River (Table 21). Sauger in the lower dredge cut may have been concentrated there by the presence of rainbow smelt.

Table 23. Miscellaneous information related to fish tag returns and movement in the Missouri River and lower portions of tributary streams in 1980[a].

Category	Fish Species					
	Sauger	Walleye	Northern Pike	Channel Catfish	Shovelnose Sturgeon	Rainbow Trout
Number of tag returns	94	11	17	5	1	1
Tagged & recaptured in Milk R	61	0	2	1	0	0
Moved from Milk R to Ft Peck Dredge cuts & tailwaters area	14	1	3	1	0	0
Tagged & recaptured in Poplar R	1	4	4	0	0	0
Tagged & recaptured in Big Muddy Cr	0	0	1	0	0	0
Moved less than 10 miles in Missouri R	1	3	5	1	0	0
Moved more than 10 miles in Missouri R or moved into or out of Missouri R	30	4	4	2	1	1
Moved between Missouri R and tributary	20	2	4	1	0	0
Moved over 100 miles	9	2	0	1	1	1
Moved from Poplar R to Missouri R	1	1	1	0	0	0
Moved to Garrison Reservoir (North Dakota)	2	0	0	0	0	1
Moved between Yellowstone and Missouri rivers	5	2	0	1	1	0

a - Tag returns both from anglers and field sampling.

Approximate minimal angler exploitation rates of sauger in the study area can be calculated by dividing the number of angler returns by the number of sauger tagged. The numbers calculated by this method are low by an unknown amount because anglers do not return all tags. Using this method, 1.5 percent of sauger tagged in 1979 were harvested by anglers in 1979 and 1980. For fish tagged in 1980, 2.3 percent were captured by anglers in 1980. Even if only half of the tags from tagged fish harvested by anglers are returned, sauger exploitation rates appear fairly low.

Age and growth of sauger collected in spring 1979 and 1980 from the lower 3 miles of the Milk River are in Table 24. These sauger grew at rates similar to approximate state averages as shown by Brown (1971).

Table 24. Age and growth of sauger collected in spring 1979 and spring 1980 from the lower Milk River.

Age	Number of fish	Mean length (inches)	Length range (inches)
I	0	-	-
II	6	10.5	9.9 - 11.5
III	66	12.0	9.7 - 13.2
IV	50	13.6	11.1 - 15.0
V and older	26	16.8	13.8 - 22.5

Minimum sauger spawning ages were obtained by aging scales from ripe fish and by comparing the size of ripe fish with the size of other aged sauger. At least some females became sexually mature at age IV and probably all by age V. Most, if not all, males ripen at age III and possibly some at age II.

Walleye

The walleye is distributed over the whole study area, but it is much less abundant than the sauger. A total of 128 walleye was sampled in the Missouri River in 1980. An additional 54 were captured in tributaries. Walleye are more abundant in the Poplar River than in other streams in the study area. By all methods of sampling, walleye made up 9.3 percent of the game fish captured in the Missouri River and 5.4 percent of the game fish captured in tributary streams. Walleye were more abundant than sauger in gill net catches only in the extreme downstream end of the study area (Table 13). Gill nets in this area were set only in backwaters. In general, the difference in abundance between sauger and walleye was less in gill net catches than by other methods of sampling. Walleye were considerably more abundant in all seasons in electrofishing catches in the downstream half of the Missouri River (Table 6). This tendency was also evident in 1979 (Stewart 1980).

No evidence of walleye spawning was found in the Missouri River in 1980. One ripe female was found in the Milk River (Table 22). Walleye spawning is well recognized in the Poplar River (Table 18 and Stewart 1980). No YOY walleye were sampled in 1980. Only eight yearlings were sampled in the Missouri River. These were distributed over the length of the study area.

Age and growth of walleye, based on a small number of fish sampled in spring 1979 and spring 1980 are shown in Table 25. The ages from scales indicated that this species grows at a rate about average for Montana.

A total of 11 tagged walleye was recaptured in 1980 (Table 23). Of these, four were tagged and recaptured in the Poplar River. Of the remaining seven, three were recaptured within 10 miles of the tagging location in the Missouri River, two moved between the Missouri River and a tributary and two moved between the Yellowstone and Missouri rivers. The walleye appears to be highly mobile in the Missouri River.

Table 25. Age and growth of walleye collected from the Missouri River in spring 1979 and spring 1980.

Age	Number of fish	Mean length (inches)	Length range (inches)
I	2	6.6	6.2 - 7.1
II	2	10.4	10.0 -10.8
III	0	-	-
IV	9	15.9	13.4 -18.0
V and older	4	19.3	18.6 -19.6

The majority of this species may not be resident in the Missouri River.

Northern Pike

The northern pike is distributed throughout the study area, but appears to be more abundant downstream of the Poplar River. In 1980, 44 northern pike were sampled by various methods in tributary streams. One hundred forty-three were captured in the Missouri River. Of this number, 60 percent were taken downstream of the Poplar River. Gill net catch rates were highest near Lakeside on the lower end of the study area (Table 11). None were sampled in 1980 upstream of Little Porcupine Creek, with the exception of one fish caught in a gill net in the Fort Peck dredge cuts. In 1979, considerable numbers were sampled between the Milk River and Little Porcupine Creek (Stewart 1980). This may be related to the large amounts of warm water that entered the Missouri River from the Milk River in 1979. This large inflow was absent in 1980.

On the basis of 1980 data, northern pike rank third in abundance, considering only the game fish, behind the sauger and shovelnose sturgeon. Northern pike made up 10.5 percent of the game fish in electrofishing samples and 10.4 percent of the game fish sampled by all methods in the Missouri River.

Reproduction of northern pike probably failed in the study area in 1980. Only a single ripe female was sampled; this was in the Poplar River. No YOY were observed in the Missouri River or in tributaries in 1980, although significant numbers were found in 1979 (Stewart 1980). Streamflows were unfavorable during the 1980 spawning season. Flows were low during early April, but dropped even more through the month and continued to fall through early May. Missouri River streamflows in April and May 1979 were considerably above average.

Northern pike are probably more sedentary than sauger and walleye in the study area. No tagged fish have been recaptured as much as 100 miles from the tagging location, as have sauger and walleye (Table 23), nor are any known to move into the Yellowstone River. Of 17 northern pike tag returns, none moved more than 10 miles within the Missouri River. Three moved from the Milk River to the Fort Peck dredge cuts (Table 23). The longest northern pike movement noted was from the Poplar River upstream approximately 25 miles to the Highway 13 bridge.

Channel Catfish

The presence of significant numbers of channel catfish in the study area is something of an anomaly, because river temperatures do not reach 75 F reported as being required for spawning (Brown 1971, Scott and Crossman 1973). Channel catfish must either spawn at temperatures considerably lower than 75 F or the population is supported by spawning in tributary streams. No indications of successful spawning have been observed in the study area; ripe adults have not been found, no larvae have been sampled nor have any YOY been captured.

Baited hoop nets were fished in the Missouri River for 95 net days (Table 26). No nets were placed in tributary streams because flows were too low. A total of 104 channel catfish was sampled, giving an average catch rate of 1.09 fish per net day. Very few fish were sampled in upstream locations (Table 26); the cold water areas of the Missouri River is probably unsuitable for this species.

Catch rates of channel catfish were considerably higher in 1980 than in 1979 (1.09 vs. 0.48 per net day). This may have been due to a more favorable placement of bait bags in 1980. This difference was described in the procedures section.

The largest channel catfish caught in hoop nets was 4.60 pounds. Much larger catfish are known to be present in the study area. For example, an 8.20 pound channel catfish was captured by electrofishing in the Missouri River (Table 4) and an 11.20 pound catfish was sampled electrofishing in the Milk River (Table 5). Only soft-bottom sampling sites were used for setting hoop nets in the Missouri River. Hoop nets partially sink into the soft bottom. This may prevent larger individuals from entering the nets.

In 1980, baited hoop nets were used having both 1.25-inch mesh and 0.50-inch mesh. In 1979, only nets with the larger mesh were used. These nets are suitable for sampling larger channel catfish, but in 1979 failed to capture any less than 12.4 inches total length.

Large mesh nets captured channel catfish over the length range of 9.8-24.1 inches. Length range for small mesh nets was 5.1-23.5 inches. Small mesh nets were as effective as large mesh nets in capturing larger catfish, but in addition sampled fish from the length range 5.1-9.7 inches. In small mesh nets, 45 percent of the channel catfish sampled were in the range 5.1-9.7 inches. The smallest channel catfish are probably age I+ (suggested by age and growth data in Carlander 1979), although age II+ is also possible. It is unlikely that the smallest channel catfish were capable of traveling far to reach the capture point. The presence of these small channel catfish in the lower portion of the study area suggests that spawning occurs there or in nearby tributaries.

Evidence for spawning rapidly decreases at upstream points. Minimum size of channel catfish sampled near Lakeside was 5.1 inches, 6.1 inches near Big Muddy Creek, 9.0 inches near the Poplar River and 10.1 inches near Wolf Point (Table 26).

Five channel catfish were recaptured in 1980 (Table 23). Only one of these moved a long distance. This fish was tagged near Wolf Creek, and was recaptured 6 days later approximately 115 miles downstream near the Nohly bridge. Another fish moved in 7 days

Table 26. Summary of channel catfish captured in baited hoop nets in the Missouri River in 1980.

Location	Net days	Number captured	No. per Net Day	Mean length (inches)	Length range (inches)	Mean weight (pounds)	Weight range (pounds)
Near Milk R	6	0					
Near upper Frazer Pump	6	1	0.17	23.5		4.47	
Near Wolf Point	21	5	0.24	14.1	10.1-20.2	1.19	0.29 - 3.17
Near Poplar River	21	34	1.62	15.0	9.0-19.1	1.12	0.25 - 2.17
Near Big Muddy Cr	20	41	2.05	11.3	6.1-19.0	0.52	0.07 - 1.98
Near Lakeside	21	23	1.09	14.1	5.1-24.1	1.38	0.04 - 4.60
Overall	95	104	1.09	13.4	5.1-24.1	0.98	0.04 - 4.60

from upstream of the Nohly bridge about 8 miles to the mouth of the Yellowstone River. Both of these movements could have been in response to handling and tagging. One channel catfish was tagged and recaptured in the Missouri River near the Redwater River, another tagged and recaptured in the Milk River near its mouth. A fifth fish moved about 8 miles from the lower Milk River upstream to the lower dredge cut.

Shovelnose Sturgeon

Drifted gill nets were tested again in 1980 for sampling shovelnose sturgeon. Nets became entangled on submerged snags too frequently for this technique to be practical. Drifted gill nets will be used in the future only to sample known concentrations of sturgeon. Only short drifts of a very few hundred yards would be needed. Short drifts should minimize the probability of net entanglement.

A total of 190 shovelnose sturgeon was sampled in the study area in 1980. Of these 114 were sampled by electrofishing and 76 by gill netting. Sturgeon made up 15.1 percent of game fish sampled in electrofishing runs on the Missouri River (second to the sauger) and 13.6 percent of the game fish sampled by all methods on the Missouri River (again second to the sauger). This species was rarely found in tributaries. It made up less than 1 percent of the game fish captured in tributary streams by all sampling methods.

Sturgeon weighed and measured in the study area in 1980 averaged 25.7 inches total length and 2.12 pounds. Maximum weight and length were 33.5 inches and 4.38

pounds. For unknown reasons these fish are considerably smaller than those present in the Missouri River upstream of Fort Peck Reservoir (Berg 1978) or in the Yellowstone River (Peterman and Haddix 1975).

Sturgeon were much more abundant in the Missouri River from Wolf Point to the Milk River than at downstream points and larger numbers were found in July than in April or October (Table 6). Of 114 fish sampled by electrofishing, 86 percent were captured in approximately one third of the length of the study area from Wolf Point to the Milk River. The largest concentration noted was in July near the town of Wolf Point where most of 28 fish were caught in approximately 500 yards. Smaller concentrations were noted upstream. None of these concentrations contained ripe fish, nor could they be related to any obvious physical feature of the river.

Sturgeon were uncommon in tributaries. None were seen while electrofishing, and only four were sampled in gill nets set in tributaries (Table 10). Gill nets caught few sturgeon in the Missouri River except in the dredge cuts (Table 11). Gill nets were usually set in backwaters and slow water areas at the channel margin. Shovelnose sturgeon prefer open channels with considerable current.

Nothing is known of sturgeon spawning or rearing in the study area. No ripe spawners have been sampled, neither have larval fish or YOY been captured in the study area.

One tagged sturgeon was recaptured in the study area. This fish was tagged in the Yellowstone River near Intake in May 1979 and recaptured in the Missouri River several miles downstream from the Milk River in July 1980. The distance moved was over 200 miles.

Burbot

Only small numbers of burbot were captured in the study area in 1980. This species may be more abundant than is indicated by field sampling as it is seasonally common in angler catches. A total of 42 burbot was sampled in 1980. Of these 36 came from the Missouri River and 6 from tributaries. Most of these were captured by electrofishing. Gill nets rarely caught burbot; none were sampled by any method in backwaters.

Average sizes of burbot were large. Maximum size in the Missouri River in 1980 was 7.30 pounds (Table 4). One burbot in the Milk River weighed 13.5 pounds (Table 5). Even larger burbot were sampled in 1979 (Sewart 1980).

Burbot were considerably more abundant in the downstream areas of the Missouri River (Table 6). Over half (56 percent) of burbot sampled were taken from the lower 35 miles (19 percent) of the study portion of the Missouri River. Only 6 (17 percent) were sampled from the upper half of the river.

Burbot spawn in winter but egg hatching probably does not occur until early spring (Brown 1971). One larval burbot was captured in 1979 near the highway 16 bridge. A burbot 4.6 inches total length was taken from near the same location in spring 1980. On the basis of its size this fish is probably a 1 year old (Brown 1971, Carlander 1969). Other burbot of a size appropriate for age II

have also been sampled. Available evidence indicates that at least some spawning occurs in the study area.

Rainbow Trout

A concentration of rainbow trout spawners was first observed in a small area approximately 2 to 3 miles downstream of Fort Peck Dam in 1979. They were present in this area only for a short time in spring. These fish utilized the east channel and the east side of the river downstream of this side channel. The spawners were not sampled in 1979, but 22 were captured by electrofishing on May 1, 1980.

The average size was exceptionally large. Average total length and weight were 22.3 inches and 4.36 pounds. Length and weight range were 16.5 to 24.8 inches and 2.00 to 6.10 pounds. All of the 22 were spawners. Twelve were ripe males, six spent females and four were ripe females. The sample was made up of ages 5, 6 and 7.

Four rainbow trout were sampled in downstream areas of the Missouri River in 1979, but none were seen in 1980. One of these fish tagged in 1979 was caught in 1980 in Garrison Reservoir, North Dakota. Because of the tag return it seems likely that the rainbow trout spawners below Fort Peck Dam are resident in Garrison Reservoir.

Rainbow Smelt

The first record of this species in Montana was from the lower part of the study area in October 1979 when a few smelt were observed. The source of these fish is Garrison Reservoir on the Missouri River in North Dakota where the rainbow smelt was introduced. In April 1980 a large run of sexually mature smelt entered the study area. They were first seen on April 17, 1980 near the mouth of Big Muddy Creek. Later in the spring the run reached Fort Peck Dam. Smelt probably did not enter the tributary streams in large numbers because they were not sampled there. One angler report of smelt in the Poplar River was received. It is felt that the angler's identification was accurate. Sauger sampled in the Milk River in June 1980 frequently regurgitated smelt, although no smelt were otherwise seen in the Milk River. These sauger may have eaten smelt in the adjacent portions of the Missouri River.

By mid-June most smelt had left the Missouri River. The last smelt seen, except for the dredge cuts-tailwater area, was on July 9, 1980 near Sand Creek. Immediately downstream from the dam smelt persisted throughout 1980. They were caught in gill nets in the dredge cuts in August 1980 and again in January 1981. It seems likely that the rainbow smelt has become resident in the dredge cuts-tailwaters areas.

The April spawning run was large. When it was first encountered on April 17, 1980 there were few instances when rainbow smelt were not visible in the electrical field. Several hundred could have been easily collected in a day. Sauger feed on smelt to the point of engorgement. They frequently regurgitated smelt when handled.

Two samples of rainbow smelt were taken for length and weight measurements. The first consisted of 24 fish collected on April 17, 1981 from the spawning run. Length and weight ranges were 6.1-7.2 inches and 0.04 to 0.09 pounds. All fish were age II and all were ripe. Two were ripe females, the remainder ripe males. The second sample consisted of 29 fish collected in gill nets in the dredge cuts in August 1981. These fish had a length range of 6.4 to 7.4 inches and a weight range of 0.07 to 0.10 pounds. Many smelt were observed by eye, but none appeared to be much smaller than 6 inches nor much longer than 7 inches.

Despite the large number of spawners no evidence for successful reproduction was found. No larval smelt were sampled, nor were any YOY found in backwater seining or fall electrofishing.

RECOMMENDATIONS

The lower Missouri River survey and inventory project should continue. Emphasis for the next year should remain on determining the status, relative abundance, concentration locations, spawning locations, reproductive success and factors influencing reproductive success for game species.

River bottom macroinvertebrates have not been sampled. These should be collected and identified at four or five stations.

Nongame fish species have been sampled only by experimental gill nets in backwaters. These species should be sampled also by electrofishing in main channel areas. Several of the larger species are too large for good sampling with experimental gill nets.

Fish population size and reproductive success in the East and Middle Forks of the Poplar River should continue to be measured. This information is needed to determine the effect of regulated streamflows on walleye and northern pike.

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LIST OF WATERS REFERRED TO

6-15-2680-02 - Milk River - section 1
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

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Ecological Services Division
August 1981

Appendix Table A. Summary of game fish captured in river sections by electrofishing in the Missouri River in 1980.

Species	Number Captured	Average Length (inches)	Length Range (inches)	Average Weight (pounds)	Weight Range (pounds)
Milk River to Frazer Irrigation Pump - 4 days of electrofishing					
Sauger	13	15.1	10.2-20.6	1.09	0.25-2.76
Shovelnose sturgeon	43	26.6	24.2-31.5	2.32	1.06-4.38
Frazer Irrigation Pump to Scott's Ranch - 3 days of electofishing					
Sauger	13	14.0	7.7-18.5	0.91	0.12-1.70
Walleye	1	11.8	-	0.45	-
Burbot	2	9.7	9.0-10.5	0.18	0.16-0.19
Shovelnose sturgeon	22	25.5	21.5-29.0	2.17	1.13-2.81
Scott's Ranch to Sand Creek - 3 days of electrofishing					
Sauger	27	12.9	7.0-19.0	0.74	0.10-2.15
Walleye	6	9.6	6.5-14.0	0.33	0.08-0.92
Northern pike	3	17.6	12.1-20.4	1.48	0.37-2.07
Burbot	1	19.0	-	1.29	-
Shovelnose sturgeon	5	26.4	23.5-33.5	2.19	1.33-4.34
Sand Creek to Highway 13 Bridge - 4 days of electrofishing					
Sauger	22	12.8	7.8-21.7	0.72	0.10-3.15
Walleye	3	11.0	5.6-14.2	0.60	0.05-0.97
Northern pike	11	25.2	9.7-40.0	5.13	0.22-16.1
Shovelnose sturgeon	28	25.5	22.6-28.9	1.78	1.25-3.00
Highway 13 Bridge to Chelsea - 3 days of electrofishing					
Sauger	34	13.6	9.2-20.2	0.81	0.19-2.40
Walleye	2	12.9	6.8-19.0	1.12	0.09-2.15
Northern pike	10	24.8	11.8-33.2	5.05	0.36-9.50
Burbot	1	12.5	-	0.33	-
Shovelnose sturgeon	2	24.3	23.9-24.7	1.76	1.60-1.92
Chelsea to Poplar River - 3 days of electrofishing					
Sauger	31	12.4	6.8-21.5	0.70	0.07-3.62
Walleye	2	12.6	6.2-18.9	1.24	0.06-2.42
Northern pike	8	24.3	19.5-31.6	4.15	1.86-8.50
Burbot	1	17.0	-	0.90	-
Shovelnose sturgeon	1	25.1	-	2.00	-

Appendix Table A continued.

Species	Number Captured	Average Length (inches)	Length Range (inches)	Average Weight (pounds)	Weight Range (pounds)
Poplar River to Sprole Bridge - 3 days of electrofishing					
Sauger	26	12.4	6.8-21.1	0.70	0.06-3.43
Walleye	4	14.4	9.9-18.1	1.20	0.25-2.20
Northern pike	9	20.9	10.4-33.3	2.96	0.18-11.20
Burbot	3	12.2	9.0-16.7	0.42	0.14-0.90
Shovelnose sturgeon	1	25.6	-	2.30	-
Sprole Bridge to Brockton - 3 days of electrofishing					
Sauger	27	12.8	6.3-24.0	0.82	0.05-4.74
Walleye	4	15.8	5.9-22.6	2.38	0.05-4.90
Northern pike	4	24.4	21.2-29.9	3.56	2.02-6.80
Burbot	3	19.5	11.0-26.4	2.11	0.22-4.30
Shovelnose sturgeon	6	26.3	23.5-28.6	2.46	1.41-3.20
Brockton to Big Muddy Creek - 3 days of electrofishing					
Sauger	68	13.6	5.8-21.4	0.89	0.05-3.54
Walleye	10	16.2	8.5-23.1	1.93	0.13-5.04
Northern pike	15	29.1	20.0-42.0	7.59	1.85-19.00
Burbot	3	21.4	19.9-23.2	2.10	1.50-2.81
Shovelnose sturgeon	2	26.2	24.8-27.5	1.90	1.49-2.30
Big Muddy Creek to Highway 16 Bridge - 3 days of electrofishing					
Sauger	44	12.6	5.9-21.2	0.80	0.05-3.46
Walleye	11	13.7	5.7-24.2	1.55	0.05-6.80
Northern pike	8	21.6	15.3-27.4	2.47	0.78-4.77
Burbot	1	4.6	-	0.01	-
Shovelnose sturgeon	1	26.0	-	1.61	-
Highway 16 Bridge to Lakeside - 4 days of electrofishing					
Sauger	84	13.0	5.7-23.2	0.88	0.04-5.22
Walleye	8	13.8	5.6-20.4	1.36	0.04-3.60
Northern pike	2	20.9	19.5-22.3	2.17	1.57-2.78
Burbot	12	17.0	6.5-32.5	2.00	0.08-6.40
Shovelnose sturgeon	2	24.7	22.7-26.7	1.76	1.64-1.88
Channel catfish	1	25.1	-	8.20	-

Appendix Table A continued.

Species	Number Captured	Average Length (inches)	Length Range (inches)	Average Weight (pounds)	Weight Range (pounds)
Lakeside to North Dakota Border - 4 days of electrofishing					
Sauger	74	11.5	5.6-21.3	0.67	0.04-3.28
Walleye	8	18.3	10.0-25.7	3.22	0.27-8.30
Northern pike	9	25.1	13.8-40.5	4.92	0.67-16.80
Burbot	9	20.3	7.6-32.7	3.00	0.06-7.30
Shovelnose sturgeon	1	26.4	-	1.91	-
Channel catfish	1	23.4	-	5.24	-
Yellow perch	1	6.5	-	0.11	-

Appendix Table B. Summary of fish captured in overnight experimental gill net sets in the Missouri River and mouths of tributary streams in 1980.

Species	Number Captured	Average Length (inches)	Length Range (inches)	Average Weight (pounds)	Weight Range (pounds
	Fort Peck Dam tailwaters and Dredge Cuts (10)[a]				
Shovelnose sturgeon	66	25.4	20.9-29.5	2.15	0.96-3.62
Goldeye	255	12.5	9.7-14.5	0.55	0.28-1.02
Rainbow smelt	29	6.9	6.4- 7.4	0.08	0.07-0.10
Northern pike	1	28.5	-	6.90	-
Carp	9	17.6	15.0-19.2	2.66	1.58-3.67
River carpsucker	23	15.6	14.2-17.2	1.75	1.36-2.69
Blue sucker	1	23.8	-	4.46	-
Shorthead redhorse	6	15.0	10.6-17.0	1.45	0.45-1.90
Longnose sucker	7	13.3	7.2-19.9	1.43	0.13-3.56
White sucker	7	14.6	10.1-17.9	1.57	0.50-2.84
Channel catfish	5	20.6	18.1-21.5	2.68	1.60-3.06
Sauger	68	14.7	10.0-18.2	1.03	0.25-2.05
Walleye	27	16.8	12.6-23.2	1.80	0.79-4.52
Total	504				
	Missouri River near Milk River mouth (4)				
Goldeye	7	12.0	11.0-13.2	0.56	0.45-0.75
Carp	1	20.0	-	3.95	-
Blue sucker	1	24.1	-	3.74	
Shorthead redhorse	2	15.3	15.0-15.6	1.60	1.42-1.78
White sucker	1	15.8	-	1.95	-
Longnose sucker	1	19.7	-	3.84	-
Sauger	4	13.6	10.5-15.8	0.74	0.31-1.05
Total	17				
	Milk River near mouth (2)				
Shovelnose sturgeon	4	26.8	24.7-30.0	2.21	1.85-2.80
Goldeye	148	11.8	8.4-13.1	0.52	0.22-0.80
Northern pike	1	29.1	-	6.50	-
Carp	1	17.2	-	2.48	-
River carpsucker	13	15.6	13.5-17.5	1.62	1.22-2.42
Blue sucker	2	25.1	25.0-25.2	4.64	4.45-4.82
Shorthead redhorse	16	15.1	12.0-19.6	1.43	0.60-3.11
Sauger	30	13.9	10.1-19.7	0.77	0.26-2.22
Walleye	4	14.8	11.5-16.2	1.14	0.36-1.55
Total	219				

Appendix Table B continued.

Species	Number Captured	Average Length (inches)	Length Range (inches)	Average Weight (pounds)	Weight Range (pounds)
	Missouri River near Little Porcupine Creek (3)				
Goldeye	54	12.2	8.9-14.9	0.58	0.21-1.27
Northern pike	7	28.1	24.1-29.5	5.16	2.84-7.50
River carpsucker	6	16.2	14.2-17.9	1.99	1.30-2.52
Longnose sucker	1	18.1	-	2.95	-
Sauger	3	9.6	8.1-10.6	0.22	0.14-0.25
Walleye	1	19.1	-	3.10	-
Total	72				
	Little Porcupine Creek near mouth (1)				
Goldeye	44	11.8	9.2-13.5	0.49	0.26-0.78
Northern pike	1	26.2	-	3.93	-
River carpsucker	7	17.3	12.6-18.8	1.61	0.86-2.93
Smallmouth buffalo	3	18.9	16.6-20.2	3.75	2.82-4.66
Shorhtead redhorse	1	11.4	-	0.61	-
Walleye	1	16.5	-	1.46	-
Total	57				
	Missouri River near Wolf Creek (7)				
Shovelnose sturgeon	1	25.4	-	2.00	-
Goldeye	203	10.7	6.5-14.0	0.41	0.09-0.97
Northern pike	10	25.9	19.2-31.6	5.18	1.72-9.40
Carp	11	16.9	14.6-19.3	2.34	1.43-3.73
River carpsucker	27	14.6	10.6-18.1	1.53	0.64-3.06
Smallmouth buffalo	1	20.6	-	5.42	-
Shorthead redhorse	6	11.7	8.5-14.5	0.80	0.26-1.49
Sauger	28	12.7	8.9-18.8	0.63	0.15-2.13
Walleye	8	14.5	10.3-23.7	1.35	0.30-5.33
Total	295				
	Missouri River near Poplar River (5)				
Shovelnose sturgeon	2	21.8	20.7-23.0	1.04	0.61-1.47
Goldeye	55	10.0	8.0-13.2	0.33	0.15-0.77
Northern pike	4	23.9	21.8-25.8	3.35	2.80-3.75
Carp	1	11.8	-	0.81	-
Flathead chub	1	8.0	-	0.17	-

Appendix Table B continued.

Species	Number Captured	Average Length (inches)	Length Range (inches)	Average Weight (pounds)	Weight Range (pounds)
		Missouri River near Poplar River (5)			
River carpsucker	6	14.4	13.3-15.6	1.43	1.09-1.98
Shorthead redhorse	1	10.5	-	0.44	-
White sucker	1	6.7	-	0.13	-
Sauger	2	11.9	11.4-12.4	0.45	0.33-0.56
Walleye	1	17.5	-	1.88	-
Total	74				
		Redwater River near mouth (2)			
Goldeye	87	10.3	8.2-13.8	0.36	0.14-1.02
Northern pike	6	20.5	17.0-25.0	2.10	1.10-3.74
Carp	8	12.9	10.3-21.1	1.20	0.53-4.16
River carpsucker	37	14.5	9.7-17.5	1.49	0.41-2.68
Shorthead redhorse	23	12.0	6.3-15.4	0.75	0.09-1.55
Channel catfish	3	16.8	15.1-19.5	1.51	0.83-2.52
Sauger	4	11.6	9.6-13.4	0.47	0.20-0.70
Walleye	2	19.4	18.1-20.6	2.48	1.89-3.06
Total	170				
		Poplar River near mouth (2)			
Goldeye	44	9.9	7.7-14.0	0.32	0.12-0.99
Carp	1	13.9	-	1.23	-
River carpsucker	2	15.2	15.1-15.3	1.50	1.49-1.51
Shorthead redhorse	8	13.0	7.0-16.0	0.97	0.10-1.56
Channel catfish	7	12.6	10.6-19.1	0.72	0.32-2.42
Total	62				
		Missouri River near Big Muddy Creek (7)			
Shovelnose sturgeon	3	25.7	24.6-26.1	1.91	1.31-2.62
Goldeye	125	10.1	6.4-14.2	0.37	0.08-1.13
Northern pike	4	25.4	21.7-30.2	4.36	2.56-7.30
Carp	2	15.6	14.0-17.2	1.72	1.28-2.15
Flathead chub	1	6.5	-	0.09	-
River carpsucker	2	13.6	12.9-14.2	1.20	0.97-1.43

Appendix Table B continued.

Species	Number Captured	Average Length (inches)	Length Range (inches)	Average Weight (pounds)	Weight Range (pounds)
		Missouri River near Big Muddy Creek			
Blue sucker	1	25.1	-	4.26	-
Shorthead redhorse	15	10.7	7.9-13.8	0.51	0.21-1.12
Sauger	17	13.5	9.0-20.5	0.89	0.17-2.67
Walleye	5	15.6	8.1-19.8	1.56	0.11-2.64
	175				
		Big Muddy Creek near mouth (3)			
Goldeye	154	9.6	6.6-13.4	0.30	0.08-1.00
Northern pike	11	24.7	19.1-32.5	3.88	1.84-6.90
Carp	8	15.4	13.5-21.0	1.78	1.13-4.40
River carpsucker	3	14.0	13.2-15.5	1.33	1.11-1.60
Blue sucker	1	23.4	-	4.30	-
Shorthead redhorse	2	13.9	11.9-15.9	1.11	0.67-1.55
Channel catfish	1	22.7	-	3.98	-
Burbot	1	22.0	-	2.58	-
Sauger	14	13.5	9.4-19.6	0.78	0.18-2.40
Walleye	12	16.6	10.3-21.6	1.98	0.29-3.98
Freshwater drum	1	14.7	-	1.48	-
Total	208				
		Missouri River below Lakeside (6)			
Goldeye	226	8.9	5.9-13.9	0.28	0.06-1.15
Northern pike	33	24.9	17.4-40.6	4.41	1.20-18.80
Carp	4	16.9	14.8-21.2	2.33	1.42-4.10
Flathead chub	1	7.0	-	0.08	-
River carpsucker	27	14.4	9.3-20.5	1.69	0.48-4.92
Shorthead redhorse	3	13.2	11.5-14.5	0.94	0.70-1.19
White bass	1	6.9	-	0.15	-
White crappie	5	6.2	5.3- 7.6	0.12	0.07-0.22
Sauger	9	14.3	8.4-21.0	1.04	0.16-2.70
Walleye	24	17.2	10.5-23.2	1.83	0.32-4.42
Total	333				

a Number of overnight gill net sets.