MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
ECOLOGICAL SERVICES DIVISION

JOB PROGRESS REPORT

State of Monana

Project No. FW-2-R-12 Title Lower Missouri River Basin Investigations (Missouri River Segment)

Job No. 1-B Title Planning Inventory, Fisheries

Period Covered July 1, 1982 through June 30, 1983

ABSTRACT

Fisheries studies and related aquatic work were continued on the Missouri River from Fort Peck Dam to the Montana-North Dakota border. Data is presented in this report on dissolved oxygen, fish age, growth, abundance and spawning and larval fish production, sauger rearing, fish movement and foods.

Dissolved oxygen data for two Missouri River stations was summarized for two stations. Values upstream of the Milk River averaged very near saturation. Values near the town of Culbertson averaged over 90 percent of saturation.

Age and growth data is presented for several nongame fish species, sauger, northern pike, and burbot. Sauger growth increased significantly from 1979 to 1981. Sauger age structure also shifted toward older age fish. Both changes were probably caused by rainbow smelt.

Large numbers of sauger were present in the river in spring 1982 with electrofishing catch rates exceeding 50 sauger per hour on one day. Lesser numbers of other game species were sampled in spring. Population estimates for sauger, goldeye, and shorthead redhorse were made in summer and fall 1982. Data is also shown for age 0+ sauger sampled by seining in September.

Sauger spawned on scattered rock and gravel areas in May. Large numbers of larval Stizostedion sp. (probably mostly sauger) were sampled in June. No evidence of shovelnose sturgeon spawning was found. Northern pike spawned over a period of approximately six weeks in spring. A ripe female paddlefish, several ripe males, and larval paddlefish were found in the Missouri River for the first time. Paddlefish spawning took place in the Milk River, the Missouri River just downstream from the Milk River, and possibly in the Missouri River near the town of Brockton and near the Highway 16 Bridge.

Additional tag return data continued to indicate sauger and walleye are highly migratory, probably spending much of their life span in Garrison Reservoir. Northern pike and burbot don't appear to move.

Limited data are given showing foods of sauger, burbot, and shovelnose sturgeon. Over 90 percent of adult sauger examined had empty stomachs. Most burbot and shovelnose sturgeon contained food items.

OBJECTIVES

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

More specific objectives for the report period include the following:

1) Tag all game fish captured, incidental to other work, for movement studies. This work was done and findings are included.
2) Determine specific locations and general areas of the river used by sauger for spawning, by sampling spawners and larvae. This work was done and findings are included.
3) Determine sauger young-of-the-year (YOY) rearing areas and abundance in late summer. This work was done and findings are included.
4) Sample rainbow trout spawners in spring below Fort Peck Dam. This work was done.
5) Make population estimates for sauger and possibly other species in summer or fall in two river sections. This work was done and findings are included.
6) Determine foods of major game species and rainbow smelt from early spring to fall. This work was done and findings are included, with the exception of rainbow smelt, because this species was not present in the study area in significant numbers.
7) Determine the age and growth of sauger and burbot. This work was done and findings are included.
8) Make at least one paddlefish count over the length of the river and tag paddlefish during counts. This work was done and findings are included.
9) Collect and identify additional bottom fauna from five stations. Collections were made but identification has not been completed.
10) Measure dissolved oxygen at five stations throughout one-year period. Dissolved oxygen data was summarized from USGS records and findings are included. Additional field measurements were not needed.
11) Make measurements of river channel profiles as aid in determining minimum instream flows. This work was done. Findings will be given in a future report.
12) Determine a field schedule and procedures for measurement of angler harvest and pressure in the dredge cuts-tailwaters area and write a proposal for this work. This work was done.

Objectives for the Poplar River segment were achieved. This segment is covered in a separate report.

DESCRIPTION OF THE STUDY AREA

The study area is described in a previous report (Stewart 1980). Figure 1 is a map of the study area.

PROCEDURES

Most procedures have been described in previous reports (Stewart 1980, 1981 and 1982). Only new procedures will be described here.

All fish species, except burbot, were aged from plastic scale impressions. Burbot were aged from the large otolith by a procedure similar to that described by Clemens (1950). The otolith was removed in the field immediately after killing the fish and placed in a 3 percent solution of trisodium phosphate to preserve annuli. Otoliths were read within two months of the collection date, although Clemens (1950) reported that otoliths were still readable after being stored in trisodium phosphate for one year. Otoliths were read without sectioning, by viewing the convex surface under low power magnification.

Stomach contents of sauger YOY, some burbot, and shovelnose sturgeon were collected by removing the stomach in the field and placing it in 10 percent formalim. Stomach contents were then identified in the laboratory. For larger burbot and sauger, which usually contained only one or a few large food items, identification of stomach contents was usually made in the field.

Attempts were initially made to collect food items from sauger age 1+ and older by pumping water into the stomach (Seaburg 1957) and by injecting an emetic, antimony potassium tartrate, (Jernejcic 1969) into the stomach through the mouth. Both methods were time consuming and were only partially successful. Most stomach contents of age 1+ and older sauger were collected by another method: The fish were placed in a vertical, head-up position with the ventral side of the fish toward the observer. The thumb was used to put gentle, slowly pulsating pressure on the ventral side of fish in the stomach area. Stomach contents, if present, were forced into the mouth where they could be removed by hand or with forceps. Any food items present could usually be felt from outside the fish. If no food items were obtained by manual pressure on the stomach, it was because the stomach was empty. This conclusion was verified by dissection of several fish.

Fish numbers were estimated in river sections by the Schnabel multiple census method (Ricker 1975). Eight to ten electrofishing trips were made through each river section. Tagging or partial fin clips were used for future recognition.

Stizostedion sp. eggs collected from the river bottom were distinguished from those of other species by the small size (less than 2.0 mm, Scott and Crossman 1973). Other early spawners, which include the white sucker, longnose sucker, shorthead redhorse and northern pike, have considerably larger eggs, or do not spawn on gravel.

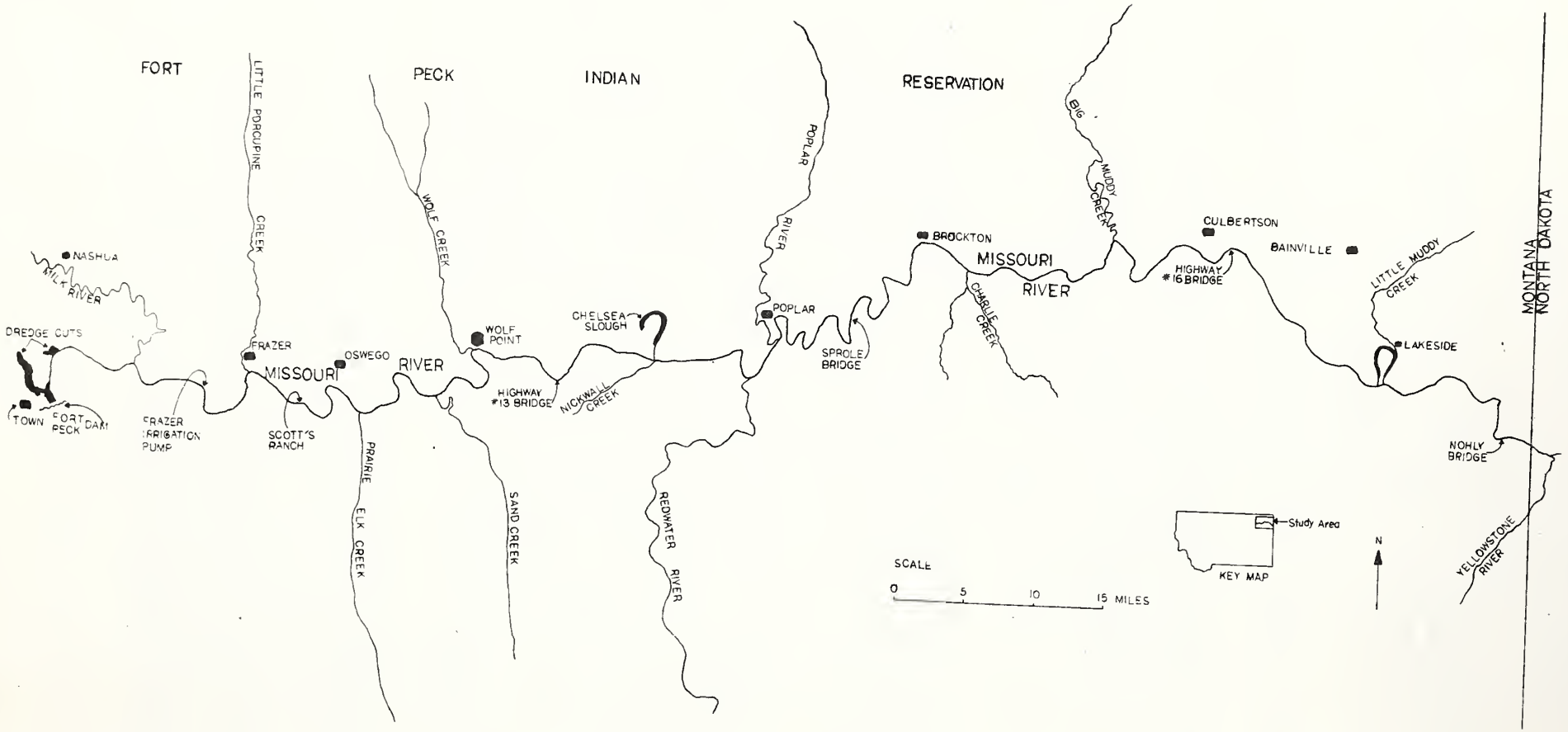

Figure 1. Map of lower Missouri River drainage in Montana.

FINDINGS

Dissolved Oxygen

Dissolved oxygen (DO) data was summarized from USGS data for water years 1975 through 1981 (Table 1) for two stations.

The upstream station is located 8 miles downstream from Fort Peck Dam. The lower station is 150 river miles downstream from the dam, near the town of Culbertson. DO averaged 100 percent saturation at the upstream station and 91 percent saturation at the downstream station, although individual measurements ranged from 72 to 129 percent saturation upstream and 67 to 104 percent saturation downstream.

The larger percentage saturations upstream suggest either photosynthetic DO increases or somewhat supersaturated values due to the dam and power production. Average values near Culbertson indicate biological decomposition of organic matter imported from upstream areas where the water is clear enough to allow production of organic matter by photosynthesis.

DO values always remained within a range favorable for all life stages of the various fish species present. The values at the upper station above 120 percent saturation raise questions about possible nitrogen supersaturation which could cause fish gas bubble disease. No measurements of dissolved gaseous nitrogen are available, but neither has any evidence of gas bubble disease been found in fish downstream from the dam.

Changes in Sauger Population

In a previous report (Stewart 1982) it was noted that the average size of sauger had increased greatly from 1979 to 1981. To pinpoint the reasons for this change a comparison was made between fish collected in fall of both years of average size at each age and age structure (Table 2).

The comparison indicates that from 1979 to 1981 growth rates increased and age structures shifted from a dominance of younger fish to a dominance of older fish (Table 2). For ages 2+ through 6+ average lengths increased 1.6, 1.7, 2.1, 2.9, and 1.7 inches. Corresponding average weight increases were 0.16, 0.26, 0.59, 0.81, and 0.97 pounds. In 1979 age 2+ was the modal year class, but by 1981 the modal year class had become age 4+. Only 16.8 percent of the sauger population were age 4+ and older in 1979. By 1981, 59.3 percent were age 4+ and older.

The rainbow smelt is the most probable cause of the observed changes in sauger growth and age structure. It is probably utilized by sauger in the upper portions of Garrison Reservoir where rainbow smelt are abundant. Large numbers of rainbow smelt have been present in the Missouri River only during spawning runs in spring 1980 and 1981.

Table 1. Annual mean[1] dissolved oxygen (ppm) and percentage saturation at two stations on the Missouri River for USGS water years 1975 through 1981[2].

	Two Miles Above Milk River				Near Culbertson			
Water Year	Mean Dissolved Oxygen	Mean Percentage Saturation	Range Dissolved Oxygen	Mean Percentage Saturation	Mean Dissolved Oxygen	Mean Percentage Saturation	Range Dissolved Oxygen	Mean Percentage Saturation
1975	11.0	98	9.2-12.6	85-115	10.4	93	7.2-13.6	87-100
1976	10.9	100	8.2-13.2	85-107	9.2	83	7.4-11.7	70- 94
1977	11.2	101	9.2-13.0	89-119	10.3	94	7.8-12.8	87-102
1978	11.3	100	8.8-13.8	83-126	10.6	95	8.3-12.6	89-104
1979	11.8	100	10.9-13.0	90-108	10.4	91	8.3-12.9	84- 97
1980	11.4	98	7.8-13.6	72-114	10.5	95	8.4-14.2	86-104
1981	11.7	103	8.6-14.3	88-129	9.7	86	7.4-12.8	67-100

[1]Annual means are each based on 12 monthly measurements.
[2]Data based on USGS annual reports 1975 through 1981.

Table 2. Comparison of Missouri River sauger length, weight, and age structure for ages 0+ through 6+, in Fall 1979 and Fall 1981.[1]

Age	Mean Length (inches)		Mean Weight (pounds)		Percentage of Sample at Given Age	
	1979	1981	1979	1981	1979	1981
0+	6.7	5.2	0.08	0.04	2.3	1.0
1+	9.6	9 6	0.22	0.25	24.0	6.3
2+	10.8	12.4	0.32	0.48	41.4	12.6
3+	13.0	14.7	0.59	0.85	15.5	20.8
4+	15.5	17.6	1.04	1.63	9.5	33.7
5+	16.6	19.5	1.33	2.14	5.0	21.8
6+	20.6	22.3	2.57	3.54	2.3	3.8

[1]Sample size is 220 for 1979 and 809 for 1981.

Age and Growth--Other Fish Species

Age and growth data for burbot are shown in Table 3. The sample size is small for some age groups but sufficient to indicate the general growth status for this species.

Otoliths proved to be a good method for aging this species in the Missouri River. Only six of 121 otoliths could not be aged because of indistinct light and dark zones.

There is a major increase in the annual length increment from age five to age six (Table 3). This increase coincides with the age at which the diet changes from invertebrates to fish. The fish diet is probably responsible for the growth increase.

Compared to growth data for burbot in other North American areas (Carlander 1969), Missouri River burbot tended to grow somewhat more slowly at younger ages, but more rapidly at older ages. Their weight at a given length is similar to North American averages given by Carlander (1969).

Age and growth of 76 northern pike from scales collected in 1982 is indicated in Table 4. Fish were assigned ages from 0+ to 7+. These fish grew more rapidly than those reported by Brown (1971) for other locations in Montana. The maximum total length and weight in this sample of 76 northern pike was 42.5 inches and 21.5 pounds. Five fish weighed in excess of 10 pounds. The rapid growth is unexpected in view of the low summer temperatures (Stewart 1980) in the Missouri River.

Table 3. Age and growth of 115 burbot collected from the Missouri River, April and May, 1982.

Age	No. of Fish	Mean Length (inches)	Mean Weight (pounds)	Length Range (inches)	Weight Range (pounds)	Average Annual Length Increment
1	1	6.3	0.04	---	---	---
2	16	8.8	0.16	6.8-10.5	0.08- 0.30	2.5
3	34	11.8	0.37	9.1-16.0	0.17- 0.96	3.0
4	21	13.7	0.59	10.8-18.1	0.25- 1.22	1.9
5	5	16.8	1.28	12.6-20.8	0.40- 2.71	3.1
6	14	23.2	3.34	16.5-28.0	0.92- 6.10	6.4
7	11	23.6	3.25	20.2-26.4	1.68- 5.10	0.4
8	6	28.4	5.36	22.6-30.0	2.22- 6.40	5.2
9	3	31.4	8.04	30.1-32.2	5.80-10.30	3.0
10	0	--	--	---	---	---
11	3	32.1	8.64	28.4-35.6	6.70-12.40	0.3
12	1	33.5	10.00	---	---	1.4

Table 4. Age and growth of Missouri River northern pike collected Summer and Fall, 1982.

Age	No. of Fish	Mean Length (inches)	Mean Weight (pounds)	Length Range (inches)	Weight Range (pounds)
0+	5	8.8	0.17	6.2-10.7	0.04- 0.30
1+	6	13.4	0.51	9.8-15.2	0.18- 0.74
2+	10	21.5	2.20	16.1-24.5	0.78- 3.06
3+	30	26.5	3.99	23.2-29.4	2.06- 5.44
4+	20	29.9	5.92	25.7-33.2	3.42- 8.10
5+	2	37.3	12.70	35.6-39.0	11.40-14.00
6+	0	--	--	---	---
7+	3	41.2	17.60	40.0-42.5	12.80-21.50

Age and growth data for an additional 11 species is presented in Table 5. Sample sizes for the various species ranged from 308 for goldeye to 21 for white crappie. The smaller sample sizes are insufficient for indicating accurate annual growth increments, but still show the general growth rate status.

Growth rates of the species in Table 5 were mostly similar to growth rates of these species at similar latitude in other states, using data from Brown (1971) and Carlander (1969) for comparison.

Younger age classes for some species are absent or present only in low numbers in the study area. With the exception of several larval blue suckers sampled in spring, no blue suckers younger than age 6+ have been sampled. The situation is similar for smallmouth buffalo and bigmouth buffalo except that significant numbers of these two species spend much of the first year of life in the Missouri River (Table 5). These missing age groups probably remain in Garrison Reservoir, entering the Missouri River in increasing numbers at older age.

Table 5. Age, growth, and average length and weight at each age for Missouri River nongame fish species and white crappie sampled in August, 1981.

Species	Age	Sample Size	Mean Length (ins.)	Mean Weight (lbs.)	Length Range	Weight Range	Annual Length Increment (ins.)
Goldeye	0+	6	3.5	0.01	2.0- 4.7	0.01-0.02	---
	1+	15	6.6	0.09	4.0- 9.0	0.02-0.26	3.1
	2+	67	9.0	0.22	6.4-11.3	0.08-0.43	2.4
	3+	79	10.2	0.31	7.5-12.9	0.13-0.60	1.0
	4+	73	11.5	0.46	8.9-13.5	0.20-0.71	1.3
	5+	38	12.2	0.53	9.7-14.2	0.28-0.96	0.7
	6+	18	11.6	0.48	10.0-14.0	0.29-0.85	-0.6
	7+	11	12.3	0.56	11.1-14.1	0.34-0.77	0.7
	8+	1	14.6	1.16	---	---	2.3
Carp	0+	23	2.0	0.01	1.6- 2.3	0.01-0.01	---
	2+	1	5.1	0.06	---	---	1.5
	3+	4	14.7	1.74	14.5-15.2	1.57-1.93	9.6
	4+	12	15.0	1.67	14.3-15.8	1.28-2.12	0.3
	5+	18	16.1	2.09	13.6-17.5	1.28-3.26	1.1
	6+	20	17.3	2.46	16.2-18.7	2.00-3.32	1.2
	7+	27	18.5	2.97	16.5-21.2	1.99-4.46	1.2
	8+	19	20.2	3.75	19.2-22.1	2.63-5.11	1.7
	9+	9	21.6	4.86	19.6-23.2	3.52-6.10	1.4
	10+ & older	11	24.6	6.92	21.6-26.3	4.31-8.90	---

Table 5. Continued.

Species	Age	Sample Size	Mean Length (ins.)	Mean Weight (lbs.)	Length Range	Weight Range	Annual Length Increment (ins.)
Flathead Chub	1+	36	3.6	0.02	2.1- 4.6	0.01-0.03	---
	2+	18	5.8	0.06	4.7- 7.1	0.03-0.12	2.2
	3+	26	7.4	0.12	6.7- 8.4	0.08-0.20	1.6
	4+	13	8.2	0.17	7.2- 9.2	0.10-0.26	0.8
	5+	6	9.1	0.23	8.4-10.2	0.17-0.30	0.9
	6+	1	10.0	0.34	---	---	0.9
	7+	1	12.5	0.65	---	---	2.5
River Carpsucker	0+	29	2.5	0.01	1.8- 3.5	0.01-0.01	---
	1+	3	5.0	0.06	3.7- 6.1	0.01-0.11	2.5
	2+	4	8.9	0.35	8.2- 9.3	0.26-0.40	4.9
	3+	5	13.0	1.05	11.0-14.2	0.68-1.29	4.1
	4+	7	14.5	1.54	14.0-15.6	1.30-2.00	1.5
	5+	18	15.2	1.67	14.4-16.2	1.40-2.40	0.7
	6+	16	16.0	1.84	15.4-16.4	1.58-2.02	0.8
	7+	14	17.1	2.45	16.1-18.4	1.80-3.72	1.1
	8+	7	18.0	2.96	16.7-20.2	2.07-4.23	0.9
	9+	4	20.6	4.63	19.5-21.7	4.12-5.10	2.6
Blue Sucker	6+	2	22.4	3.57	22.3-22.6	3.50-3.64	---
	7+	7	23.6	4.12	22.9-24.5	3.70-4.72	0.8
	8+	19	25.0	4.82	22.7-28.8	3.40-8.90	1.4
	9+	15	25.1	4.80	23.4-27.9	3.72-6.50	0.1
	10+	9	26.0	5.52	23.3-29.3	3.76-8.60	0.9
	11+	4	25.5	5.71	24.2-26.8	4.78-6.30	-0.5
	12+	1	26.5	5.90	---	---	1.0
Smallmouth Buffalo	0+	11	1.5	0.01	1.3- 2.2	0.01-0.01	---
	4+	2	15.6	2.08	15.3-15.8	2.01-2.16	---
	5+	5	18.6	3.26	17.1-20.3	2.33-4.55	3.0
	6+	10	19.6	3.73	17.4-21.7	2.88-4.94	1.0
	7+	7	20.8	4.74	19.8-23.8	3.89-7.20	1.2
	8+	7	21.8	5.18	20.3-22.8	4.14-6.00	1.0
	9+	4	22.3	6.01	21.3-23.5	4.83-7.70	0.5
	10+	3	22.4	5.69	21.0-24.5	4.38-8.10	0.1
Bigmouth Buffalo	0+	9	1.5	0.01	1.2- 2.0	0.01-0.01	---
	4+	1	16.5	2.40	---	---	---
	5+	3	21.4	6.08	20.0-24.2	4.46-8.60	4.9
	6+	5	20.8	5.70	19.5-21.9	5.11-7.00	-0.6
	7+	4	22.7	7.52	21.0-26.0	5.70-11.60	1.9
	8+	2	23.8	9.00	22.6-25.0	7.30-10.80	1.1
	9+	2	25.8	10.25	25.0-26.6	9.00-11.50	2.0

Table 5. Continued.

Species	Age	Sample Size	Mean Length (ins.)	Mean Weight (lbs.)	Length Range	Weight Range	Annual Length Increment (ins.)
Shorthead Redhorse	1+	5	4.1	0.02	2.7- 4.9	0.01-0.04	---
	2+	39	6.6	0.11	5.2- 8.0	0.06-0.18	2.5
	3+	4	8.6	0.22	7.7- 9.5	0.15-0.30	2.0
	4+	14	10.7	0.47	8.9-13.8	0.27-1.10	2.1
	5+	5	12.2	0.68	10.8-14.7	0.45-1.03	1.5
	6+	11	13.3	1.01	9.1-16.7	0.27-2.21	1.1
	7+	10	14.4	1.27	12.4-16.7	0.70-2.52	1.1
	8+	10	15.0	1.32	12.7-17.1	0.70-2.20	0.6
	9+	9	16.1	1.70	14.7-18.1	1.23-2.46	1.1
	10+ & older	6	16.8	1.93	15.5-18.1	1.36-2.48	---
Longnose Sucker	0+	13	2.4	0.01	1.9- 3.8	0.01-0.02	---
	1+	5	8.6	0.27	7.2-10.4	0.15-0.50	6.2
	2+	2	11.5	0.64	11.1-11.9	0.60-0.67	2.9
	3+	3	11.9	0.82	10.5-12.8	0.41-1.30	0.4
	4+	4	16.4	1.98	15.7-17.2	1.70-2.11	4.5
	5+	1	18.3	2.55	---	---	1.9
	6+	2	21.2	4.38	20.2-22.2	3.48-5.28	2.9
White Sucker	0+	33	2.2	0.01	1.2- 3.4	0.01-0.01	---
	1+	7	5.0	0.05	4.0- 5.8	0.02-0.07	2.8
	2+	2	5.7	0.07	5.6- 5.8	0.07-0.07	0.7
	3+	0	---	---	---	---	---
	4+	2	13.1	1.16	13.1-13.2	1.05-1.26	3.7
	5+	3	14.5	1.36	13.9-14.9	1.09-1.75	1.4
	6+	4	15.8	1.90	14.2-16.6	1.27-2.18	1.3
	7+	3	16.6	1.97	14.5-18.3	1.30-2.80	0.8
White Crappie	0+	5	2.0	0.01	1.6- 2.3	0.01-0.01	---
	1+	14	2.8	0.01	1.8- 3.4	0.01-0.01	0.8
	2+	2	5.5	0.07	5.4- 5.7	0.07-0.08	2.7

Spring Electrofishing Sampling

Twenty-one days were spent in April and May 1982 sampling game fish in the Missouri River and the lowermost two or three miles of tributary streams. A variety of information was collected including stomach contents, burbot otoliths for aging, location of spawners, and catch rates.

Catch rates were calculated in 1982 on the basis of fish per electrofishing hour rather than fish per day as in past years (Stewart 1980, 1981, 1982). In past years an electrofishing day consisted of approximately five hours of actual electrofishing. Actual electrofishing time on each day of April and May 1982 was less because of the time required for removing burbot otoliths and stomach contents of burbot and other species.

Table 6 shows sauger numbers, sizes, and catch rates for April and May 1982. Catch rates in April exceeded catch rates for sampling in previous years, indicating that large numbers of sauger were present. Catch rates for individual days ranged from 3.2 to 56.7 sauger per hour (Table 6) and averaged 20.6 for the month of April for Missouri River sampling. This mean catch rate was never exceeded on even a single day in any previous year. These high sauger numbers in the Missouri River in April 1982 may have been related to above-average inflow from tributaries in that month.

Sauger catch rates for the Missouri River decreased from an average of 20.6 fish per hour in April to 4.2 in May, approximately a five-fold difference. Inflow to the Missouri River from tributaries was much lower in May than April. However, other factors may be related to the decreased catch rates including lower turbidity and higher water temperature in May.

Sauger catch rates near the mouths of tributary streams for April and May 1982 were similar to Missouri River catch rates (Table 6). Catch rate values were highest in the Milk River in late April and lowest in Big Muddy Creek in late May.

Sauger average sizes in spring 1982 remained similar to values determined for fall 1981 and well above average sizes in 1979 and 1980 (Stewart 1982). Average sizes on tributary streams were somewhat smaller than for the Missouri River in 1982. This may indicate the presence of larger numbers of young, nonmigratory sauger in the tributary streams than in the Missouri River.

Walleye numbers, sizes, and catch rates for April and May 1982 are shown in Table 7. The mean catch rate for sauger was 9.8 times higher than for walleye on the Missouri River. Catch rates were only 4.0 times greater on tributaries. The smaller sauger-walleye difference on tributaries is largely accounted for by the high walleye catch rate on the Poplar River, where resident walleye are abundant.

Table 6. Number, size, and catch rate (fish per electrofishing hour) of sauger sampled in the Missouri River and mouths of tributary streams, Spring 1982.

Location	Date	Number Sampled	Mean Length (ins.)	Mean Weight (lbs.)	Length Range	Weight Range	Fish Per Hour
			Missouri River				
Highway 13 Bridge	4-13	10	18.3	1.72	14.3-21.6	0.70-2.69	10.0
Highway 13 Bridge	4-14	37	16.1	1.22	12.1-21.2	0.44-3.02	16.4
Near Poplar River	4-15	60	16.4	1.32	10.1-21.1	0.24-2.55	34.2
Sprole Bridge	4-16	85	16.3	1.28	10.0-20.7	0.25-2.93	56.7
Below Highway 16 Bridge	4-20	22	14.5	0.92	8.2-20.5	0.12-2.22	14.7
Above Highway 16 Bridge	4-21	64	15.9	1.30	8.0-22.0	0.11-2.95	23.2
Highway 13 Bridge	4-23	57	16.6	1.36	9.0-21.5	0.14-2.88	19.0
Brockton	4-26	50	16.7	1.42	9.4-21.2	0.21-2.86	15.8
Below Milk River	4-27	29	16.3	1.32	11.9-20.1	0.41-2.38	19.3
Below Scott's Ranch	4-28	8	18.0	1.72	13.5-20.6	0.60-2.39	3.2
Below Milk River	4-30	22	15.6	1.19	11.4-20.9	0.37-30.5	14.6
Sprole Bridge	5-3	25	16.6	1.49	8.6-22.1	0.14-3.45	6.5
Below Milk River	5-11	4	18.2	1.75	15.0-20.3	0.87-2.27	5.3
Brockton	5-12	4	19.0	1.82	17.9-19.7	1.18-2.21	1.2
Below Highway 16 Bridge	5-13	6	19.5	2.26	16.1-21.0	1.35-3.21	2.0
Nohly Bridge	5-14	27	18.5	1.89	11.2-22.8	0.37-3.84	8.3
Below Poplar River	5-17	2	19.1	2.07	18.5-19.8	1.77-2.37	0.7
Below Highway 13 Bridge	5-18	7	18.9	1.89	13.9-21.3	0.71-2.69	4.7
Nohly Bridge	5-19	9	17.0	1.46	5.4-20.9	0.04-2.76	3.6
Below Big Muddy Creek	5-24	23	14.7	1.01	5.9-22.6	0.05-2.34	7.1
Above Big Muddy Creek	5-25	7	18.7	1.58	15.3-20.9	1.48-2.10	3.1
Total or Mean	21 days	558	16.5	1.36	5.4-22.8	0.04-3.84	12.8

Table 6. Continued.

Location	Date	Number Sampled	Mean Length (ins.)	Mean Weight (lbs.)	Length Range	Weight Range	Fish Per Hour
			Tributary Streams				
Poplar River	4-15	5	14.5	0.92	12.1-17.2	0.47-1.43	5.0
Milk River	4-27	37	14.9	0.99	10.4-20.8	0.26-3.37	55.5
Milk River	4-30	32	14.3	0.79	10.0-18.6	0.26-1.92	13.7
Milk River	5-11	18	16.5	1.31	10.7-20.5	0.29-2.63	18.0
Big Muddy Creek	5-24	5	12.5	0.67	9.9-17.7	0.26-1.26	4.0
Total or Mean	5 days	97	14.9	0.96	9.9-20.8	0.26-3.37	19.2

Table 7. Number, size, and catch rate (fish per electrofishing hour) of walleye sampled in the Missouri River and mouths of tributary streams, Spring 1982.

Location	Date	Number Sampled	Mean Length (ins.)	Mean Weight (lbs.)	Length Range	Weight Range	Fish Per Hour
			Missouri River				
Highway 13 Bridge	4-13	1	17.2	1.64	---	---	1.0
Highway 13 Bridge	4-14	1	19.8	2.97	---	---	0.4
Near Poplar River	4-15	1	22.7	4.39	---	---	0.6
Sprole Bridge	4-16	12	17.1	2.06	8.5-26.1	0.20-6.80	8.0
Below Highway 16 Bridge	4-20	5	17.7	2.12	15.0-22.1	1.10-3.82	3.3
Above Highway 16 Bridge	4-21	3	21.2	3.66	17.1-25.1	1.64-6.00	1.1
Highway 13 Bridge	4-23	1	16.9	1.60	---	---	0.3
Brockton	4-26	10	17.6	2.18	9.8-23.3	0.22-4.38	3.2
Below Milk River	4-27	1	13.1	0.63	---	---	0.7
Below Scott's Ranch	4-28	2	20.4	3.22	19.9-20.9	2.81-3.63	0.7
Below Milk River	4-30	1	16.4	1.71	---	---	0.7
Sprole Bridge	5-3	3	23.1	4.86	21.9-24.5	4.21-6.00	0.8
Below Milk River	5-11	0	---	---	---	---	0.0
Brockton	5-12	0	---	---	---	---	0.0
Below Highway 16 Bridge	5-13	4	21.8	3.68	18.3-24.0	2.34-5.22	1.3
Nohly Bridge	5-14	9	23.3	4.42	19.5-26.3	2.47-6.00	2.8
Below Poplar River	5-17	2	15.4	1.65	8.7-22.1	0.15-3.15	0.7
Below Highway 13 Bridge	5-18	3	19.9	2.67	16.4-22.6	1.51-3.64	1.3
Nohly Bridge	5-19	2	23.4	5.07	22.2-24.5	4.83-5.30	0.8
Below Big Muddy Creek	5-24	0	---	---	---	---	0.0
Above Big Muddy Creek	5-25	0	---	---	---	---	0.0
Total or Mean	21 days	61	19.4	2.92	8.5-26.3	0.15-6.80	1.3

Table 7. Continued.

Location	Date	Number Sampled	Mean Length (ins.)	Mean Weight (lbs.)	Length Range	Weight Range	Fish Per Hour
			Tributary Streams				
Poplar River	4-15	14	12.7	1.14	8.7-25.5	0.19-7.10	14.0
Milk River	4-27	4	11.9	0.50	10.2-13.3	0.31-0.71	6.0
Milk River	4-30	2	11.4	0.44	10.4-12.3	0.29-0.58	0.9
Milk River	5-11	0	---	---	---	---	0.0
Big Muddy Creek	5-24	4	17.8	1.79	14.8-19.6	1.01-2.36	3.2
Total or Mean	5 days	24	13.3	1.08	8.7-25.5	0.19-7.10	4.8

Walleye catch rates in April and May were approximately five times greater than for the corresponding period in 1979 through 1981. Whatever factor or factors increased sauger catch rates in 1982 over previous years were probably related to increased walleye catch rates also.

The average size of walleye in spring 1982 on the Missouri River (19.4 inches and 2.92 pounds) was nearly equal to the average size in 1981. Sample sizes in 1979 and 1980 are low, but still suggest an increase in average size in 1981 and 1982.

Northern pike number, size, and catch rate data are given in Table 8. Catch rates and average sizes in 1982 were similar to previous years. The average size in the Missouri River (4.20 pounds) for 69 fish sampled in spring 1982 is fairly large. Sizes in tributary streams were similar to the Missouri River.

Burbot are common throughout the study area, but can be sampled in large numbers by electrofishing only when water temperatures are 45°F or lower and turbidity is sufficiently high that visibility into the water is only an inch or two. These conditions are attained in the study area when there is considerable surface runoff from snowmelt or rainfall in the early spring or fall.

Table 9 is a summary of numbers, sizes, and catch rates for burbot in April and May 1982. For the game species, burbot catch rates averaged second only to sauger, indicating that this species is second in abundance among the game species in the study area. A total of 112 burbot were sampled during April and May 1982, but catch rates were higher in April by a factor of 5.9 (4.1 fish per hour in April versus 0.7 in May). Water temperatures were lower and turbidity considerably higher in April.

Average size as well as catch rate declined significantly from April to May. The average length and weight of burbot decreased from 18.2 inches and 2.34 pounds in April to 13.1 inches and 1.07 pounds in May. The difference was caused by increased water temperature and decreased water turbidity in May. Small burbot remain vulnerable to electrofishing gear at higher water temperatures and lower turbidities than larger burbot.

Burbot of a large size for the species were common in the spring sample in 1982. Burbot weighing between 5 and 10 pounds were sampled on 10 of 16 days that burbot appeared in the sample (Table 9). Individuals in the 10-15 pound range are not uncommon.

A total of 38 shovelnose sturgeon were sampled during 21 sampling days in April and May 1982 (Table 10). Average catch rates for this species (1.0 fish per hour) were lower than catch rates for other game species. Sturgeon were not collected on eight sampling days previous to April 27. On April 28 relatively large numbers were sampled in the Missouri River just downstream of the Milk River and small numbers were found at downstream points in late April and May. Apparently very few were present in the Missouri River previous to late April.

Table 8. Number, size, and catch rate (fish per electrofishing hour) of northern pike sampoled in the Missouri River and mouths of tributary streams, Spring 1982.

Location	Date	Number Sampled	Mean Length (ins.)	Mean Weight (lbs.)	Length Range	Weight Range	Fish Per Hour
			Missouri River				
Highway 13 Bridge	4-13	2	25.1	5.20	19.0-31.3	1.50- 8.9	2.0
Highway 13 Bridge	4-14	3	25.0	5.00	19.0-32.5	1.48- 9.7	1.3
Near Poplar River	4-15	1	12.7	0.45	---	---	0.6
Sprole Bridge	4-16	0	---	---	---	---	0.0
Below Highway 16 Bridge	4-20	0	---	---	---	---	0.0
Above Highway 16 Bridge	4-21	3	23.6	4.30	11.1-34.5	0.31- 9.3	1.1
Highway 13 Bridge	4-23	1	11.2	0.33	---	---	0.3
Below Brockton	4-26	0	---	---	---	---	0.0
Below Milk River	4-27	0	---	---	---	---	0.0
Below Scott's Ranch	4-28	2	26.0	4.79	22.8-29.1	2.97- 6.6	0.7
Below Milk River	4-30	0	---	---	---	---	0.0
Sprole Bridge	5-3	1	24.9	2.73	---	---	0.3
Below Milk River	5-11	0	---	---	---	---	0.0
Brockton	5-12	4	23.3	4.09	6.7-31.7	0.06- 6.7	1.2
Below Highway 16 Bridge	5-13	7	28.3	5.40	25.8-32.8	3.48- 8.6	2.3
Nohly Bridge	5-14	14	26.2	4.93	11.8-41.7	0.34-16.7	4.3
Below Poplar River	5-17	6	21.1	3.69	11.1-34.0	0.29-10.8	2.0
Below Highway 13 Bridge	5-18	1	23.2	2.88	---	---	0.4
Nohly Bridge	5-19	15	25.1	4.03	11.2-36.0	0.26-11.2	6.0
Below Big Muddy Creek	5-24	6	18.2	2.51	9.8-31.9	0.21- 7.1	3.0
Above Big Muddy Creek	5-25	3	27.4	4.91	23.6-34.5	2.40- 9.6	1.3
Total or Mean	21 days	69	24.2	4.20	6.7-41.7	0.06-16.7	1.3

Table 8. Continued.

Location	Date	Number Sampled	Mean Length (ins.)	Mean Weight (lbs.)	Length Range	Weight Range	Fish Per Hour
			Tributary Streams				
Poplar River	4-15	5	20.9	2.32	12.8-25.3	0.44-3.64	5.0
Milk River	4-27	0	---	---	---	---	0.0
Milk River	4-30	0	---	---	---	---	0.0
Milk River	5-11	0	---	---	---	---	0.0
Big Muddy Creek	5-24	4	30.2	6.68	29.2-31.1	6.0 -7.1	3.2
Total or Mean	5 days	9	25.0	4.26	12.8-31.1	0.44-7.1	1.6

Table 9. Number, size, and catch rate (fish per electrofishing hour) of burbot sampled by electrofishing in the Missouri River and mouths of tributary streams, Spring 1982.

Location	Date	Number Sampled	Mean Length (ins.)	Mean Weight (lbs.)	Length Range	Weight Range	Fish Per Hour
			Missouri River				
Highway 13 Bridge	4-13	3	17.0	2.11	10.5-29.5	0.23-5.80	3.0
Highway 13 Bridge	4-14	9	22.0	4.25	9.8-33.4	0.16-10.3	4.0
Near Poplar River	4-15	5	21.8	3.42	10.5-32.2	0.20-8.00	2.9
Sprole Bridge	4-16	6	24.3	4.72	15.9-33.5	0.88-10.0	4.0
Below Highway 16 Bridge	4-20	5	16.4	1.55	6.3-24.3	0.04-3.00	3.3
Above Highway 16 Bridge	4-21	15	14.9	1.23	7.2-26.9	0.07-5.18	5.5
Highway 13 Bridge	4-23	7	19.7	2.58	12.3-31.5	0.36-7.90	2.3
Below Brockton	4-26	13	21.0	2.63	13.8-29.4	0.63-6.10	4.1
Below Milk River	4-27	13	19.2	2.54	11.5-35.6	0.26-12.4	8.7
Below Scott's Ranch	4-28	7	11.4	0.32	9.0-13.6	0.13-0.57	2.8
Below Milk River	4-30	7	12.3	0.38	10.8-14.1	0.25-0.52	4.7
Sprole Bridge	5-3	2	19.8	3.07	9.6-29.9	0.14-6.00	0.5
Below Milk River	5-11	0	---	---	---	---	0.0
Brockton	5-12	1	9.1	0.16	---	---	0.3
Below Highway 16 Bridge	5-13	0	---	---	---	---	0.0
Nohly Bridge	5-14	7	10.3	0.24	9.1-12.2	0.13-0.45	2.2
Below Poplar River	5-17	0	---	---	---	---	0.0
Below Highway 13 Bridge	5-18	1	12.0	0.39	---	---	0.4
Nohly Bridge	5-19	3	19.7	2.75	9.6-30.1	0.19-6.60	1.2
Below Big Muddy Creek	5-24	6	11.7	0.75	7.1-24.2	0.09-3.40	1.8
Above Big Muddy Creek	5-25	2	9.4	0.16	8.9-10.0	0.12-0.20	0.9
Total or Mean	21 days	112	17.1	2.03	6.3-35.6	0.04-12.40	2.5

Table 9. Continued.

Location	Date	Number Sampled	Mean Length (ins.)	Mean Weight (lbs.)	Length Range	Weight Range	Fish Per Hour
			Mouths of Tributary Streams				
Poplar River	4-15	2	20.9	2.64	19.8-22.0	1.97-3.30	2.0
Milk River	4-27	1	27.5	5.13	---	---	1.5
Milk River	4-30	1	12.2	0.44	---	---	0.4
Milk River	5-11	2	12.3	0.39	11.5-13.1	0.28-0.50	2.0
Big Muddy Creek	5-24	4	12.0	0.45	9.0-13.7	0.21-0.60	3.2
Total or Mean	5 days	10	15.4	1.34	9.0-27.5	0.39-5.13	1.8

Table 10. Number, size, and catch rate (fish per electrofishing hour) of shovelnose sturgeon sampled by electrofishing in the Missouri River, Spring 1982.

Location	Date	Number Sampled	Mean Length (ins.)	Mean Weight (lbs.)	Length Range	Weight Range	Fish Per Hour
Highway 13 Bridge	4-13	0					
Highway 13 Bridge	4-14	0					
Near Poplar River	4-15	0					
Near Sprole Bridge	4-16	0					
Below Highway 16 Bridge	4-20	0					
Above Highway 16 Bridge	4-21	0					
Highway 13 Bridge	4-23	0					
Below Brockton	4-26	0					
Below Milk River	4-27	23	26.6	2.27	23.0-30.9	1.64-3.53	15.3
Below Scott's Ranch	4-28	0					
Below Milk River	4-30	3	27.9	2.60	26.2-29.0	2.20-3.18	2.0
Near Sprole Bridge	5-3	4	24.6	1.58	23.0-27.6	1.04-2.32	1.0
Below Milk River	5-11	1	27.1	1.99	---	---	1.3
Near Brockton	5-12	0					
Below Highway 16 Bridge	5-13	2	27.4	2.30	26.6-28.2	2.07-2.52	0.7
Nohly Bridge	5-14	1	30.2	2.84	---	---	0.3
Below Poplar River	5-17	2	24.0	1.30	23.5-24.4	1.10-1.50	0.7
Below Highway 13 Bridge	5-18	0					
Nohly Bridge	5-19	0					
Below Big Muddy Creek	5-24	1	23.8	1.36	---	---	0.3
Above Big Muddy Creek	5-25	1	28.4	3.03	---	---	0.4
Total or Mean	21 days	38	26.4	2.18	23.0-30.9	1.04-3.53	1.0

Shovelnose sturgeon were not found in tributary streams in April and May. However, small numbers were noted in the Milk River in June.

The average size of shovelnose sturgeon in the Missouri River has held quite constant during the years 1979 through 1982.

Game Fish Spawning

Fish spawning is indicated by the presence of ripe or freshly spent females. Males sexually ripen many days or even weeks before actual spawning occurs. Similarly, ripe males can be found many miles from the spawning locations. A female was judged ripe if eggs could be easily stripped. Freshly spent females were fish with a flaccid abdomen and from which at least one or two eggs could be stripped.

Table 11 summarizes numbers, dates, and locations of sauger, walleye, and northern pike ripe and freshly spent females. A total of 50 ripe or spent female sauger were found over the period April 26 to May 25. Ripe female sauger were still found on the last day of sampling (May 25), so it could be reasonably presumed that sauger spawning may have continued into early June.

Sauger spawners were found in the Missouri River only between the Highway #13 Bridge near Wolf Point and the Nohly Bridge near the North Dakota border. Spawners were not found at upstream points, although less sampling for spawners was done at upstream points. Spawners were concentrated near 14 gravelly or rocky areas between the Highway 13 Bridge and Nohly Bridge. These hard bottom areas varied in length from approximately 200 to 600 yards of river length and often did not extend the full width of the river. During the spawning period in May, few sauger of any kind could be found at any location except near these rocky and gravelly areas of the river. Of the 50 ripe and freshly spent female sauger sampled, 22 (44 percent) were found near the Nohly Bridge. The gravel and rock area here is probably the largest of the hard bottom areas downstream of the Highway 13 Bridge. Few sauger female spawners were found in tributary streams (Table 11).

Much of the preceding is also true of walleye. Only nine walleye spent females were sampled. No ripe females were present in the samples. Spent females were sampled over the period from May 3 to May 19. Female spawners were found only downstream of the Poplar River, with the largest numbers being present near the Nohly Bridge (Table 11). No ripe or spent female walleye were sampled in tributaries.

Northern pike had a long spawning period. The first spent female was found on the first day of sampling in 1982, April 13 (Table 11). It may be reasonably concluded that some spawning occurred before this date. The latest spawner was a ripe female on May 19; none were sampled after this date. Northern pike ripe and freshly spent females were found in the Missouri River only between the Highway 13 Bridge and Nohly Bridge. One was collected during a brief sampling run in the Poplar River.

Table 11. Ripe and freshly spent female sauger, walleye, and northern pike sampled in the Missouri River and mouths of tributary streams, Spring 1982.

Location	Date	Sauger				Walleye				Northern Pike			
		R[1]	S[2]	Mean Length	Mean Weight	R	S	Mean Length	Mean Weight	R	S	Mean Length	Mean Weight
Missouri River													
Highway 13 Bridge	4-13									0	1	31.3	8.9
Highway 16 Bridge	4-21									1	1	30.8	7.9
Brockton	4-26	1	0	15.2	0.74								
Sprole Bridge	5-3					0	1	22.9	4.21				
Brockton	5-12	1	1	18.0	1.46					0	1	31.7	6.7
Highway 16 Bridge	5-13	0	2	20.6	2.40	0	2	23.2	4.32	2	0	29.1	6.61
Nohly Bridge	5-14	3	12	20.1	2.31	0	4	24.0	4.64	0	1	31.4	7.1
Below Poplar River	5-17	1	0	18.5	1.77	0	1	22.1	3.15	1	0	34.0	10.8
Highway 13 Bridge	5-18	5	1	19.8	2.09								
Nohly Bridge	5-19	0	7	19.6	1.99	0	1	24.5	5.30	1	0	32.0	7.3
Below Big Muddy Creek	5-24	3	7	18.5	1.63								
Above Big Muddy Creek	5-25	2	4	19.2	1.74								
Mean or Total		16	34	19.4	1.96	0	9	23.5	4.43	5	4	31.1	7.77
Tributary Streams													
Poplar River	4-15									0	1	25.3	3.42
Milk River	5-11	2	0	16.0	0.85								
Big Muddy Creek	5-24	0	1	17.7	1.26								
Mean or Total		2	1	16.6	0.97					0	1	25.3	3.42

[1]R = Ripe
[2]S = Spent

Average sizes of sauger, walleye, and northern pike female spawners were large for these species (Table 11). Female spawners averaged nearly 2 pounds in weight for sauger, 4.5 pounds for walleye, and nearly 8 pounds for northern pike.

No substantial evidence for shovelnose sturgeon spawning in the Missouri River or tributary streams has been found. No ripe or spent females have been found; neither have any ripe males been collected. Gonads of 28 shovelnose sturgeon were examined internally from April 27 to July 15, 1982 (Table 12). Eighty-six percent of these were females. Of the 24 females examined only 7 contained mature eggs. Much of the Missouri River between Fort Peck and Garrison Reservoir does not reach temperatures probably required for this species to spawn by late spring or early summer. Significant spawning by this species in the study area is doubtful.

Table 12. Gonad condition of shovelnose sturgeon in the Missouri River, 1982, as determined by internal examination.

			Females		Males	
Location	Date	Number Examined	Mature Eggs	Immature Eggs	Immature	Mature
Below Milk River	4-27	5	1	2	2	0
Below Milk River	4-30	2	0	2	0	0
Below Milk River	5-11	1	0	1	0	0
#16 Bridge	5-13	1	1	0	0	0
Poplar River vic.	5-17	2	0	1	1	0
Big Muddy Ck. vic.	5-25	1	1	0	0	0
#13 Bridge	7-8	4	4	0	0	0
Nohly Bridge	7-12	1	0	1	0	0
Below Milk River	7-13	5	0	5	0	0
Below Milk River	7-14	1	0	1	0	0
Below Milk River	7-15	1	0	0	1	0
Totals		24	7	13	4	0

Paddlefish spawning was found for the first time in the Milk River and in the Missouri River approximately one mile downstream from the Milk River in June 1982. Because of an exceptionally large snowstorm in north-central Montana the last week of May, the Milk River near its mouth ran at an exceptionally high flow for the whole month of June 1982. The mean streamflow for the Milk River near the mouth in June 1982 was 3730 cfs (USGS 1982, in print). The mean streamflows for June in 1979, 1980, and 1981 were 1170, 53, and 247 cfs. No evidence for paddlefish spawning was found in 1979 through 1981.

One ripe female paddlefish was captured on June 7, 1982 from the north side of the Missouri River, approximately one mile downstream from the Milk River. The water temperature was 59°F on the north side of the Missouri River and 43°F on the south side of the river. The large temperature difference between the north and south sides of the river was caused by inflow of the Milk River from the north side of the Missouri River. On the date of the capture of the ripe paddlefish the flow of the Milk River was 6380 cfs while the Missouri River upstream of the Milk River flowed at the rate of 14,100 cfs.

A paddlefish egg was collected from the Milk River at a gravel riffle approximately 2.5 miles upstream from the mouth on June 21, 1982. This egg hatched as it was being picked from the sampling net with forceps. The larval fish was easily indentified as a paddlefish. Other larval paddlefish were sampled with plankton nets. This will be discussed under the heading "larval fish."

Several ripe male paddlefish were captured on June 10 and June 21, 1982. These were all located in the Missouri River, north side, a few hundred yards downstream of the Milk River.

The mixing rate of the turbid Milk River water with the colder, clearer Missouri River water was measured over the period June 7 and 8, 1982, during paddlefish counting. One mile downstream of the Milk River, Missouri River water temperatures were 59°F north side and 43°F south side. Fifteen miles downstream from the Milk River the north side temperature was 52°F and the south side was 48°F. Twenty-six miles downstream from the Milk River mixing was essentially complete, with 51°F on the north side and 50°F on the south side of the Missouri River. The Milk River water entering the Missouri River and its slow mixing with the colder, clearer Missouri River water is thought to have much to do with the observed Missouri River distribution of paddlefish.

Table 13 shows paddlefish numbers by five-mile intervals in the Missouri River from the Milk River to the Highway 13 Bridge during the period June 7 through June 9, 1982. Numbers were highest in the first five miles downstream from the Milk River. Numbers dropped steadily downstream and then became static at approximately the point where water temperatures on the north and south banks were equalized.

Paddlefish were also counted on June 21, 1982 from the mouth of the Milk River to a point 1.5 miles downstream, on the north side of the river. Approximately 200 paddlefish were counted in this short reach, far exceeding any previous number counted in this reach. It is apparent that large numbers of paddlefish congregated in this area for spawning.

A paddlefish count was made during the early part of the migration on May 21, 1982 from the Highway 13 Bridge to the Poplar River. One hundred twelve paddlefish were counted in this reach on that date. This number exceeds by 41 the previous high number of paddlefish counted in this reach in 1980 and 1981 when several counts were made. This data suggest that larger numbers of paddlefish may have entered the annual migration from Garrison Reservoir in 1982 than in 1981 or 1980.

Table 13. Number of paddlefish counted during electrofishing in the Missouri River from the mouth of the Milk River to the Highway 13 Bridge, June 7 to June 9, 1982.

River Mileage[1]												
174.9-170.0	169.9-165.0	164.9-160.0	159.9-155.0	154.9-150.0	149.9-145.0	144.9-140.0	139.9-135.0	134.9-130.0	129.9-125.0	124.9-120.0	119.9-115.0	Total
75	30	35	17	26	12	3	12	10	5	15	1	241

[1]Miles upstream from Montana-North Dakota border.

Sauger-Walleye Egg Sampling

Sampling for Stizostedion sp. eggs was done at 16 locations--two on tributaries and 14 on the Missouri River. No sampling was done in the Poplar River where spawning by walleye is well recognized (Stewart 1979). No attempt was made to distinguish walleye from sauger eggs because there is considerable overlap in the egg diameter range for the two species. The 16 locations were sampled for eggs because of gravel-rock substrate and, in most cases, the presence of spawners.

Stizostedion eggs were found at seven of the 16 locations sampled (Table 14). Eggs may have been present at some of the locations where none were found. The large angular substrate at some locations prevented substrate agitation and made egg collection less likely.

Eggs were not found upstream of the Highway 13 Bridge in the Missouri River. Eggs were sampled in the Milk River, but not in Big Muddy Creek (Table 14). Five of the six locations where eggs were found are located downstream of the town of Brockton.

Table 14. Stizostedion sp. egg sampling locations, Missouri River and tributary streams, May 1982.

River Miles[1]	Stizostedion Eggs Found	River Miles	Stizostedion Eggs NOT Found
174.9	Milk River--3 mi. above mouth	174.9	Milk River near mouth
114.9	Highway 13 Bridge	173.9	1 mi. below Milk River
59.1	4 mi. below Brockton	109.9	5 mi. below Highway 13 Bridge
55.8	12 mi. above Big Muddy Ck.	67.1	4 mi. above Brockton
27.1	8 mi. below Hwy. 16 Bridge	51.8	8 mi. above Big Muddy Ck.
24.1	11 mi. below Hwy. 16 Bridge	43.8	Big Muddy Ck--1 mi. above mouth
2.4	Nohly Bridge	43.7	Just downstream of Big Muddy Ck.
		31.1	4 mi. below Hwy. 16 Bridge
		9.4	7 mi. above Nohly Bridge

[1]River miles upstream from Montana-North Dakota border.

Larval Fish Sampling -- Game Species

Larval fish samples were collected in 1982 from May 26 to June 30. Sampling was begun as soon as it was thought fish eggs could be hatching. Many of the late May samples contained no larval fish. Sampling could have profitably been continued into early July, rather than ending in late June as larval fish were abundant in late June samples.

A total of at least 11 larval paddlefish were collected in towed nets (Table 15). Probably a twelfth was sampled, but this larval fish was mutilated to the point that it could not be positively identified. Larval paddlefish were found at the locations expected on the basis of a ripe female, a paddlefish egg, and fish concentrations. These locations were the lower Milk River and the Missouri River just downstream of the Milk River. Paddlefish larvae were also found in the Milk River at a sampling station approximately 100 miles upstream from the mouth (Bob Needham, personal communication). The large June flow apparently allowed paddlefish to travel long distances up the Milk River for spawning.

Paddlefish larvae were also collected in the Missouri River near Brockton and near the Highway 16 Bridge (Table 15). These fish could have drifted downstream from the Milk River or the Missouri River just below the Milk River, where spawning was found in June 1981, or they could have resulted from spawning in the Brockton and Highway 16 Bridge areas. The first explanation seems somewhat unlikely because no paddlefish were sampled at several stations closer to the Milk River than stations in the Brockton area.

Table 15. Numbers of larval fish sampled in 1982, by sampling locations, from 5-26 to 6-30. Stations are listed in upstream to downstream order.

Station	Number of Samples	Paddlefish	*Stizostedion* sp.	Goldeye	Carp	Cyprinidae	River Carpsucker	Blue Sucker	*Ictiobus* sp.	Shorthead Redhorse	White Sucker	Yellow Perch	Freshwater Drum	Mean Total Number of Larvae Per Sample
Missouri River Stations														
Above Milk River	5	0	0	0	0	0	0	0	0	0	1	0	0	0.2
1.5 miles below Milk River	7	4	2	6	7	1	411	0	197	1	0	1	0	90.0
Frazer pump	6	0	0	0	0	0	0	0	127	0	0	0	0	21.2
Near Wolf Creek	5	0	0	2	0	0	22	0	65	0	2	0	0	18.2
Highway #13 Bridge	8	0	0	0	0	0	65	0	12	2	9	0	0	11.0
5 miles below #13 Bridge	5	0	0	0	2	0	0	0	52	0	1	0	0	11.0
2 miles below Chelsea	3	0	1	0	6	0	15	0	1	0	5	0	0	9.3
Above Poplar River	4	1[1]	2	1	3	0	54	0	0	0	0	0	0	15.2
Below Poplar River	3	0	0	0	2	0	6	0	0	0	2	0	0	3.3
Sprole Bridge	4	0	1	0	0	0	14	0	1	0	0	0	0	4.0
4 miles above Brockton	5	1	8	0	9	0	14	0	89	0	2	0	0	24.6
Brockton	6	1	1	1	2	0	100	0	0	0	2	0	0	17.8
4 miles below Brockton	4	1	4	0	6	0	96	0	1	0	0	0	0	27.0
12 mi. above Big Muddy Creek	3	0	8	0	11	0	53	0	14	0	0	0	0	28.7
8 mi. above Big Muddy Creek	3	0	10	0	0	0	35	0	79	0	0	0	0	41.3
Above Big Muddy Creek	3	0	6	0	1	0	16	0	31	0	0	0	0	18.0
Below Big Muddy Creek	3	0	4	0	4	3	19	0	0	0	0	0	0	10.7
4 mi. below Big Muddy Creek	3	0	9	0	5	0	19	0	27	0	0	0	0	20.0
#16 Bridge	4	0	3	0	0	0	45	0	14	0	1	0	0	15.8

Table 15. Continued.

Station	Number of Samples	Paddlefish	*Stizostedion* sp.	Goldeye	Carp	Cyprinidae	River Carpsucker	Blue Sucker	*Ictiobus* sp.	Shorthead Redhorse	White Sucker	Yellow Perch	Freshwater Drum	Mean Total Number of Larvae Per Sample
Missouri River Stations (continued)														
0.5 miles below #16 Bridge	3	2	9	2	3	0	80	0	0	0	0	0	0	32.0
4 miles below #16 Bridge	4	0	4	1	1	0	74	0	3	0	1	0	2	21.5
8 miles below #16 Bridge	3	0	5	0	3	0	20	0	39	0	0	0	0	22.3
11 miles below #16 Bridge	4	0	4	0	5	0	55	0	5	0	0	0	0	17.2
3 miles above Nohly Bridge	5	0	26	1	13	0	41	0	51	0	0	0	0	26.4
Nohly Bridge	10	0	23	0	20	0	93	0	17	0	1	0	0	15.4
Totals	114	9	130	8	103	4	1,347	0	825	3	29	1	2	
Tributary Stations														
Milk River 3 mi. above mouth	9	2	2	9	22	0	31	2	2,176	4	5	0	0	250.3
Milk River mouth	7	0	0	5	1	0	24	0	685	0	14	0	1	104.3
Poplar River mouth	3	0	0	0	0	0	0	0	0	0	16	0	0	5.3
Big Muddy Creek mouth	3	0	0	30	14	0	321	2	112	0	2	0	0	160.3
Totals	22	2	2	44	37	0	376	4	2,973	4	37	0	1	

[1]Mutilated larvae which is either a paddlefish or a sturgeon.

No sampling was done in 1982 for paddlefish spawners in the downstream areas because previous work had indicated that paddlefish only used the downstream portion of the study area as a passageway to upstream points (Stewart 1981, 1982). Future work should include June sampling for spawners and eggs to determine if spawning does occur in the downstream locations.

Larval paddlefish were not sampled until after June 21 (Table 16), indicating spawning probably began approximately June 7.

A total of 130 Stizostedion larvae were collected at Missouri River stations in 1982 (Table 15). Only two were sampled from tributary stations, with both of these from the Milk River. These will be referred to as sauger larvae because sauger spawners were much more abundant than walleye. A comparison with numbers sampled in previous years is tenuous because sampling stations were changed in 1982 to sample immediately downstream of known and suspected sauger spawning locations. Even with this consideration, numbers of larval sauger produced seem to be at least as large and probably larger than previous years.

The areas of the Missouri River where sauger spawners and eggs were found is very nearly equal to the area where larval sauger were sampled. Spawners, eggs, and larvae were found only downstream of the Highway 13 Bridge. Production of larval fish increased in a downstream direction. Dividing the Missouri River into four segments from the Highway 13 Bridge to the Nohly Bridge, the average number of larval sauger per sample was 0.15, 0.55, 1.91, and 2.45, for the four segments in a downstream direction.

Further evidence for the importance of hard bottom areas as sauger spawning sites can be seen by comparing stations in 1982 downstream of the Poplar River that were immediately downstream of rock and gravel bottom with those that were downstream of soft bottom areas. The stations downstream of hard bottom areas had an average of 2.28 larval sauger per sample while those downstream of soft bottom areas had only 0.54 larval sauger per sample, giving a difference factor of 4.2. Sauger larval sampling in the future would be most efficient by sampling only downstream of rock and gravel areas.

Sauger larval abundance in 1982 had a bimodal peak (Table 16), with the largest peak in late June and a lower peak in late May.

Larval Fish Sampling -- Nongame Species

River carpsucker and Ictiobus sp. made up the bulk of larval fish present in both Missouri River and tributary larval samples (Table 15). These two species were especially abundant in Milk River and Big Muddy Creek samples. Only larval white sucker appeared in tributary samples before June 21 (Table 16). Most species at Missouri River stations reached peak abundance in late June. Sampling carried on in early July, had it been done, would probably have showed a decrease in abundance for most species.

Table 16. Larval fish catch rates (average number of fish per ten-minute sample[1]) by sampling periods in Missouri River and tributary stream samples, 1982.

	5/26--5/31	6/1--6/10	6/11--6/20	6/21--6/30
	Missouri River Stations			
Number of Samples	16	19	25	56
Paddlefish				0.2
Stizostedion sp.	0.6		0.2	2.0
Goldeye				0.2
Carp			2.9	0.9
River carpsucker	0.2		0.2	24.4
Ictiobus sp.			0.9	14.3
Shorthead redhorse		0.1		<0.1
White sucker	0.1	0.3	0.1	0.3
Freshwater drum				<0.1
Totals	0.9	0.4	4.3	42.3
	Tributary Stream Stations			
Number of Samples	2	2	3	13
Paddlefish				0.2
Stizostedion sp.				0.1
Goldeye				3.5
Carp				2.8
River carpsucker				31.2
Blue sucker				0.2
Ictiobus sp.				228.5
Shorthead redhorse				0.3
White sucker	9.5	1.5	4.3	0.2
Freshwater drum				0.1
Totals	9.5	1.5	4.3	267.1

[1]Ten-minute sample equals 262 cubic meters of water passing through sampling nets.

Sauger-Walleye YOY Sampling

The Missouri River in 1982 reared significant numbers of sauger, but very few walleye were present (Table 17). Sauger were most abundant in the Nohly Bridge area, with an average of 2.9 sauger YOY per seine haul. No sauger YOY were sampled in the Highway 13 Bridge area; sauger YOY had been sampled in this area in previous years.

Walleye YOY appeared to be more abundant in past years, but sauger have outnumbered walleye YOY in each sampling year (Stewart 1981, 1982). The study portion of the Missouri River may be less important than Garrison Reservoir as a rearing area for walleye.

Although the adults are abundant in the Missouri River, northern pike YOY have never been sampled by seining. Only a few YOY have been sampled by electrofishing in late summer and fall. The principle rearing area for northern pike in the Missouri River has not yet been identified.

Table 17. Results of backwater and channel margin seining for sauger and walleye YOY in the Missouri River, September 1982.

Location	No. Hauls	Sauger Captured	Sauger Mean Length (in.)	Sauger Length (in.)	Mean No. Sauger/ Seine Haul	Walleye Captured
Highway #13 Bridge	7	0	---	---	0.0	1
Highway #16 Bridge	8	8	3.9	3.2-4.7	1.0	0
Nohly Bridge	8	23	3.0	2.7-3.2	2.9	0

Fish Population Estimates

Population estimates were made in three river sections in summer and fall 1982. Estimates were attempted for all of the game species but sufficient recaptures were obtained only for sauger. Goldeye and shorthead redhorse were used also for population estimates. The goldeye appears to be the most abundant species in the river, while the shorthead redhorse is intermediate in abundance.

Numbers and sizes of fish captured during population estimates are shown in Table 18. All sauger captured were weighed and measured, but only a sample of the goldeye and redhorse were retained for weighing and

Table 18. Average size and size ranges of fish species for which population estimates were made, Summer and Fall, 1982.

Section	Species	No. Weighed & Measured	Mean Length (ins.)	Mean Weight (lbs.)	Length Range	Weight Range
Below Milk River	Sauger	346	15.2	0.96	9.6-22.5	0.20-3.21
Highway #13 Bridge to Chelsea	Sauger	71	15.7	1.17	8.4-23.0	0.14-3.46
	Goldeye	62	10.7	0.37	8.7-14.8	0.20-0.82
	Shorthead redhorse	38	13.0	0.99	6.5-17.7	0.10-2.07
Big Muddy Creek to Highway #16 Bridge	Sauger	218	14.6	1.06	5.0-21.4	0.20-3.34
	Goldeye	72	9.6	0.30	2.5-14.2	0.01-0.93
	Shorthead redhorse	33	12.9	0.90	5.7-17.6	0.07-2.14

measuring. Only sauger numbers were estimated in the section downstream of the Milk River. No attempt was made to estimate numbers of other species at that location. Average sizes of the species shown in Table 18 are typical of the study area.

Mean estimates and confidence intervals for these estimates are shown in Table 19. Reliability of the estimates is largely dependent on the number of recaptures and on marked fish staying in the section while electrofishing runs are being made. The reliability of the sauger estimate below the Milk River is considered high because sauger were moving to that location at that time rather than through the area, recaptures are relatively high, and the estimate was made over a short period of time. The other sauger estimates are considered to have low reliability because of significant sauger movement and the low number of recaptures. One sauger marked in the section below the Highway 13 Bridge was caught by an angler near Fort Peck Dam several days after electrofishing runs were completed. Movement of marked fish out of the section before electrofishing runs were completed would cause the estimate to be biased upward.

Reliability of the goldeye estimates is considered high because goldeye were thought to be nonmigratory at the time of the estimates and the number of recaptures was high. Reliability of the redhorse estimates is considered somewhat lower only because of the fewer numbers of recaptures (Table 19).

The highest of the Missouri River sauger population estimates, 2,028 per mile, was found just below the Milk River (Table 19). Almost all of the sauger were located along the north bank in the warm, turbid plume resulting from the inflow of the Milk River. Few sauger were present downstream of the lower end of this section, where the Milk River and Missouri River water become mixed. The number of sauger present at the time of the estimate was a temporary concentration not present during spring electrofishing and was probably dispersed by late summer. The sauger in this section were even more concentrated than the number indicates, because almost all of the sauger were located along the north bank.

Sauger estimates for the lower two sections (Table 19) are only suggestive of absolute numbers present because of movement, few recaptures, and wide confidence intervals. The actual numbers are probably lower than the mean estimates because of movement of marked sauger out of the section.

Goldeye estimates were approximately 2,000 fish per mile in both the 13 Bridge and 16 Bridge sections (Table 19). This number is probably a typical density for goldeye in the Missouri River because goldeye catch rates during electrofishing runs for the estimate were similar to goldeye numbers seen in other parts of the study area.

Shorthead redhorse estimates were approximately 6 to 12 percent of the estimate for goldeye. Several other nongame fish species found in the Missouri River probably are present in densities similar to that of redhorse.

Table 19. Modified Schnabel electrofishing population estimates for Missouri River fishes, 1982.

Run Date	River Section Location	Section Length (mis.)	Number Marked	Number of Re-captures	Number Estimate	95% Confidence Interval	Estimated Number per River Mile	Reliability of Estimate
				Sauger				
7-13 to 7-19	Below Milk River[1]	1.0	346	25	2,028	1,314-2,985	2,028	High
7-20 to 8-12	#13 Bridge to Chelsea	10.3	71	3	560	112-1,643	54	Low
10-12 to 11-1	Big Muddy Ck. to #16 Bridge	9.7	218	5	3,530	1,130-8,260	364	Low
				Goldeye				
8-16 to 9-8	Big Muddy Ck. to #16 Bridge	9.7	1,925	97	16,958	13,566-20,681	1,748	High
7-20 to 8-12	#13 Bridge to Chelsea	10.3	1,386	36	22,055	15,377-30,509	2,141	High
				Shorthead Redhorse				
7-20 to 8-12	#13 Bridge to Chelsea	10.3	240	9	2,417	1,074-4,592	236	Intermediate
8-16 to 9-8	Big Muddy Ck. to #16 Bridge	9.7	152	8	1,124	478-2,220	116	Intermediate

[1]North side of river only.

No estimate was made for burbot because no recaptures were made for this species during electrofishing runs for population estimates. However, it can reasonably be inferred that numbers of burbot present are large because 67 were marked during the summer estimate period between Big Muddy Creek and the Highway 16 Bridge, and 63 during the fall estimate period. These numbers are apparently very small compared to population size because no recaptures were obtained during electrofishing runs.

Fish Movement and Migration

Sauger tag returns in 1982 and early 1983 continued to show sauger highly migratory, with Missouri River sauger proving to be closely tied to Garrison Reservoir. Tag return data for sauger and other species is summarized in Table 20. Predominant movement patterns for sauger in 1982 were opposite from 1981. In 1981 most movement of sauger was upstream from Garrison Reservoir, into the Missouri River, with many fish reaching the dredge cuts-tailwater area below Fort Peck Dam. In 1982 the predominant movement pattern was from the Missouri River into Garrison Reservoir. In 1981 upstream movement exceeded downstream movement by a factor of 4.7. In 1982 downstream movement exceeded upstream by a factor of 2.2. In 1982 only 13 percent of sauger at large more than one month failed to move at least 10 miles.

Anglers harvested sauger heavily from the July concentration below the Milk River. This concentration was discussed under the "fish population estimates" section. Of 346 sauger tagged in this section in July 1982, 42 (12 percent) were harvested by anglers within a month after tagging. Actual harvest rates from this section may have been significantly higher, because it is thought that many tags were not returned.

Movement patterns for walleye appear to be very similar to sauger for 1982 and for previous years. Tag return data for walleye is summarized in Table 20. Only 16 percent of walleye tag returns in 1982 failed to show significant movement. Eight of 19 tag returns (42 percent) were from Garrison Reservoir. An additional 5 (26 percent) were caught by anglers in Fort Peck dredge cuts-tailwater area. Upstream and downstream movements were about equal in 1982, as indicated by tag returns (Table 20).

Tag return data for 1982 reinforced the previous conclusion (Stewart 1982) that northern pike in the study area are relatively sedentary. Tag returns from 18 northern pike indicated that only 2 (11 percent) moved significantly from the tagging location (Table 20).

Tagged burbot were caught by anglers and field sampling for the first time in 1982. A total of 5 fish were recaptured, but only 3 had been at large more than one month. None of these fish moved significantly from the tagging location.

Four rainbow trout were recaptured in the dredge cuts-tailwater areas. All of these had been previously tagged at the same location.

Table 20. Fish movement and nonmovement in the Missouri River and tributary streams for tags recovered from January, 1982 through February, 1983.

Category	Number of Tag Returns[1]					
	Sauger	Walleye	Northern Pike	Burbot	Rainbow Trout	Shovelnose Sturgeon
Total number of tag returns	126	19	18	5	4	2
Tag returns from dredge cuts and tailwater	8	5	0	0	4	0
Tag returns from Missouri River excluding dredge cuts and tailwater	79	5	17	5	0	2
Tag returns from lower[2] Milk River	4	0	1	0	0	0
Moved 10 mis. or more or moved from Milk R. to dredge cuts or tailwater	61	16	2	0	0	2
Moved from Milk R. to dredge cuts or tailwater	0	0	0	0	0	0
Moved from Milk R. to Missouri R. except dredge cuts/tailwater	1	0	0	0	0	0
Moved Missouri R. to Garrison Reservoir	32	8	0	0	0	0
Moved between Missouri R. and Yellowstone R.	3	1	0	0	0	1
Moved Missouri R. below Milk R. to dredge cuts/tailwater	7	5	0	0	0	0
Not moving[3] and at large more than one month	17	2	16	3	4	0
Moved upstream	19	8	1	0	0	1
Moved downstream	42	9	1	0	0	1
Tagged and recaptured in Milk R.	2	0	0	0	0	0
Tagged and caught by anglers in Missouri R. between Milk R. and 1 mi. below Milk R. and at large 1 month or less	42	0	0	0	0	0

[1]Based on angler tag returns and field sampling recapture of tagged fish.
[2]Lower = mouth to distance two miles upstream.
[3]Not moving = recaptured within 10 miles of tagging location.

Two additional shovelnose sturgeon were recaptured in 1982. Only one tagged sturgeon had been recaptured in previous years. All of the three had moved significant distances. Two of the three sturgeon had been tagged in the Yellowstone River and later moved to the Missouri River.

Game Fish Food Habits

Sauger, burbot, shovelnose sturgeon, northern pike, and walleye stomach contents were examined in 1982. Data for the latter two species is not shown because of very small sample sizes. Sauger gut contents were examined in spring, summer, and fall; shovelnose sturgeon in spring and summer; and burbot only in spring.

Results of examining 1,335 age 1+ and older sauger for food items are shown in Table 21. Guts of 96 percent of the sauger examined contained no food. This observation leads to the conclusion that the Missouri River is probably not an important feeding area for adult sauger and that this species must obtain most of its food in Garrison Reservoir. Movement of Missouri River sauger to and from Garrison Reservoir has been discussed in an earlier section of this report.

Insects were found only in sauger less than approximately ten inches total length. Sauger of all sizes age 1+ and older ate fish. The majority of food items consisted of fish that were decomposed beyond the point of being identifiable. Only 18 sauger contained identifiable fish food items. These fish food species were goldeye, flathead chub, fathead minnows, white suckers, black bullhead, sauger, and freshwater drum (Table 21).

Contents of 28 sauger YOY guts were examined in September 1982 (Table 22). In contrast to older sauger no YOY guts were empty. Ninety-three percent contained copepods, a small crustacean. Lesser percentages contained ephemeroptera, hydropsychidae, chironomidae, and larval fish (Table 22). The Missouri River appears to be providing the food needs of sauger YOY in contrast to older sauger.

A total of 99 burbot guts were examined for food items (Tables 23 and 24). This total was divided into fish smaller than 20 inches total length (Table 23) and fish larger than 20 inches total length (Table 24) because of obvious differences in diet between large and small burbot. Each of the two size classifications was further subdivided into fish sampled upstream and downstream of the Poplar River.

For burbot less than 20 inches total length, only 15 percent had empty stomachs. Invertebrates were the predominant food items at both upstream and downstream locations, with Ephemeroptera nymphs and Hydropsychidae larvae being common food items both upstream and downstream. Simuliidae larvae were important food items only upstream of the Poplar River. Twenty-nine percent contained fish, but almost all of these were downstream of the Poplar River (Table 23). The fathead minnow was the most common fish food item. There were often a large number of these in a single stomach. One 18.5 inch burbot contained 102 fathead minnows that were 1 to 2 inches long, plus a few other food items.

Table 21. Number and percentage of the total sample of age 1+ and older sauger containing various food items for the Missouri River, 1982.

	Spring (N = 576)	Summer (N = 546)	Fall (N = 218)
Orconectes	0	1 = 0.2%	0
Ephemeroptera nymphs	0	4 = 0.7%	0
Trichoptera larvae	1 = 0.2%	0	0
Hemiptera	0	1 = 0.2%	0
Diptera	0	0	1 = 0.5%
Unidentifiable insects	0	0	1 = 0.5%
Goldeye	0	2 = 0.4%	2 = 0.9%
Flathead chub	0	5 = 0.9%	0
Fathead minnow	0	1 = 0.2%	3 = 1.4%
White sucker	0	1 = 0.2%	0
Black bullhead	1 = 0.2%	0	0
Sauger	0	0	1 = 0.5%
Freshwater drum	0	2 = 0.4%	0
Unidentifiable fish remains	3 = 0.5%	20 = 3.7%	8 = 3.7%
Stomach empty	571 = 99.1%	512 = 93.8%	198 = 90.8%

Table 22. Number and percentage of the total sample of sauger YOY (N=28) containing various food items for the Missouri River, September 1982.

Copepods	Ephemeroptera	Hydropsychidae	Chironomidae	Larval Fish	Stomach Empty
26 = 93%	5 = 18%	7 = 25%	2 = 7%	1 = 4%	0 = 0%

Table 23. Number and percentage of the total sample of burbot <20 inches total length containing various food items for the Missouri River, April and May 1982.

Item	Above Poplar River (N = 33)	Below Poplar River (N = 29)
Annelida	0 = 0%	6 = 21%
Gammarus	3 = 9%	0 = 0%
Orconectes	1 = 3%	6 = 21%
Ephemeroptera nymphs	20 = 61%	11 = 38%
Hydropsychidae larvae	10 = 30%	12 = 41%
Chironomidae larvae	9 = 27%	4 = 14%
Simuliidae larvae	16 = 48%	0 = 0%
Tipulidae larvae	1 = 3%	2 = 7%
Odonata nymphs	0 = 0%	1 = 3%
Unidentifiable insects	1 = 1%	0 = 0%
Fathead minnow	0 = 0%	9 = 31%
Emerald shiner	0 = 0%	1 = 3%
White crappie	0 = 0%	1 = 3%
Goldeye	0 = 0%	1 = 3%
Unidentifiable fish	1 = 3%	4 = 14%
Frog	0 = 0%	1 = 3%
Stomach empty	8 = 24%	1 = 3%

Table 24. Number and percentage of the total sample of burbot >20 inches total length containing various food items for the Missouri River, April and May 1982.

Item	Above Poplar River (N = 15)	Below Poplar River (N = 22)
Hydropsychidae larvae	0 = 0%	1 = 5%
Orconectes	0 = 0%	6 = 27%
Goldeye	13 = 87%	10 = 45%
Burbot	0 = 0%	1 = 5%
Shorthead redhorse	1 = 7%	1 = 5%
Sauger	0 = 0%	1 = 5%
Unidentifiable fish	1 = 7%	3 = 14%
Stomach empty	0 = 0%	4 = 18%

For burbot larger than 20 inches, only 11 percent of the stomachs were empty and goldeye were the predominant food item (Table 24). Sixty-two percent of burbot longer than 20 inches contained goldeye. Only larger goldeye were eaten; most of the goldeye in burbot guts were 10-14 inches long. Only one burbot had eaten an insect larvae, but the crayfish, Orconectes, was common in burbot stomachs downstream of the Poplar River. Other fish food items included burbot, shorthead redhorse, and sauger.

Data for shovelnose sturgeon food habits are based on examination of stomachs from only 26 fish (Table 25), and are not sufficient to draw conclusions about the relative importance of the various kinds of food eaten during various seasons and river locations. Only insects were found in sturgeon stomachs. Chironomidae were found in all but one of the 26 stomachs. Ephemeroptera and Hydropsychidae were also common.

Table 25. Number and percentage of the total sample of shovelnose sturgeon containing various food items for the Missouri River, 1982.

Item	Above Poplar River		Below Poplar River	
	April-May (N = 9)	July (N = 8)	April-May (N = 7)	July (N = 2)
Ephemeroptera	0 = 0%	8 = 100%	2 = 29%	1 = 50%
Hydropsychidae	7 = 78%	1 = 11%	2 = 29%	1 = 50%
Chironomidae	9 = 100%	8 = 100%	6 = 86%	2 = 100%
Corixidae	0 = 0%	0 = 0%	0 = 0%	1 = 50%
Muscidae	1 = 11%	0 = 0%	0 = 0%	0 = 0%
Simuliidae	1 = 11%	0 = 0%	0 = 0%	0 = 0%
Stomach empty	0 = 0%	0 = 0%	1 = 14%	0 = 0%

Other Activities

Missouri River bottom fauna were collected in spring, summer, and fall 1982. These organisms are not identified yet. Data will be shown in a future report. River channel profiles were measured at three locations on the Missouri River to determine the suitability of the recording fathometer for channel profile measurements. Resulting channel profiles were highly readable. This method will probably be used in determining minimum in-stream flows for fish populations.

A proposal to estimate angler pressure, success rate, and harvest in the dredge cuts-tailwaters area was developed with the help of Bob McFarland. This proposal will be implemented when money is available.

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Date: July, 1983