MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION
JOB PROGRESS REPORT

STATE: Montana PROJECT TITLE: Statewide Fisheries Investigations

PROJECT NO.: F-46-R-7 STUDY TITLE: Survey and Inventory of Warmwater Streams

STUDY NO.: III JOB TITLE: Yellowstone River Paddlefish Spawning Study

JOB NO.: E

Period Covered: July 1, 1993 through June 30, 1994

ABSTRACT

A study to determine the locations of paddlefish spawning sites and evaluate spawning success in the lower Yellowstone and lower Missouri rivers was continued for the fifth year. Larval fish sampling with plankton nets collected a total of 47 paddlefish larvae. Eighty-five percent of the paddlefish larvae captured in the Yellowstone River were sampled during the June 4 and June 16 periods.

OBJECTIVES AND DEGREE OF ATTAINMENT

1. Locate paddlefish spawning areas. Efforts towards this objective were made and results are reported.

2. Evaluate paddlefish spawning success. Efforts towards this objective were accomplished and results are reported.

3. Determine effect of commercial roe harvest, if any, on the paddlefish population. This is discussed under the heading "Results and Discussion".

4. Report amount of roe harvested commercially. This is reported under the heading "Results and Discussion".

PROCEDURES

Larval fish sampling was used to evaluate paddlefish spawning success and locate spawning sites. Larval samples were obtained using boat mounted, plankton net samples. Conical, 20-inch diameter, 6 feet long Nitex nets (750 micron mesh) were used in tandem so that duplicate samples could be taken simultaneously. The nets had a 3-rope harness that was fastened to and suspended off a weighted line attached to each end of a cross-boom mounted on the bow of the boat.

Samples were collected near the channel bottom while drifting slightly downstream. This allowed the nets to filter the water without addition of excess weights. Most of the sampling occurred in strong current areas of the river, at a depth range of 6-12 feet, and therefore power was provided by an outboard motor to decrease the downstream drift rate. The nets were positioned in the river usually for a duration of 6-15 minutes, depending on the amount of debris suspended in the river. The volume of water filtered was determined using General Oceanic flow meters (Model 2030) mounted on the net aperture and positioned at one-third of the net diameter.

Larval samples were preserved with formalin in the field and later sorted in the laboratory. Retained larvae were identified to family using taxonomic keys by Auer (1982) and Wallus (1990). Mr. Darrel Snyder, director of the Colorado State University Larval Fish Laboratory, examined a sample of tentatively identified Polydon and Scaphirhynchus larvae to insure that these two taxonomically similar fish were correctly identified.

INTRODUCTION

Every year during the late spring paddlefish from Lake Sakakawea Reservoir migrate up the Yellowstone River to spawn. The Yellowstone contains one of the five known natural paddlefish spawning areas within their geographical range (U.S. Fish and Wildlife Service, 1990). Although paddlefish larvae have been previously collected in the river (Penkal 1981), exact spawning sites and habitat preferences have not been determined.

In 1989 the Montana Legislature passed House Bill 289 which allows for the commercial sale of paddlefish eggs from paddlefish harvested only in the Yellowstone River at the Intake fishing access area. The bill emphasized protection of the paddlefish

population from overharvest. One of the methods of protection was to collect more information on spawning success and locate spawning sites so that effects of potential increased harvest of female paddlefish could be better evaluated.

DESCRIPTION OF STUDY AREA

The study area consists of a 185 mile reach of the lower Yellowstone River in southeastern Montana, from Miles City to the confluence with the Missouri River at Fort Buford, ND. Also included is the lower 10-mile portion of the Missouri River. The Yellowstone is one of the few remaining free-flowing rivers. The river is fairly large with a mean annual flow of 12,430 cfs (USGS 1994). The Tongue and Powder Rivers are the only two major tributaries entering the Yellowstone in the reach. The headwaters of Lake Sakakawea Reservoir begin about 35 miles downriver of the confluence. Intake Diversion Dam is the only major diversion in the study area. This diversion is constructed of scattered boulders and spans the width of the river. The drop is approximately 4 feet in 100 feet and is characterized by very turbulent water (Graham and Penkal, 1978). The diversion acts as a partial barrier for upstream travel to most fish species.

The Missouri River is similar in size to the Yellowstone but unlike the Yellowstone, the Missouri's flow is completely regulated by Fort Peck Dam located 183 miles upstream. The mean annual flow is 10,570 cfs (USGS 1992). The Milk, Poplar and Redwater rivers are the three major tributaries in this reach.

Ten sampling stations were established at 5 sites on the lower Yellowstone in the study area (Figure 1 and Table 1). The distances between successive sampling sites were 44, 11, 7 and 7 miles. Both the right (-R) and left (-L) side of the river channel were sampled at each of the 5 sites to evaluate whether drifting larvae orientated to a particular side.

One site on the lower Missouri River, 8 miles upriver from the confluence with the Yellowstone, was also sampled routinely. Sampling stations were established on both right and left sides of the river channel.

Table 1. Locations of sampling stations in the Yellowstone and Missouri rivers, 1992.

Station Number	Locality	River Mile	Legal Description
1-L	Intake (Yel. R)	71	T18N R56E Sec 36
1-R	Intake (Yel. R)	71	T18N R56E Sec 36
2-L	Benny Peer (Yel R)	27	T22N R59E Sec 2
2-R	Benny Peer (Yel R)	27	T22N R59E Sec 2
3-L	Cheney (Yel. R)	16	T24N R60E Sec 31
3-R	Cheney (Yel. R)	16	T24N R60E Sec 31
4-L	Fairview (Yel. R)	9	T151N R104W Sec 26
4-R	Fairview (Yel. R)	9	T151N R104W Sec 26
5-L	Confluence (Yel. R)	2	T152N R104W Sec 26
5-R	Confluence (Yel. R)	2	T152N R104W Sec 26
6-L	Nohly Bdg. (Mo. R)	6	T26N R59E Sec 16
6-R	Nohly Bdg. (Mo. R)	6	T26N R59E Sec 16

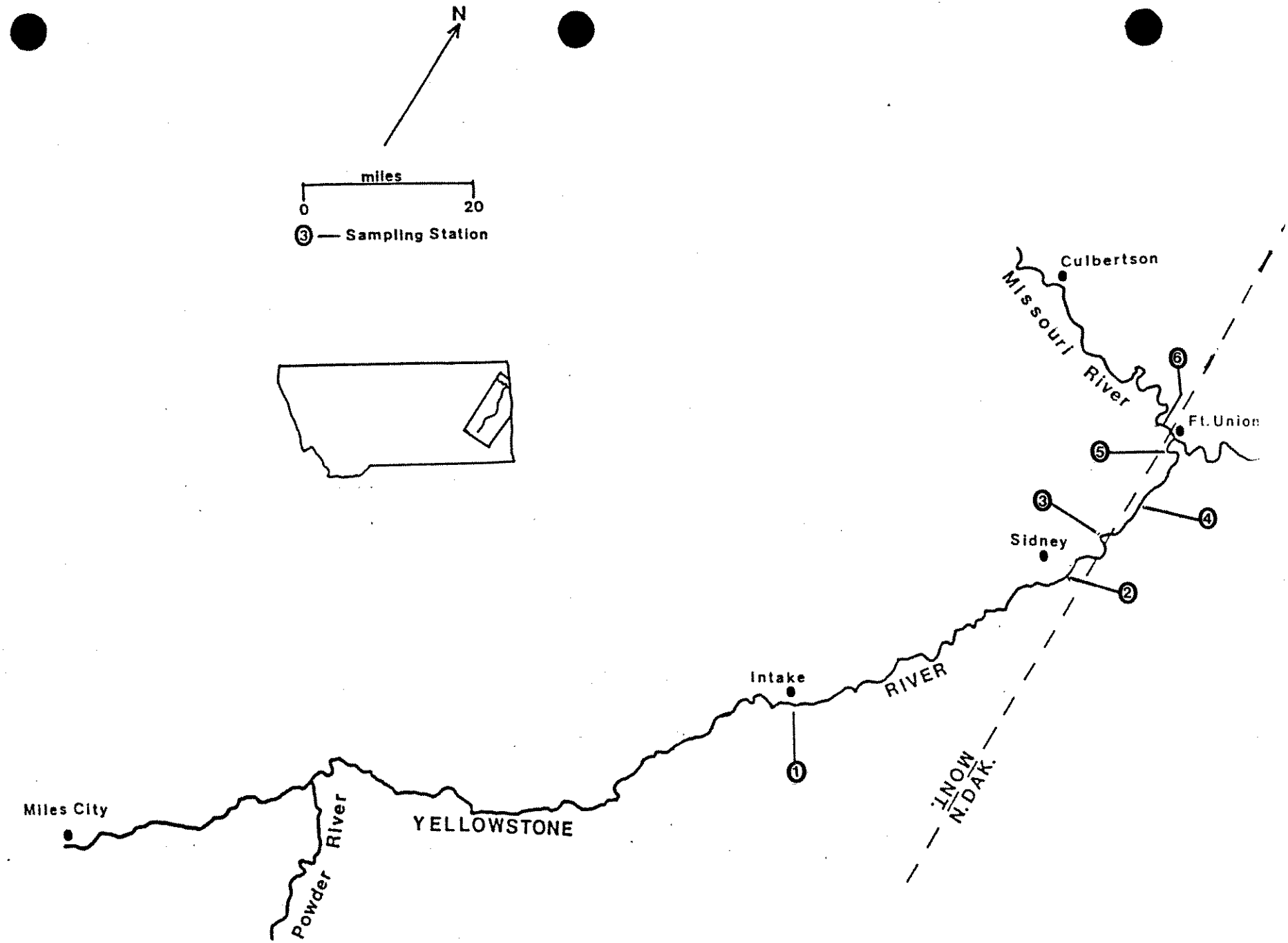

Figure 1. Map of the lower Yellowstone River.

RESULTS AND DISCUSSION

The Yellowstone River experienced above normal flows during the 1993 paddlefish spawning season. The average monthly flows for May, June and July 1993 ranged from 94 to 150% of average (USGS 1994). Peak flows greater than 40,000 cfs occurred on May 25 and 26, June 9 and 12, and July 5-8, 29 and 30. The maximum flow of 51,900 occurred on July 29. River flows in the Missouri were below normal during the paddlefish spawning because of flow regulation at Fort Peck Dam. The average monthly flows for May June and July ranged from 80 to 86% of average (USGS 1994). The maximum flow of 16,200 cfs occurred on July 24 and was largely the result of heavy run-off from the Milk River. The Milk River flows during the paddlefish spawning season were far below normal until early July when heavy rains in the drainage caused the river to rise substantially. The average monthly flows for May, June and July ranged from 18% in May to 669% of average in July. The peak flow of 6,370 cfs occurred on July 30.

Paddlefish Spawning Success and Spawning Locations

Larval fish were sampled in the Yellowstone and Missouri rivers from late May through the third week of August, 1993, to determine timing and location of paddlefish hatching and emergence.

A volume of 716,487 ft^3 of water was filtered for both rivers combined. Physical parameters and sampling effort for each station are presented in Table 2. A total of 229 larvae were collected in 331 samples representing 7 taxonomic families (Table 3). Goldeye was the most common larval fish species sampled, comprising 35% of all the larvae collected. Average larval densities ranged from a low of 1.9 to a high of 6.2 larvae/10,000 ft^3 at stations 6R and 4L, respectively.

A total of 47 paddlefish larvae were sampled during 1993 (Table 4). Paddlefish larvae were sampled at all stations except 1-L, 1-R and 2-L, and they comprised 19% of the total larvae collected.

From Table 4 it is evident that paddlefish larvae were found in the Yellowstone River samples from June 4, through August 17, however, 85% of the total were sampled during the two sampling periods, June 4 and June 16. The greatest densities of paddlefish larvae were collected during the third sampling period, June 16. Peak larval paddlefish catches occurred within 7 days after the Yellowstone reached its second river discharge peak (June 9). The first river discharge peak occurred on May 25, 10 days before the June 4

sampling period, where larval paddlefish densities were the second highest. The flow in the Yellowstone exceeded 40,000 cfs again in early July and for the last time in late July, but larval paddlefish catches did not likewise increase, indicating that the greater portion of the larval drift had been completed by June 27.

Larval paddlefish did not appear in Missouri River samples until July 20 sampling. These larvae may have resulted from sharp increases in Milk River flows on July 6. These high flows continued through July and most of August.

Paddlefish larvae were collected further up the Yellowstone than has been the case for previous years (Gardner 1990-92). Paddlefish larvae were regularly collected at station 3, located 16 miles upriver from the confluence, and on one occasion a paddlefish larvae was collected at station 2, 27 miles above the confluence (Table 4).

Table 2. Physical measurements of larval fish samples taken in the Yellowstone and Missouri rivers, 1993.

Station Number	Number Samples	Avg. Depth at Station (ft.)	Average Net Velocity (ft/s)	Average Net Volume (ft^3)
1-L	30	9 (6 - 11)	2.3 (1.5 - 3.7)	2,168 (1151 - 7062)
1-R	30	9 (6 - 10)	2.4 (1.2 - 3.7)	2,249 (1105 - 6268)
2-L	26	11 (10 - 14)	2.1 (1.5 - 2.8)	1,920 (1151 - 2962)
2-R	26	11 (7 - 13)	2.0 (1.0 - 3.0)	2,076 (928 - 5663)
3-L	26	9 (7 - 13)	1.9 (0.7 - 2.6)	1,871 (650 - 3347)
3-R	23	10 (7 - 11)	2.0 (1.2 - 3.7)	2,087 (1052 - 4972)
4-L	28	9 (8 - 11)	2.2 (1.1 - 2.9)	1,970 (688 - 4223)
4-R	28	10 (9 - 11)	2.0 (1.5 - 2.7)	1,882 (964 - 4693)
5-L	26	11 (8 - 13)	1.9 (0.8 - 2.4)	1,773 (893 - 4075)
5-R	26	10 (7 - 13)	2.0 (1.3 - 2.8)	1,875 (1155 - 3217)
6-L	31	9 (8 - 12)	1.5 (0.7 - 2.3)	2,804 (1310 - 4382)
6-R	31	10 (8 - 12)	1.6 (0.6 - 2.4)	3,026 (1190 - 4573)

Table 3. Summary statistics for larval fish collections sampled in the Yellowstone River, 1993.

Station Number	Number of Samples	Total No. Larvae	Avg Larval Density (No. Filtrd 10,000 ft^3)	Total No. of Taxa
1-L	30	17	3.1 (0 - 14.2)	2
1-R	29	11	4.4 (0 - 11.9)	4
2-L	26	14	3.2 (0 - 14.4)	4
2-R	26	18	4.4 (0 - 36.2)	2
3-L	26	13	3.3 (0 - 21.2)	5
3-R	23	13	3.2 (0 - 13.0)	4
4-L	28	27	6.2 (0 - 28.6)	5
4-R	28	24	5.2 (0 - 27.5)	5
5-L	26	15	3.4 (0 - 17.5)	5
5-R	26	22	5.2 (0 - 16.7)	4
6-L	31	36	3.9 (0 - 18.7)	6
6-R	31	19	1.9 (0 - 13.3)	5
Totals	330	229	—	7

Paddlefish larvae were collected in the Missouri samples considerably later than that of the Yellowstone's. All nine larvae were collected in the late July and early August sampling periods. The presence of paddlefish larvae this late in the season is considered unusual. It was interesting to note that the sizes of larvae were different between the two sampling dates. Average total lengths were 10.3 and 15.7 mm for the July 20 and August 3 collections. The collection of one Scaphirhynchus larvae confirms the occurrence of successful sturgeon reproduction in the lower Missouri.

Table 4. Average densities (number/10,000 ft^3) and total number of paddlefish larvae sampled in the Yellowstone and Missouri rivers, 1993.

Station	Sampling Period				
	May 26	Jun 4	Jun 16	Jun 27	Jul 8
1-L	0	0	0	0	0
1-R	0	0	0	0	0
2-L	0	0	0	0	0
2-R	0	3.7	0	0	0
3-L	0	4.2	4.0	0	0
3-R	0	9.3	5.9	0	0
4-L	0	15.0	21.5	0	0
4-R	0	7.6	22.6	3.7	0
5-L	0	3.4	11.0	8.2	0
5-R	0	7.6	16.1	8.8	10.1
6-L	0	0	0	0	0
6-R	0	0	0	0	0
Total No. larvae	0	13	18	3	2

Table 4. Continued.

Station	Sampling Period Jul 20	Aug 3	Aug 17	Total Number	Number of Samples
1-L	0	0	0	0	30
1-R	0	0	0	0	29
2-L	0	0	0	0	26
2-R	0	0	0	1	26
3-L	0	0	0	2	26
3-R	0	0	0	3	23
4-L	0	0	0	9	28
4-R	0	0	0	8	28
5-L	0	0	3.7	5	26
5-R	3.7	0	0	10	26
6-L	5.9	14.4	0	7	31
6-R	2.0	3.7	0	2	31
Total No. larvae	5	5	1	47	

Paddlefish Caviar

The Glendive Chamber of Commerce and Agriculture continued their collection of paddlefish roe at Intake for a fourth year in 1993. The low percentage of females in the 1993 harvest, combined with a moderately low havest resulted in a relatively low collection.

The Chamber cleaned 1,877 fish and collected usuable roe from approximately 600 females. From these fish a total of 3,592 pounds of caviar was produced, for which the Chamber received gross income of $68,825.30. Price received by the Chamber varied from $30.00 to $0.50 per pound, depending on quality.

RECOMMENDATIONS

1. Larval fish sampling should continue as a means for evaluating paddlefish spawning success and discovering spawning sites.

2. Improvements in sampling methodology for collecting paddlefish larvae are still needed. Efforts at improving sampling efficiencies along with further study of paddlefish larvae drifting behavior should continue to be addressed.

ACKNOWLEDGEMENTS

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Waters Referred to:

Yellowstone River Section 1	21-1350-02
Yellowstone River Section 2	21-1400-02
Missouri River Section 2	16-2420-0