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

STATE: Montana PROJECT TITLE: Statewide Fisheries Investigations

PROJECT NO.: F-46-R-6 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, 1992 through June 30, 1993

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 fourth year. Larval fish sampling with plankton nets collected a total of 53 paddlefish larvae. All of the paddlefish larvae were sampled at the Fairview and Confluence stations on the Yellowstone River or the Nohly Bridge station on the Missouri. A sampling efficiency comparison was made between D-net and conical net configurations and it was determined that both types exhibited similar efficiencies.

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. 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 apeture 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 all Polydon and Scaphirhynchus larvae to ensure that these two taxonomically similar fish were correctly identified.

In an effort to improve on the sampling efficiencies a different net configuration was tested and compared to the conical nets. This net consisted of a frame shaped in a "D" configuration, the bottom width being 29.5 inches. The net length was 10 feet and consisted of 0.03 inch (800 micron) mesh. The surface area of the opening for both these two types of nets were similar; the D-net had an area of 2.37 $ft.^2$ compared to 2.18 $ft.^2$ for the conical net.

Mr. Lance Beckman with the USFWS at Cook, WA has used these nets successfully for sampling larval white sturgeon.

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 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 1992). 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.

Six sampling stations were established at 3 sites on the lower Yellowstone in the study area (Figure 1 and Table 1). The distances between successive sampling sites were 60 and 7 miles. Both the right (-R) and left (-L) side of the river channel were sampled at each of the 4 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)	69	T18N R56E Sec 36
1-R	Intake (Yel. R)	69	T18N R56E Sec 36
2-L	Fairview (Yel. R)	9	T151N R104W Sec 26
2-R	Fairview (Yel. R)	9	T151N R104W Sec 26
3-L	Confluence (Yel. R)	2	T152N R104W Sec 26
3-R	Confluence (Yel. R)	2	T152N R104W Sec 26
4-L	Nohly Bdg. (Mo. R)	8	T26N R59E Sec 16
4-R	Nohly Bdg. (Mo. R)	8	T26N R59E Sec 16

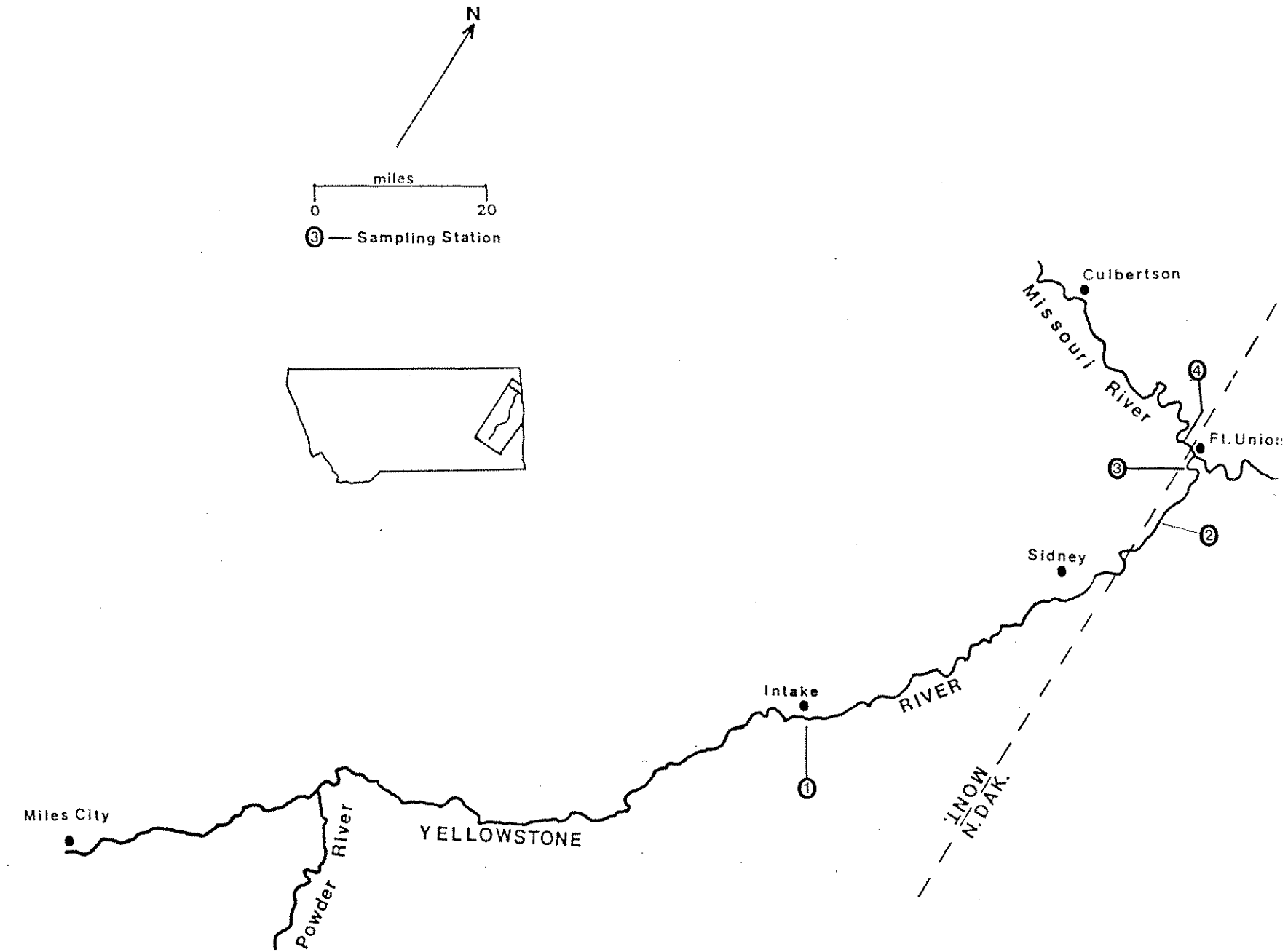

Figure 1. Map of the lower Yellowstone River.

RESULTS AND DISCUSSION

The Yellowstone River experienced below normal flows during the paddlefish spawning season. The monthly average flow for June, 1992 was 21,770 cfs, considerably less than the 68-year average June flow of 37,230 cfs (USGS 1992). The run-off pattern for this year consisted of three peak flow periods; the first one occurring May 4 through May 14 with a maximum flow of 21,200 cfs on May 12 and 13; the second one lasted for 13 days commencing May 23 with the maximum flow of 22,000cfs occurring on May 31; and the third peak occurring during the period June 16 through July 19 with a maximum flow of 39,300cfs on June 20.

River flows in the Missouri were also substantially below normal during the paddlefish spawning. The monthly average flows for June and July, 1992 were 7,842 and 7,598 cfs compared to the 19-year June and July mean flows of 9,553 and 10,270 cfs, respectively.

Paddlefish Spawning Success and Spawning Locations

Larval fish were sampled in the Yellowstone and Missouri rivers from late May through mid July, 1992, to determine timing and location of paddlefish hatching and emergence.

A volume of 370,656 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 227 larvae were collected in 193 samples representing 8 taxonomic families (Table 3). The family Catastomidae was the most common larval fish group sampled, comprising 41% of all the larvae collected. Average larval densities ranged from a low of 3.1 to a high of 13.9 larvae/10,000 ft^3 at stations 1L and 3L, respectively.

Table 2. Physical measurements of larval fish samples taken in the Yellowstone and Missouri rivers, 1992.

Station Number	Number Samples	Avg. Depth at Station (ft.)	Average Net Velocity (ft/s)	Average Net Volume (ft^3)
1-L	25	7 (5 - 9)	2.7 (1.1 - 3.6)	2,059 (904 - 3008)
1-R	32	7 (6 - 8)	2.3 (1.2 - 3.7)	1,907 (1151 - 2804)
2-L	10	7 (7 - 8)	2.2 (1.7 - 2.5)	1,681 (1013 - 1882)
2-R	11	7 (5 - 8)	2.2 (1.7 - 2.8)	1,751 (1402 - 2338)
3-L	36	9 (7 - 10)	2.0 (1.1 - 3.6)	1,571 (911 - 2627)
3-R	38	8 (6 - 9)	2.0 (0.8 - 2.9)	1,560 (621 - 2475)
4-L	18	7 (6 - 9)	2.2 (0.8 - 3.3)	2,348 (1109 - 2754)
4-R	23	7 (6 - 10)	2.2 (1.8 - 2.9)	2,782 (1430 - 4329)

Table 3. Summary statistics for larval fish collections sampled in the Yellowstone River, 1992.

Station Number	Number of Samples	Total No. Larvae	Avg Larval Density (No. Filtrd 10,000 ft^3)	Total No. of Taxa
1-L	25	15	3.7 (0 - 25.5)	5
1-R	32	26	4.5 (0 - 22.4)	5
2-L	10	19	12.7 (0 - 37.4)	3
2-R	11	12	7.1 (0 - 19.5)	3
3-L	36	75	13.9 (0 - 94.3)	5
3-R	38	45	7.9 (0 - 26.6)	6
4-L	18	14	3.1 (0 - 13.0)	5
4-R	23	21	3.1 (0 - 37.7)	3
Totals	193	227	—	8

A total of 53 paddlefish larvae were sampled during 1992, all of which were collected at stations 2L, 2R, 3L, 3L, and 4R (Table 4). Paddlefish larvae represented 23% of the total larval catch and were the second most common taxonomic group.

From Table 4 it is evident that paddlefish larvae were found in the Yellowstone River samples from the first sampling date, May 26, through July 11. The greatest densities of paddlefish larvae were collected during the second sampling period, June 10 and last sampling period, July 11. Peak larval paddlefish catches occurred within 10 days after the Yellowstone reached its second river discharge peak (May 31) and 20 days after the third, longer duration and greater peak (June 21). during 1992. Paddlefish larvae were only collected in the Missouri samples June 17 and June 29.

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 9 miles upriver from the confluence (Table 4). The larval paddlefish densities observed here were approximately the same as densities observed at the lower station 4, indicating that a significant portion of the paddlefish egg incubation sites may be further upstream.

A different shaped net was tested for sampling paddlefish larvae. Researchers studying larval white sturgeon have found that a "D" shape was more efficient at sampling sturgeon larvae than the conventional conical type because the shape of the D-net enables it to rest closer to the bottom where larval white sturgeon are known to occur while drifting to rearing areas. Table 5 compares the catch statistics for the two nets. The catch rates for paddlefish larvae were similar with the conical nets averaging 0.3 larvae/sample compared to 0.2 larvae for the D-nets. Based on these findings it is apparent that for the Yellowstone and Missouri rivers, there is no improvement in sampling efficiencies for paddlefish larvae using the D-nets. Considering the increased handling difficulties associated with this type of net it is concluded that the conical nets are the best suited for this study. The change in sampling methodology that has improved efficiencies the most has been the positioning of the net near the bottom. This is most likely the reason for the improved numbers of larval paddlefish catches for this year compared to years past.

Table 4. Average densities (number/10,000 ft^3) and total number (in parentheses) of paddlefish larvae sampled in the Yellowstone and Missouri rivers, 1992.

Station	Sampling Period					Total Number	Number Samples
	May 26	Jun 10	Jun 17	Jun 29	Jul 11		
1-L	0	0	0	0	0	0	25
1-R	0	0	0	0	0	0	31
2-L	NS[1/]	12.5 (4)	1.8 (1)	0	NS	5	10
2-R	NS	6.1 (4)	0	0	NS	4	11
3-L	2.6 (2)	12.3 (16)	0	0.8 (1)	5.7 (10)	29	37
3-R	0	5.1 (6)	0.9 (1)	0	3.2 (6)	13	38
4-L	0	0	0	0	0	0	18
4-R	0	0	0.6 (1)	0.5 (1)	0	2	23
Total No. larvae	2	30	3	2	16	53	

[1/] denotes that no sample was taken.

Table 5. Comparisons of performance parameters between the D-configuration 1 meter net and the circular ½ meter net.

Parameter	D-shaped net	Circular net
Total No. Larvae	56	173
Avg. No. Larvae	0.8	1.3
No./ 10,000 ft^3	5.1	7.9
Total No. of Paddlefish Larvae	13	41
Average No. of Paddlefish Larvae	0.2	0.3
Avg. Volume of water filtered (ft^3)	1,995	1,822

Commercial Roe Collection

The Glendive Chamber of Commerce and Agriculture continued their collection of paddlefish roe at Intake for a third year in 1992. The small paddlefish harvest in 1992 greatly decreased the weight of roe collected and gross income. The Chamber cleaned 735 fish of which 529 were females and usable roe was taken from 491 females. From these fish a total of 3,522.8 pounds of roe was produced giving the Chamber a gross income of $63,000. Cooperation by anglers in donating roe was high.

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	16-2420-02