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

State: Montana Title: Northcentral Montana Fisheries Study

Project No.: F-46-R-4 Title: Missouri River Pallid Sturgeon Inventory

Study No.: III

Job No.: D Title: Planning Inventory, Fisheries

Period Covered: July 1, 1990 through June 30, 1991

ABSTRACT

A study to evaluate the status of the pallid sturgeon in the middle Missouri River was continued. A total of 5 pallid and 382 shovelnose sturgeon were captured during 1990. Two of the pallids were successfully radio tagged and monitored intermittently for a minimum period of 132 days. The Tiber Dam tailwater trout fishery was evaluated for population improvements that have been anticipated since the Bureau of Reclamation began providing recommended instream flows in 1985. The trout standing crop was estimated at 42 fish/mile. Numbers of trout have declined since 1987, mainly resulting from decreases in rainbow trout numbers.

OBJECTIVES AND DEGREE OF ATTAINMENT

1. **To determine current status (abundance and distribution) of pallid sturgeon in Missouri River upstream of Fort Peck Dam.** Sampling for pallid sturgeon was continued and carried out throughout the study area.

2. **To enhance trout populations and trout fishing opportunity in Marias River immediately downstream from Tiber Dam.** Trout populations in the Marias were monitored and wild rainbow trout fingerlings of Madison River origin were stocked in the Marias.

3. **To secure adequate instream flows in 20 - 30 streams in the mid-Missouri drainage.** The Montana Department of Natural Resources and Conservation has released for review the Missouri River Basin Draft Environmental Impact Statement for water reservation applications above Fort Peck Dam.

4. **To maintain streambanks and beds in a stable and near-natural condition in Chouteau and Liberty counties** (state funded). Four stream alteration projects were evaluated and recommendations were submitted to the applicants.

PROCEDURES

Setlines and trammel nets were used to capture sturgeon. The setlines were 100 - 200 ft long with 7 - 15 hooks. Circular-type hooks were attached to the one-quarter inch diameter groundline by 16 inch long staging lines. The hooks ranged in size from 11/0 to 14/0. The setline was anchored in position with a 40 lb cement block at each end; a steel stake and block were used as anchors when the lines were set from the river bank. The terminal end was usually marked with a buoy. Setlines were positioned in the river either parallel, perpendicular or angled to the current and left overnight. Catch per unit effort for setline sampling was expressed as number of fish caught for an overnight set. This sampling method has been used with satisfactory results for white sturgeon in the Columbia River (Kim Apperson, Idaho Fish and Game Dept., pers. com.).

Trammel nets were 150 ft. long and 6 ft. deep. Two mesh sizes were used: 1 inch inner walls with 10 inch outer walls, and 2 inch inner walls with 12 inch outer walls. Mesh material for both inner and outer walls were light-weight for better fish tangle characteristics and to insure that the net could be retrieved off submerged objects in the event that net material had to be torn free. The trammel nets were set in snag-free areas of the river and allowed to drift with the current along the bottom. Distances of the drift varied from 50 to 400 yds. Catch per unit effort for drift netting was expressed as number of fish caught per drift.

A radio telemetry system was tested to determine if this method could be applied to pallid sturgeon research in the study area. A Smith-Root SR-40, 10 channel search receiver with a frequency range between 40.0 and 41.0 MHz was used to monitor the individual transmitters. Omnidirectional and directional loop antennas were used with this system. The radio transmitters manufactured by Smith-Root Company, model P-40-1000L -6V, had a battery life of 120 days and were 5.5 inches long with a 0.88 inch diameter and weight of 85 grams. The transmitters were fastened externally to the back of the pallid sturgeon with monel trolling wire line. Two 12 inch wire pieces were pierced through the 6th and 9th dorsal scutes and then used to fasten the transmitter and foam padded buttress plate to the fish. Similar attachment techniques have been successfully used for white sturgeon by Haynes et al. (1978).

All sturgeon were measured to the nearest 0.1 inch and weighed to the nearest 0.1 pound. A numbered plastic cinch tag was attached to the keel of the dorsal fin for identification purposes. Morphometric measurements recorded from sturgeon were: total, fork and standard lengths, head length, barbel lengths, mouth width, caudal peduncle length, distance between inner barbel and mouth; and distance between outer barbel and snout tip. These measurements were then used for a Character Index, as modified by Carlson and Pflieger (1981), to test for hybridization. This index gives a single expression of how each sturgeon used in the analysis compares with every other sturgeon in the composite of the characters studied. It can be used to objectively rank the sturgeon with the most shovelnose-like characteristics at one extreme of the ranking and the most pallid-like characteristics at the other extreme.

The electroshocking system used to capture trout and whitefish was adapted from the system described by Novotny and Priegal (1974). The electroshocking apparatus was a boom-type and mounted on a 14-foot aluminum McKenzie style driftboat powered by a 10 hp outboard motor. Power was supplied by a 3500-watt AC generator. The alternating current was delivered to a Coffelt Model VVP-10 rectifying unit which changes the alternating current to pulsed or continuous direct current. The positive electrode consisted of two circular hoops with twelve 16-inch stainless steel droppers fastened on each hoop. These electrodes were supported by fiberglass booms and were positioned about six feet in front of the boat. The hull of the boat served as the negative. The unit was typically operated at 2-7 amps, 100-215 volts and continuous direct current.

The mark/recapture technique as described by Vincent (1971 and 1974) was used to estimate the trout populations in the Marias River. The following formula as modified by Chapman (1951) was used:

$$N = \frac{(M+1)\ (C+1)}{(R-1)}$$

Where:

N = population estimate
M = number of marked fish
C = number of fish in the recapture sample
R = number of marked fish in the recapture sample

FINDINGS

Introduction

Pallid sturgeon are found in the Wild and Scenic portions of the Missouri River in Montana. They exist in low numbers throughout their geographic range (Pflieger 1975) as is probably the case in this section of the Missouri River. In 1990 the U.S.

Fish and Wildlife Service listed the pallid as "endangered" under the Endangered Species Act 1976. Reasons for listing are habitat modification and apparent lack of reproduction. Reports of pallid sturgeon sightings have also declined dramatically in the last 20 years (U.S. Fish and Wildlife Service, 1989). The pallid sturgeon has been listed as a class A "species of special concern" in Montana since 1973 (Holton, 1980).

In an effort to determine the past and present status of the pallid sturgeon in this 200 mile reach of river, the Montana Department of Fish Wildlife and Parks (MDFWP) began conducting a fisheries study directed at learning more about this species during 1989. Results from the study will be used to develop a status report. This report will aid in devising management and recovery plans designed to maintain and enhance the pallid population in the river.

Description of Study Area

The study area for the pallid sturgeon study consists of a 175 mile reach of the mainstem middle Missouri River in northcentral Montana from Fort Benton to the headwaters of Fort Peck Reservoir near Lewistown (Fig. 1). There are two major tributaries entering the Missouri in this reach; the Marias River from the north and Judith River from the south. The present flow regimen of the Missouri River in the study area is not entirely natural because of regulation and storage at several upriver dams. The study area was divided into 8 study sections and the mileage for each is given in Table 1.

Table 1. Locations of study sections on the middle Missouri River.

SECTION	RIVER MILE upper	lower	LOCATION		
Fort Benton	0	18	T24N R8E Sec26	to	T25N R10E Sec28
Loma	18	33	T25N R10E Sec28	to	T26N R11E Sec28
Coal Banks	33	51	T26N R11E Sec28	to	T26N R13E Sec31
White Rocks	51	76	T26N R13E Sec31	to	T23N R15E Sec31
Judith Landg.	76	100	T23N R15E Sec31	to	T23N R18E Sec33
Stafford F.	100	122	T23N R18E Sec33	to	T23N R21E Sec3
Cow Island	122	142	T23N R21E Sec3	to	T22N R23E Sec17
Robinson Bg.	142	175	T22N R23E Sec17	to	T21N R27E Sec10

The study area for the Tiber Dam tailwater study is a 21 mile reach of the Marias River extending from the dam near Chester to the Circle Bridge at Highway 223. Tiber Reservoir is a water storage reservoir with no hydroelectric power generation. Flows in the river downstream are completely controlled by discharges from the dam.

Present Status of the Pallid Sturgeon Population

The pallid sturgeon is a difficult fish to study because of its life habits and sparse abundance. Historical sightings of pallids in the study area appear to have been scarce. Gardner (1990) recorded a total of only 35 pallid sightings for the period 1876 - 1987. Carlson and Pflieger (1981) studied pallid sturgeon populations in Missouri and caught only 11 pallids out of 4062 sturgeon sampled in two field seasons. A second project is underway to evaluate pallid sturgeon populations in the lower Missouri River and the lower Yellowstone River in Montana. In that study, a total of 3 pallids were captured during the 1989 field season and another 5 during 1990 (Clancey, 1991). Berg (1981) conducted a 5-year fisheries planning and inventory study in the middle Missouri River above Fort Peck Reservoir and only captured one pallid and observed two others. Primary sampling methods he used were electroshocking, gill netting and frame traps. Use of electroshocking for sampling pallid sturgeon is now discouraged because this method may cause back injuries to the fish. Gill netting and setline fishing are probably the most effective means of capturing sturgeon.

A total of 5 pallid and 382 shovelnose sturgeon were captured using setlines and trammel nets during the period April 20 through November, 1990. The average total length for the 5 pallids was 57.0 inches and average weight was 36.8 pounds. The average total length and weight of shovelnose were 31.3 inches and 4.5 pounds.

Sampling with setlines was relatively effective. A total of 165 sets were made capturing only 24 sturgeon for a combined catch rate of 0.1 sturgeon per set (Table 2). However, two pallid sturgeon were caught using this method; one in the Cow Island and another in the Robinson Bridge sections. Setline sampling ended in late July because large quantities of drifting filamentous algae fouled the gear.

Trammel net sampling was fairly successful; 363 sturgeon were captured for a combined catch rate of 4.5 sturgeon per drift (Table 3). Three pallid sturgeon were caught using this method; one in the Cow Island section and two other in the Robinson Bridge section. Trammel net sampling was initiated in August and continued to be effective even when filamentous algae densities were the greatest. Sturgeon catch rates for both setlines and trammel net sampling were highest in the Loma section and lowest in the Robinson Bridge section. Ninety-nine percent of the sturgeon catches were comprised of shovelnose.

Table 4 is a record of the various morphometric measurements collected from each pallid. These 5 pallid sturgeon sampled were all caught in the lower two sections with three of the five being taken in the Robinson Bridge section. The river habitat in these two sections is characterized by a wide meandering channel with numerous sandbars and islands.

Table 2. Setline fishing results for sturgeon sampled in the middle Missouri River, April - October, 1990.

Study Section	Total No. of Sets	No. Sturgeon Caught	Avg. No. Sturgeon/Set	Avg. Sturgeon Weight [1]
Fort Benton	5	0	0	---
Loma	38	8	0.2	6.4
Coal Banks	26	6	0.2	5.3
White Rocks	0			---
Judith Landing	26	2	0.1	[2] -
Stafford Ferry	2	0		---
Cow Island	12	2	0.2	[2] -
Robinson Bridge	56	6	0.1	3.0
Total	165	24	0.1	

[1] Pallid sturgeon not included
[2] Sturgeon not measured

Table 3. Trammel netting results for sturgeon sampled in the middle Missouri River, August - November, 1990.

Study Section	Total No. of Drifts	No. Sturgeon Caught	Avg No. Sturgeon/Set	Avg. Sturgeon Weight [1]
Fort Benton	12	8	0.7	6.1
Loma	7	92	13.1	6.2
Coal Banks	9	55	6.1	5.0
White Rocks	0			---
Judith Landing	14	96	6.9	4.8
Stafford Ferry	1	13	---	2.6
Cow Island	13	56	4.3	3.3
Robinson Bridge	25	43	1.7	2.7
Total	81	363		

[1] Pallid sturgeon not included

Table 4. Morphometric measurements of pallid sturgeon (in inches) sampled in the middle Missouri River, Montana, 1990.

Measurement	Pallid Sturgeon Number #1	#2	#3	#4	#5
Capture Date	May 16	Jun 15	Oct 3	Nov 1	Nov 1
Study Sec.	Rob B.	Cow I.	Cow I.	Rob B.	Rob B.
Tag Number	S07479	S07398	00084	00154	00162
Weight	30.0	30.0	37.0	50.0	37.0
Total Length	55.0	53.5	58.3	61.5	56.7
Fork Length	50.0	52.0	54.0	60.0	53.8
Std. Length	47.0	49.0	51.0	57.5	50.6
Head Length	19.7	16.0	16.9	18.5	17.7
Mouth Width	4.0	4.8	4.7	5.2	5.2
Outer Barbel L.	5.1	4.4	5.5	5.9	6.8
Inner Barbel L.	2.0	1.7	1.9	2.0	2.4
Nose to Out. Barbel L.	7.0	7.0	7.5	8.5	7.5
Mouth to In. Barbel L.	2.8	2.2	2.4	2.6	2.6
Caudal Peduncle L.	7.0	7.5	6.2	7.5	8.6

Two pallids were captured in pools located near the downstream end of islands. One of the pools had a maximum depth of 8 ft. and the other about 11 ft. The remaining 3 pallids were captured in one 20 ft. deep pool. Other species found in association with the 3 pallid sturgeon that were netted included shovelnose sturgeon and sauger.

Radio transmitters were attached to 2 pallid sturgeon and the system appeared to provide satisfactory results. Transmitters were tested for performance in deep water and it was determined that 20 ft. was the maximum depth that the signal could still be received at a distance of 100 yds. At a depth of 28 ft. the omnidirectional antenna had to be within 20 yds. of the transmitter. The system was tested for use in an airplane and satisfactory results were also experienced from the air. The 2 radio tagged pallid sturgeon were relocated on every attempt. A summary of the radio telemetry information is provided in Table 5.

Table 5. A summary of radio telemetry information collected from monitoring two pallid sturgeon in the middle Missouri River, Montana, 1990-91.

Parameter	Radios Channel #8	Channel #5
Period Monitored	(Oct 3 - Feb 12)	(Nov 1 - Apr 4)
Transmitter Duration	132 days	156 days
Number of Relocations	14	7
Average Distance Moved between Relocations	2.6 mi.	2.6 mi.
Average Water Depth at Relocation Site	10 ft.	10 ft.

Hybridization between pallid and shovelnose sturgeon has been reported by Carlson et al. (1985) and Bobby C. Reed (Louisiana Dept. of Wildlife and Fisheries; pers. com. 1991) and it may present a threat to survival for pallid sturgeon populations. None of the 387 sturgeon examined during this study appeared to exhibit noticeable hybrid characteristics. A sturgeon character index based on morphometric measurements was used by Carlson and Pflieger (1981) to evaluate both sturgeon populations for hybridization in the study area. This character index was used to evaluate 135 sturgeon during the present study. Sturgeon with strong shovelnose characteristics score on the low end of the scale at 100, and a fish with strong pallid characteristics score in the 500 range. The 5 pallid sturgeon sampled in the study area had an average score of 481 while, the 130 shovelnose averaged 253. The highest ranking shovelnose scored 295 and the lowest ranking pallid scored 460. This was a separation of 165 points and demonstrated that the two species were not hybridizing in the study area. Clancey (1991) examined several shovelnose and 9 pallid sturgeon and found no sturgeon that appeared to be hybrids in the lower Missouri and Yellowstone rivers.

There were 2 confirmed sightings of pallid sturgeon in the study area by fishermen in addition to the 5 pallids sampled by this study. These fishermen caught and released the 2 pallids while snagging for paddlefish in the Robinson Bridge section during late May, 1990 (Scott Jackson; USFWS; pers. com. 1990).

Marias River - Tiber Dam Tailwater

A coldwater fishery in the 21 mile reach of Marias River immediately below Tiber Dam is maintained by coldwater release. Prior to 1985 the coldwater fishery existed far below its potential because of inadequate instream flows and periodic surface warmwater releases from the dam (Gardner and Berg 1983). Flows in the Marias below Tiber have been 500 cfs or greater for the periods June 1985 through August 1988 and May 1989 to present. Summertime water releases from Tiber have been from the bottom of the reservoir since 1985, thereby maintaining the coldwater conditions.

The trout fishery has improved substantially since 1985, most likely in response to the better flow and temperature conditions (Gardner 1988). Field studies in 1987 showed marked improvements in trout numbers, sizes and reproductive success. Results from the 1988 survey indicated that the trout populations had stabilized and did not continue to improve as anticipated.

A number of mountain whitefish, brown and rainbow trout were sampled while conducting the population estimates (Table 5). Data indicated that populations of all three species were dominated by large older fish. Small fish or yearlings were noticeably absent during 1989 and 1990 sampling runs.

A trout population estimate was conducted during the summer, 1990 to evaluate the effects of the improved water releases from Tiber. Results demonstrated a steady decline in numbers of rainbows, especially the smaller size group. Population estimates indicate rainbow numbers have declined 71% between 1987 and 1990. During this same period the brown trout population has increased 19%.

A brown trout redd survey was conducted in the 4.5 mile section downstream of the dam during late November, 1990. A total of 94 redds were counted. This is a substantial increase from the previous years total of 54 redds. The increase was observed to be greater numbers of redds constructed at already known areas and attributed to increases in numbers of adult browns since the USBR began providing minimum instream flows in 1985.

Table 5. Comparison of size statistics for mountain whitefish and trout sampled over the years, Marias River, Tiber section, 1987-90.

Year	Number	Avg. Length (inches)	Avg. Weight (pounds)	Mode (inch)	Median (inch)
Mountain whitefish					
1988	104	12.3	0.78	9	12.6
1989	99	13.1	0.91	15	13.2
1990	114	13.1	0.95	12	13.3
Brown trout					
1987	102	15.7	2.00	8	17.0
1988	111	14.0	1.24	13	13.9
1989	27	17.0	1.89	16	16.3
1990	118	17.0	1.92	17	17.6
Rainbow trout					
1987	108	12.2	0.87	7	12.3
1988	124	11.5	0.63	10	11.5
1989	5	13.8	1.00	15	15.1
1990	65	14.9	1.19	15	15.2

Table 6. Standing Crop estimates of trout in a 4.5 mile reach of the Marias River, tailwaters of Tiber Dam.

Size Group	Year 1987	1988	1990	Number of Fish Sampled
Rainbow				
(6.0 - 10.9)	202	126	--	(4 - 51)
(11.0 - 20.4)	222	176	124	(61 - 73)
Brown				
(6.0 - 10.9)	50	38	50	(18 - 33)
(11.0 - 32.0)	156	134	195	(85 - 100)

The rainbow trout population does not appear to be responding to the better flow and temperature regimes in the Marias. The 1990 estimate for 11+ inch rainbows is nearly half of what it was in 1987. Reasons for this decline are still unclear but it is fairly evident that recruitment to the population is extremely low. In response to the declining rainbow trout population a plan was developed to stock the Marias with wild fingerling rainbows from the Madison River. This action was taken to: 1) increase numbers of rainbow trout to anglers, 2) possibly enhance natural reproduction by introducing rainbow from a population known to reproduce effectively by spawning in a mainstem river, and 3) determine whether or not survival of juvenile fish during the first year is a critical limiting factor. We intended to collect 15,000 -20,000 eggs from the wild source during the spring, incubate them in the state hatchery and stock them in the Marias during September when they reach 3 inches in length. All the fingerlings would be adipose clipped for identification in future years.

Approximately 400 rainbows averaging about 15 inches long were examined on the Madison River near Ennis for spawning condition in spring 1990. From this total only 10 females could be spawned with 20 males, yielding approximately 7,000 eggs to be incubated in the hatchery. Incubation of these wild trout eggs was highly successful, producing 5,300 fish at the fingerling stage. A total of 5,000 rainbow trout fingerlings were stocked in fall 1990, after flows from Tiber were reduced for the winter season. The fingerlings averaged 3.0 inches and ranged between 1.8 and 4.0 inches.

A genetics evaluation of the resident Marias River rainbow trout and the introduced Madison River rainbows was initiated in 1990. Tissue samples were analyzed at the University of Montana genetics lab using electrophoresis to help determine if there is a genetic basis for failure of the Marias population to increase. The results from the study will be reported in next years annual report.

RECOMMENDATIONS

1. Continue with the pallid sturgeon study. Sampling results were fairly promising this year. Both setline and trammel net methods should continue to be used to capture pallids. More radio transmitters should be deployed to obtain more information on habitat use and movements. Also radio tagged pallid sturgeon could possibly direct us to other pallids.

2. Monitor trout population trends and success of wild rainbow fingerling plants in the Tiber Dam tailwater section by conducting annual standing crop estimates. Factors limiting trout populations need to be evaluated, perhaps through a graduate research project.

3. Install and evaluate artificial habitat structures designed to enhance juvenile trout habitat in the Marias River below Tiber.

LITERATURE CITED

Berg, R. K. 1981. Fish populations of the Wild and Scenic Missouri River, Montana. Mont. Dept. of Fish, Wildlife & Parks. Helena. Fed. Aid to Fish & Wildlife Rest. Proj. FW-3R. Job Ia. 242 pp.

Carlson, D. M. and W. L. Pflieger. 1981. Abundance and life history of the lake, pallid, and shovelnose sturgeons in Missouri. Missouri Dept. of Consv. Jefferson City. Endangered Species Proj. SE-1-6. Sturgeon Studies in Missouri, Job I. 63 pp.

_____, W. L. Pflieger, L. Trial, and P. S. Haverland. 1985. Distribution, biology and hybridization of Scaphirhynchus albus and S. platorrynchus in the Missouri and Mississippi Rivers. Environmental Biology of Fishes 14: 51-59.

Clancey, P. 1991. Fort Peck pallid sturgeon study. Annual Report to the U.S. Army Corps of Engineers. Mont. Dept. of Fish Wildlife and Parks. 13pp.

Gardner, W. M. 1988. Northcentral Montana Fisheries Study, Middle Missouri River Basin - instream flow studies. Mont. Dept. of Fish Wildlife and Parks. Helena. Fed. Aid to Fish and Wildlife Rest. Proj. F-38-R-3. Study No. II, Job B. 20pp.

_____. 1989. Northcentral Montana Fisheries Study, Middle Missouri Basin - instream flow studies. Mont. Dept. of Fish Wildlife and Parks. Helena. Fed. Aid to Fish and Wildlife Rest. Proj. F-38-R-4. Study No. II, Job B. 15pp.

_____. 1990. Northcentral Montana Fisheries Study, Missouri River Pallid Sturgeon Inventory. Mont. Dept. of Fish, Wildlife & Parks. Helena. Fed. Aid to Fish and Wildlife Rest. Proj. F-46-R-3. Study No. III, Job D. 16pp.

_____ and R. K. Berg. 1983. Instream flow requirements for the Marias River fishery downstream of Tiber Dam. Mont. Dept. Fish, Wildlife & Parks. Helena. 32 pp.

Holton, G. 1980. The riddles of existence: fishes of "special concern". Montana Outdoors 11(1): 26 pp.

Keenlyne, K. D. 1989. A report on the pallid sturgeon. U.S. Fish and Wildlife Service. Pierre, SD. 51 pp.

Novotny, D. W. and G. R. Priegal. 1974. Electrofishing boats - improved designs and operational guidelines to increase the effectiveness of boom shockers. Wisc. Dept. Nat. Resc. Tech. Bull. No. 73. 48 pp.

Pflieger, W. L. 1975. The fishes of Missouri. Missouri Dept. of Consv., Jefferson City, MO. 343 pp.

U.S.Fish and Wildlife Service. 1989. Endangered and threatened wildlife and plants; rule to list the pallid sturgeon as an endangered species. Federal Register. Vol. 55, No. 173. pp 36641 - 36647.

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Code numbers of waters referred to in this report are:

16-2520	Missouri River	Section 06
16-2522	Missouri River	Section 06B
17-4864	Missouri River	Section 07
14-3240	Marias River	Section 01