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

State: Montana **Title:** Northcentral Montana Fisheries Study

Project No.: F-46-R-5 **Title:** Missouri River Pallid Sturgeon

Study No.: III Inventory

Job No.: D **Title:** Planning Inventory, Fisheries

Period Covered: July 1, 1991 through June 30, 1992

ABSTRACT

A study to evaluate the status of the pallid sturgeon in the middle Missouri River was continued. A total of 3 pallid and 624 shovelnose sturgeon were captured during 1991. Two of the pallids were "new " fish and one was a recapture from the previous year. All pallids were radio tagged and monitored throughout the year. 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 88 fish/mile. Numbers of trout have declined since 1987, mainly resulting from decreases in rainbow trout numbers. Fall stocking of fingerling rainbows from Madison River stock was largely unsuccessful. Electrophoretic testing revealed significant differences between Marias and Madison rivers rainbow stocks.

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 1973. 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).

The Montana Department of Fish Wildlife and Parks (MDFWP) initiated a fisheries study during 1989 to determine the past and present status of the pallid sturgeon in the 175 mile reach of river between Fort Benton and Fort Peck Reservoir. Results from

the study will be used to develop a status report. This report will aid in devising management and recovery plans to maintain and enhance the pallid population in the river.

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 Marais 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.** Water reservation court hearings were conducted and the application for these streams along with several others in the middle Missouri basin were successfully defended. The Montana Board of Natural Resources approved the Department of Fish Wildlife and Parks instream flow application for all streams filed on. This objective is now completed and no further work will be carried on.

4. **To maintain streambanks and beds in a stable and near-natural condition in Chouteau and Liberty counties** (state funded). Two 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 (personal communication, Kim Apperson, Idaho Fish and Game Dept.).

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. Transmitters 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 scored 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 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

DESCRIPTION OF STUDY AREA

The pallid sturgeon study area consists of a 175 mile reach of the mainstem middle Missouri River in northcentral Montana between Fort Benton and 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.

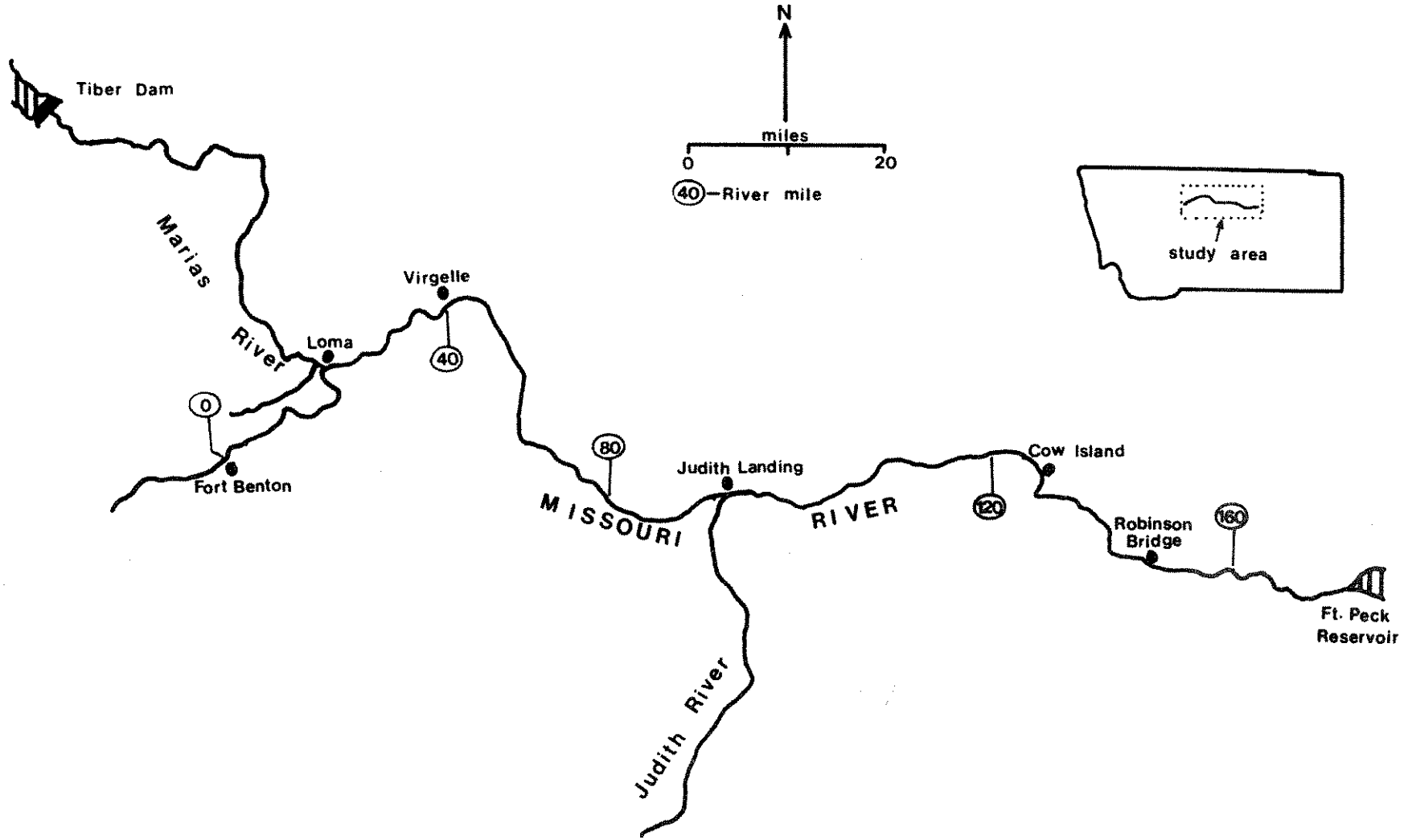


Figure 1. Map of the study area.

FINDINGS

Present Status of the Pallid Sturgeon Population

The pallid sturgeon is a difficult fish to study because of its life habits and sparce abundance. Historical sightings of pallids in the study area appear to have been scarce. Gardner (1990) reported only 35 pallid sightings for the period 1876 - 1987. Recent investigations have indicated that pallid sturgeon populations exist in low numbers in Montana and in other states. 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 13 pallids were captured during the three field seasons, 1989-91 (Clancey, 1991). Watson and Stewart (1991) sampled the sturgeon populations of the middle Yellowstone River and caught 349 shovelnose and 1 pallid sturgeon. 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. 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 total of 2 pallid and 624 shovelnose sturgeon were captured in the study area using setlines and trammel nets during the period April 20 through November, 1991. The average total length for the 2 pallids was 54.0 inches and average weight was 34 pounds. The average total length and weight of shovelnose were 31.9 inches and 4.9 pounds. Setline sampling for sturgeon this year was reduced compared to the previous year. A total of 31 sets were made capturing only 6 sturgeon for an overall catch rate of 0.2 sturgeon per set (Table 2). This catchrate was similar to that reported for last year (Gardner, 1991). No pallid sturgeon were caught using this method. Setline sampling ended in late July because large quantities of drifting filamentous algae fouled the gear.

Trammel net sampling was fairly successful; 624 sturgeon were captured for an overall catch rate of 2.7 sturgeon per drift (Table 3). Two pallid sturgeon were caught using this method; one in the Stafford Ferry section and the other in the Cow Island section. Trammel net sampling was initiated in April and continued to be effective even when filamentous algae densities were the greatest. Shovelnose sturgeon catch rates for trammel net sampling were highest in the Coalbanks section and lowest in the Stafford Ferry section.

Table 4 is a record of the various morphometric measurements taken from each pallid. These 2 pallid sturgeon were caught in the lower half of the study area. Since the study began in 1989 a total of 7 pallid sturgeon have been caught; all of these pallids being captured in the lower 90 miles of the 175-mile study reach.

Table 2. Setline fishing results for shovelnose sturgeon sampled in the middle Missouri River, April - July, 1991.

Study Section	Total No. of Sets	No. Sturgeon Caught	Avg. No. Sturgeon/Set	Avg. Sturgeon Weight (lbs.)
Loma	2	0	0	---
Coal Banks	9	3	0.3	6.5
White Rocks	5	1	0.2	---
Judith Landing	6	1	0.2	---
Cow Island	1	1	1.0	---
Robinson Bridge	8	0	0	---
Total	31	6	0.2	

Table 3. Trammel netting results for shovelnose sturgeon sampled in the middle Missouri River, April - November, 1991.

Study Section	Total No. of Drifts	No. Sturgeon Caught	Avg No. Sturgeon/Set	Avg. Sturgeon Weight (lbs)
Fort Benton	9	35	3.9	7.2
Loma	42	175	4.2	5.9
Coal Banks	16	139	8.7	5.1
White Rocks	14	55	3.9	4.3
Judith Landing	45	48	1.0	4.6
Stafford Ferry	13	2	0.2	4.5
Cow Island	53	108	2.0	4.2
Robinson Bridge	39	56	1.4	2.8
Total	231	618	2.7	5.0

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

Measurement	Pallid Sturgeon Number #7	#8
Capture Date	Jul 10	Aug 13
Study Sec.	Cow I.	Sta F.
Tag Number	G01352	G01433
Weight	38.0	30.0
Total Length	56.5	51.5
Fork Length	55.0	50.3
Std. Length	40.0	47.8
Head Length	16.8	15.0
Mouth Width	4.9	4.8
Outer Barbel L.	4.6	5.5
Inner Barbel L.	2.1	2.3
Nose to Out. Barbel L.	7.5	6.3
Mouth to In. Barbel L.	2.5	2.0
Caudal Peduncle L.	8.0	7.1

The two pallids captured this year were found in pools located near the downstream end of islands. One of the pools had a maximum depth of 8 ft. and the other about 12 ft. No other fish species were caught with these pallids. One of the pallid sturgeon was netted while attempting to recapture a previously radio tagged pallid.

Radio transmitters were attached to 3 pallid sturgeon; the 2 "new" sturgeon plus one recaptured pallid that was transmittered in 1990 (Table 5). Results from radio-tracking indicated that the method of transmitter attachment was unsatisfactory. Radio transmitters appeared to have caused abnormal downriver movements for two of the pallids. One pallid moved downriver 69 miles and another moved downriver 37 miles shortly after the transmitter attachment. Both ended up in deep water areas within a two miles of each other. These fish apparently could not be relocated in the lower river because deep water severely reduced the signal range of the transmitters. Other researchers conducting aquatic radiotelemetry studies have also noted abnormal fish behavior attributed to the attachment of external transmitters (Ross and McCormick 1981, Mellas and Haynes 1985).

The channel #9 pallid was recaptured April, 1991. It had been radio tagged the previous year. The old transmitter had caused some irritation so the replacement was positioned slightly posterior from the original site. This fish was relocated three times until the transmitter apparently tore loose (Table 5). All

three relocations were upriver from the release site. The change in locations between dates was gradual and consistent, therefore it was assumed that this fish was displaying more normal movements.

Because of the problems encountered with some of the external radio transmitters, testing of another type of radio transmitter was initiated. Three internal transmitters were evaluated during the late fall and winter. These transmitters were different from the previously used types because they had a coiled antenna that was completely encased within the transmitter shell. This type of transmitter could be surgically implanted internally into the body cavity of a fish without having to be concerned about positioning of an external antenna. A problem inherent with the coil antenna transmitters is the decrease in signal strength in comparison to the external antenna transmitters (personal communication, Richard Huempfner-ATS Inc.). Tyus et al. (1984) studied the Colorado squawfish using radiotelemetry and found this type of transmitter suitable for their purposes.

The internal radio transmitters were surgically implanted into three shovelnose sturgeon. Shovelnose were selected as test fish because they are similar to the pallid sturgeon and are abundant in the study area. The transmitters were all manufactured by Smith-Root Company and varied in signal strength and size. The greatest output transmitter weighed 36 gm. and was 4 inches long, 0.75 inches in diameter with a longevity of 80 days. The moderate output transmitter was 27gm. X 2.9in. X 0.75in. X 80 days and the lowest output transmitter dimensions were 14gm. X 2.2in. X 0.6in. X 150 days. The lowest output transmitter was similar to the type that was successfully used by researchers studying the Colorado squawfish (personal communication; Mr. Lee Carsesen - Smith-Root Co.).

Results from the testing of the three transmitters and the different method of transmitter placement were encouraging. Radio transmittered shovelnose were relocated nearly every time an attempt was made. Eighteen relocations on these fish were made during the period November 11, 1991 to April 23, 1992. The sturgeon were located at depths ranging between 4 and 11 feet and most of the time they were within 1.5 miles of the release site. The radio signals from all three transmittered sturgeon could be received from an airplane at an elevation of 300 feet above the river. Signals from the two most powerful transmitters could be detected from a distance of 400 yards compared to about 200 yards for the lowest output transmitter. The movement behavior of the sturgeon appeared to be unaffected by the surgery or internal placement of the transmitter. All sturgeon remained in the general area of the release site and exhibited both upward and downward movements. After being at large for 124 days one of the shovelnose was recaptured to evaluate its condition and appeared to be in good health. The incision was nearly healed and would have probably been entirely healed if water temperatures were warmer than those experienced during the winter test period. Similar testing was conducted for sturgeon in the Yellowstone River, and the incision

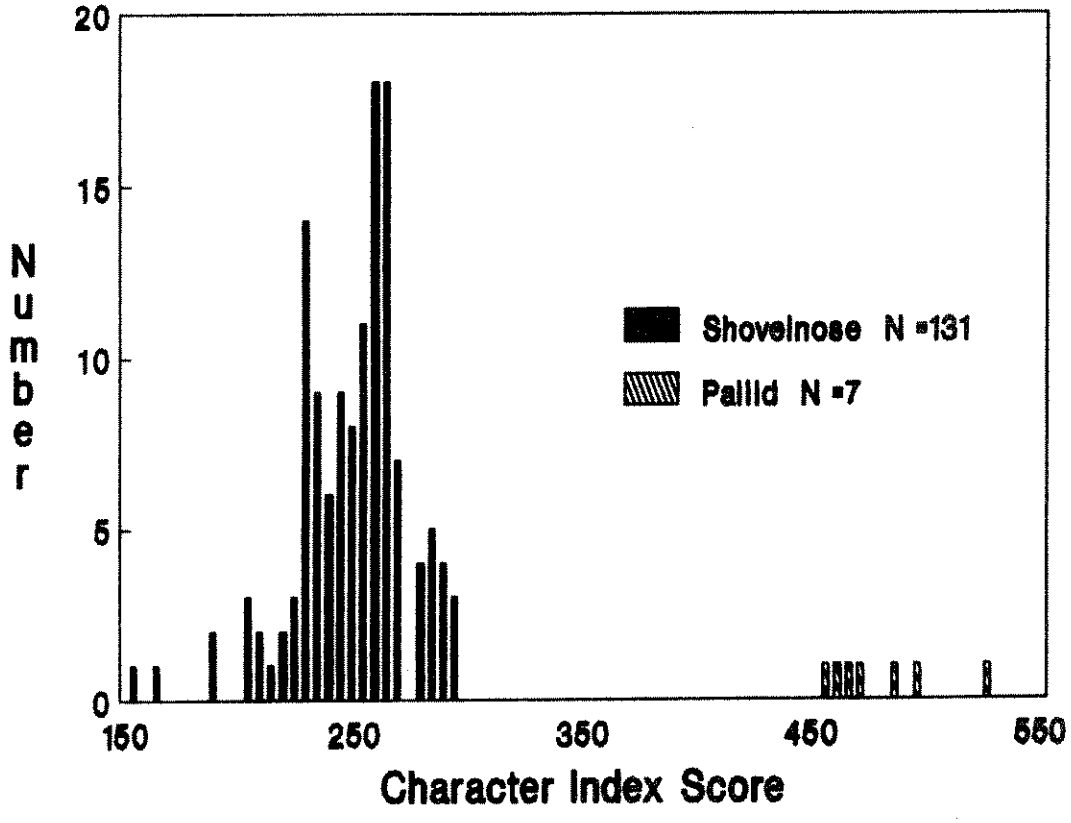
of one recaptured sturgeon was completely healed after this fish was at large for about 8 months (personal communication; Mr. Pat Clancey - MDFWP). Based on these results it is recommended that the coiled antenna transmitters be surgically implanted into pallid sturgeon on a trial basis so that habitat preferences of this species can be studied.

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

Parameter	Transmitter Number Channel #9	Channel #1	Channel #3
Period Monitored [1/]	(Apr 4 - Jul 1)	(Jul 10 - Aug 8)	(Aug 13 - Aug 21)
Number of Relocations	5	4	1
Distance Traveled Upriver	43	0	0
Distance Traveled Downriver	?	38	69

Hybridization between pallid and shovelnose sturgeon has been reported by Carlson et al. (1985) and Bobby C. Reed (personal communication, Louisiana Dept. of Wildlife and Fisheries) and it may present a threat to survival for pallid sturgeon populations. None of the 626 sturgeon examined since 1989 in this study area appeared to exhibit noticeable hybrid characteristics. A sturgeon character index based on morphometric measurements (Carlson and Pflieger 1981) was used to evaluate for possible hybridization of 138 sturgeon captured during 1990-91 (Figure 2). 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 7 pallid sturgeon sampled in the study area had an average score of 481 while the 131 shovelnose averaged 253. The highest ranking shovelnose scored 299 and the lowest ranking pallid scored 459. This was a separation of 160 points and demonstrated that the two species were not hybridizing in the study area.

Figure 2. Character indices scores for Shovelnose and pallid sturgeon, upper Missouri River, MT, 1991.



Clancey (1991) examined several shovelnose and 13 pallid sturgeon and found no sturgeon that appeared to be hybrids in the lower Missouri and Yellowstone rivers.

There were 5 confirmed sightings of pallid sturgeon in the study area by fishermen in addition to the 2 pallids sampled by this study during 1991. These fishermen caught and released the 5 pallids while snagging for paddlefish in the Robinson Bridge section near the headwaters of Fort Peck Reservoir during May and June.

Marias River - Tiber Dam Tailwater

A trout 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 coldwater conditions.

The trout fishery has improved substantially since 1985, most likely in response to 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. Numbers of younger trout have been exceptionally low since 1989.

A trout population estimate was conducted during the summer, 1991 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 (Table 6). Population estimates indicate rainbow numbers have declined 64% between 1987 and 1991. During this same period the brown trout population has remained about the same.

Table 5. Comparison of size statistics for mountain whitefish and trout sampled in the Marias River below Tiber Dam during 1987-91.

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
1991	99	13.1	0.99	9	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
1991	118	17.7	1.79	18	18.1
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
1991	79	13.8	0.88	16	14.0

Table 6. Standing Crop estimates of trout in a 4.5 mile reach of the Marias River below Tiber Dam during 1987- 1991.

Size Group	Year 1987	1988	1990	1991	Number of Fish Sampled
Rainbow					
(6.0 - 10.9)	202	126	--	48	(4 - 51)
(11.0 - 20.4)	222	176	124	105	(56 - 73)
Brown					
(6.0 - 10.9)	50	38	50	--	(6 - 33)
(11.0 - 32.0)	156	134	195	200	(85 - 123)

Water temperatures in the Marias River were abnormally warm during the summer months of 1991 because of unintentional surface water releases. Maximum and minimum water temperatures exceeded 70° F 100% and 20% respectively, of the days between July 28 and August 21 (USBR 1991). Under the normal operating plan for Tiber Dam water temperatures are cold with maximums rarely exceeding 60°. Warm temperatures undoubtly harmed the trout fishery in the Marias. MacKay (1963) reported 55.4° as the preferred optimum for rainbow trout, with 66° and 77° maximums for growth and short exposure survival, respectively (Brungs and Jones 1977). Trout numbers were similar between 1990 and 1991 except the larger brown trout were in poor condition in 1991. Browns averaged 17.0 inches and 1.92 lbs. in 1990 compared to 1991 averages of 17.7 inches and 1.79 lbs. Average weight decreased 0.13 lbs. while average length increased by 0.7 inches. Clearly the brown trout did not fair as well in 1991 as they did in the previous years.

Another noticeable change in the trout population was the occurrence of 5 trout with "popeye" condition. Most likely this was a symtom of gas bubble disease caused by gas supersaturation (Meyer and Barclay 1990). Water samples below Tiber Dam were analyzed for gas supersaturation during November while surface water was still being discharged. A value of 109% total gas was recorded. The EPA (1978) recommends that gas concentrations in water should not exceed 110% for the protection of aquatic life. The value recorded in the Marias was higher than expected for natural waters and was near the recommended maximum. To avoid gas bubble disease problems and elevated temperatures, water should not be released from Tiber Dam through the surface outlet during base flow conditions. Use of the surface outlet should be confined to periods when the bottom outlet cannot accommodate the entire amount of water that is to be discharged.

The Marias River rainbow trout population does not appear to be improving in the Marias. The 1991 estimate for 11+ inch rainbows is less than 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 in 1990 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. The first plant of Madison River rainbows was made on 25 September, 1990 when 5,085 fingerlings averaging 2.8 inches were stocked below Tiber Dam. Only two of these fish were captured in the fall, 1991 electrofishing, suggesting the first year at stocking was largely unsuccessful. The program continued during spring, 1991 with the collection of approximately 6,000 rainbow trout eggs from the Madison River. A total of 4,300 fingerlings averaging 2.7 inches were stocked in the Marias below Tiber Dam during fall, 1991 after being reared at the Giant Springs hatchery in Great Falls.

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 determine the identity of these two rainbow stocks. Between the samples, 17 loci were observed to be polymorphic (Table 7). Contingency table chi-square analysis indicates that the allele frequencies at nine of these loci were statistically heterogenous between the samples. A summation of chi-square values and degrees of freedom over all loci equaled a value of 142.919 ($p < 0.001$), and indicates a highly significant genetic difference between the two rainbow stocks.

Table 2. Allele frequencies at the polymorphic loci in Madison River and Marias River rainbow trout. Chi-square is contingency table chi-square statistic for homogeneity of allele frequencies between samples.

Locus	Alleles	Sample and allele frequencies: Madison	Marias	Chi-square	D.F.
bGLUA	100	0.890	0.692	10.834***	1
	72	0.110	0.30		
CK-C1	100	0.880	1.000	10.042**	1
	150	0.020	--		
	38	0.100	--		
G3PDH-1	100	0.930	1.000	5.692*	1
	140	0.070	--		
GPI-A	100	0.970	1.000	2.364	1
	92	0.030	--		
GPI-B1	100	1.000	0.987	1.280	1
	200	--	0.013		
IDDH	100	1.000	0.868	13.940***	1
	0	--	0.132		
LDH-B2	100	0.880	0.795	2.395	1
	76	0.120	0.205		
LDH-C	100	0.960	0.885	3.671	1
	95	0.040	0.115		
mIDHP-2	100	0.500	0.895	29.354***	1
	140	0.500	0.105		
PEPB	100	0.980	1.000	1.589	1
	135	0.020	--		
PGM-1	100	0.626	0.715	0.723	1
	null	0.374	0.285		
PGM-2	100	0.770	0.769	0.000	1
	90	0.230	0.231		
sAAT-3,4	100	0.995	1.000	0.788	1
	90	0.005	--		
sIDHP-1,2	100	0.860	0.737	17.276***	3
	114	0.015	0.038		
	71	0.065	0.045		
	40	0.060	0.179		
sMDH-B1,2	100	1.000	0.891	22.885***	2
	125	--	0.032		
	83	--	0.064		
	74	--	0.013		
sMDP-1	100	0.990	0.865	11.236***	1
	83	0.010	0.135		
sSOD-1	100	0.600	0.808	8.850***	1
	152	0.400	0.192		
			TOTAL	142.919***	20

* = P<0.05, ** = P<0.01, *** = P<0.001, D.F.= degrees of freedom

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. Radiotelemetry methods as a means of acquiring pallid sturgeon habitat use information should be continued. Different types of radio transmitters should be tested so that effects of the transmitter placement on the pallid is minimal.

2. Monitor trout population trends and success of wild rainbow fingerling plants in the Tiber Dam tailwater section by conducting annual standing crop estimates. Continue to stock the river with wild rainbow trout fingerlings. If possible, hold over a portion of the fingerlings and stock as yearlings in the spring. Factors limiting trout populations need to be evaluated, perhaps through a graduate research project.

ACKNOWLEDEMENTS

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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