LOWER YELLOWSTONE RIVER PALLID STURGEON STUDY III
AND
MISSOURI RIVER PALLID STURGEON CREEL SURVEY

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Abstract

Gill and trammel nets were drifted on the Tongue, Powder and Yellowstone Rivers to locate pallid sturgeon in 1993. While no pallid sturgeon were found upstream of Intake Diversion Dam, two were caught immediately downstream of the dam. In three years of sampling only one pallid sturgeon has been found upstream of Intake Diversion Dam. Upstream of Intake, including the lower Powder and Tongue rivers, 663 shovelnose sturgeon and 449 fish of other species were sampled in 1993. Downstream of Intake, an additional 153 shovelnose sturgeon were tagged to assess movement upstream over Intake Diversion Dam. Paddlefish anglers near the Fred Robinson Bridge on the Missouri River released at least two pallid sturgeon.

PART I - YELLOWSTONE RIVER STUDY

Introduction and Objectives

Listing of the pallid sturgeon (Scaphirhynchus albus) as an endangered species in 1990 (Federal Register 1990) stimulated the question of its current abundance in the Yellowstone River. In response, the Bureau of Reclamation has provided funding for Yellowstone River pallid sturgeon investigations each year since 1991.

The 1993 objective, as in previous years, was to determine the occurrence of pallid sturgeon in the Yellowstone River above Intake diversion dam, including the Tongue and Powder Rivers. All pallids caught would be weighed, measured, and tagged with an individual number prior to being released. The primary goal below Intake was to record lengths and weights, tag both pallid and shovelnose sturgeons landed by anglers and paddlefish snaggers and, especially, to find small immature pallid sturgeon.

Study Area Description

The study area encompassed 268 km (166 miles) of the Yellowstone River between Intake and Cartersville diversion dams. The lower 32.8 km (20 miles) of the Tongue River and lower 13.5 km (8.4 miles) of the Powder River were also sampled during high water (Figure 1). Seven river sections were established for the study, five on the Yellowstone River and one each on the Tongue and Powder Rivers. Physical characteristics for each section are shown in Table 1. Stream flows for 1993 and long term mean flows are provided in Table 2.

Methods

Sinking gill and trammel nets were drifted, from a boat, for an average of twenty minutes. Trammel nets were 150 feet long, six feet deep with two inch inner and twelve inch outer mesh. Gill nets were either 50 or 100 feet long by six feet deep with three inch mesh. Netted fish were retained momentarily to allow lengths and weights to be recorded. Time (hours) and distance (miles) traveled were recorded for each drift by using a stopwatch and the River Mile Index of the Yellowstone River (DNRC 1976). Total hours and miles drifted per river section and time period were calculated (Tables 3 and 4).

Physical descriptions of the river, at random drift sites, were recorded to describe habitats preferred by sturgeon. Conclusions could not be drawn from this data and results were not provided in this report. This data is on file for future use.

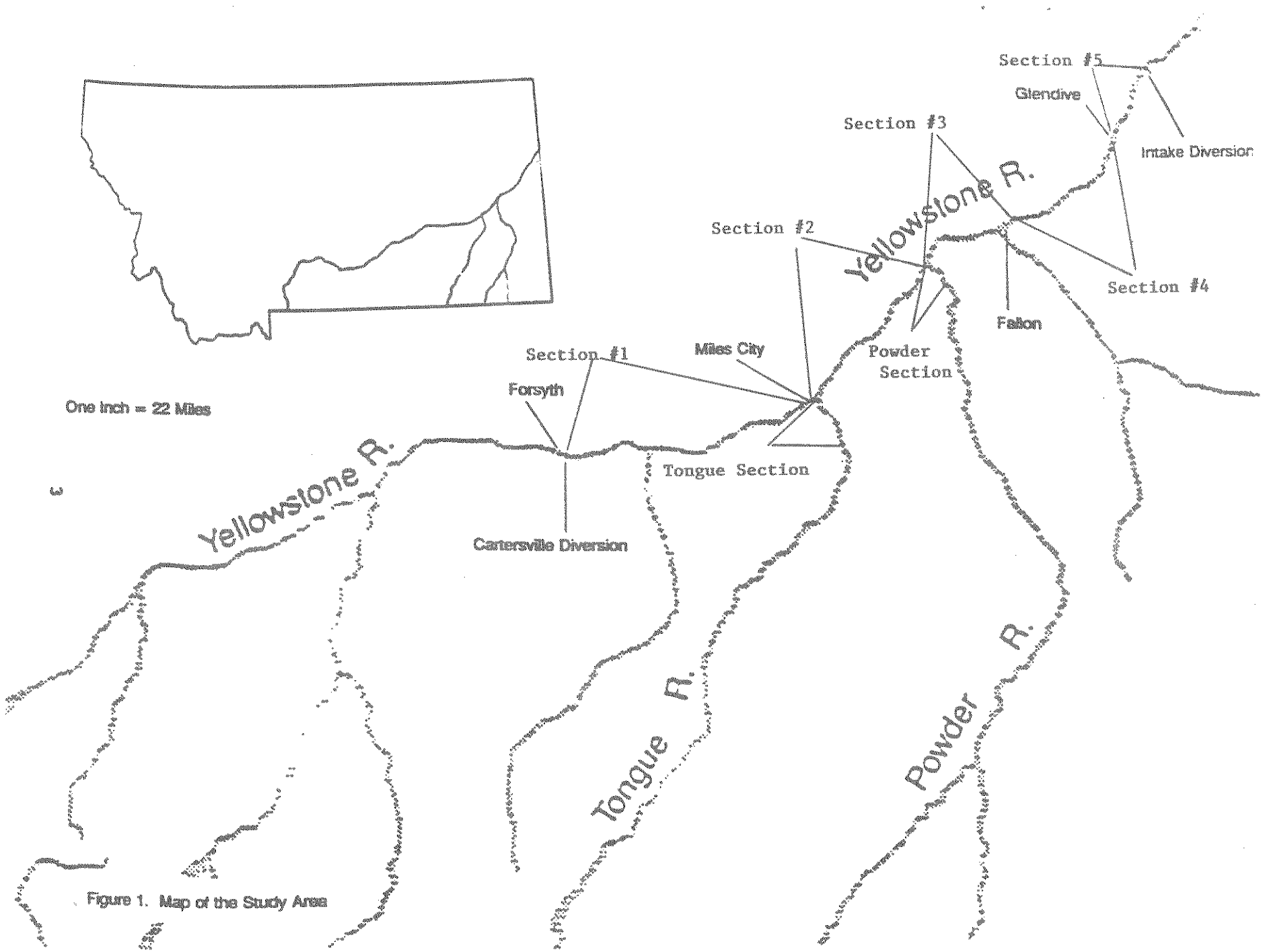

Figure 1. Map of the Study Area

Fork lengths of shovelnose sturgeon and total lengths of other fish species were recorded. Weights were recorded in kilograms. When a tagged fish was caught the style, color, and numbers on the tag were recorded. Measurements to determine hybridization between pallid and shovelnose sturgeon were not made in 1993 as other research has provided no evidence of hybridization (Clancey 1991).

Below Intake, sturgeon incidentally snagged by paddlefishermen and those that anglers did not keep were placed in steel tanks. Fork length and weight were recorded and an orange cinch up tag (numbered from 7-00316 to 7-00500) was placed just below the dorsal fin before releasing the fish. Pallid sturgeon received a pit tag and radio transmitter in addition to a visible cinch-up tag. Most sturgeon weighing less than 200 grams were not tagged.

Results

No pallids were collected upstream of Intake Diversion but two were snagged by paddlefisherman below the dam. The first, caught on May 21, was four feet one inch long (weight not taken), was affixed with a orange cinch up tag (number 7-00341), pit tag (number 7F7E695405) and a radio transmitter prior to releasing. The second was caught on June 25. Length and weight were not recorded but a pink spaghetti tag (number R66-10052) and pit tag (number 7F7D4C4113) was attached before releasing. Below Intake, 234 shovelnose sturgeon were also collected. 153 were tagged while 81 were too small or were kept by anglers. Above Intake, 1112 fish were netted with 663 (60%) being shovelnose sturgeon. This is similar to 1992's figure of 52% (Backes, et al. 1992). The number and efficiency (fish per hour) of sturgeon caught was calculated for each time period and river section (Tables 5 and 6). The highest efficiency, by section, was in Yellowstone River Section 4 and was highest during Mid-August when comparing time intervals (Table 6).

Maximum, minimum, and mean lengths and weights for shovelnose sturgeon were recorded by river section, above Intake (Table 7). Sturgeon size, upstream and downstream of Intake is compared in Table 12. Data collected in 1992 (Backes et al. 1992), showed a tendency for sturgeon to be larger in upstream areas and that minimum sturgeon size was largest in the Tongue and Powder rivers. This year's data (Table 7) suggests little size difference in sturgeon between sections of the Yellowstone River and the Tongue and Powder Rivers. However, sturgeon were again much larger upstream of Intake than downstream (Tables 12 and 13). Sturgeon weighing less than 0.9 kilograms (smaller fish) made up less than 3% of the catch upstream of Intake (Table 13), while the same figure for downstream of Intake was over 17%. This constitutes evidence that small sturgeon may not be able to move upstream over Intake Diversion Dam.

Sturgeon were more abundant in areas of fast to moderate current associated with a flat gravel bottom but were present in most habitat types available except dead current areas. Locations of high sturgeon concentrations in 1992, such as the area downstream of the Powder River mouth, seemed sparsely occupied in 1993. In general, sturgeon were more dispersed in 1993 than in 1992.

A total of 449 other fish (non sturgeon) from twelve different species was collected above Intake, with 40% being river carpsuckers. Numbers caught per day and per river section were recorded for each species (Tables 8 and 9). A subsample (349) from the total fish caught was weighed and measured to establish maximum, minimum and mean values for each species (Table 10).

Twenty previously tagged shovelnose sturgeon were collected upstream of Intake (Table 11). Six fish are not reported or shown in Table 11 because original tagging information could not be located. One sturgeon was originally tagged below Intake in 1992 and two were tagged in Wyoming. These three fish demonstrate the ability of sturgeon to travel long distances. The sturgeon tagged below Intake in 1992 and recaptured upstream of Intake in 1993, along with three other shovelnose sturgeon tagged in 1992 below Intake and recaptured upstream of Intake the same year (Backes, et. al. 1992), indicates at least some ability of sturgeon to move over the Intake Diversion Dam.

Discussion

As in 1992, water flows were a key factor affecting numbers of fish netted. Except in June, mean water flows were above average during the period of this study (Table 2). Heavy rain showers throughout the Yellowstone River drainage caused numerous influxes of high water that carried large amounts of debris. During these periods, netting efficiency was poor due to fast water currents and clogging of nets. Water flows in the Powder River were much above average, except in May, resulting in exceptionally fast currents. Consequently, little time was spent sampling in this tributary. Sturgeon congregate in the Tongue River when high water coincides with spawning periods. Tongue River sturgeon catches were high in 1991 (Watson and Stewart 1991) and again in 1993 (Table 6) when above average flows occurred. With low Tongue River flows in 1992, sturgeon catches were also low (Backes et al. 1992).

Overall numbers of fish collected upstream of Intake were just over half of 1992's catch. This is attributed to the high water experienced in 1993. Fewer sturgeon were also sampled downstream of Intake in 1993. In past years, a large back eddy was created along the river's south bank below Intake that attracted both sturgeon and paddlefish. This year the structure of the dam had changed and the large back eddy was less pronounced. This back eddy may facilitate sturgeon movement over Intake. This could be

an important future issue because this back eddy might also facilitate pallid sturgeon movement over the dam.

Pallid sturgeon do migrate to Intake each year but only one pallid has been found above Intake in the last three years of sampling. This suggests a very low density of pallid sturgeon upstream of Intake.

Based on tag returns, some shovelnose sturgeon may live 30 plus years as some have been tagged for 18 years and were adults when originally tagged. The long distance these fish can cover is illustrated by the one sturgeon that traveled approximately 330 river miles, from Crazy Woman Creek in Wyoming down to Glendive, Montana (Table 11). The second Wyoming sturgeon's original tagging information was not located before the completion of this report. Both fish traveled down the Powder River which allows movement of large fish only during high water periods.

RECOMMENDATIONS

1. Use additional weights on nets to ensure they stay on the bottom of the river and follow the sharp contours that may occur.

2. Continue sampling for pallid sturgeon in the study area with primary emphasis on river sections 4 and 5 to further investigate the ability of sturgeon and other large fish to migrate upstream of Intake Diversion Dam.

3. Continue to tag shovelnose sturgeon to gain further information about fish movements.

4. Use gill nets during high debris periods to avoid spending excessive time cleaning trammel nets.

PART II - MISSOURI RIVER PALLID STURGEON CREEL SURVEY

The Missouri River upstream of Fort Peck Reservoir is one of the few remaining reaches of the Missouri where the pallid sturgeon is known to exist. The Montana Department of Fish, Wildlife and Parks (MDFWP) has been conducting a pallid sturgeon study here since 1989 and has captured 24 different pallids during this five year period. In addition to these pallid captures, several other unconfirmed pallid sturgeon sightings have been reported each year by fishermen in the Fred Robinson Bridge area.

The U.S. Bureau of Reclamation (USBR) has two large storage reservoirs that significantly alter the flow and sediment transport regimes of the Missouri River in the study area. Canyon Ferry Reservoir, located 150 miles upstream of the study area, has maximum storage of 2,043,000 acre-feet. Tiber Reservoir, located

80 miles upstream on the Marias River (a large tributary of the Missouri River), is the other USBR reservoir. Maximum storage of Tiber is approximately 1,190,000 acre-feet. The operation of these two projects could affect the pallid sturgeon population in the study area.

The USBR was interested in assisting with the pallid sturgeon study and it was agreed that a pallid sturgeon creel survey at the Fred Robinson Bridge would be beneficial for acquiring more information about this endangered species.

The purpose of the survey was to 1) locate any pallids caught by fishermen before they were released and tag and attach radio transmitters to them so that general movement and habitat utilization information could be collected; 2) distribute information pamphlets to paddlefish snaggers and bait fishermen and answer questions concerning identification and reporting of pallid sturgeon sightings; and 3) increase the amount of department activity in the area to ensure that anglers release all captured pallid sturgeon.

Fishermen were surveyed in a 22-mile reach of the Missouri River near the Fred Robinson Bridge (river mile 149-171). The eight established access sites in this reach were checked at least twice a day. All fishermen were interviewed concerning their fishing activity. Information about the pallid sturgeon along with an information pamphlet about the pallid was given to each fisherman.

A total of 2,017 days snagging for paddlefish and 552 days bait fishing were accounted for during the creel census period of April 6 through June 13, 1992 (Table 14). Only two confirmed pallid sturgeon were caught and released by fishermen during this period; both pallids were caught by fishermen snagging for paddlefish. These two pallids were not observed by MDFWP personnel. They were confirmed as pallids based on approximate size reported by the fishermen. There was an additional report of a small pallid less than 10 pounds caught and released; however, this sighting could not be confirmed because pertinent information was lacking. A total of 77 shovelnose sturgeon were harvested by bait fishermen during the study period. Most of these shovelnose were caught during the period April 27 - May 31.

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Table 1. General description of river sections in the study area.

River Section	Section Length (Kilometers)	Characteristics
Tongue River T & Y Diversion to mouth	32.6	Shallow, slow and meandering with few riffles. Many cut and undercut soil banks. Downstream ends of inside banks usually slow and of a uniform shallow depth. Mostly sand and small gravel substrate.
Powder River - River Kilometer 13.5 to mouth	13.5	Shallow and braided with slow to moderate current. Numerous rocks and shelf rock ledges. Mostly sand and small gravel substrate.
Yellowstone River #1 Cartersville Diversion to Tongue River	84.3	Showed a variety of features including deep pools, riffles and some braided sections around islands. The current is mostly moderate with some fast areas where the river narrows. Substrate contains mostly medium sized gravel and rock.
Yellowstone River #2 Tongue River to Powder River	57.1	Characterized by moderate to fast current with numerous rapids. Mostly a single channel with few islands. Some deep pools occur between the fast water areas. Medium to large gravel and rock make up the majority of the substrate. Many large bedrock shelves are scattered throughout the section.
Yellowstone River #3 Powder River to Fallon Bridge	36.4	Deeper and slower for the most part with a few sets of rapids on the upper end. Many deep outside bends occur on the north side of the river. Inside corners can be very slow and shallow. Medium gravel, rock and large rocks comprise the bulk of the substrate.

Table 1. Continued

River Section	Section Length (Kilometer)	Characteristics
Yellowstone River #4 Fallon Bridge to Glendive	5[illegible].7	Many large islands located in the middle and lower portions making for numerous shallow channels. Long, straight and fairly deep stretches occur between islands. Substrate contains mostly medium sized gravel with some rocky areas.
Yellowstone River #5 Glendive to Intake Diversion Dam	35.1	Slow and deep for the most part with several large islands. Mostly larger and deeper channels. Some areas are relatively fast with deep water where channels converge. Current slows dramatically as it nears the diversion. Substrate is mainly gravel of medium to large size.

Table 2. 1993 and long term (for period of record) monthly mean stream flows (cfs) for key stream gauges in the study area.[1]

	Tongue River Near Miles City (1938-1992)	Powder River Near Locate (1939-1992)	Yellowstone River at Miles City (1922-1992)
May			
1993	532	1408	20990
Mean	723	1139	17260
June			
1993	1391	2356	29790
Mean	1311	1662	35140
July			
1993	1287	2015	27110
Mean	468	559	20380
August			
1993	538	507	12150
Mean	181	208	8111

[1] Data from USGS. 1993 data are provisional and subject to revision.

Table 3. Trammel net and gill net sampling effort by time period.

Date	2" Trammel Net			3" Gill Net		
	Hours	Miles	# Drifts	Hours	Miles	# Drifts
5/11 - 5/31	3.2	9.4	16	10.0	27.5	44
6/1 - 6/15	3.1	11.4	12	3.9	15.3	18
6/16 - 6/30	2.9	7.6	9	3.1	7.7	7
7/1 - 7/15	5.0	18.3	18	2.6	6.8	9
7/16 - 7/28	7.1	24.7	22	0	0	0
8/1 - 8/15	11.8	28.6	26	0	0	0
8/16 - 8/18	3.4	9.8	9	0	0	0
Totals	36.5	109.8	112	19.6	57.3	78

Table 4. Trammel net and gill net sampling effort by river section.

River Section	2" Trammel Net			3" Gill Net		
	Hours	Miles	# Drifts	Hours	Miles	# Drifts
Tongue	1.5	5.3	5	11.2	29.1	40
Powder	0	0	0	2.8	9.8	12
Yellowstone						
1	7.8	20.4	18	0.5	1.7	3
2	0.7	1.9	3	0.4	1.1	2
3	5.4	12.0	15	1.1	4.3	5
4	11.8	35.9	41	2.1	7.3	11
5	9.3	34.3	30	1.5	4.0	5
Totals	36.5	109.8	112	19.6	57.3	78

Table 5. Number of shovelnose sturgeon caught in drift nets by time period and river section (hours of netting effort in parentheses).

Time Period	Tongue	Powder	Yellowstone 1	2	3	4	5	Period Total
5/11 - 5/31	22(4.5)	38(1.9)	0(0.3)	6(0.9)	16(1.0)	55(2.1)	3(2.4)	140(13.1)
6/1 - 6/15	81(3.5)	0(0.9)	12(1.2)		3(0.6)	12(0.5)	1(0.5)	109(7.0)
6/16 - 6/30	55(3.8)				4(0.3)	5(0.8)	3(1.2)	67(6.1)
7/1 - 7/15	23(1.1)				19(1.9)	8(3.2)	23(1.4)	73(7.6)
7/16 - 7/28			2(1.6)		1(0.5)	20(3.6)	19(2.0)	41(7.7)
8/1 - 8/15			34(4.0)		34(2.2)	80(3.4)	13(2.2)	161(11.8)
8/16 - 8/18			15(1.3)			41(0.9)	15(1.3)	71(3.5)
Totals	181(12.7)	38(2.8)	63(8.4)	6(0.9)	77(6.5)	221(14.5)	77(11.0)	663(56.8)

Table 6. Number of shovelnose sturgeon caught per hour of netting effort by time period and river section.

Time Period	Tongue	Powder	Yellowstone 1	2	3	4	5	Time Period Mean
5/11 - 5/31	4.9	20.0	0	6.7	16.0	26.2	1.3	10.7
6/1 - 6/15	23.1	0	10.0		5.0	24.0	2.0	15.6
6/16 - 6/30	14.5				13.3	6.2	2.5	11.0
7/1 - 7/15	20.9				10.0	2.5	16.4	9.6
7/16 - 7/28			1.2		2.0	5.6	9.5	5.3
8/1 - 8/15			8.5		15.5	23.5	5.9	13.6
8/16 - 8/18			11.5			45.6	11.5	20.3
River Section Mean	14.3	13.6	7.5	6.7	11.8	15.2	7.0	11.7

Table 7. Maximum, minimum and mean fork length and weight of shovelnose sturgeon by river section.

	Tongue	Powder	Yellowstone 1	Yellowstone 2	Yellowstone 3	Yellowstone 4	Yellowstone 5	All Fish Combined
			Fork Length (mm)					
Max	985	890	976	902	893	920	913	985
Min	540	630	544	686	408	501	396	396
Mean	783	775	788	814	744	748	732	761
			Weight (Kg)					
Max	6.82	3.84	4.36	4.34	4.12	3.94	5.00	6.82
Min	0.24	1.10	0.64	1.26	0.26	0.48	0.20	0.20
Mean	2.34	2.31	2.35	2.65	1.89	1.95	2.03	2.12
Sample Size	181	38	63	6	77	221	77	663

Table 8. Fish species and number caught by time period (excluding sturgeon).

Species	5/11-5/31	6/1-6/15	6/16-6/30	7/1-7/15	7/16-7/28	8/1-8/15	8/16-8/18	Total
Bigmouth buffalo	3		1	1			6	11
Blue sucker	5		6	2	1	5	7	26
Carp	3	3	10	2	1	20	12	49
Channel catfish	14	9	12	4	2	6	7	54
Goldeye	41	11	8	1		6	6	73
Longnose sucker		3		1		1		5
River carpsucker	36	50	59	15	3	5	12	180
Sauger	4	1	2		1	2		10
Shorthead redhorse		3	1	1	2	5	3	15
Smallmouth buffalo		1	4	7	3	6	3	24
White sucker							1	1
Walleye			1					1
Totals	106	79	104	34	13	56	57	449

Table 9. Fish species and number caught by river section (excluding sturgeon).

			Yellowstone					
Species	Tongue	Powder	1	2	3	4	5	Total
Bigmouth buffalo	1		6		2		2	11
Blue sucker	5				5	5	11	26
Carp	10		7		4	17	11	49
Channel catfish	23		5		10	10	6	54
Goldeye	14	1	5	36	4	12	1	73
Longnose sucker			4			1		5
River carpsucker	113	3	11	17	16	7	13	180
Sauger	1		1		3	2	3	10
Shorthead redhorse			9		2	3	1	15
Smallmouth buffalo	1		5		5	9	4	24
White sucker			1					1
Walleye	1							1
Totals	169	4	54	53	51	66	52	449

Table 10. Maximum, minimum and mean total length and weight for a subsample of all fish species collected (excluding sturgeon).

Species	Total Length (mm)			Weight (kg)			Sample Size
	Max.	Min.	Mean	Max.	Min.	Mean	
Bigmouth buffalo	743	574	673	7.73	2.51	4.91	11
Blue sucker	802	573	701	5.00	1.38	2.78	26
Carp	660	356	478	3.37	0.56	1.38	49
Channel catfish	838	354	546	5.46	0.38	1.79	54
Goldeye	360	264	314	0.42	0.17	0.29	48
Longnose sucker	446	390	424	1.01	0.56	0.82	5
River carpsucker	910	330	432	5.23	0.40	1.05	107
Sauger	451	266	358	0.76	0.12	0.40	10
Shorthead redhorse	524	352	442	1.10	0.50	0.83	14
Smallmouth buffalo	734	419	616	6.36	1.00	3.34	23
White sucker	446	446	446	0.96	0.96	0.96	1
Walleye	356	356	356	0.45	0.45	0.45	1
Total							349

Table 11. Tagged shovelnose sturgeon that were recaptured in 1993.

		Original Tagging Data					Recapture Data			
Color	Tag Number	Date	Length (mm)[1]	Weight (kg)	Location	River Miles[2]	Date	Fork Ln.(mm)	Weight Wt.(kg)	Location[2]
Yellow	7-01809	6/23/80	880	2.28	TR	1.5	6/1/93	805	2.30	3.3 TR
	7-01393	6/9/80	765	1.76	TR	1.5	6/15/93	759	2.09	17.4 TR
	7-01347	6/9/80	725	2.67	TR	1.5	6/15/93	747	2.05	18.1 TR
	7-02172	5/15/78	727	1.80	TR	1.5	6/16/93	761	1.80	9.5 TR
	7-01370	6/90/80	751	1.74	TR	1.5	6/16/93	755	2.00	9.5 TR
	7-01378	6/9/80	855	2.59	TR	1.5	6/17/93	821	2.56	12.5 TR
	7-01449	6/13/80	806	1.63	TR	1.5	6/17/93	750	1.54	12.5 TR
	7-01400	6/9/80	806	2.53	TR	1.5	7/1/93	812	2.57	6.2 TR
	7-01234	5/12/77	778	2.05	PR	1.0	7/14/93	822	2.24	77.4 YR
	7-01406	6/11/80	742	1.52	TR	1.5	8/2/93	693	1.55	225.1 YR
Orange	7-00003	5/17/92	702	1.42	YR	71.1	5/13/93	716	1.56	92.6 YR
Red	7-02790	unknown	737	3.79	TR	1.5	6/6/93	731	1.68	1.7 TR
	7-02212	6/3/75	770	3.78	TR	1.5	8/9/93	725	1.54	217.8 YR
Wyoming Tags										
Yellow	802002(A00115)		+++				8/12/93	833	2.94	92.6 YR
Aluminum Tag	306	6/15/93	*	*	PR	**	8/17/93	716	1.40	92.6 YR

Abreviations: YR - Yellowstone River, TR - Tongue River, PR - Powder River

[1] Unknown whether lengths are total or fork lengths.

+++ Information was not located prior to completion of this report.

* Data not available

** Approximately 50 miles south from Montana-Wyoming state line at Crazy Woman Creek.

[2] Distance upstream from mouth

Table 12. Maximum, minimum and mean length and weight for shovelnose sturgeon above and below Intake.

	Below Intake			Above Intake
	Fish Tagged	Fish Not Tagged	Combined	
Length (mm)				
Maximum	915	950	950	985
Minimum	359	275	275	396
Mean	710	632	683	761
Weight (kg)				
Maximum	4.20	3.52	4.20	6.82
Minimum	0.14	0.06	0.06	0.20
Mean	1.48	1.20	1.37	2.12
Number of Fish	153	81	234	663

Table 13. Percentages of shovelnose sturgeon weighing less than 0.9 kg and 0.45 kg above and below Intake.

	Below Intake (234 Fish)		Above Intake (663 Fish)	
	Number	Percent	Number	Percent
Less than 0.9 kg	40	17.10	19	2.87
Less than 0.45 kg	19	8.12	3	0.45

Table 14. Fishermen survey and sturgeon creel information for the Missouri River in the Fred Robinson Bridge area, April 6 - June 13, 1993.

Survey Period	Number of Anglers Interviewed: Paddlefish Snaggers	Number of Anglers Interviewed: Bait Fishermen	No. Pallids Caught and Released	No. of Sturgeon Harvested
4/6 - 4/12	115	43	0	0
4/13 - 4/19	88	22	0	0
4/20 - 4/26	82	40	0	4
4/27 - 5/3	249	20	0	5
5/4 - 5/11	201	42	1	9
5/12 - 5/17	351	105	0	1
5/18 - 5/26	293	74	1	16
5/27 - 6/1	484	134	0	38
6/2 - 6/7	144	57	0	4
6/8 - 6/13	10	15	0	0
Totals	2017	552	2	77