MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION
JOB PROGRESS REPORT

STATE:	Montana	PROJECT TITLE:	Statewide Fisheries Investigations
PROJECT:	F-46-R-7	STUDY TITLE:	Survey and Inventory of Warmwater Streams
JOB NO:	III-C	JOB TITLE:	Yellowstone River Paddlefish Investigations

PROJECT PERIOD: July 1, 1993 through June 30, 1994

REPORT PERIOD: April 1, 1993 through March 30, 1994

ABSTRACT

Creel census at Intake and statewide for the Yellowstone-Sakakawea population in 1993 indicated a paddlefish harvest of 1,635 fish at Intake and an additional 689 paddlefish harvested at other locations. While 70% of the fish were harvested at Intake, only 28% of the fishing pressure was at this site. Females made up only 35.1% of the Intake harvest, well outside the range of 57%-83% found in the years 1975-1992. Data suggest a much higher paddlefish exploitation rate in the 1980s than in the 1970s or 1960s and a long-term higher exploitation rate of females. Present exploitation rates are probably near 10% annually, of the spawning population. The Glendive Chamber of Commerce and Agriculture continued their paddlefish caviar program in 1993.

OBJECTIVES AND DEGREE OF ATTAINMENT

1. Prevent over harvest of the paddlefish population during the spawning migration; limit harvest to 5,000 of fewer fish most years at Intake. This objective was met. Harvest in 1993 was an estimated 1,635 fish.

2. Determine acceptable angler harvest. Progress was made toward this objective in 1993. Data is presented in Table 10 on angler exploitation rates of paddlefish.

3. Locate and preserve paddlefish spawning habitat. Progress was made toward this objective in 1993 by sampling paddlefish downstream of the Intake area.

PROCEDURES

A partial creel census was conducted during the paddlefish season at Intake in 1993. As many anglers as possible were questioned concerning amount of time spent fishing and number of fish caught. The interview total in 1993 was 1,226 which amounted to 43.5% of estimated total angler days. The season was divided into three sampling periods and calculations for angler hours, harvest and success rate were made for each period. Anglers were counted each day of the season (May 15 through June 30). Counts were made at eight randomly chosen times each day between the hours of 6:00 am and 9:00 pm. A twenty-four hour fishing day was used in fishing pressure calculations. Analysis of the data was accomplished by adapting formulas 5 through 32 from Spence (1970) to the census. Calculations were made by computer.

A mail survey was used to obtain paddlefish harvest information from anglers at all points on the Yellowstone River in Montana and on the Missouri River in Montana, below Fort Peck Dam. These are the Montana locations where Lake Sakakawea paddlefish are harvested. Names and addresses were obtained from paddlefish tag sale records. Non-responding anglers were telephoned. Anglers were questioned concerning number of days fished, number of paddlefish caught and number of paddlefish kept, by river reaches. This work was supervised by Bob McFarland of the Department's Bozeman office.

Angler caught paddlefish were weighed to the nearest pound. Body length (center of eye to fork of caudal fin) was measured to the nearest millimeter. Sex was determined by internal examination of the gonad.

Drifted five inch bar mesh gill nets 100 to 150 feet long were used to obtain paddlefish for examination of gonadal condition and tagging. All paddlefish collected were tagged on the lower jaw with a white individually numbered plastic band from the National Band and Tag Co.

RESULTS

GENERAL OBSERVATIONS

A rising Yellowstone River before the May 15 paddlefish opening at Intake resulted in good paddlefishing in May. Very cool June weather combined with below average river flows resulted in a very low June harvest. In the month of June paddlefish catches did not increase with rises in river stage, possibly because of the very cool weather and resultant low water temperatures.

Total paddlefish tag sales were the largest ever and non-residents accounted for 25% of sales. (Table 1) Tag sales previous to 1992 cannot be compared directly to sales in 1992 and 1993 because tags were not required state-wide until 1992.

PADDLEFISH SIZE AND SEX RATIO

A total of 1,659 were weighed, measured and sexed from the 1993 angler catch at Intake (Table 2). This total included approximately 300-400 paddlefish not caught at Intake. These fish were brought to Intake by anglers fishing one to five miles downstream.

Female paddlefish made up only 35.1% of the catch in 1993. This is the lowest female percentage in the angler catch since 1970 and is well outside the range of 57-83 percent females found in the Intake catch for the years 1975 through 1992. The cause and significance of the low female percentage are presently unknown. If this percentage is representative of the true female percentage in the spawning population, possibly the decrease could have come through long term higher exploitation rates of females.

Table 3 shows average length and weight by sex of paddlefish weighed and measured at Intake. Size of males in 1993 remained within the relatively narrow range of recent years. For females the pattern of slowly increasing length and weight of recent years was broken in 1993. Average length and weight of females in 1993 dropped slightly.

Small paddlefish continued to appear in the angler catch at Intake (Table 4). Small males were especially abundant in 1993. The 3.7 percent of males in the 10-15 pound range was exceeded only in 1991 for the years 1981 through 1993.

CREEL CENSUS

Results from the 1993 creel census at Intake are given in Table 5. Results for 1993 can be compared to with previous years in Table 6. In 1993 anglers fished 2818 days with an average of 4.56 hours per day to catch an estimated 1,635 paddlefish. The success rate was 0.13 fish per hour. Both harvest and success rate were relatively low in 1993. Angler days were similar to recent years. In 1993 angler success did not seem to rise and fall with changes in river stage. Most of the Intake harvest and the seasons highest success rate occurred in May (Table 5).

In 1993, for the first time, harvest and success rate information is available for all Montana locations where the Yellowstone-Sakakawea paddlefish population is harvested (Table 7). Approximately 81 percent of anglers buying paddlefish tags were included in the survey. Results from these anglers were expanded to total paddlefish tag sales.

A number of conclusions can be drawn by comparing Tables 5 (Intake) and 7 (all Montana fishing areas). In 1993 most (70%) of the total harvest was at the Intake Fishing Access Site (1,635 of 2,324 fish). Of the 1,949 fish caught in area 5 (Intake to Cottonwood Creek) 314 (16%) were caught downstream of the Intake Fishing Access Site. This agrees rather closely with records kept on fish cleaning by the Glendive Chamber of Commerce and

Agriculture. They list approximately 350 paddlefish brought to Intake for cleaning, but caught downstream of Intake FAS to Cottonwood Creek.

Despite the higher harvest at Intake FAS, most of the total pressure was at other sites. Only 2,818 angler days of a total 9,942 angler days (28%) was at Intake FAS. Most of the remainder of the fishing pressure was in Area 5 (Table 7) downstream of Intake (5019 days). A relatively small portion (21.2%) of the total fishing pressure was at sites outside of Area 5.

Success rate was highest at Intake where anglers caught 0.56 fish per day and lowest in the Missouri River downstream of Fort Peck Dam (0.11 fish per day). Although the Area 5 portion of the Yellowstone River downstream of Intake was fished heavily, success rate was much lower than at Intake (Tables 5 and 7).

TAG RETURN AND EXPLOITATION RATE

Return rate of individually numbered plastic bands placed around the dentary bone are used to infer angler exploitation rate. Of the 6,479 paddlefish tagged in the Yellowstone River (mostly near Intake), at least 1,480 (22.8%) have been harvested by anglers (Table 8). Because Department personnel are present at Intake continuously during the paddlefish season, most tags from Intake caught fish are recovered. A similar route for tag recovery was not present for Montana tagged fish caught in North Dakota previous to 1993. Beginning in 1993 a roe donation program, with free fish cleaning at the Missouri-Yellowstone confluence was begun in North Dakota. Tagging information is now recorded there for angler caught fish.

In 1993, 43 tags were recovered from Yellowstone River tagged fish. Of these 34 were from fish caught between Intake and Cottonwood Creek, 2 from the Sidney area and 7 from North Dakota. An additional 4 tags were recovered at Intake from fish tagged in the Montana portion of the Missouri River downstream of Fort Peck Dam. Eight paddlefish tagged in North Dakota in 1993 were caught at Intake. For Yellowstone River tagged fish most (33 of 43, or 77%) were tagged in the years 1990, 1992 and 1993.

Data from Table 8 are grouped into three time periods in Table 9. Data for fish tagged 1991 through 1993 is not included because these fish have been exposed to relatively little fishing pressure. Table 9 suggests increasing angler exploitation rates of paddlefish. The differences between the time periods are even greater than suggested by the percentages returned in Table 9. For fish tagged previous to 1971 no additional returns are likely, and for fish tagged 1971-1980 there will probably be only a few additional returns. However, for fish tagged 1981-1990 there will be substantial numbers of additional returns in the next few years. The percentage of tags returned for the last time period (1981-1990) in Table 9 will probably exceed 50% by the late 1990s, a substantially higher percentage than for fish tagged in earlier periods.

Tag return data is converted to annual exploitation rates for fish tagged in the years 1986 through 1993 (Table 10). Rates for earlier years are not shown because of compounding underestimation from natural mortality and unrecovered tags on some angler caught fish. Average calculated rates range from 3.6% to 7.2%. The range would be 5.2% to 7.2% if 1986, which probably has the largest underestimation, is excluded. Because of unknown natural and fishing mortality true rates may be close to 10%.

Exploitation rate of female paddlefish may be more important than overall exploitation rates. Tag return percentages by sex for fish tagged in six years are shown in Table 11. The rate is higher in each year for females, with an average of 31.9% for females and 19.3% for males. The calculated "t" for the sex difference in tag return rate is 5.336 with 5 degrees of freedom. This difference is significant at the 99% level of probability.

GILL NET CATCH RATE

As an indicator of paddlefish density in the Yellowstone River, we timed gill net drifts and recorded number of paddlefish caught per drift for most gill net drifts in 1993 (Table 12). Catch rate was highest in the area just downstream of Intake and much lower in the Sidney area. Yearly averages are probably much more important than daily catch rates. The latter fluctuates greatly. Catch rate trends through the years may be important information.

PADDLEFISH CAVIAR

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

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

LITERATURE CITED

Spence, L. 1970 Georgetown Lake Winter Creel Census. Job Progress Report, F-12-R-16, Job I-b. Montana Dept. of Fish & Game. 29 pp.

Prepared by: Phillip A. Stewart

Date Prepared: February 17, 1994

Waters Referred to: Yellowstone River Sec. 1 21-350-02

Key Words:

Angler success rate
Fishing pressure
Creel census
Paddlefish caviar
Paddlefish exploitation rate
Paddlefish sex ratio
Paddlefish tagging

Table 1. Number of anglers purchasing paddlefish tags.

Year	Total	Resident	Nonresident	% Nonresident
1993	5541	4169	1372	25
1992[3]	4779	3503	1276	27
1991	4438	3021	1417	32
1990	3960	2826	1134	29
1989	4255	3081	1174	28
1988[4]	3526	2620	906	26
1987	2877	2182	695	24
1986	3696[2]	2661	1035	28
1985	3593			
1984	5063			
1983	4636			
1982	4834			
1981[1]	4166			

1 Tags were free in 1981

2 Resident and nonresident tag sales were calculated separately beginning in 1986.

3 Previous to 1992 tags were required only for Yellowstone River paddlefish snagging. Beginning in 1992 tags were required statewide.

4 Data for 1988 through 1992 is updated from previous reports to show complete sales

Table 2. Summary of paddlefish measurements obtained from the angler catch at Intake, Yellowstone River, 1963-1992.

Year	Average No. of fish Measured	Average Total Length (Inches)	Eye-fork Length (mm)	Average Weight (pounds)	Percentage of Females
1963	46	43.4		29.6	0
1964	920	48.8		21.0	2.8
1965	453	50.6		21.3	2.9
1966	28	49.2		21.2	0
1967	123	50.9		21.8	0
1968	149	52.6		25.0	4.3
1969	499	51.9		23.4	3.7
1970	700	52.0		25.6	11.4
1971	1136	53.1		30.8	45.4
1972	1678	55.5		34.0	48.2
1973	1696	53.9		33.1	44.1
1974	1910	55.1		35.6	51.2
1975	1158	57.3		42.3	67.8
1976	940	57.6		47.4	67.8
1977	1003	58.2		48.2	64.0
1978	809	55.6		43.0	68.0
1979	637	60.1[1]		50.4[2]	67.5
1980	-	58.3[1]		49.1[2]	80.2
1981	2528		1086	46.7	75.1
1982	2004		1078	45.1	71.2
1983	1400		1086	50.2	82.6
1984	2691		1080	44.0	69.1
1985	628		1087	47.2	78.7
1986	1462		1064	43.7	63.3
1987	1412		1091	49.7	77.2
1988	1780		1058	43.5	61.0
1989	1583		1084	47.0	70.0
1990	1493		1073	45.6	65.4
1991	2558		1055	45.0	57.2
1992	670		1087	48.7	67.3
1993	1659		1005	36.9	35.1

[1] Based on 62 measurements
[2] Based on 131 measurements

Table 3. Summary of paddlefish average length and weight, by sex, obtained from the angler catch at Intake, Yellowstone River, 1963-1992.

	Males			Females		
Year	Sample Size	Length (E-F,mm)	Weight (pounds)	Sample Size	Length (E-F,mm)	Weight (Pounds)
1963	46		29.6			
1964	28		21.2			
1967	123		21.8			
1968				6		42.3
1970	620		26.3			
1971	620		25.7	516		52.6
1972	869		23.5	809		53.4
1974	932		24.4	978		55.4
1976	303		25.9	637		60.2
1978	259		30.0	550		66.0
1979	207		25.0	430		61.6
1981	630	954	27.8	1898	1130	53.0
1982	577	937	24.4	1427	1138	53.8
1983	244	932	25.8	1156	1117	55.3
1984	832	954	24.0	1859	1136	52.9
1985	134	914	24.2	494	1134	53.4
1986	537	932	24.7	925	1142	54.7
1987	322	916	25.6	1090	1143	56.8
1988	695	929	25.5	1085	1141	55.0
1989	475	931	24.8	1108	1150	56.9
1990	516	922	23.8	977	1153	57.1
1991	1080	916	24.9	1462	1159	60.3
1992	214	917	24.7	451	1170	60.2
1993	1076	925	25.2	583	1152	58.6

Table 4. Number (and percentage) of the total number of paddlefish weighed at Intake that are in specific size groups.

Year	Males <10 lbs.	Males 10-15 lbs.	Females <25 lbs.	Females 25-30 lbs	Total Weighed	Sum of Four size Groups
1993	6(.36)	62(3.7)	7(.42)	3(.18)	1659	78(4.7)
1992	0(.00)	14(2.1)	4(.60)	4(.60)	670	22(3.3)
1991	3(.12)	141(5.5)	8(.31)	3(.12)	2558	155(6.1)
1990	8(.54)	52(3.4)	11(.74)	15(1.0)	1493	86(5.8)
1989	3(.19)	28(1.8)	6(.38)	7(.44)	1583	44(2.8)
1988	3(.16)	40(2.2)	2(.11)	15(.84)	1780	60(3.4)
1987	1(.07)	24(1.7)	1(.07)	14(1.0)	1412	40(2.8)
1986	1(.07)	26(1.8)	5(.34)	10(.68)	1462	42(2.9)
1985	1(.15)	5(.80)	3(.48)	4(.64)	628	13(2.1)
1984	2(.07)	56(2.1)	6(.22)	20(.74)	2691	84(3.1)
1983	1(.06)	29(1.9)	4(.26)	17(1.1)	1554	51(3.3)
1982	2(.10)	34(1.7)	4(.20)	8(4.0)	2004	48(2.4)
1981	2(.08)	40(1.6)	6(.24)	23(.91)	2528	71(2.8)

Table 5. Estimate of anglers, hours fished and harvest for the 1993 paddlefish season at Intake.

Time Period	No. of Angler Days	Hours/ Angler Days	Angler Hours	No. of Fish Caught	Fish Caught/ Angler Hr	Fish Caught Per Angler Day
5-15-5-31	1551	3.97	6159	1009	0.16	0.65
6-01-6-15	811	5.41	4389	416	0.09	0.51
6-16-6-30	456	4.50	2054	210	0.10	0.46
Total/Mean	2818	4.56	12602	1635	0.13	0.56

Table 6. Comparison of paddlefish fishing pressure, harvest and success rate data at Intake from 1972 to 1992.

Year	Angler Days	Fish Caught	Fish Kept	Fish/ Angler Day	Fish/ Angler Hour	Total Weight Harvested (pounds)
1972	2118	2935	1805	1.39	0.40	61,370
1973	2449	4670	2675	1.91	0.46	88,543
1974	3363	4359	2182	1.30	0.39	70,680
1975	2784	2950	1473	1.06	0.28	77,038
1977	3524	2764	1410	0.78	0.34	67,962
1978	6130	4814	2887	0.78	0.49	124,141
1979	2904	2202	1727	0.76	0.07	87,041
1981	3982	5318	5318	1.34	0.81	248,251
1982	3535	4713	4713	1.33	0.45	212,556
1983	3142	3193	3193	0.92	0.38	160,289
1984	3978	3860	3860	0.98	0.35	169,840
1985	1745	550	550	0.34	0.09	25,960
1986	2521	1791	1791	0.73	0.15	78,267
1987	2386	2612	2612	1.13	0.28	129,816
1988	2320	2923	2923	1.25	0.34	127,151
1989	2208	2242	2242	1.00	0.19	105,374
1990	2877	2046	2046	0.65	0.15	93,298
1991	3332	4203	4203	1.19	0.30	189,135
1992	2396	762	762	0.34	0.09	37,109
1993	2818	1635	1635	0.56	0.13	60,331

Table 7. Results of state-wide paddlefish mail creek survey for fish harvested in Montana from the Yellowstone-Sakakawea population.

Variable	Area 3[a]	Area 4	Area 5	Area 6	Mean or Total
Angler days	247	850	7837	1008	9942
Percentage of Total Angler Days	2.5	8.5	78.8	10.1	100%
Harvest	25	163	1949	187	2324
Percentage of Total Harvest	1.1	7.0	83.9	8.0	100%
Fish Kept Per Angler Day	0.10	0.19	0.25	0.19	0.23
Mean Number of Fish Kept Per Angler	0.33	0.47	0.63	0.68	0.61
Mean Number of Fish Kept per Tag	0.16	0.23	0.32	0.34	0.31
Number of Anglers Reporting They Fished Area	55	258	2300	204	2817

Area 3 Missouri River-Fort Peck Dam to Montana-North Dakota Border
Area 4 Yellowstone River-upstream from Intake Diversion Dam
Area 5 Yellowstone River-Intake Diversion Dam to Cottonwood Creek
Area 6 Yellowstone River-Cottonwood Creek to Montana-North Dakota Border

Table 8. Summary of Paddlefish Tagging at Intake and tag returns 1964-1993.

Year	Number Tagged	# Returned In 1993	Total # Returned	Percentage Returned
1964-1970	1703	0	278	16.3
1971	396	0	89	22.5
1972	385	1	78	20.3
1973	455	0	93	20.4
1974	561	0	182	32.4
1975	161	0	36	22.4
1976	194	0	69	35.6
1977	341	0	83	24.3
1978	607	1	141	23.2
1979	129	0	29	22.5
1980	13	0	2	15.4
1984	551	3	227	41.2
1985	2	0	2	100.0
1986	153	1	39	25.5
1988	156[1]	3	51	32.7
1989	10[1]	1	2	20.0
1990	153[1]	11	32	20.9
1991	20[1]	0	2	10.0
1992	221[1]	8	31	14.0
1993	268[1]	14	14	5.2
TOTAL	6479	43	1480	22.8

[1] Some of this total between Intake and Crittenden Island. Most tagged between Intake and five miles downstream.

Table 9. Tag return rate averages for multi-year periods.

Period	Number Tagged	# Returned Through 1993	Percentage Returned
1964-1970	1703	278	16.3
1971-1980	3242	802	24.7
1981-1990	1025	355	34.6

Table 10. Annual angler exploitation rates (percent) of Lake Sakakawea paddlefish as indicated by returns of angler caught fish.

Number (%)[1] Returned In	Year tagged and (number of fish tagged)				
	1986 (153)	1988 (156)	1990 (153)	1992 (221)	1993 (268)
1986	9 (5.9)				
1987	0 (0.0)				
1988	7 (4.9)	22 (14.1)			
1989	7 (5.1)	3 (2.2)			
1990	4 (3.1)	8 (6.1)	6 (3.9)		
1991	7 (5.5)	14 (11.4)	4 (2.7)		
1992	4 (3.4)	1 (0.9)	10 (7.0)	23 (10.4)	
1993	1 (0.9)	3 (2.8)	11 (8.3)	8 (4.0)	14 (5.2)
Average Annual Percentage	(3.6)	(6.2)	(5.5)	(7.2)	(5.2)

[1] Percentage = $\frac{\text{Number caught that year x 100}}{\text{Number Tagged-Number caught previous years}}$

Table 11. Comparison of male and female tag return rates.

Year Tagged	Number Tagged	Percentage of tags returned	
		Female	Male
1977	341	35.8	19.3
1978	607	32.3	16.9
1984	551	45.7	29.4
1986	153	26.1	21.5
1988	156	38.8	22.0
1990	153	12.6	6.9
Mean		31.9	19.3

Table 12. Paddlefish catch per unit effort for drifted gill nets, 1993.

Date	Drift Time (Hours)	Number of Paddlefish Caught	Paddlefish Caught per Hour
		Intake to Cottonwood Creek (RM 71.1 to 64.6)	
5/13	0.17	9	54.0
5/27	1.12	30	26.9
5/28	1.14	21	15.0
6/ 1	0.95	8	8.4
6/ 8	3.75	1	0.3
6/14	1.50	11	7.3
6/15	1.67	10	6.0
6/16	1.25	18	14.4
6/17	2.25	29	12.9
6/21	1.67	9	7.7
6/22	1.50	25	16.7
6/24	0.75	11	14.7
Total/Mean	17.47	182	10.4
		Near Sidney (RM 31.5 to 20.0)	
[illegible]24	1.03	7	6.8
5/25	2.35	2	0.9
6/3	1.67	0	0.0
Total/Mean	5.05	9	1.8
		Near Powder River (RM 149.5 to 142.0)	
6/ 9	2.00	0	0.0