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

STATE: Montana

PROJECT: F-46-R-4

JOB NO.: III-C

PROJECT TITLE: Statewide Fisheries Investigations

STUDY TITLE: Survey and Inventory of Warm Water Streams

JOB TITLE: Yellowstone River Paddlefish Investigations

PROJECT PERIOD: July 1, 1990 through June 30, 1991

REPORT PERIOD: April 1, 1990 through March 31, 1991

ABSTRACT

The Intake paddlefish harvest in 1990 was estimated at 2,046 fish. Average angler success rate was very low. Paddlefish tag sales dropped somewhat from 1989 to 1990. Female paddlefish made up 65.4% of the harvest in 1990. Average length and weight of paddlefish caught at Intake is remaining constant, but percentages of small paddlefish of both sexes at Intake in 1990 were high. Angler annual exploitation rate of the Garrison Reservoir paddlefish population is probably near 10%. Spawning paddlefish were noted from the angler catch at Intake and at downstream points from drifted gill nets in 1990. The commercial caviar operation at Intake collected roe from 974 paddlefish and had gross income of $108,622.

OBJECTIVES AND DEGREE OF ATTAINMENT

1. Prevent overharvest of the paddlefish population during the spawning migration, limit harvest to 5,000 or fewer fish most years at Intake. This objective was met. Harvest in 1990 was an estimated 2,046 fish.

2. Determine acceptable angler harvest. Progress was made toward this objective in 1990. Data is presented in Table 6 on angler exploitation rates of paddlefish.

3. Locate and preserve paddlefish spawning habitat. Progress was made toward this objective in 1990 by locating spawning fish. This is discussed in the RESULTS AND DISCUSSION section.

(State funded)

PROCEDURES

A partial creel census was conducted during the paddlefish season at Intake in 1990. As many anglers as possible were interviewed. The interviews total in 1990 was 868 which amounted to 30% of the estimated total angler days. The season was divided into four sampling periods and calculations for angler hours, harvest and

success rate were made for each period. Anglers were counted from May 15 (opening day of paddlefish season) through July 8 when paddlefishing had all but ceased. Angler counts were made at 8 randomly chosen times each day between the hours of 6:00 A.M. and 9:00 P.M. A 24 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 creel census. Calculations were made by computer.

Angler caught paddlefish were weighed to the nearest pound. Eye to fork length was measured to the nearest millimeter. Sex was determined by internal examination of the gonad.

Paddlefish were located in the Yellowstone River with boat mounted electrofishing gear. Approximately 10 amps were used to bring paddlefish to the surface where they could be observed. Power was turned off briefly when a fish approached close enough to the positive electrode to possibly cause immobilization. Location of paddlefish was noted on maps.

Drifted gill nets were used to sample paddlefish to observe spawning condition from one mile downstream of Intake (River Mile 70) to Shadwell Creek (River Mile 45). These nets were 100 to 150 feet long and 6 or 8 feet deep with 5 inch square mesh. Spawning condition was noted as ripe or green. Fish that ran eggs or milt with only handling or gentle abdominal pressure were considered ripe. Spent females from the angler catch were observed when fish were cleaned.

RESULTS AND DISCUSSION

General Observations

1990 was the first year of operation for a new program at Intake. The 1989 Legislature set in place the limited commercialization of paddlefish roe. Legislation required the Department to select one non-profit corporation to accept angler donated roe and market the roe as caviar. Profits were to be split between the Department and an advisory committee who would then fund historical, cultural, recreational and fish and wildlife projects. The Department's half of the money was to be used to benefit the paddlefish fishery. The non-profit corporation selected was the Glendive Chamber of Commerce and Agriculture. They encouraged anglers to donate roe by offering free paddlefish cleaning.

Considering the season as a whole, paddlefishing at Intake in 1990 was poor. The river was very slow to rise in May and very few fish were caught at Intake until May 28. Fishing was good for only brief periods. The Yellowstone river peaked four times during the paddlefish season: May 29 (16,400 cfs), June 4(24,400 cfs) June 15(33,900 cfs) and June 28 (36,600 cfs) (unpublished data, USGS). Streamflows for both May and June were well below average. The

average flow for May was 11,650 cfs and 24,750 cfs for June. Because of the poor regular season fishing and because of a late peak in flows on the Yellowstone River, the Commission extended the season closing from June 30 to July 10. The last paddlefish caught at Intake was taken on July 5. Creel census was ended on July 8.

Total paddlefish tag sales dropped for the first time since 1987 (Table 1). About 500 fewer anglers bought tags in 1990 than in 1989. Almost all of the decrease was in resident tag sales. Non-residents purchased 30% of the tags 1990. This was the highest non-resident percentage since we began recording non-resident sales separately in 1986.

Paddlefish Size and Sex Ratio

A total of 1,493 paddlefish were weighed, measured and sexed from the 1990 angler catch at Intake (Table 2). This number was 73% of the estimated Intake paddlefish harvest. Average length and weight of all fish harvested was 1073 mm and 45.6 pounds. Females made up 65.4% of the angler harvest (Table 2). For the past 16 years female percentage of the harvest has been mostly between 60 and 80%.

Table 3 shows average length and weight by sex of paddlefish from the Intake angler harvest. In 1990 males averaged 922 mm and 23.8 pounds. Corresponding figures for females were 1153 mm and 57.1 pounds. The mean figures for both sexes have remained quite constant over the past ten years. The same is true for females, although the average length and weight in 1990 are the highest recorded in the past 10 years.

Small fish in the angler catch at Intake are of particular interest because their presence at Intake indicates a continuing recruitment of young paddlefish to the spawning population . Table 4 shows numbers and percentage of two size classes of small fish for each sex at Intake for the past 10 years. Past aging of paddlefish from Intake has indicated that a significant percentage of small paddlefish are young fish. Percentages of fish in the weight categories indicated in Table 4 have fluctuated within a rather narrow range, suggesting a continuous recruitment of young paddlefish to the spawning population. In 1990 small paddlefish of both sexes were more abundant in the angler catch than in most previous years. This is particularly evident when the four size groups are summed.

Tag Return and Exploitation Rate

Individually numbered plastic poultry bands placed around the dentary bone have been used to study paddlefish movements since 1964. More recently, return of tagged paddlefish has been used to infer angler exploitation rate of paddlefish.

Of the 5,960 paddlefish tagged at Intake and at downstream points in the Yellowstone River since 1964, at least 1,339 (22.5%) have been harvested by anglers (Table 5). Because Department personnel are present at Intake almost continuously during the paddlefish season, it is thought that most tags on angler caught fish are returned. For paddlefish tagged at Intake, but caught by anglers in North Dakota, many tags are probably not returned. In 1990, 50 tags were returned from paddlefish tagged in the Yellowstone River. Of these, 21 were returned from fish tagged in 1984. Two tags were returned from fish tagged in 1974. Seven tags were returned at Intake from fish tagged in the Missouri River.

Of the 50 tags returned from Intake tagged fish most were returned from fish caught at Intake, but five tags were returned from fish caught in North Dakota near the Missouri-Yellowstone confluence.

Exploitation rates are most reliably calculated from fish tagged in recent years because of compounding underestimation from non-angling mortality and angler failure to return tags. Exploitation rates are shown in Table 6 for paddlefish tagged in 1984, 1986, 1988 and 1990. For the four groups, calculated average annual exploitation rates range from 3.8 to 7.5 %. These calculated rates are known to be low, but the degree of underestimation is unknown. True exploitation rates could easily be as much as 10%. Paddlefish literatures (Pasch and Alexander 1986) would suggest that even 10% is not excessive. Whatever the present true rate of exploitation, the lack of decrease in size of paddlefish at Intake suggests the rate is not excessive.

Creel Census

Results from the 1990 creel census at Intake are shown in Table 7. Results for 1990 are compared with previous years in Table 8. Creel census results in 1990 showed anglers spent 2,877 days or 12,657 hours paddlefishing to catch 2,046 fish. The average angler day was 4.4 hours. Anglers caught on the average 0.15 fish per hour or 0.65 fish per day. Some anglers boat downstream from Intake, especially when paddlefishing is not good at Intake. Guide service is also available at Intake for downstream points. Of the 1,493 paddlefish weighed and measured at Intake, 170 or 11.4% were caught at points downstream of the Intake Fishing Access Site.

Overall, paddlefishing at Intake was poor in 1990. Of the 17 years in which creel census has been done for paddlefish at Intake, fish caught per angler day was lower only in 1985. Pressure (angler days) in 1990 was the highest since 1984, but well below fishing pressure of the 1970's and early 1980's.

The added 10 days on the 1990 paddlefishing season added very little to the total season fishing pressure and harvest. For the first 8 days of July pressure was only 120 angler days with an estimated harvest of 66 paddlefish (Table 7).

Paddlefish Migration and Spawning

Yellowstone River flows were again too low to allow movement of paddlefish upstream of Intake. Two days were spent electrofishing for paddlefish upstream of Intake on July 2, and 3, 1990, after the river had reached its highest peak of the season on June 28. No paddlefish were observed electrofishing from Glendive to Intake on July 2 (18.2 river miles), or from the Calypso Bridge to the Fallon Bridge (18.5 river miles) on July 3.

Significant paddlefish spawning occurred in the Intake area. In the angler catch 19 ripe males (flowing milt) were noted over the period June 4 through July 1. Six of these fish were observed on June 14. An additional four ripe females (flowing eggs) were seen over the period June 5 to June 20. Twenty-seven spent females were noted during cleaning at Intake over the period May 30 through June 26. Of the spent female paddlefish 6 each day were seen on June 18 and 19.

Gill nets drifted to sample paddlefish downstream of Intake also found evidence of paddlefish spawning. These nets were fished from one mile downstream of Intake (river mile 70) to Shadwell Creek (river mile 45), a distance of 25 river miles, from June 4 through June 27, 1990. A total of 124 paddlefish were captured in drifted gill nets. Three ripe (flowing eggs) female paddlefish were collected. Specifics for three fish are as follows:

Date sampled	Location	River Mile	Weight
6-5-90	Island channel above Savage - near cable car	56	60 pounds
6-19-90	5 miles below Intake	66	80 pounds
6-20-90	1/2 mile above Burns Cr.	61	63 pounds

Twenty-nine ripe males were also sampled. The remainder of fish sampled in gill nets were green or could not be sexed.

Paddlefish were also located in the Yellowstone River using boat-mounted electrofishing gear. This was done largely for finding locations to drift gill nets for spawning paddlefish. Locations of paddlefish observed are given in Table 9.

Paddlefish Caviar Activities

For a first time activity, this operation proceeded quite smoothly during the 1990 paddlefish season. The only significant point of contention between the Department and the Glendive Chamber of Commerce concerned the definition of the Intake Fishing Access Site. House bill 289 (1989), authorizing the sale of paddlefish roe allowed donation of paddlefish roe to the non-profit corporation from fish caught "at the Intake fishing access site." The Department interpreted this language to mean only the

approximately one half mile of Yellowstone River immediately downstream of the Intake Diversion Dam. The Chamber disagreed, claiming the legislature's intent was to allow donation of roe from fish caught at points further downstream. The Chamber agreed, for the 1990 season, to accept the Department's interpretation and not retain roe from fish caught at the downstream points.

To encourage roe donation, the Chamber offered free paddlefish cleaning (both sexes) at Intake. They cleaned 1,690 fish of which 1,065 were females. They collected eggs from 974 fish. These fish had a total ovary weight of 9,723 pounds. This produced 3,608 pounds of #1 grade caviar which sold for $30 per pound and produced a gross income of $108,240. Also 765 pounds of #3 caviar was produced. This was sold for $382.50.

The Chamber cleaned 100 female paddlefish caught at downstream points and discarded the roe. Only 16 anglers failed to donate roe from the fish they caught. Fifty-eight anglers cleaned their own fish and then donated the roe to the Chamber. Roe collected in late June and early July was quite soft and of inferior quality for producing caviar.

Paddlefish Roe Pesticide Analysis

On June 2, 1990 samples of eggs were collected from ovaries of 10 paddlefish caught at Intake. These samples were analyzed for a panel of chlorinated hydrocarbon pesticides. Analysis for most compounds gave very low values, mostly below detection limits of the analytical technique.

LITERATURE CITED

Pasch, R. W. and C. M. Alexander. 1986. Effects of Commercial fishing on paddlefish populations. IN: The paddlefish: status, management and propagation. Dillard, J.G., L.K. Graham and T. R. Russell. Eds. North Central Division American Fish. Soc. Spec. Pub. #7

Spence, L. 1970. Georgetown Lake winter creel census. Job. Prog. Rept. F-12-R-16, Job I-b. Mont. Dept. Fish, and Game, 29 pp.

Prepared by: Phillip A. Stewart

Date Prepared: March 1, 1991

Waters Referred to:
Yellowstone River Section 1 21-1350-02

Key Words:
Angler success rate
Fishing Pressure
Creel census
Paddlefish exploitation rate
Paddlefish migration and passage
Paddlefish sex ratio
Paddlefish spawning
Paddlefish tagging

Table 1. Number of anglers purchasing paddlefish tags (tags were free in 1981).

Year	Total	Resident	Nonresident	% Nonresident
1990	3745	2625	1120	30
1989	4243	3070	1173	28
1988	3374	2471	903	27
1987	2877	2182	695	24
1986	3696	2661	1035	28
1985	3593			
1984	5063			
1983	4636			
1982	4834			
1981	4166			

Table 2. Summary of paddlefish measurements obtained from the angler catch at Intake, Yellowstone River, 1963-1990.

		Average			
Year	Number of fish Measured	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

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

Table 3. Summary of paddlefish length and weight, by sex, obtained from the angler catch at Intake, Yellowstone River, 1963-1990.

	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

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

	Males		Females		Total	Sum of Four Size
Year	<10 lbs.	10-15 lbs.	<25 lbs.	25-30 lbs.	Weighed	Groups
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(.40)	2004	48(2.4)
1981	2(.08)	40(1.6)	6(.24)	23(.91)	2528	71(2.8)

Table 5. Summary of paddlefish tagging at Intake and tag returns 1964-1990.

Year	Number Tagged	Number Returned In 1990	Total Number Returned	Percentage Returned
1964	958	0	126	13.2
1965	283	0	56	19.8
1966	14	0	4	28.6
1967	60	0	7	11.7
1968	28	0	3	10.7
1969	163	0	28	17.2
1970	197	0	53	26.9
1971	396	0	89	22.5
1972	385	0	76	19.7
1973	455	0	93	20.4
1974	561	2	182	32.4
1975	161	0	35	21.7
1976	194	3	69	35.6
1977	341	1	82	24.0
1978	607	2	136	22.6
1979	129	3	29	22.5
1980	13	0	2	15.4
1984	551	21	203	36.8
1985	2	0	0	0.0
1986	153	4	27	17.6
1988	156	8	33	21.1
1990	153 [1]	6	6	3.9
Totals	5960	50	1339	22.5

[1] Some of this total tagged between Intake and Crittenden Island.

Table 6. Annual angler exploitation rates of Garrison Reservoir paddlefish as indicated by tag returns for fish tagged in 1984, 1986, 1988 and 1990.

Year Tagged	Number of Fish	Number (%)[1] Returned In: 1984	1985	1986	1987	1988	1989	1990	Average Annual
1984	551	73(13.2)	2(0.4)	33(6.9)	42(9.5)	13(3.2)	19(4.9)	21(5.7)	6.3
1986	153			9(5.9)	0(0.0)	7(4.9)	7(5.1)	4(3.1)	3.8
1988	156					22(14.1)	3(2.2)	8(6.1)	7.5
1990	153							6(3.9)	3.9

[1] Percentage = $\frac{\text{number caught that year}}{\text{number tagged - number caught in previous years}}$

Table 7. Estimate of anglers, hours fished and harvest for the 1990 paddlefish season at Intake.

Time Period	No. of Angler Days	Hours/ Angler Day	Angler Hours	No. of Fish Caught	Fish Caught/ Angler Hr.	Fish Caught Per Angler Day
5-15 - 5-31	628	4.75	2982	159	0.05	0.25
6-01 - 6-15	1324	4.54	6009	1058	0.18	0.80
6-16 - 6-30	836	3.83	3201	762	0.24	0.91
7-01 - 7-08	120	3.86	465	66	0.14	0.55
Total/Mean	2,877	4.40	12,657	2046	0.15	0.65

Table 8. Comparison of paddlefish fishing pressure and harvest data at Intake from 1972 to 1990.

Year	Angler Days	Fish Caught	Fish Kept	Fish/ Angler Day	Total Weight Harvested(Pounds)
1972	2118	2935	1805	1.39	61,370
1973	2449	4670	2675	1.91	88,543
1974	3363	4359	2182	1.30	77,680
1975	2784	2950	1473	1.06	77,038
1977	3524	2764	1410	0.78	67,962
1978	6130	4812	2887	0.78	124,141
1979	2904	2202	1727	0.76	87,041
1981	3982	5318	5318	1.34	248,251
1982	3535	4713	4713	1.33	212,556
1983	3142	3193	3193	0.92	160,289
1984	3978	3860	3860	0.98	169,840
1985	1745	550	550	0.34	25,960
1986	2521	1791	1791	0.73	78,267
1987	2386	2612	2612	1.13	129,816
1988	2320	2923	2923	1.25	127,151
1989	2208	2242	2242	1.00	105,374
1990	2877	2046	2046	0.65	93,298

Table 9. Number of Paddlefish counted in two mile intervals during electrofishing in 1990 on the lower Yellowstone River.

River Mile	5-30, 31	6-18	6-28, 29
71-70 (Intake			3
69-68			18
67-66			6
65-64			0
63-62			0
61-60	2	5	3
59-58	1	0	0
57-56	4	3	0
55-54	1	1	0
53-52 (Elk Island)	6	0	0
51-50	1	1	1
49-48	0		0
47-46	1		0
45-44	3		2
43-42	0		0
41-40 (7 Sisters)	12		5
39-38	2		
37-36	7		
35-34	1		
33-32	4		
31-30	8		
29-28	3		
27-26	3		
25-24	5		
23-22	3		
21-20	0		
19-18	2		
17-16	7		
15- (ND Border)	4		