Region 7
F-113-R-1
3740

Montana Department of Fish, Wildlife and Parks
Fisheries Division

Job Progress Report

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ABSTRACT

Low Yellowstone River flows in 2000 produced a relatively low paddlefish harvest and catch rate. Tag sales were down in 2000 from 1999, which was a near record year. The trend of a low female percentage in the harvest that began in 1993 continued through 1998 but showed a dramatic increase in 1999 and 2000. Average male and female size have remained static in recent years. Data suggests that maturing females began entering the fishery in 1999. Relative exploitation of the paddlefish population was higher from 1995 through 1997 after a decrease in the early 1990,s. Exploitation rates have been lower the last three years. Exploitation rates for the sexes was similar from 1995 through 1998, but heavier female exploitation occurred in 1999 and 2000.

PROCEDURES

A partial creel census was conducted during the paddlefish season at Intake in 2000. As many anglers as possible were questioned concerning amount of time spent fishing and number of fish caught. The interview total for periods requiring retention of fish was 465 or 29.1% of the estimated angler days in 2000. Anglers were counted each day of the season during daylight hours. On days with no catch and release, eight counts were made. On catch and release days, three counts were made on the catch and release portion of the day and eight counts were made on the remaining portion of the day. A 24 hour fishing day was used in calculations to estimate fishing pressure on days with no catch and release. An 18 hour day was used on catch and release days (6 hours per day of catch and release fishing. Analysis of the data was accomplished by adapting formulas 5 through 32 from Spence (1970) to the census.

Catch and release statistics were estimated by counting of fish caught and by three angler counts made during each 6-hour catch and release day.

Angler caught and kept paddlefish were weighed to the nearest pound. Body length (front of eye to fork of caudal fin) was measured to the nearest millimeter. Sex was determined by examination of the gonad for fish kept by anglers. For fish released sex was assigned on the basis of length and shape. Angler released fish were not weighed. Most of the released paddlefish were jaw tagged. Monel metal bands (National Band and Tag Co.) were placed around the dentary bone.

RESULTS

General Observations

Yellowstone River flows in 2000 peaked on May 31 and June10 at approximately 30,000 c.f.s. Most of the paddlefish harvested at Intake were caught during a three week period (last week of May and the first two weeks of June) surrounding these peak flows. By way of comparison, the long term, mean daily flow for the Yellowstone River at Miles City is 35,340 c.f.s. for the month of June (USGS, 2000). The low flows in 2000 resulted in a relatively low harvest .

Paddlefish tag sales were down about 12 percent in 2000 from the near record sales of 1999 (Table 1). Years with low river flows result in fewer paddlefish at Intake and consequently less interest in fishing there. Some anglers ether do not fish for paddlefish during low flow years or may bypass Intake to fish at the Confluence area in North Dakota where fishing is usually better when flows are low in the Yellowstone River. The non-resident portion of tag sales has remained fairly constant in recent years.

Catch and release fishing remains popular during those periods when paddlefish are present at Intake.

Paddlefish Size and Sex Ratio

A total of 541 paddlefish were weighted, measured and sexed from the angler catch at Intake in 2000 (Table 2). This total included 87 fish (16.1%) caught at downstream locations and was 81.2% of the estimated catch.

Females made up 55.3% of the total fish weighed and measured for length in 2000 (Table 2). This is an increase over the prior five years but is short of the heavily dominated female harvests of the 1970s and 80s.

Male and female paddlefish show no trend in size (Table 3). Average female size has held steady since 1991 and is remaining at a level above what was found in the 1980's and 1970's. Male paddlefish size has fluctuated in a narrow range with average lengths in 1995 and 1996 being somewhat smaller.

Creel Census

Results from the 2000 creel census are shown in Table 4. Results from 2000 can be compared to previous years in Table 5. In 2000 at Intake, anglers fished an estimated 1599 days with an average of 2.81 hours per day to catch an estimated 666 paddlefish. Effort to catch a paddlefish in 2000 was similar to that required in 1998, another low water year, and was considerably greater than in 1999, a good water year.

The calculated harvest at Intake in 2000 may be higher than actually occurred. In 2000, 541 paddlefish were actually weighed and measured. This number is 81.2% of the estimated harvest. It seems unlikely that 19% of the Intake catch missed going through the cleaning station to take advantage of the free cleaning service. If the Intake harvest is somewhat of an overestimate it is likely caused from using daytime counts to estimate night time fishing pressure when less night time fishing actually occurs. The discrepancy in the estimated harvest and the fish logged through the cleaning station has been near 20 % for a number of years.

The angler catch rate in 2000 (0.15 fish per hour) was similar to that in 1998,1997 and 1996 (Table 5). The percentage of females harvested has increased over the last four years (Table 2). This trend is indicative of maturing females entering the migration after seeing the younger maturing males enter the fishery some years earlier.

Tagging, Tag Return and Exploitation Rate

Return rates of individually numbered plastic and monel metal bands placed around the dentary bone are used to infer exploitation rate. Of 7,659 paddlefish tagged in the Yellowstone River (mostly near Intake) at least 1,960 (25.6%) have been harvested by anglers (Table 6).

In 2000, 56 tags from angler harvested fish were recovered from paddlefish tagged in the Yellowstone River. Of these, 20 were caught in North Dakota, and the remainder from Intake or within a few miles downstream. Also, of the 56 returned tags, four were tagged in 2000. An additional eighteen tags recovered at Intake were from paddlefish tagged in North Dakota.

Table 7 summarizes tag return rates for multi-year periods. Tag returns in 2000 reinforce the past conclusion of lighter exploitation in the 1960's and 1970's, heavier in the 1980's and lighter in the 1990's.

Tables 6 and 8 indicate heavier exploitation for paddlefish tagged in 1995 through 1997. To date exploitation for fish tagged in 1994 averages 4.5% per year. However, for fish tagged in 1995, 1996 and 1997 the corresponding figures are 6.8, 9.3 and 9.5 percent. Also, for fish tagged in 1997, the first year return of tags was 24.3%, the highest ever measured. Subsequent year tag returns for 1997 have been much lower. First year tag returns for 1998 and 1999 were a more reasonable 2.1% and 12.8%, respectively. First year tag returns for paddlefish tagged in 2000 is 20%, but few (20) fish were tagged in 2000. The apparent decrease in the last three years exploitation rate may be at least partially caused by an increase in the size of the population migrating to Intake, do to maturing female paddlefish entering the fishery.

Table 9 shows angler exploitation of paddlefish for five years after tagging. Exploitation of 1995 tagged paddlefish shows a dramatic increase over what was seen in the early 1990's. 1995 was a year in which more male paddlefish were tagged than females (257 males vs 185 females) Table10. Since male paddlefish appear to enter the run on a more regular basis than female paddlefish they may be exposed to greater angler exploitation over a short period of time.

Table 10 compares tag return rate by sex for fish tagged in the years 1977 through 2000. The heavier harvest rate for females in the earlier years is not apparent for the years 1995 through 1998 where return rates for the sexes are similar. The tag return rate by sex in 1999 and 2000 indicates a heavier harvest of female paddlefish which may be indicative of maturing females entering the fishery.

Paddlefish Caviar

The Glendive Chamber paddlefish caviar program is summarized in Table 11. On average, 3,513 pounds of caviar are sold for 138,488 dollars each year.

LITERATURE CITED

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Paddlefish sex ratio

Table 1. Number of anglers purchasing paddlefish tags.

Year	Total	Resident	Nonresident	% Nonresident
2000	5952	4780	1172	20
1999	6785	5522	1263	19
1998	6051	5004	1047	17
1997	6169	4930	1239	20
1996	6787	5495	1292	19
1995	6544	5495	1049	16
1994	4065	3237	828	20
1993	5577	4194	1383	25
1992	4779	3503	1276	27
1991	4438	3021	1417	32
1990	3960	2826	1134	29
1989	4255	3081	1174	28
1988	3526	2620	906	26
1987	2877	2182	695	24
1986	3696	2661	1035	28
1985	3593			
1984	5063			
1983	4636			
1982	4834			
1981	4166			

Notes: Tags were free in 1981.
Resident and nonresident tag sales were calculated separately beginning in 1986.
Previous to 1992 tags were required only for Yellowstone River paddlefish snagging.
Beginning in 1992 tags were required statewide.
2000 numbers are preliminary (approximately 95%).

Table 2. Summary of Paddlefish measurements obtained from the angler catch at Intake, Yellowstone River, 1963-2000.

Year	No. of fish Measured	Average Total Length (Inches)	Average Eye-fork Length (mm)	Average Weight (Pounds)	Percentage of Females
1963	46	43.4		29.6	0.0
1964	920	48.8		21.0	2.8
1965	453	50.6		21.3	2.9
1966	28	49.2		21.2	0.0
1967	123	50.9		21.8	0.0
1968	149	52.6		25.0	4.3
1969	499	51.9		23.4	3.7
1970	700	52		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		50.4	67.5
1980		58.3*		49.1**	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
1994	309		1070	47.4	62.8
1995	1448		1003	39.1	43.6
1996	1120		1002	40.1	42.1
1997	797		1007	38.2	38.7
1998	580		1046	41.0	47.9
1999	1345		1049	43.0	54.0
2000	541		1053	44.4	55.3

* Based on 62 measurements.

** Based 0n 131 measurements.

Table 3. Summary of paddlefish average length and weight, by sex, obtained from the angler catch at Intake, Yellowstone River, 1963-2000.

	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	117	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
1994	115	914	25.9	194	1163	60.1
1995	815	889	23.5	631	1151	59.2
1996	649	882	24.0	471	1168	62.3
1997	488	912	24.8	309	1158	59.5
1998	300	933	24.0	278	1173	59.5
1999	619	926	24.9	726	1154	58.5
2000	242	919	25.2	299	1161	60.0

Table 4. Estimate of anglers, hours fished and harvest for the 2000 paddlefish season at Intake.

Time Period	Number of Angler Days	Hours per Angler Day	Angler Hours	Number of Fish Caught	Fish Caught per Angler Hour	Fish Caught per Angler Day
			2000			
			Periods Requiring Angler Retention of Fish			
Wed. & Sun.	567	1.97	1118	281	0.25	0.50
Other Days	1032	3.27	3378	385	0.11	0.37
Total or Mean	1599	2.81	4496	666	0.15	0.42
			Periods Requiring Anglers to Release Fish			
			260	26	0.10	

Table 5. Comparison of paddlefish fishing pressure, harvest and success rate data at Intake from 1972 to 2000.

Year	Angler Days	Fish Caught	Fish Kept	Fish per Angler Day	Fish per 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	0.27	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	204	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
1994	1037	278	278	0.27	0.08	13,177
1995	2098*	2008	1657*	0.81*	0.39*	64,789*
1996	2062*	1328	1199*	0.58*	0.19*	48,080*
1997	2217*	1149	1075*	0.48*	0.17*	41,065*
1998	1766*	857	717*	0.41*	0.16*	29,397*
1999	2608*	2091	1706*	0.65*	0.28*	73,358*
2000	1599*	692	666*	0.42*	0.15*	29,570*

* Does not include catch and release periods.

Table 6. Summary of paddlefish tagging and tag returns 1964-2000.

Year	Number Tagged	Number Returned in 1999	Number Returned In 2000	Total Number Returned	Percentage Returned
1964-1970	1703	0	0	279	16.4
1971-1980	3242	2	0	807	24.9
1984	551	0	1	246	44.6
1985	2	0	0	2	100.0
1986	153	0	0	47	30.1
1988	156	1	0	65	41.7
1989	10	0	1	4	40.0
1990	153	1	5	49	32.0
1991	20	0	1	8	40.0
1992	221	4	5	74	33.5
1993	268	8	3	45	16.8
1994	180	10	9	50	27.8
1995	442	23	9	154	34.8
1996	139	14	5	54	38.8
1997	70	5	2	24	34.3
1998	48	0	5	6	12.5
1999	281	36	6	42	14.9
2000	20		4	4	20.0
Totals	7659	104	56	1960	25.6

Note: Most fish tagged at Intake or within a few miles downstream of Intake.

Table 7. Tag return rate averages for multi-year periods.

Period Tagged	Number Tagged	Number Returned through 2000	Percentage Returned
1964-1970	1703	279	16.4
1971-1980	3242	807	24.9
1981-1990	1025	413	40.3
1991-1995	1131	331	29.3
1996-2000	558	130	23.3

Table 8. Annual angler exploitation rates in percent for Yellowstone - Sakakawea paddlefish as indicated by returns of angler caught fish.

	Year tagged and (number of fish tagged).											
	1994 (180)		1995 (442)		1996 (139)		1997 (70)		1998 (48)		1999 (281)	
	Tag Returns		Tag Returns		Tag Returns		Tag Returns		Tag Returns		Tag Returns	
Year	%*	#	%*	#	%*	#	%*	#	%*	#	%*	#
1994	6.1	11										
1995	1.2	2	15.4	68								
1996	5.4	9	1.9	7	14.4	20						
1997	1.3	2	7.1	26	3.4	4	24.3	17				
1998	4.5	7	6.2	21	9.6	11	0.0	0	2.1	1		
1999	6.7	10	7.3	23	13.5	14	9.4	5	0.0	0	12.8	36
2000	6.5	9	3	9	5.6	5	4.2	2	10.6	5	2.0	5
Mean Annual Percentage	4.5		6.8		9.3		9.5		4.2		7.4	

* Percentage = $\frac{\text{Current Year tag reurns x 100}}{\text{\# tagged - \# of previous years tag returns}}$

Table 9. Average annual angler exploitation rates of paddlefish for five years following tagging.

Year tagged	Number fish tagged	Average exploitation rate (%)
1984	551	6.35
1986	153	4.18
1988	156	6.25
1990	153	4.33
1992	221	4.80
1994	180	4.27
1995	442	6.82

Table 10. Comparison of male and female tag return rates.

Year Tagged	Number Tagged		Number Returned		Percentage Returned	
	Female	Male	Female	Male	Female	Male
1977	123	223	44	43	35.8	19.3
1978	158	451	53	76	33.5	16.9
1984	313	238	155	75	50.0	31.5
1986	88	65	29	16	33.0	24.7
1988	98	59	47	18	48.0	30.5
1990	77	77	26	9	33.8	11.7
1992	108	110	35	36	32.4	32.8
1993	63	204	11	33	17.5	16.2
1994	109	74	35	13	32.1	17.6
1995	185	257	66	87	35.7	33.9
1996	47	92	18	35	38.3	38.0
1997	26	44	7	17	26.9	38.6
1998	12	36	0	7	0	19.4
1999	127	154	22	19	17.3	12.3
2000	11	9	3	1	27.3	11.1

Table 11. Glendive Chamber of Commerce and Agriculture caviar production and income summary.

Year	Pounds of Caviar	Number of Paddlefish	Income (gross)	Income (net)	Administration Expenses	FWP Share (dollars)	(percent)
1990	4,000	1,600	110,000	68,452	41,548	34,226	50
1991	10,000	3,000	292,000	232,428	59,572	116,214	50
1992	2,200	781	63,000	36,634	26,366	18,317	50
1993	3,592	1,933	68,810	39,667	29,143	19,833	50
1994	1,166	355	48,137	20,114	33,770	15,036*	40
1995	4,162	1,462	240,056	173,701	66,355	69,481	40
1996	3,090	1,145	231,910	177,839	76,381	71,136	40
1997	1,211	797	118,377	58,756	47,009	23,502	40
1998	2,016	553	45,767	13,892	31,875	5,557	40
1999	3,691	1,333	166,831	72,425	94,405	28,970	40
Totals	**35,128**	**12,959**	**1,384,888**	**893,908**	**506,424**	**387,236**	
Averages	**3,513**	**1,296**	**138,489**	**89,391**	**50,642**	**43,026**	

* Includes prior year revenue of $9,290 as a result of underpayment from the program audit of 1994.