Montana Department of Fish, Wildlife and Parks
Fisheries Division

Job Progress Report

STATE: Montana **PROJECT: Statewide Fisheries Management**

JOB TITLE: Yellowstone River Paddlefish Investigations-3740

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ABSTRACT

The paddlefish harvest cap shared by North Dakota and Montana was 1,000 fish in 2005. The lower Yellowstone River flows were near or above 20,000 c.f.s. for the entire paddlefish season. Paddlefish were present at Intake from the start of the season until the end. The harvest of paddlefish was closed May 24 with an estimated 1,323 fish harvested. The remainder of the season was left open to catch-and-release fishing and 1,322 paddlefish were tagged with jaw tags. Statewide paddlefish tag sales were down 4.7 percent in 2005 from that of the previous year. Young male paddlefish dominated the harvest in 2005. The average size of both male and female paddlefish in 2005 was less than in 2004.

PROCEDURES

A partial creel census was conducted during the paddlefish season at Intake in 2005. 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 558 or 39.7% of the estimated angler days in 2005. 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 number 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 inch. Sex was determined by examination of the gonads of harvested fish. 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., Size 16, ½ inch inside diameter) were placed around the dentary bone.

A statewide paddlefish telephone creel was conducted in 2005 to obtain harvest numbers for the paddlefish population above Fort Peck Reservoir as well as the Yellowstone River/Lake Sakakawea population. The creel was design to gather information on the harvest of paddlefish by different river sections thereby giving an estimate of harvest at sites not covered by the Intake Creel (Riggs, 2005).

RESULTS

General Observations

The Montana-North Dakota Paddlefish Management Plan (Scarnecchia, et al. 1995), establishes the goals and objectives guiding the management of the Yellowstone River/Lake Sakakawea paddlefish population. This plan is currently being updated. A 3,000 fish per year harvest cap was established in 1995 to slow the harvest of this late maturing , long lived species. Montana and North Dakota were each allowed to harvest 1,500 paddlefish per year. Beginning in 2003, the harvest cap was reduced to 2,000 paddlefish (1,000 paddlefish per state). This reduction was necessary to bring harvest in line with recruitment and has its basis in the paddlefish stock index developed by Dr. Dennis Scarnecchia as outlined in objectives 1 and 2 of the management plan. Dr. Scarnecchia discusses the method of obtaining the model outputs in a letter attached as Appendix A. In Montana, when the observed harvest approaches the harvest cap, the Fish, Wildlife and Parks Commission can close the paddlefish season early.

The 2005 paddlefish season began with Yellowstone River flows above 25,000 c.f.s. (Figure 1). By way of comparison, the long term, mean daily flow for the Yellowstone River at Sidney is 38,840 c.f.s. for the month of June (USGS, 2002). While the June, 2005 flows in the Yellowstone were not huge, they were consistently above 20,000 c.f.s and paddlefish were present at the Intake Fishing Access Site from the start of the season until the end.

The first four days of the 2005 paddlefish season saw approximately 200 paddlefish harvested. Over the course of the next six days, an additional 1,100 paddlefish were harvested. Notice was given on May 22 that in 48 hours the harvest season was going to close. By the time the closure took affect on May 24 at 5:00 p.m.; the harvest cap (1,000 fish) had been exceeded by over 300 fish.

The criteria for closing the season to harvest of paddlefish is to give public notice that the season will close in 48 hours when the number of paddlefish harvested at the Intake Fishing Access Site reaches 800 fish.

Paddlefish tag sales were down 4.7 percent in 2005 from tag sales in 2004 (Table 1). The non-resident portion of tag sales has been trending down in recent years. In 2005, non-residents purchased 12 percent of paddlefish tags sold which is the lowest since resident and non-resident tag sales have been recorded separately.

Catch and release fishing remains popular during those periods when paddlefish are present at Intake. When the harvest season was closed on May 24, catch and release fishing remained open until June 30, 2005. During catch-and-release angling efforts Department personnel placed jaw tags on 1330 paddlefish.

Paddlefish Size and Sex Ratio

A total of 1051 paddlefish were checked by creel clerks, from the angler catch, at Intake in 2005 (Table 2). Of these, a complete record of length, weight and sex was recorded for 1040.

Females made up 26.8% of the total fish weighed and measured for length in 2005 (Table 2). This is a substantial decrease from 2004 and is the lowest female harvest since 1970. Many young male paddlefish have recruited to the adult population and were dominate in the 2005 harvest.

The average size of male and female paddlefish in 2005 was less than that observed in 2004 (Table 3).

Creel Census

Results from the 2005 Intake creel census are shown in Table 4. Results from 2005 can be compared to previous years in Table 5. In 2005 at Intake, anglers fished an estimated 1406 days with an average of 0.85 hours per day to catch an estimated 1323 paddlefish. Much greater effort was required to catch a paddlefish in 2004 when 2.22 angler hours per day were required and only 205 fish were harvested. The angler catch rate in 2005 (1.11 fish per hour) was the highest ever seen for the Intake paddlefish fishery (Table 5).

The calculated harvest at Intake in 2005 (1,323 paddlefish) was 25.9 percent greater than the observed harvest. In 2004, 221 paddlefish were checked by creel clerks. This number is 107.8 percent of the estimated harvest

The harvest estimate from the 2005 telephone paddlefish creel survey is compared with the Intake creel harvest estimate and the Intake observed harvest in Table 6. The telephone creel harvest estimate for the Intake Fishing Access Site was 1,586 paddlefish. This is 51% higher than the observed harvest of 1,051 paddlefish. While the observed harvest is less than the actual harvest, it is unlikely that it is off by 51% as predicted by the phone creel harvest estimate.

Regardless of which harvest number is used, the harvest of paddlefish exceeded the 1,000 fish target for this population in Montana. In the future it will be necessary to begin to close the harvest season earlier to avoid exceeding the 1,000 fish harvest target.

The percent of harvest occurring at sites other than the Intake Fishing Access Site was 1.9 % in 2005 (Table 6). Because fish were present at Intake in abundance from the beginning of the season until the end, little fishing occurred anywhere else.

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 9,428 paddlefish tagged in the Yellowstone River (mostly near Intake), at least 2,179 (23.1%) have been harvested by anglers (Table 7).

In 2005, 59 tags from angler harvested fish were recovered from paddlefish tagged in the Yellowstone River. Of these, 16 were caught in North Dakota, and the remainder from Intake or within a few miles downstream. Also, of the 59 returned tags, 38 were tagged in 2005. An additional 37 tags recovered at Intake were from paddlefish tagged in North Dakota.

Table 8 summarizes tag return rates for multi-year periods. Tag returns through 2005 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 through 2005.

Tables 7 and 9 indicate lower exploitation for paddlefish tagged from 1998 through 2000. To date the average exploitation rate of fish caught in 1999 and 2000 are 5.0 and 3.3 percent, respectively (Table 9). Exploitation rates for fish tagged in 2001 and 2002 are higher at 9.5 and 6.0 percent, respectively. The 33.3 percent exploitation rate in 2003 of the fish tagged in 2001 is the highest one-year return ever seen. Only seven fish were tagged in 2001. Three years of returns from fish tagged in 2003 show a mean annual exploitation rate of 2.5 percent.

Table 10 shows angler exploitation of paddlefish for five years after tagging. Exploitation of 1995, 1996 and 1997 tagged paddlefish shows a dramatic increase over what was seen in the early 1990’s. The average exploitation of paddlefish tagged in 1998, 1999 and 2000 was again lower.

Table 11 compares tag return rates by sex for fish tagged in the years 1977 through 2005. The heavier harvest rate for females in the earlier years is not as apparent from 1992 to the present. Since the early nineties, with the exception of 1994, 2000 and 2001, tag return rates for the sexes have been similar or heavier toward males. The tag return rate by sex in 2000 and 2001 indicates a heavier harvest of female paddlefish, but few fish overall were tagged in those years.

Young male paddlefish are recruiting to the population as confirmed by ageing and recruitment studies conducted by Dr. Dennis Scarnecchia (2002) of the University of Idaho. Later maturing young female paddlefish should begin recruiting several years into the future.

Paddlefish Caviar

The Glendive Chamber paddlefish caviar program is summarized in Table 12. On average, 2,639 pounds of caviar are sold for 137,270 dollars each year.

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Paddlefish exploitation rate
Paddlefish sex ratio

Figure 1. Paddlefish harvested per day at Intake, MT and mean daily flow (1000 cfs) at Sidney, MT in 2005.

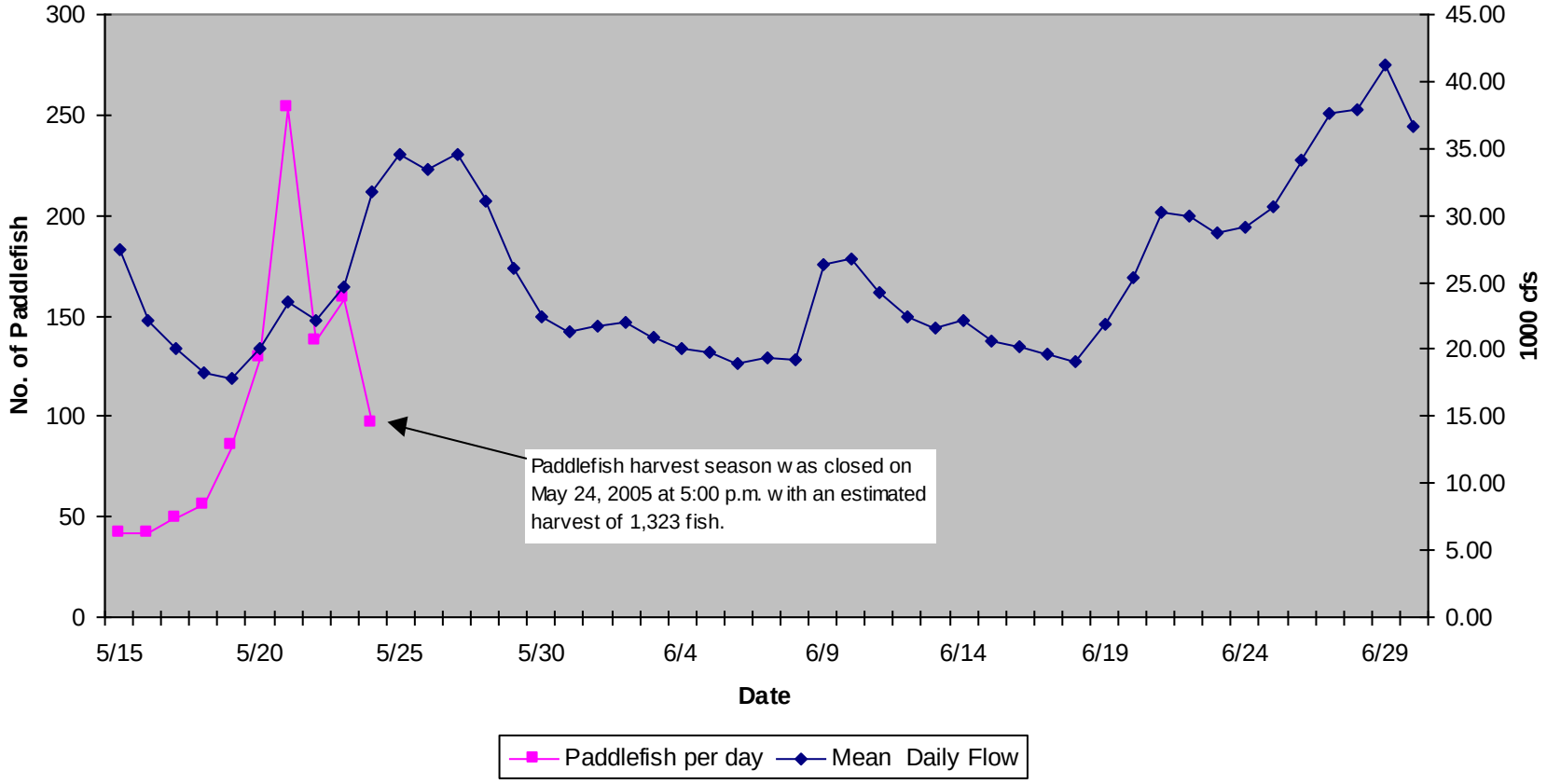

Table 1. Number of anglers purchasing Montana paddlefish tags.

	Total Tag sales				All Area Tag Sale				Upper Missouri River Tag Sales			
Year	Total	Resident	Nonresident	% Nonresident	Total	Resident	Nonresident	% Nonresident	Total	Resident	Nonresident	% Nonresident
2005	6596	5833	763	12	4267	3691	576	13	2329	2142	187	8
2004	6920	6032	888	13	4442	3759	683	15	2478	2273	205	8
2003	7366	6363	1003	14	4812	4020	792	16	2554	2343	211	8
2002	5901	5002	899	15								
2001	4524	3770	754	17								
2000	6056	4859	1197	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 the Yellowstone River paddlefish snagging.
Beginning in 1992 tags were required statewide.
Paddlefish tags were added to the automated licensing system in 2003 allowing for all area and upper Missouri tags to be separated.

Table 2. Summary of Paddlefish measurements obtained from the angler catch at Intake, Yellowstone River, 1963-2005.

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
2001	344		1064	43.0	52.9
2002	713		1025	38.5	44.6
2003	831	39.1	993	38.1	52.8
2004	221	40.0	1016	41.2	54.3
2005	1051	36.9	937	29.8	26.8

* 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, 1963-2005.

	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
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
2001	162	960	27.2	182	1156	57.0
2002	395	932	24.2	318	1146	56.4
2003	392	866	20.6	439	1107	53.8
2004	100	879	22.0	120	1133	57.3
2005	768	873	21.1	281	1122	54.1

Table 4. Estimate of anglers, hours fished and harvest for the 2005 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
2005						
Periods Requiring Angler Retention of Fish						
6 Days-24 hrs	979	0.89	876	914	1.04	0.93
3 Days-18 hrs	321	0.76	245	298	1.22	0.93
1 Day-17 hrs	106	0.71	75	106	1.41	1.00
Total or Mean	1406	0.85	1196	1323	1.11	0.94
Periods Requiring Anglers to Release Fish						
			2829	3111*	1.10	

* estimated number of paddlefish caught during catch and release.

Table 5. Comparison of paddlefish fishing pressure, harvest and success rate data at Intake from 1972 to 2005.

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	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
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*
2001	1005*	410	360*	0.36*	0.15*	15,480*
2002	2419*	1330	1208*	0.50*	0.22*	46,508*
2003	2009*	1981	1060*	0.52*	0.23*	40,386*
2004	1147*	227	205*	0.18*	0.08*	9,095*
2005	1406*	4434	1323*	0.94*	1.11*	39,425*

* Does not include catch and release periods.

Table 6. A comparison of paddlefish harvest estimates and the percentage of harvest not occurring at Intake.

Year	Intake Creel Harvest Estimate	Intake Observed Harvest	Telephone Survey Harvest Estimates					
			Intake	Below Intake	Above Intake	Below Ft Peck	Total	Percent Non-Intake
2003	1060	831	848	167	103	91	1209	29.9
2004	205	221	218	24	12	65	319	31.7
2005	1323	1051	1586	30	0	0	1616	1.9
2006	904	1194	648	196	265	0	1109	41.6

Note: There are some number of paddlefish harvested on the Ft. Peck Indian Reservation every year that do not show up in any of the harvest estimates.

Note: The 2004 telephone harvest estimates have been corrected and are slightly different from that reported in the 2003/2004 report.

Table 7. Summary of paddlefish tagging and tag returns 1964-2005.

Year	Number Tagged	Number Returned In 2005	Total Number Returned	Percentage Returned
1964-1970	1703	0	279	16.4
1971-1980	3242	2	812	25.0
1984	551	0	249	45.2
1985	2	0	2	100.0
1986	153	0	47	30.7
1988	156	0	67	42.9
1989	10	0	4	40.0
1990	153	0	49	32.0
1991	20	0	8	40.0
1992	221	2	82	37.1
1993	268	1	59	22.0
1994	180	1	59	32.8
1995	442	4	175	39.6
1996	139	0	61	43.9
1997	70	0	30	42.9
1998	42	0	10	23.8
1999	281	5	86	30.6
2000	20	0	4	20.0
2001	7	0	3	42.9
2002	145	2	32	22.1
2003	282	4	21	7.4
2004	20	0	2	10.0
2005	1321	38	38	2.9
Totals	9428	59	2179	23.1

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

Table 8. Tag return rate averages for multi-year periods.

Period Tagged	Number Tagged	Number Returned During Period	Percentage Returned
1964-1970	1703	279	16.4
1971-1980	3242	811	25.0
1981-1990	1025	418	40.8
1991-2000	1683	573	34.0
2001-2005	1775	96	5.4

Table 9. 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).											
	1999 (281)		2000 (20)		2001 (7)		2002(145)		2003(282)		2004(20)	
	Tag Returns		Tag Returns		Tag Returns		Tag Returns		Tag Returns		Tag Returns	
Year	%*	#	%*	#	%*	#	%*	#	%*	#	%*	#
1999	12.5	35										
2000	2.0	5	20.0	4								
2001	5.4	13	0	0	14.3	1						
2002	4.8	11	0	0	0	0	13.1	19				
2003	5.6	12	0	0	33.3	2	4.0	5	5.0	14		
2004	2.0	4	0	0	0	0	5.0	6	1.1	3	10.0	2
2005	2.6	5	0	0	0	0	1.7	2	1.5	4	0	0
Mean Annual Percentage	5.0		3.3		9.5		6.0		2.5		5.0	

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

Table 10. 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
1996	139	8.33
1997	70	7.40
1998	42	4.35
1999	281	5.38
2000	20	3.33

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

Year	Number Tagged		Number Returned		Percentage Returned	
Tagged	Female	Male	Female	Male	Female	Male
1977	123	223	44	43	35.8	19.3
1978	158	451	54	76	34.2	16.9
1984	313	238	158	75	50.5	31.5
1986	88	65	29	16	33.0	24.7
1988	98	59	49	18	50.0	30.5
1990	77	77	26	9	33.8	11.7
1992	108	110	39	39	36.1	35.5
1993	63	204	15	42	23.8	20.6
1994	109	74	41	15	37.6	20.3
1995	185	257	74	96	40.0	37.4
1996	47	92	21	39	44.7	42.4
1997	26	44	9	19	34.6	43.2
1998	12	36	1	10	8.3	27.8
1999	127	154	42	43	33.1	27.9
2000	11	9	3	1	27.3	11.1
2001	4	3	2	1	50.0	33.3
2002	66	79	16	16	24.2	24.1
2003	160	119	12	9	7.5	7.6
2004	10	10	2	2	20.0	20.0
2005	426	895	12	26	2.8	2.9

Table 12. Glendive Chamber of Commerce and Agriculture caviar production and income summary.

Year	Pounds of Caviar	Number of Females	Income (Gross)	Processing & Marketing Costs	Income (Net)	Admin. Expen. CC	FWP Share	Local Gants
1990	4,000	1046	$110,000	41,548	68,452	41,548	34,226	$0
1991	10,000	1716	$292,000	59,572	232,428	59,572	116,214	$24,224
1992	2,200	526	$63,000	26,366	36,634	26,366	18,317	$96,927
1993	3,592	678	$68,810	29,143	39,667	29,143	19,833	$5,300
1994	1,166	223	$48,137	28,023	20,114	33,770	15,036	$11,896
1995	4,162	637	$240,056	66,355	173,701	66,355	69,481	$80,950
1996	3,090	482	$231,910	54,071	177,839	76,381	71,136	$90,055
1997	1,211	308	$118,377	59,621	58,756	47,009	23,502	$23,910
1998	2,016	265	$45,767	31,875	13,892	31,875	5,557	$0
1999	3,691	720	$166,831	94,406	72,425	94,405	28,970	$15,000
2000	1,587	291	$257,680	77,065	180,615	182,501	72,246	$109,600
2001	966	177	$173,764	47,648	126,116	105,273	50,446	$41,325
2002	1,517	307	$66,687	51,421	15,266	110,803	5,874	$0
2003	1,470	435	$64,624	49,186	15,438	40,466	4,632	$0
2004	713	119	$127,714	41,309	86,405	36,653	25,921	$0
2005	848	275	$120,966	34,216	86,751	13,293	26,025	$28,000
TOTALS	42,228	8,205	$2,196,323	$791,825	$1,404,499	$995,413	$383,790	$527,187
AVERAGES	2,639	513	$137,270	$49,489	$87,781	$62,213	$23,987	

Appendix A

March 1, 2006

To: Fred Ryckman
Greg Power
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From: Dennis Scarnecchia

Subject: Yellowstone-Sakakawea Paddlefish Harvest Model Update prior to the 2006 Fishing Season

We have completed the 2005 age assessment of paddlefish from both states, and have used the results to update the harvest model. Outlined below is the methodology for assessing stock status, a summary of current stock status, and a brief discussion of selected relevant issues. Total catch for Montana is an estimate as of the date of this report , but is very close to the actual number and any minor inaccuracy will not materially affect the results presented.

Harvest Model Calculations

The first step was to estimate the total harvest over the period 2001-2005. North Dakota harvest was estimated from a phone creel census. Montana harvest for 2001-2002 was estimated from calculations by Vic Riggs using the on-site Intake creel. Montana harvest for 2003-2005 was estimated from a phone creel similar as that used in North Dakota. Estimated Montana harvest in 2000-2002 did not include off-site non-tribal harvest or tribal harvest, which was very low in 2005 as a high fraction of fish moved into the Yellowstone R. Estimated harvest for 2003-2005 included off-site non-tribal harvest but not tribal harvest.

Estimated Harvest -- 2000-2005

Year	***ND***	***MT***
2001	***1,566***	***360#***
2002	***1,364***	***1,208#***
2003	***1,041***	***1,209****
2004	***1,076***	***329****
2005	***1,100***	***1175* (est)***

 # not including off-site harvest and tribal harvest
*** non including tribal harvest.**

Total Harvest = 10,428 for 5 years, or 2,086 fish per year.

Note that this harvest exceeds the combined current 1,000 fish per state harvest cap, mainly because of higher harvest in North Dakota in 2001- 2002, under a higher harvest cap (1,500 fish per state), and harvest of more than 1,000 fish in Montana in 2002, 2003 and 2005, the latter two years under a 1,000 fish harvest cap.

Because some fish harvested are young recruits from ages not fully recruited to the fishery (<10 for males, <17 for females) and not recruited to the tag-recapture population estimates (except for Intake C-R fish), they are considered too young to be included in the harvest totals, so an adjusted harvest was calculated for all fish of only fully recruited ages. The number of fish to be removed from the harvest total was estimated by assuming that the number of recruits of these youngest ages was proportional to their abundance in the actual harvest. The adjusted harvest is obviously somewhat less than the total harvest:

Estimated harvest of fish of ages not fully recruited (<10 for males, <17 for females) = 828 fish (500 MT, 328 ND).

Adjusted Harvest = Harvest of all fish of fully recruited ages (10 and older for males, 17 and older for females) = 11,024 - 500 (MT) - 328 (ND) = 9,600 for 5 years, or 1,920 fish per year.

The next estimate was of the total recruitment of young, fully-recruited age classes based on the age distribution of fish harvested from the fisheries. With mandatory retention, the age structure of the harvested fish was assumed to accurately reflect the age distribution of the actual mature, harvestable population:

Estimated Recruitment -- 2001-2005 (ages 10-14 males, 17-21 females)

Year	***ND***		***MT***	
	M	***F***	***M***	***F***
2001	***85/694***	***94/527***	***37/124***	***75/170***
2002	***95/823***	***93/434***	***119/353***	***150/288***
2003	***54/404***	***100/351***		***102/232***
2004	***57/304***	***113/396***		***13/50***
2005		***184/484***	***94/364***	

319/440	
51/120	
590/748	***168/275***

Total = 2,593/7,581 = 0.342, or 34.2% of the aged fish were young recruits (ages 10-14 for males, ages 17-21 for females.)

Total population estimates of the mature, recruited portion of the stock were obtained from Jeff Hendrickson. They were based on mark-recapture estimates from spring netting and tag and creel recovery data for North Dakota:

Population estimates and 95% confidence intervals (J. Hendrickson; updated 2005)

1. Spring tagging only and angler harvest (5-year average 2001-2005): 24,841

The percentage of the total catch of fully recruited ages consisting of young recruits (34.2%) was then multiplied by the population estimate in order to estimate total 5-year recruitment as well as mean annual recruitment over the period 2001-2005:

Using a 5-year average population estimate of 24,841 fish, total recruitment was estimated as 24,841 (0.342) = 8,596 young recruits over the period 2000-2004, or 1,719 new recruits per year.

Stock status

In summary, total harvest over the period 2000-2004 was estimated as 2,086 fish per year, or an adjusted harvest (i.e., fully recruited ages only) of 1,920 fish per year. The corresponding recruitment was estimated to be 1,719 per year. About 201 more fish were being harvested than were being recruited over the 5-year period. This difference does not include additional tribal harvest or natural mortality. The 1,000 fish per state cap is appropriate. In 2005, 2,275 fish were estimated to have been caught, not including tribal harvest, which is higher than the estimated average recruitment over the past 5 years (1,719 fish per year). The key characteristic of the harvest in 2005 was that of 1082 paddlefish from Intake for which date were collected, 798 (74%) were males and only 26% were females. Of the 775 males for which age was determined, 517 (67%) were age-10 fish, the result of a very strong recruitment of the 1995 year class. In North Dakota, where older fish constitute a higher fraction of the total catch than at Intake, of 916 fish for which data were collected, 525 (57%) were males and 391 (43%) were females. Of the 503 males for which age was determined, 135 (27%) were age-10. ***Despite the harvest in both states that slightly exceeded the harvest cap, the year 2005 thus was not a deficit year for paddlefish from a harvest-management perspective, because of very strong recruitment of young male fish from the 1995 brood year.*** We have seen these fish coming as age-8 and age-9 fish in 2003 and 2004, but 2005 was the first year that they arrived in large numbers, especially at Intake. Ten years ago, age-0 paddlefish were abundant in 1995 transects and tagging efforts, and many young pre-adults were also commonly counted in the next few years when the reservoir had re-filled. It is now clear that the secondary trophic upsurge that occurred with the re-filling was associated with a strong 1995 year class. ***The key questions now are how many of these 1995 brood-year fish will recruit at age-11 and 12, and contribute to the fishery over the next decade, and will there be similarly strong brood years in 1996 and 1997 filling in behind them.*** Transect counts in 1996 and 1997 suggest that there should be good year classes in those two years, but how good will dictate if the harvest cap is appropriate or should be reduced. By monitoring the actual abundance of recruits over the next

two years, we will have reliable data for assessing whether the reservoir filling in the mid-1990s will rebuild the stock, or if it will merely provide a temporary boost in abundance of recruits.

Recommendations

Based on the foregoing analyses, no changes in the harvest cap are recommended at this time. In 2006, each state should again take steps to promptly close if and when their total harvest from all fisheries, including tribal, approaches 1,000 fish. Currently, the estimated recruitment is comparable to the actual harvest and not far below to the maximum allowable harvest. The total population size is a minimum of about 25,000 fish, recruitment of young males in 2005 was very strong, and just as importantly, we are still seeing a wide range of older-aged spawners in the stock. (One fish, a male less than 30 pounds, was estimated at age-61!)***. I do not recommend considering increasing the harvest cap in the next two years, even if we get strong recruitment over the next two years and see numerous small male recruits at Intake.*** The reason for not considering it is that lower age-0 counts and low water levels in Lake Sakakawea for the past several years do not bode well for paddlefish recruitment from several year classes after 1997 (and especially so after about the year 2000). If we get high recruitment in the next two years, we will need it to carry us through the lean years that our data indicates are coming. ***If we do not get continued good recruitment of young males over the next 2 years, however, as well as a higher reservoir level, it may also become necessary to lower the cap below 1,000 fish per state to sustain the mature population.*** Future low recruitment under the existing mandatory-retention/harvest cap system would have another effect besides low numbers of potential spawners. Just as the high recruitment of young males in 2005 buffered the older, prime spawners from harvest, a lower the recruitment of young males from year classes produced in low reservoir years would increase the harvest of older, prime spawners just when they would be needed. Some of these older brood fish need to be present every year in any well-managed paddlefish stock.