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

FEDERAL GRANT: F-113-R-5

PROJECT PERIOD: July 1, 2004 through June 30, 2005

REPORT PERIOD: April 1, 2004 through March 30, 2005

ABSTRACT

The paddlefish harvest cap shared by North Dakota and Montana was 1,000 fish in 2004. The lower Yellowstone River flow peaked at 24,900 c.f.s. on June 14., well below the long term average flow for the month. Creel clerks recorded data for 221 paddlefish. This was the fewest number of paddlefish seen at Intake since the 1960's. Statewide paddlefish tag sales were down six percent in 2004 from that of the previous year. The percentage of females in the harvest was up in 2004 over what was seen in 2003. The average size of both male and female paddlefish in 2004 was greater than in 2003.

PROCEDURES

A partial creel census was conducted during the paddlefish season at Intake in 2004. 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 570 or 49.7% of the estimated angler days in 2004. 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.

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.

Yellowstone River flows in 2004 peaked on June 14 at 24,900 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).

Paddlefish tag sales were down about 6 percent in 2004 from tag sales in 2003 (Table 1). The non-resident portion of tag sales has been trending down in recent years. In 2004, non-residents purchased 13 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.

Paddlefish Size and Sex Ratio

A total of 221 paddlefish were checked by creel clerks, from the angler catch, at Intake in 2004 (Table 2). Of these, a complete record of length, weight and sex was recorded for 220.

Females made up 54.3% of the total fish weighed and measured for length in 2004 (Table 2). This is an increase from 2003 but similar to the four years prior to 2002 and is short of the heavily dominated female harvests of the 1970s and 80s.

The average size of male and female paddlefish in 2004 was greater than that observed in 2003 (Table 3).

Creel Census

Results from the 2004 creel census are shown in Table 4. Results from 2004 can be compared to previous years in Table 5. In 2004 at Intake, anglers fished an estimated 1147 days with an average of 2.22 hours per day to catch an estimated 205 paddlefish. Much greater effort was required to catch a paddlefish in 2004 than in the previous two years.

The calculated harvest at Intake in 2004 (205 paddlefish) was 7.8 percent less than the observed harvest. In 2004, 221 paddlefish were checked by creel clerks. This number is 107.8 percent of the estimated harvest

The angler catch rate in 2004 (0.08 fish per hour) was tied with that in 1994 as the lowest ever (Table 5).

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 8,107 paddlefish tagged in the Yellowstone River (mostly near Intake), at least 2,120 (26.2%) have been harvested by anglers (Table 6).

In 2004, 23 tags from angler harvested fish were recovered from paddlefish tagged in the Yellowstone River. Of these, 12 were caught in North Dakota, and the remainder from Intake or within a few miles downstream. Also, of the 23 returned tags, 2 were tagged in 2004. An additional 12 tags recovered at Intake were from paddlefish tagged in North Dakota.

Table 7 summarizes tag return rates for multi-year periods. Tag returns through 2004 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 2004.

Tables 6 and 8 indicate lower exploitation for paddlefish tagged from 1998 through 2000. To date the average exploitation rate of fish caught in 1998, 1999 and 2000 are 3.7, 5.4 and 4.0 percent, respectively (Table 8). Exploitation rates for fish tagged in 2001 and 2002 are higher at 11.9 and 7.4 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. Two years of returns from fish tagged in 2003 show a mean annual exploitation rate of 3.1 percent.

Table 9 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 and 1999 was again lower.

Table 10 compares tag return rates by sex for fish tagged in the years 1977 through 2004. 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, 2001 and 2004, tag return rates for the sexes have been similar or heavier toward males. The tag return rate by sex in 2000, 2001 and 2004 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 11. On average, 2,912 pounds of caviar are sold for 138,521 dollars each year.

LITERATURE CITED

Berkas, M. K., et. al. 2002. Montana Resources Data. Montana. Water Year 2002. U.G.G.S. Water-Data Report MT-02-1.

Scarnecchia, D., P. A. Stewart, and L. F. Ryckman. 1995. Management Plan for the Paddlefish Stocks in the Yellowstone River, Upper Missouri River and Lake Sakakawea.ND Game and Fish Dept., MT Dept. FWP and U. of ID. 44pp.

Scarnecchia, D. 2002. University of Idaho. Unpublished data.

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

Prepared by: _____
Vic Riggs

Date Prepared: March 1, 2005

Waters Referred to: Yellowstone River Sec. 1 21-1350-02

Key Words:

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

Figure 1. Paddlefish harvested per day at Intake, MT and mean daily flows (1000 cfs) at Sidney, MT in 2004.

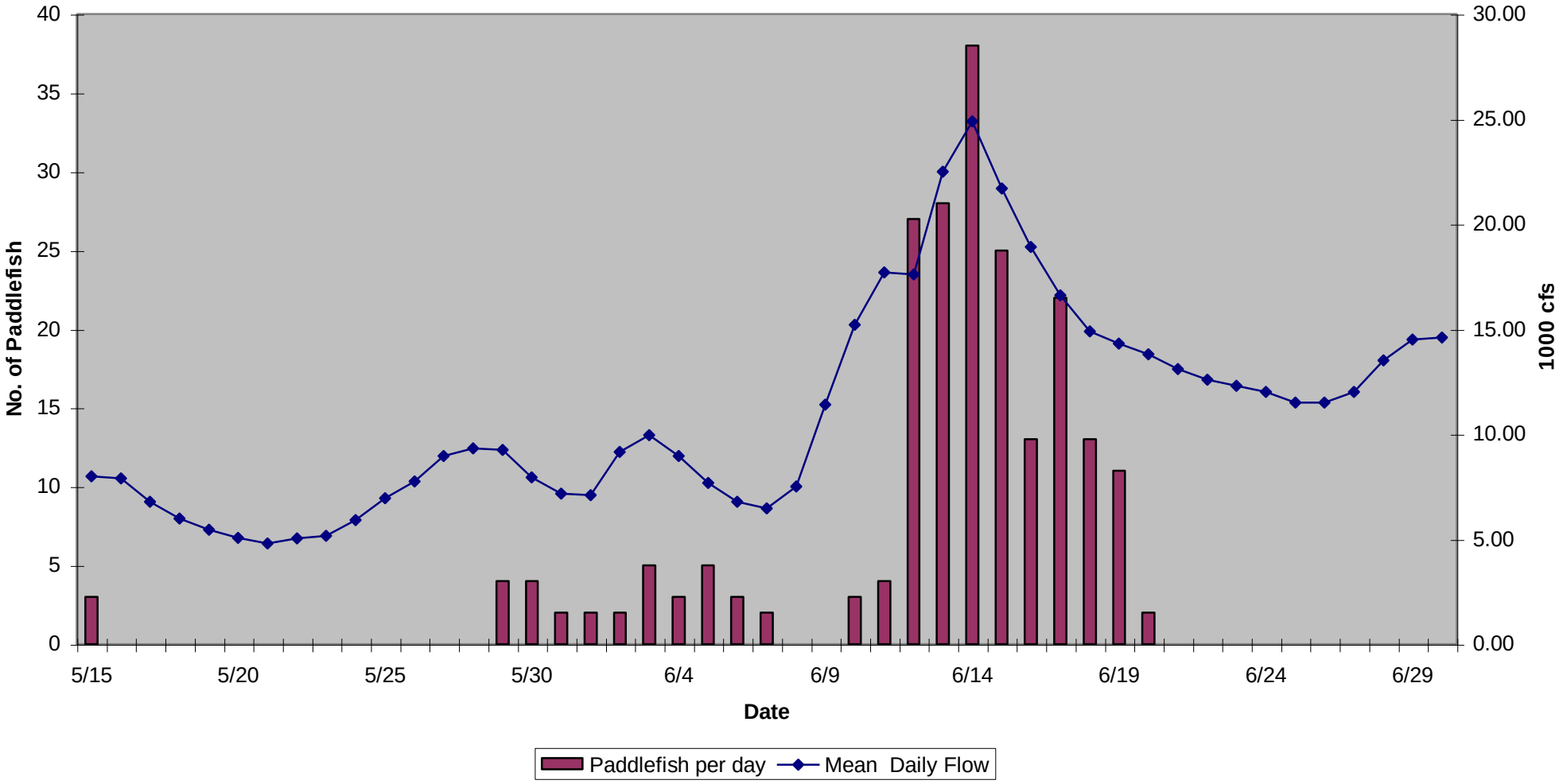

Table 1. Number of anglers purchasing Montana paddlefish tags.

	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
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, 1963-2004.

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

* 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, 1963-2004.

	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

Table 4. Estimate of anglers, hours fished and harvest for the 2004 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
			2004			
			Periods Requiring Angler Retention of Fish			
Wed. & Sun.	322	1.96	632	55	0.09	0.17
Other Days	825	2.32	1917	150	0.08	0.18
Total or Mean	1147	2.22	2549	205	0.08	0.18
			Periods Requiring Anglers to Release Fish			
			106	22*	0.21	

* actual 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 2004.

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*

* Does not include catch and release periods.

Table 6. Summary of paddlefish tagging and tag returns 1964-2004.

Year	Number Tagged	Number Returned In 2004	Total Number Returned	Percentage Returned
1964-1970	1703	0	279	16.4
1971-1980	3242	1	810	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	0	80	36.2
1993	268	0	58	21.6
1994	180	1	58	32.2
1995	442	4	171	38.7
1996	139	1	61	43.9
1997	70	1	30	42.9
1998	42	0	10	23.8
1999	281	4	81	28.8
2000	20	0	4	20.0
2001	7	2	3	42.9
2002	145	6	30	20.7
2003	282	3	17	6.0
2004	20	2	2	10.0
Totals	8107	23	2120	26.2

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 During Period	Percentage Returned
1964-1970	1703	279	16.4
1971-1980	3242	809	25.0
1981-1990	1025	418	40.8
1991-1995	1131	359	31.7
1996-2000	552	165	29.9
2001-2004	454	52	11.5

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).											
	1998 (42)		1999 (281)		2000 (20)		2001 (7)		2002(145)		2003(282)	
	Tag Returns		Tag Returns		Tag Returns		Tag Returns		Tag Returns		Tag Returns	
Year	%*	#	%*	#	%*	#	%*	#	%*	#	%*	#
1998	2.4	1										
1999	0.0	0	12.5	35								
2000	12.2	5	2.0	5	20.0	4						
2001	5.6	2	5.4	13	0	0	14.3	1				
2002	5.9	2	4.8	11	0	0	0	0	13.1	19		
2003	0	0	5.6	12	0	0	33.3	2	4.0	5	5.0	14
2004	0	0	2.0	4	0	0	0	0	5.0	6	1.1	3
Mean Annual Percentage	3.7		5.4		4.0		11.9		7.4		3.1	

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

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
1996	139	8.33
1997	70	7.40
1998	42	4.35
1999	281	5.38

Table 10. 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	38	39	35.2	35.5
1993	63	204	14	42	22.2	20.6
1994	109	74	41	15	37.6	20.3
1995	185	257	73	96	39.5	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	40	41	31.5	26.6
2000	11	9	3	1	27.3	11.1
2001	4	3	2	1	50.0	33.3
2002	66	79	12	17	18.2	21.5
2003	160	119	9	7	5.6	5.9
2004	10	10	2	0	20.0	0.0

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
2000	1,587	527	249,328	180,615	77,064	72,246	40
2001	966	335	173,764	126,116	69,623	50,446	40
2002	1,611	688	66,687	15,266	23,951	6,106	40
2003	1,470	824	64,624	15,438	22,615	3,860	25
Totals	**40,762**	**15,333**	**1,939,291**	**1,231,343**	**699,677**	**534,930**	
Averages	**2,912**	**1,095**	**138,521**	**87,953**	**49,977**	**38,209**	

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

Appendix A

January 30, 2005

To: Fred Ryckman
Greg Power
Brad Schmitz
Bill Wiedenheft
Ken McDonald

From: Dennis Scarnecchia

Subject: Yellowstone-Sakakawea Paddlefish Harvest Model Update prior to 2005 Fishing Season

We have completed the 2004 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.

Harvest Model Calculations

The first step was to estimate the total harvest over the period 2000-2004. North Dakota harvest was estimated from a phone creel census. Montana harvest for 2000-2002 was estimated from calculations by Vic Riggs using the on-site Intake creel. Montana harvest for 2003-2004 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. Estimated harvest for 2003 and 2004 included off-site non-tribal harvest but not tribal harvest. Based in contacts with tribal members in 2004, total actual harvest in Montana in 2003-2004 combined may therefore be higher by 150-250 fish, most of it occurring in 2004.

Estimated Harvest -- 2000-2004

Year	***ND***	***MT***
2000	***2,205***	***666#***
2001	***1,566***	***360#***
2002	***1,364***	***1,208#***
2003	***1,041***	***1,209****
2004	***1,076***	***329****

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

Total Harvest = 11,024 for 5 years, or 2,205 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 2000- 2003, under a higher harvest cap (1,500 fish per state), and harvest of more than 1,000 fish in Montana in 2002 and 2003, the latter year 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 I also calculated an adjusted harvest of 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) = 943 fish (561 MT, 382 ND).

Adjusted Harvest = Harvest of all fish of fully recruited ages (10 and older for males, 17 and older for females) = 11,024 - 561 (MT) - 382 (ND) = 10,081 for 5 years, or 2,016 fish per year.

Although the age at full recruitment of males is estimated at 10, it has varied somewhat over the years, so that age-9 might be as appropriate. If so, the calculation is slightly different:

Estimated harvest of fish of ages not fully recruited (<9 for males, <17 for females) = 567 fish (363 MT, 204 ND).

Adjusted Harvest = Harvest of all fish of fully recruited ages (10 and older for males, 17 and older for females) = 11,024 - 363 (MT) - 204 (ND) = 10,457 for 5 years, or 2,091 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 -- 2000-2004 (ages 10-14 males, 17-21 females)

Year	***ND***		***MT***	
	M	***F***	***M***	***F***
2000	***84/433***	***68/390***	***78/167***	***96/260***
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***	***319/440***
2004	***57/304***	***113/396***	***13/50***	***51/120***

Total = 1,883/6,960 = 0.271, or 27.1% of the aged fish were young recruits (ages 10-14 for males, ages 17-21 for females.)

Again, if it is assumed that males fully recruit at age-9, with ages 9-13 being considered young recruits, the numbers change slightly:

Estimated Recruitment -- 2000-2004 (ages 9-13 males, 17-21 females)

Year	***ND***		***MT***	
	M	***F***	***M***	***F***
2000	***54/439***	***68/390***	***77/190***	***96/260***
2001	***81/716***	***94/527***	***46/145***	***75/170***
2002	***85/831***	***93/434***	***123/365***	***150/288***
2003	***57/410***	***100/351***	***125/266***	***319/440***
2004	***144/395***	***113/396***	***61/99***	***51/120***

Total = 2,012/7,232 = 0.271, or 27.8% of the aged fish were young recruits (ages 9-13 for males, ages 17-21 for females.)

The difference in considering the age at first recruitment as 9 instead of 10 for males is slight; only a 0.7% change in percent of young recruits (27.1% vs. 27.8%). Hereafter, therefore, I used the figure 27.1% recruits in calculations below.

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

Population estimates and 95% confidence intervals (J. Hendrickson; updated 09-20-04)

1. Spring tagging only and angler harvest : 2004: 29,454 (14,259, 44,648)
2003: 29,399 (14,508, 42,290)
2. Previous fall tagging only and angler harvest:
2004: 22,360 (10,001, 39,190)
2003: 22,402 (10,474, 39,307)
3. Prev. fall and spring tagging/ang. harvest:
2004: 28,719 (17,222, 40,216)
2003:28,778 (17,439, 40,118)

The percentage of the total catch of fully recruited ages consisting of "young" recruits (27.1%) was then multiplied by the population estimates in order to estimate total 5-year recruitment as well as mean annual recruitment over the period 2000-2004:

Using a 5-year average population estimate of 30,000 fish, total recruitment was estimated as 30,000 (0.271) = 8,130 young recruits over the period 2000-2004, or 1,626 new recruits per year.

With 29,454 fish, estimated new recruits = 7,982 or 1,596 per year

With 28,719 fish, estimated new recruits = 7,782 or 1,557 per year

With 22,360 fish, estimated new recruits = 6,059 or 1,212 per year

Stock status

In summary, total harvest over the period 2000-2004 was estimated as 2,205 fish per year, or an adjusted harvest (i.e., fully recruited ages only) of 2,016 fish per year. The corresponding recruitment was estimated to be from 1,212 to 1,596 per year, depending on the population estimate used. If a 5-year "median" population estimate of 30,000 fish is used, the total recruitment was 1,626 per year fish versus a harvest of 2,016 fish per year. About 390 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. Clearly, the 1,500 fish per state harvest cap in place three years ago was too high. The 1,000 fish per state cap is more appropriate. In 2004, only 1,405 fish were estimated to have been caught, not including tribal harvest, which is comparable to the estimated recruitment over the past 5 years (1,212-1,596 fish per year). Also, an estimated 228 of the total harvest of the 1,405 fish were young fish not fully recruited to the model; 217 of these were young males. ***The year 2004 thus was not a deficit year for paddlefish from a harvest-management perspective, because of a combination of low harvest in Montana and good recruitment of young male fish. The low harvest in 2004 was in part the result of the all-time record-low discharge at Sidney in May-June, which reduced fish***

movements and availability up the Yellowstone River. It is doubtful that fishing in one or both states will be as poor in future years as it was in 2004 in Montana.

The year 2004 provided clear evidence of a strong year class from the 1995 brood year. Forty-nine of the 100 males caught at Intake were age-9 fish. Even in North Dakota, where younger, smaller fish are always less common, age-9 fish constituted 22% of the catch of males. We have expected some strong recruitment of young paddlefish resulting from the high river and reservoir levels of the mid-1990s. Age-0 paddlefish were abundant in 1995 transects and tagging efforts, and many young pre-adults were also commonly counted in the years when the reservoir had re-filled. It is now clear that a secondary trophic upsurge occurred with the re-filling. Over the past several years, we have seen occasional small very young male paddlefish in the fisheries at the Confluence and Intake, and we expected to see the strong recruitment from the 1995 year class in 2004. The questions now are how many of these 1995 brood-year fish will recruit at age-10, 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. The actual abundance of recruits over the next two years will have a strong influence on the recommended course of action by 2007.

Recommendations

Based on the foregoing analyses, no changes in the harvest cap are recommended at this time, as long as each state promptly closes 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. Total population size remains close to 30,000 fish, recruitment of young males in 2004 was strong, and just as importantly, we are still seeing a wide range of older-aged spawners in the stock. 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 will become necessary to lower the cap below 1,000 fish per state to sustain the mature population. Reproduction (based on age-0 fish in Lake Sakakawea transects) is poor at these low reservoir levels, and much poorer future recruitment than in 2004 will be the long-term outcome. In addition to fewer young recruits as potential spawners, low recruitment under the existing mandatory-retention/harvest cap system has another effect. The lower the recruitment of young males, the higher the harvest rate on older brood fish. Some of these older brood fish need to be present every year in any well-managed paddlefish stock.

Plans for 2005 season

There are several important items that we should investigate more closely, and I am listing a few of them for us to think about before our next meeting.

1. ***Refinement of phone creel results*****.** The phone creel results are providing critical information on actual total harvest, so efforts should be undertaken to insure their accuracy. The wording on catch location in Montana should be clarified in this year's survey.

2. ***Estimates of tribal harvest*****.** The need for good information here is especially important following last year's fishery on the Missouri on tribal lands. We might consider setting up a creel at the two main tribal fishing sites (near Wolf Point and Frazer Rapids). I would be willing to try to coordinate and set up a creel there "informally" as a "research" project, with their field people and their approval, if I also get the approval from Montana. Something congenial and low-key but effective. I would anticipate a reasonable prospect of good cooperation. The tribal harvest is of course heavily dependent on river flows. Yellowstone flows are projected to be low again this year.

3. ***Effective use of creel results to know when to recommend closure.*** Based on results from Montana in 2003 and 2004, it was estimated that the percentages of harvest actually brought into Intake was 68.7% (2003) and 67.1% (2004), respectively, not including tribal harvest. In contrast, figures for North Dakota were 76.7% and 76.3%, respectively. If these figures are correct and typical, a higher fraction of fish caught in Montana are not finding their way to the cleaning station. This is probably the case; the Montana fishery is more dispersed. This difference should be taken into account when setting target numbers at cleaning stations used for recommending closures. Using the figures above, closure in Montana might be recommended to coincide with the date when the number of fish cleaned at Intake reached 675 fish. Closure in North Dakota might be recommended to coincide with the date when the number of fish cleaned at the confluence reached 760 fish. These number might of course change if retrieval of harvested fish to cleaning stations becomes more efficient. This approach also underscores our need to get reliable harvest figures from the phone creel, as well as decent estimates of tribal harvest, as defensible support for recommendations as to when to close a fishery.

4. ***Non-harvest mortality from boat propellers.*** I am even more concerned than last year about this issue, especially in North Dakota and in these years of low river and reservoir levels. It is a concern not only during the season, but in the river during walleye fishing in early spring and fall, as well as in the reservoir itself in summer. There may also be a bit more concern in Montana with the new ramp at Richland Park. Even if fish are difficult to catch downriver, as we suspect, more fish may be killed as anglers hunt for them. It would be a good idea for an eye to be kept on the fishery down there this year. I can arrange to do that with a local seasonal helper if you think it is a good idea.

5. ***Effects of low reservoir and river levels*****.** Last year we were worried about stranding. The main evidence of problems was found in the presence of several females with egg reabsorption (recrudescence). This was not found in other years, suggesting that a combination of low reservoir and low river might be negatively affecting reproduction. We obviously need more water in Sakakawea, and soon.

6. ***Population estimates.*** The reliability of our population estimates is critical to our stock assessment model. We should take a good look at these during our meeting this year, and make sure we can live with the unavoidably violated assumptions. We should also run a brief sensitivity analysis to see what effect violated assumptions might have on our estimates. The situation with the population estimate is sufficiently statistically complex that it might be worth us working with a statistics graduate student on it. I can look into it, and find such a person, if you want me to.

Since late fall, I have been working steadily on two papers summarizing our work group's investigations (on age validation and the entire life history of the stock) as well as on the revised management plan. The age validation paper will be ready this week, and the other two are far along. I will have drafts to you of the other two before the April meeting for comments and discussion. I am planning again this year on being on-site from late April until the fisheries close, and back in Williston in late July for transects and age-0 sampling.

I will be sending the data summaries for the 2004 age determination via regular mail, along with a copy of this letter.

Hope all is well.