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-9

PROJECT PERIOD: July 1, 2008 through June 30, 2009

REPORT PERIOD: April 1, 2008 through March 30, 2009

ABSTRACT:

The paddlefish harvest cap of 1,000 fish for each North Dakota and Montana continued in 2008. The lower Yellowstone River flows were near 8,000 cubic feet per second (CFS) at the start of the paddlefish season on May 15, 2008 and peaked at 56,500 CFS on June 29, 2008. The harvest of paddlefish was allowed on Tuesday, Wednesday, Friday and Saturday during 2008. Catch-and-release fishing only was allowed on Sunday, Monday and Thursday. Paddlefish were abundant at Intake Fishing Access Site (FAS) at the start of the season and the harvest of paddlefish was closed at the Intake FAS in ten harvest days. An estimated 1102 paddlefish were harvested from this population in Montana in 2008. Intake FAS was left open to catch-and-release fishing until June 10, 2008 and 1,344 paddlefish were tagged with jaw tags. Young male paddlefish continued to dominate the harvest in 2008 accounting for 71.0 percent of total harvest. Average sizes of fish caught in 2008 reflect modest increases for both male and female paddlefish from the previous year's harvest averages.

INTRODUCTION:

Paddlefish *Polyodon spathula* are a highly sought after sport-fish in the Yellowstone and Missouri rivers. They also garner commercial interest in North American big rivers for their eggs that supply the caviar trade (Carlson and Bonislawsky 1981). They are native to Montana and are an integral part of the aquatic community in the lower Yellowstone (Holton and Johnson 2003). Paddlefish have highly developed gill rakers which facilitate filter feeding of zooplankton in large river systems and reservoirs (Meyer 1960, Rosen and Hales 1981). They are sexually dimorphic with males demonstrating earlier sexual maturity and smaller size while females are larger and reach maturity later (Scarnecchia et al 1996; Scarnecchia and Stewart 1997). Paddlefish of the Yellowstone/Sakakawea stock reside in the slow and quiet waters of Lake Sakakawea as juveniles. Upon reaching sexual maturity which occurs around age 10 for males and age for 14 females they make spawning runs out of the reservoir into the lower Yellowstone below Intake Diversion dam and Missouri river below Ft. Peck dam where they spawn on the clean gravel bars of these large rivers during the heavy flow period in the spring (Rehwinkel 1978; Carlson and Bonislawsky 1981). Some fish from this stock function as river residents remaining in the rivers above Lake Sakakawea year round i.e. in the dredge cuts below Ft. Peck reservoir (Frazier 1985).

The harvest of paddlefish at Intake, MT has been documented for over a century and several important management decisions have been made in the last two decades (Scarnecchia et al. 2008). Since 1989 a non- profit the Glendive Chamber of Commerce has been allowed to offer fish cleaning services in exchange for any roe from female fish, which is processed on site. Proceeds from marketed caviar fund community improvement grants administered by the chamber and research, monitoring and management of paddlefish administered by Montana Fish, Wildlife and Parks (MTFWP) (Scarnecchia et al. 2008). This arrangement and tight management of the fishery has prevented over-commercialization and subsequent exploitation that plague fisheries of other roe bearing species worldwide (Speer et al. 2000). Since 1995 there have been mandatory catch and release periods for paddlefishing at Intake Fishing Access Site (FAS) providing additional angling opportunity without increasing harvest and allowing FWP personnel the opportunity to measure and tag paddlefish for exploitation estimates (Scarnecchia and Stewart 1997). The Montana-North Dakota Paddlefish Management Plan (Scarnecchia et al. 2008) establishes the goals and objectives guiding the management of the Yellowstone/ Sakakawea paddlefish population. A 3,000 fish per year (1,500 per state, North Dakota and Montana) harvest cap was established in 1996 to slow the harvest of this late maturing, long lived species (Scarnecchia et al. 2008). 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.

In Montana, when the observed harvest approaches the harvest cap, the Fish, Wildlife and Parks (FWP) Commission can close the paddlefish season. In 2005, the harvest of paddlefish was closed in ten days and in 2006, the harvest was closed in thirteen days. In both years, the harvest cap was exceeded because procedures for closing the season to harvest were not adequate. Regulation changes were made for the 2007 season to allow the harvest of paddlefish to be

closed more quickly and to attempt to spread the harvest over a longer period of time (Riggs 2007). The new regulations for 2007 were to allow harvest only fishing on Tuesday, Wednesday, Friday and Saturday and catch-and-release only fishing on Sunday, Monday and Thursday. The fishing day for paddlefish was reduced to 15 hours (6 a.m. to 9 p.m.). The harvest of paddlefish at Intake FAS could be closed instantaneously when 800 paddlefish were harvested at Intake FAS and elsewhere the harvest season could be closed with 24-hour notice. The new changes were unsuccessful in lengthening the harvest season as it closed in just three days in 2007, however the season was closed quickly enough to keep the harvest under the 1000 fish quota at 998.

The 2008 paddlefish season was the second season under new regulations aimed at facilitating more efficient season closure and combating the crowding problems caused by the harvest quotas being met in progressively shorter time periods. Objectives for the 2008 season were as follows 1) keep harvest under quota of 1000 fish, while spreading over more days to increase angler satisfaction and maintain tag sales, 2) provide additional paddlefish angling opportunity with catch and release days, while using this opportunity to gather data and increase number of tagged fish in the river, 3) monitor trends in size structure, sex ratio, and exploitation of the population.

METHODS:

A statewide paddlefish telephone creel was conducted in 2008 to obtain harvest numbers for the Yellowstone/Sakakawea paddlefish population. The 2008 season was the first year that the Missouri River above Ft. Peck reservoir and Yellowstone/Sakakawea paddlefish populations have been surveyed separately. Past surveys have provided inconsistent results when compared to on-site creel information and demonstrated that the structure of the phone survey was confusing and did not provide accurate estimates of paddlefish harvested at sites other than Intake FAS. Accurate estimates of paddlefish harvested at Intake FAS are critical for insuring that the harvest season is closed before the 1000 fish quota is exceeded. The eight question revised creel survey was design to gather information on the harvest of paddlefish, tag sales, use of Glendive Chamber of Commerce cleaning services, and participation in catch and release fishing days.

Data from both harvested fish and catch and release fish are used to infer information about size structure, sex ratio, and exploitation. Paddlefish termed harvested are those that were caught and kept by anglers. Harvested paddlefish were weighed to the nearest pound and measured to the nearest inch (front of eye to fork of caudal fin). Sex was determined by examination of the gonads. Most but not all of the paddlefish caught during designated catch and release fishing days were tagged, measured and assigned sex based on length and shape by FWP staff. Catch and release fish were not weighed. Paddlefish were jaw tagged with Monel metal bands (National Band and Tag Co., Size 16, ½ inch inside diameter), placed around the dentary bone. Return rates of these individually numbered bands are used to infer exploitation rate.

A linear regression was used to determine the relationship between tag sales and year for the period 1981-2008. ANOVA analysis was used to determine how tag sales have varied by

decade (periods 1981-1989, 1990-1999, 2000-2008). ANOVA analysis was used to compare tagging efforts of paddlefish by decade (periods 1981-1990, 1991-2000, 2001-2008).

RESULTS/DISCUSSION

Harvest and Length of Season

The 2008 paddlefish season began with Yellowstone River flows near 8,000 CFS (Figure 1). The long term, mean daily flow for the Yellowstone River at Sidney is 38,840 CFS for the month of June (USGS, 2002). Flows peaked at 56,500 CFS on June 29, 2008. Harvest at Intake closed at 9pm on May 31, 2008 after ten days, three times longer than the 2007 season and equally as long as the 2005 and 2006 seasons (Figure 1). The remainder of the Yellowstone and Missouri (below Fort Peck Dam) Rivers closed to paddlefish harvest the next day (June 1, 2008). While the new regulations were adequate to close the paddlefish harvest before exceeding the 1,000 fish in 2007 the quota was again exceeded in 2008 and no effect on slowing the pace of the harvest was observed. The telephone creel harvest estimate for the Yellowstone/Sakakawea paddlefish population was 1102 fish for 2008. The Intake creel survey underestimated the paddlefish harvest in 2006 and 2007 (Table 2). This creel survey design has worked well in the past when the harvest was spread out over a longer period of time (Riggs 2005). When the harvest is compressed into a few days and anglers catch a fish in a few minutes rather than a few hours this survey design undercounts anglers participating in the harvest. The result is a low harvest estimate. The post-season telephone creel survey that does not rely on angler counts to estimate harvest is the better tool at this time for estimating harvest.

Paddlefish tag sales were up from 2007, consistent with the overall direction of sales for the last 30 years confirmed by linear regression analysis of total tag sales by year ($R^2 = 0.44$, $F = 20.49$, $P = 0.0001$) (Table 1, Figure 2). When broken down by decade ANOVA analysis of the mean total tag sales demonstrate that sales have not stayed at the same level in the last three decades ($F = 10.13$, df = 2, $P = 0.001$). Tukey HSD post hoc test demonstrates that mean total tag sales have been higher in the periods 1990-1999 and 2000-2008 than they were in the period 1981-1989 (Figure 3). It does not appear that tag sales have declined in response to reductions in harvest quota and season duration.

Catch and Release Fishing

The implementation of the catch and release days and the sale of catch and release tags are a likely factor for the maintained interest in the face of reduced harvest opportunity. The three catch-and-release days per week appeared to be popular with paddlefish anglers accounting for 19.4% of angling effort. The catch and release days have provided a fringe benefit to FWP staff allowing larger numbers of paddlefish to be tagged and released than ever before ($F = 4.58$, df=2, $P = 0.02$)(Table 3, Figure 4). During 2008 catch-and-release angling efforts department personnel placed jaw tags on 1,344 paddlefish.

Size structure Sex Ratio and Exploitation

Females made up 29.0% of the total fish weighed and measured for length in 2008 (Figure 4). This is an increase from 2007, and may indicate the beginning of recruitment of

females from the same year classes of young male paddlefish that were dominant in the 2007 harvest. The average size of male and female paddlefish in 2008 was slightly greater than that observed in 2007 (Figure 4). The 2008 harvest included paddlefish from 24 to 59 inches eye-fork length, with the distribution demonstrates peaks in frequency of harvested fish around the lengths 36 and 44 inches eye-fork length (Figure 5).

Of 13,517 paddlefish tagged in the Yellowstone River (mostly near Intake), at least 2498 (31.2%) have been harvested by anglers (Table 3). In 2008, 157 tags from angler-harvested fish were recovered from paddlefish tagged in the Yellowstone River. Tag returns through 2008 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 2008 (Table 4). Exploitation of paddlefish tagged in 1995, 1996 and 1997 shows a dramatic increase over what was seen in the early 1990's (Table 5). The average exploitation of paddlefish tagged in 1998, 1999 and 2000 was again lower. Only seven paddlefish were tagged in 2001 and two were caught in 2003 leading to a high rate of exploitation. The five-year average exploitation rate for paddlefish tagged in 2003 is 3.95 percent (Table 5).

Young male paddlefish have recruited 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. While variable recruitment is common to many fish species with intermittent strong year classes driving the population, paddlefish like other migratory riverine species have suffered population declines across its range due to loss of spawning habitat (Carlson and Bonislasky 1981). Upstream migration of fish is impeded by the Intake diversion dam (Scarnecchia et al. 1996). A successful fish passage project at Intake diversion dam could have a strong positive effect on paddlefish spawning success allowing fish access to more river miles of spawning habitat in the main stem of the Yellowstone as well as its tributaries. This habitat project also has the potential to spread harvest out temporally and spatially.

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Date Prepared: March 1, 2008

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

Key Words:

Paddlefish caviar
Paddlefish exploitation rate
Paddlefish sex ratio
Fishing pressure
Creel Survey
Paddlefish tagging

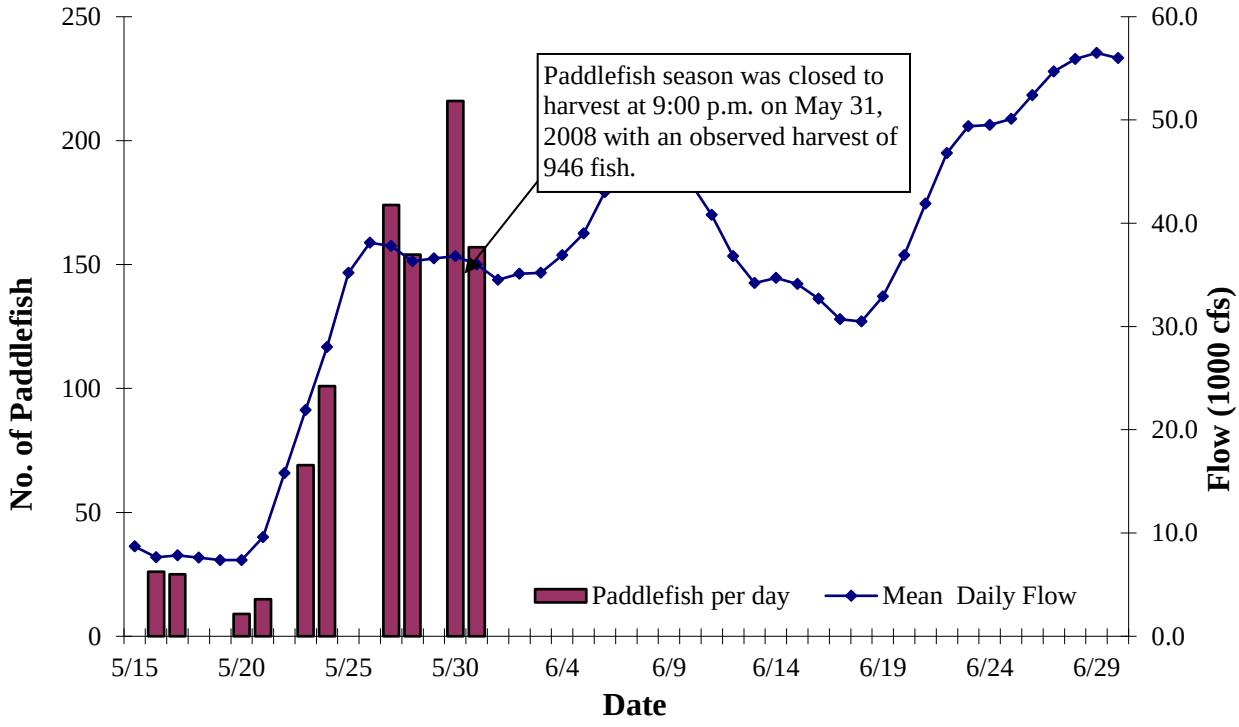

Figure 1. Paddlefish harvested per day from Yellowstone River at Intake, MT and mean daily flow (1000 cubic feet per second) of Yellowstone River at Sidney, MT during 2008 season.

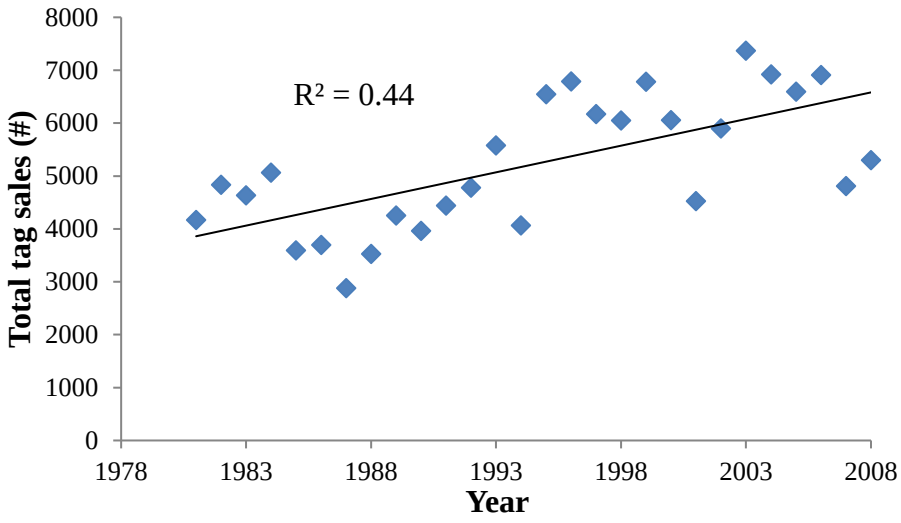

Figure 2. Regression of paddlefish total tag sales by year.

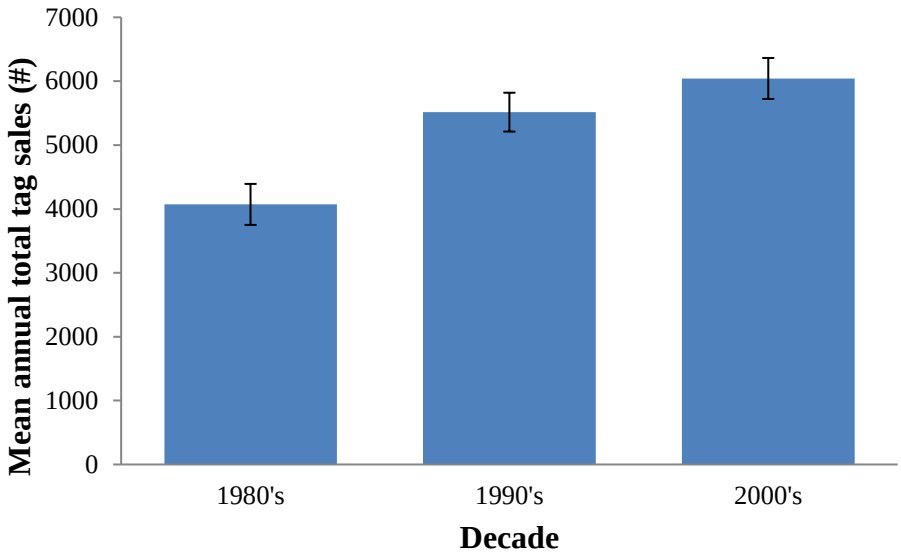

Figure 3. Paddlefish tag sales by decade.

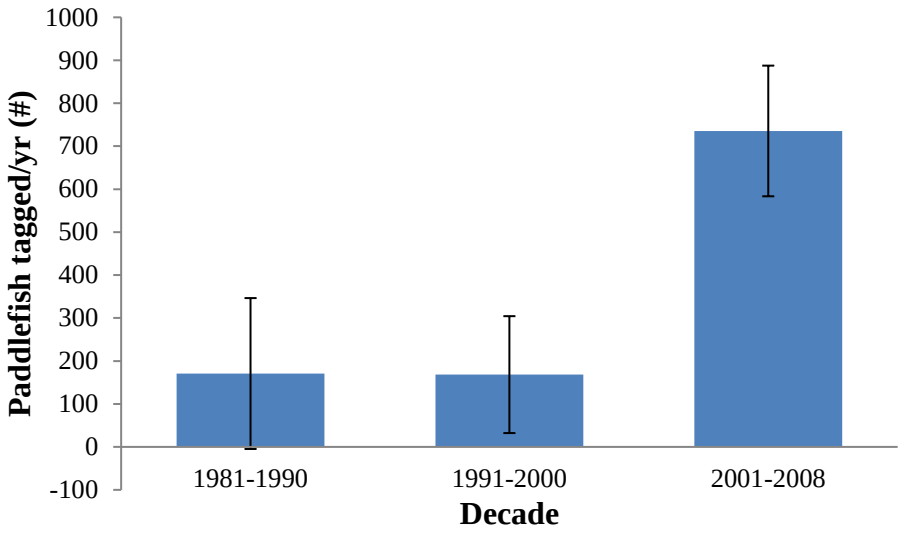

Figure 4. Number of paddlefish tagged over the period 1981-2008

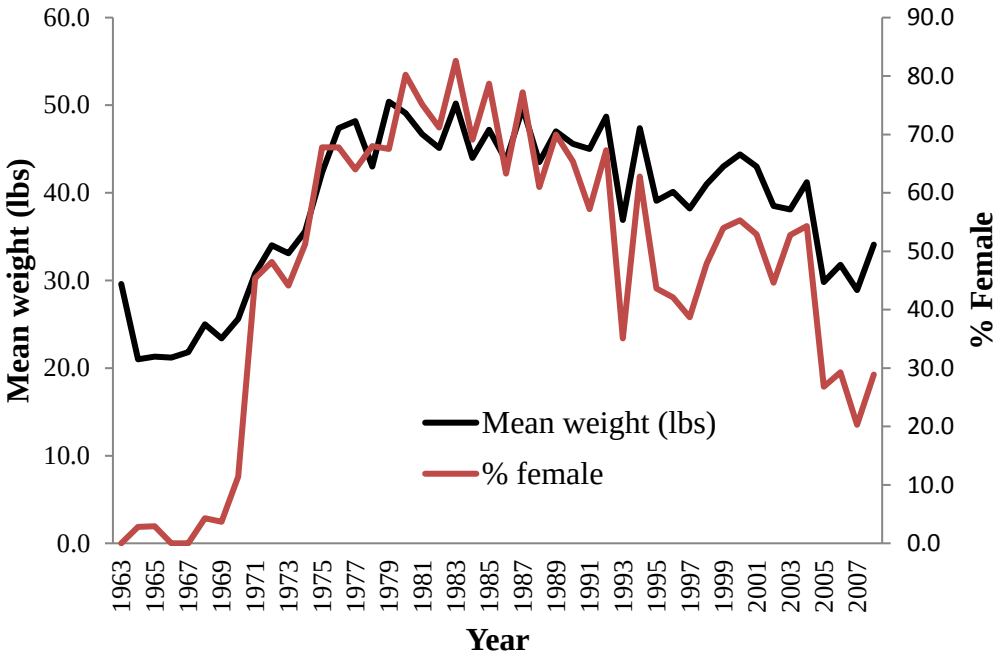

Figure 4. Mean weight (lbs) and % female of paddlefish harvested at Intake, Yellowstone River, MT 1963-2008.

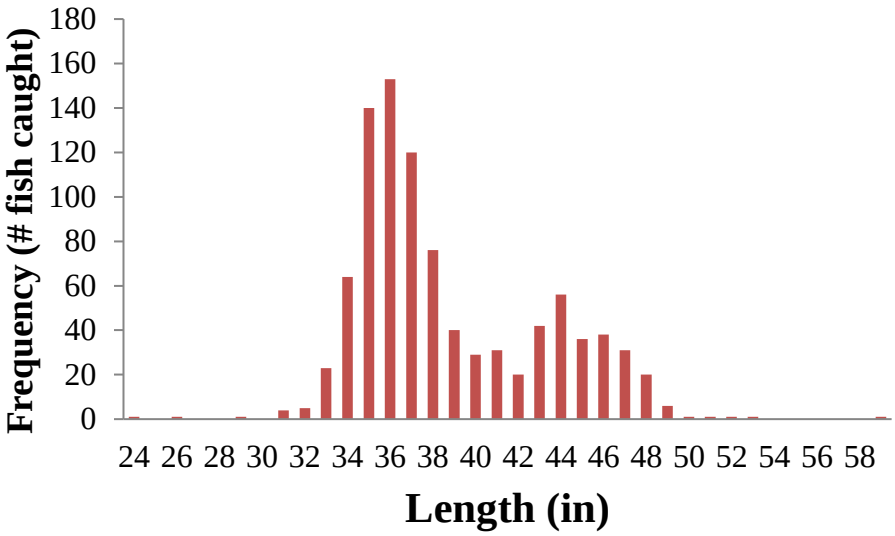

Figure 5. Number of paddlefish harvested by length from Intake, MT in 2008

Table 1. Number of anglers purchasing Montana paddlefish tags.

Year	Total Tag sales			Yellowstone/Lower Missouri River			Upper Missouri River		
	Total	Resident	Nonresident	Total	Resident	Nonresident	Total	Resident	Nonresident
2008	5301	4344	957	3017	2239	778	2284	2105	179
2007	4810	4061	749	2329	1809	520	2481	2252	229
2006	6910	6022	888	5329	4496	833	2605	2391	214
2005	6596	5833	763	4267	3691	576	2329	2142	187
2004	6920	6032	888	4442	3759	683	2478	2273	205
2003	7366	6363	1003	4812	4020	792	2554	2343	211
2002	5901	5002	899						
2001	4524	3770	754						
2000	6056	4859	1197						
1999	6785	5522	1263						
1998	6051	5004	1047						
1997	6169	4930	1239						
1996	6787	5495	1292						
1995	6544	5495	1049						
1994	4065	3237	828						
1993	5577	4194	1383						
1992	4779	3503	1276						
1991	4438	3021	1417						
1990	3960	2826	1134						
1989	4255	3081	1174						
1988	3526	2620	906						
1987	2877	2182	695						
1986	3696	2661	1035						
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. Prior to 2007, the Yellowstone/Lower Missouri River tag could also be used on the Upper Missouri River.

Table 2. A comparison of paddlefish harvest estimates and the percentage of harvest not occurring on the Yellowstone River at Intake, MT.

			Telephone Survey Harvest Estimates						
Year	Intake Creel Harvest Estimate	Intake Observed Harvest	Intake	Below Intake	Above Intake	Below Ft Peck	Total	Percent Non-Intake	Percent Cleaned by Chamber
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	
2007	553	867	767	94	137	0	998	23.1	
2008	NA	946					1102		82.76

Note: There is harvest on the Ft Peck Indian reservation that is not accounted for in any of our harvest estimates. 2004 telephone harvest estimates have been corrected and may be different from those presented in the 2003/2004 report.

Table 3. Summary of paddlefish tagging and tag returns 1964-2008.

Year(s)	Number Tagged	Number Returned in 2008	Total Number Returned	Percentage Returned
1964-1970	1703	0	279	16.4
1971-1980	3242	0	812	25.0
1984	551	1	250	45.4
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	82	37.1
1993	268	1	61	22.8
1994	180	1	61	33.9
1995	442	1	179	40.5
1996	139	0	62	44.6
1997	70	0	28	40.0
1998	42	1	11	26.2
1999	281	2	89	31.7
2000	20	0	5	25.0
2001	7	0	2	28.6
2002	147	3	52	35.4
2003	286	7	63	22.0
2004	20	0	6	30.0
2005	1317	58	160	12.1
2006	921	26	50	5.4
2007	1824	17	30	1.6
2008	1342	39	39	2.9
Totals	13517	157	2498	31.2

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

Table 4. Tag return rates for multi-year periods

Period Tagged	Number Tagged	Number During Period	Percentage Returned
1964-1970	1703	279	16.4
1971-1980	3242	812	25.0
1981-1990	1025	419	40.9
1991-2000	1683	586	34.8
2001-2008	5864	402	6.9

Table 5. 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	4.8
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
2001	7	7.93
2002	145	5.91
2003	282	3.95

Appendix A

Year	N	Mean TL (in)	Mean EF Length (mm)	Mean Weight (lbs)	%Females
1963	46	43.4	NA	29.6	0.0
1964	920	48.8	NA	21.0	2.8
1965	453	50.6	NA	21.3	2.9
1966	28	49.2	NA	21.2	0.0
1967	123	50.9	NA	21.8	0.0
1968	149	52.6	NA	25.0	4.3
1969	499	51.9	NA	23.4	3.7
1970	700	52	NA	25.6	11.4
1971	1136	53.1	NA	30.8	45.4
1972	1678	55.5	NA	34.0	48.2
1973	1696	53.9	NA	33.1	44.1
1974	1910	55.1	NA	35.6	51.2
1975	1158	57.3	NA	42.3	67.8
1976	940	57.6	NA	47.4	67.8
1977	1003	58.2	NA	48.2	64.0
1978	809	55.6	NA	43.0	68.0
1979	637	60.1	NA	50.4	67.5
1980		58.3	NA	49.1	80.2
1981	2528	NA	1086	46.7	75.1
1982	2004	NA	1078	45.1	71.2
1983	1400	NA	1086	50.2	82.6
1984	2691	NA	1080	44.0	69.1
1985	628	NA	1087	47.2	78.7
1986	1462	NA	1064	43.7	63.3
1987	1412	NA	1091	49.7	77.2
1988	1780	NA	1058	43.5	61.0
1989	1583	NA	1084	47.0	70.0
1990	1493	NA	1073	45.6	65.4
1991	2558	NA	1055	45.0	57.2
1992	670	NA	1087	48.7	67.3
1993	1659	NA	1005	36.9	35.1
1994	309	NA	1070	47.4	62.8
1995	1448	NA	1003	39.1	43.6
1996	1120	NA	1002	40.1	42.1
1997	797	NA	1007	38.2	38.7
1998	580	NA	1046	41.0	47.9
1999	1345	NA	1049	43.0	54.0
2000	541	NA	1053	44.4	55.3
2001	344	NA	1064	43.0	52.9
2002	713	NA	1025	38.5	44.6
2003	831	NA	993	38.1	52.8
2004	221	NA	1016	41.2	54.3
2005	1051	NA	937	29.8	26.8
2006	1194	NA	955	31.8	29.3
2007	867	NA	942	28.9	20.3
2008	946	NA	983	34.1	28.9

Appendix B

Year	Male N	Male Mean FE Length (mm)	Male Mean weight (lbs)	Female N	Female Mean EF Length (mm)	Female Mean Weight (lbs)
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
2006	844	882	21.8	350	1130	56.0
2007	691	897	22.3	176	1128	55.2
2008	672	922	24.9	274	1138	56.7