

**Job Progress Report** 

STATE: MontanaPROJECT: Statewide Fisheries ManagementJOB TITLE: Yellowstone River Paddlefish Investigations-3740FEDERAL GRANT: F-113-R-17PROJECT PERIOD: July 1, 2018 through June 30, 2019REPORT PERIOD: April 1, 2019 through March 30, 2012

ABSTRACT:

Each spring Paddlefish migrate upstream out of the headwaters of Lake Sakakawea with rising river discharge to reach river spawning grounds. Yellowstone River discharge in 2019 was near the historical average. Anglers harvested Paddlefish at a rate of about 50 fish per day through Memorial Day Weekend, mostly from downstream locations like Sidney Bridge Fishing Access Site. As discharge increased with mountain snowmelt runoff more migrating Paddlefish became available at Intake Fishing Access Site and harvest peaked on May 31<sup>st</sup> with 154 fish observed at the Intake cleaning station on that day. Harvest was closed at the end of the next day June 1<sup>st</sup>. Catch and release fishing at Intake Fishing Access Site lasted until June 11<sup>th</sup> with an average of 74 Paddlefish landed per day. Fish, Wildlife & Parks (FWP) staff tagged 667 Paddlefish with jaw tags in 2019 during catch-and-release fishing. Thirty-three Paddlefish from a native species radio telemetry study migrated up to Intake in 2019. Of those Paddlefish that reached Intake Diversion Dam six migrated past by going over the diversion dam and five migrated through Joes Island side channel after a temporary construction culvert crossing blew out with the high water. The Joes Island side channel passage route will not be available to fish in the coming season as the upper end of it was filled during the ongoing construction of the Intake Bypass Channel. Ten of the 11 telemetered Paddlefish that migrated past Intake Diversion Dam continued to the Powder River with six of these fish observed going into the Powder River.

#### INTRODUCTION:

Paddlefish Polyodon spathula are a highly sought-after sport-fish in the Yellowstone and Missouri rivers. They also garner commercial interest for their eggs that support 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 River (Holton and Johnson 2003). Paddlefish have highly developed gill rakers that facilitate filter feeding of zooplankton in large river systems and reservoirs (Meyer 1960, Rosen and Hales 1981). Paddlefish are sexually dimorphic. Males become sexually mature earlier and at a smaller size than females (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. After the onset of sexual maturity, approximately age 10 for males and age 14 for females, they make spawning runs out of the reservoir up the Missouri River to its confluence with the Yellowstone River. Many Paddlefish spend the spawning season in the immediate vicinity of this confluence area while others continue to migrate up the Missouri River below Ft. Peck Dam or up the Yellowstone River. They spawn on clean gravel bars during the high flow period in May and June (Purkett 1961, Rehwinkel 1978; Carlson and Bonislawsky 1981). The Yellowstone/Sakakawea stock is sustained primarily through natural recruitment although hatchery stocking has occurred periodically with the specific purpose of introducing known age fish into the stock for validating aging methods. It has also been observed that some Paddlefish immigrate from the Fort Peck stock that resides in Fort Peck Lake and the Missouri River upstream of Fort Peck Dam. Similarly, it has been observed that Paddlefish emigrate and are permanently lost from the Yellowstone Sakakawea population by passing over Garrison Dam into the Garrison reach of the Missouri River below the Dam (e.g. as observed in 2011 during historic Missouri River flows).

The harvest of Paddlefish at Intake, MT has been documented for over a century and as knowledge of the fishery has improved some important management decisions have been made particularly in the last two decades (Scarnecchia et al. 2008). 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. Currently a 2,000 Paddlefish harvest cap is shared by North Dakota and Montana (1,000 fish each). In 2017, the Montana legislature passed a bill that extended the statute allowing production of caviar from the roe of harvested Paddlefish at Intake Fishing Access Site (FAS) until 2028. Since 1990, the Glendive Chamber of Commerce, a non-profit organization, has been allowed to offer onsite fish cleaning services in exchange for roe from female Paddlefish under a memorandum of understanding with Fish, Wildlife & Parks (FWP) because of this legislation. Proceeds from the sale of caviar fund community improvement grants, as well as Paddlefish research, monitoring and management (Scarnecchia et al. 2008). This arrangement and regulated management of the fishery has prevented over-commercialization and subsequent exploitation that plague fisheries of other roe bearing species worldwide (Speer et al. 2000).

In Montana, the harvest of Paddlefish at Intake FAS is closed instantaneously when FWP staff estimates that harvest is approaching the 1,000-fish harvest cap. Paddlefish harvest closes elsewhere 24 hours after the closure at Intake. After the instantaneous harvest closure at Intake FAS catch-and-release fishing is permitted at Intake FAS for an additional 10 consecutive days. Regulation changes in 2007 created the current season structure with harvest (mandatory) on Tuesday, Wednesday, Friday and Saturday and catch-and-release (mandatory and only at Intake

FAS) on Sunday, Monday and Thursday. Legal fishing hours are from 6 a.m. to 9 p.m. mountain time.

Objectives for the 2019 season were as follows: 1) keep harvest under the 1,000 fish harvest cap, while spreading harvest over more days to increase angler satisfaction and maintain opportunity, 2) provide additional Paddlefish angling opportunity with catch-and-release days, and use this opportunity to increase number of tagged fish in the river, 3) characterize size distribution, condition of fish, and sex ratio of the population, 4) document movements of radio tagged Paddlefish with emphasis on passage at Intake FAS.

## METHODS:

The 2019 Paddlefish season was the fourth season requiring mandatory report of harvested Paddlefish by either phone or in person at the Intake cleaning station. The data collected by this hotline was used to document Paddlefish harvest that was not detected by the physical data collection station at Intake FAS. A post season Paddlefish telephone creel has been conducted since 2003 to obtain harvest estimates for the Yellowstone/Sakakawea Paddlefish population. The content of the annual phone creel has varied over the years as regulations and management concerns have changed. Estimation of total harvest is the one component of the phone creel that has remained consistent since 2003. The structure of the phone creel has been consistent enough since 2008 to provide useful annual estimates of angler participation, effort, and catch rates for both harvest fishing and catch and release fishing. The 2019 phone creel included 7 questions about angler harvest, angler effort, use of Glendive Chamber of Commerce fish cleaning services, and participation in catch-and-release fishing. The phone creel was used to provide the final estimate of harvest.

University of Idaho and FWP staff ran a biological check station to collect data from harvested Paddlefish brought by anglers to Intake FAS to be cleaned by the Glendive Chamber of Commerce Caviar Contractors. Harvested fish were weighed to the nearest pound, measured to the nearest inch (front of eye to fork of the caudal fin), and inspected for tags (i.e. jaw, radio, coded wire, etc.). Gender of harvested fish was recorded by FWP staff and confirmed when filleted by caviar staff. A portion of the Paddlefish caught during designated catch-and-release fishing by anglers were measured and tagged by FWP creel clerks. Fish sex was estimated based on length, abdominal shape and presence of tubercles on rostrum and head. Monel metal bands (National Band and Tag Co., Size 16, <sup>1</sup>/<sub>2</sub> inch inside diameter) have been used to tag Paddlefish around the dentary bone since 1997. Recent runs of the bands have been corroding badly, so that the numbers are not discernible after just a few years. This lack of longevity for tags being put on fish that could be at large after tagging for half a century poses a problem. In 2016 FWP staff began using an aluminum version of the metal jaw tags. North Dakota Game and Fish Department (NDGF) staff annually attempt to jaw tag roughly 500 Paddlefish below the confluence prior to both the North Dakota and Montana Paddlefish seasons. The NDGF tagging effort functions as the mark event and the harvested fish from both states function as the recapture events used to model population (Scarnecchia et al. 2008). Both states collected jaw sections from harvested Paddlefish to be aged by the University of Idaho. This age data was used to model population (Scarnecchia et al. 2014) and recruitment (Scarnecchia et al. 2008) so the fishery can be managed sustainably (i.e. balance fish harvested out with fish recruited into the population). To test a hypothesis that expanding catch-and-release opportunity has resulted in FWP staff increasing the number of Paddlefish tagged annually a single factor analysis of variance and TukeysHSD post hoc test was used to test for differences in the average number of Paddlefish tagged per year between three distinct management periods, no formal catch-and-release fishing (1984-1994), limited formal catch-and-release fishing (1995-2006) and expanded catch-and-release fishing (2007-2019).

Paddlefish length and weight data were used to determine relative weight ( $W_r$ ), an index of condition (Murphy and Willis 1996). Length frequency histograms were calculated to describe the length distribution of harvested Paddlefish (Murphy and Willis 1996, Brouder et al. 2009). These indices provide a metric for analysis of the size and condition of the Yellowstone/Sakakawea population relative to other Paddlefish across the species range.

Sex identification of harvested Paddlefish was used to infer future trends. Inferences are made using the combination of knowledge of dominant year classes and differing age at maturity. Consideration of sex ratio, population modeling, and knowledge of strong year classes (i.e. identified by dentary bone aging, Scarnecchia et. al 2006) are used to ensure harvest from this Paddlefish population is sustainable (Scarnecchia et. al 2008).

During the month of August NDGF staff conducted transects in the upper end of Lake Sakakawea counting young-of-the-year Paddlefish with methods as described by Fredericks and Scarnecchia (1997). While conducting these visual transects from a boat it is also common for NDGF staff to observe sub-adult Paddlefish. This effort provides an indication of the relative strength of reproduction from the current year as well as recruitment of the previous few year classes to sub-adulthood.

Additionally, since the 2015 season FWP and the Bureau of Reclamation (BOR) have conducted a telemetry study using radio tagged native species (Pallid Sturgeon, Shovelnose Sturgeon, Blue Sucker, Sauger, and Paddlefish) to evaluate passage at Intake Diversion Dam under current conditions. Only a description of the movements of telemetered Paddlefish will be summarized in this report. Paddlefish were surgically equipped with Lotek MCFT2-3L radio transmitters adapting methods described by Ross and Kleiner (1982). Incisions were made on fishes left just offset from the abdominal midline and closed with wax coated braided silk sutures (Photo 1). Relocations of telemetered fish were made weekly by boat and continuously with a network of ground receivers.

#### **RESULTS / DISCUSSION:**

Yellowstone River discharge was approaching 20,000 cubic feet per second (CFS) by May 17, 2019 (USGS station #06329500 Sidney, MT) when Paddlefish were first observed at Intake FAS and discharge continued to increase exceeding 50,000 CFS on June 11, 2019 (Figure 1). Rate of harvest was about 65 Paddlefish per day with 11 full days of harvest fishing before the harvest season was closed at both Intake and river side at 9pm on June 1<sup>st</sup>. Catch-and-release fishing for Paddlefish was allowed for 10 additional days at Intake FAS, ending June 11th. The Yellowstone/Sakakawea telephone creel estimated total harvest at 758 Paddlefish for 2019 (Skaar and Selby 2019, Appendix A).

Harvest has been kept under the harvest cap 9 of the last ten years. An estimated 2,035 anglers participated in the 2019 Paddlefish season on the Lower Missouri and Yellowstone Rivers, generating 3,482 harvest fishing angler days and 1,423 catch-and-release fishing angler

days (Table 1). Phone creel results indicate that staying under the harvest cap and increasing catch-and-release opportunity has been successful, but regulations have not increased the average number of harvest days per season (Figure 2). An estimated 92.4% of fish harvested were cleaned by the Glendive Chamber of Commerce in 2019 (Table 1). Phone surveys have estimated that 81-92% of the annual harvest has come through the Chamber of Commerce fish cleaning station at Intake over the period 2008-2019 (Table 1).

A special phone creel survey was completed in 2012 and numerical results as well as angler comments can be found in the 2012 report (Bollman 2012). The survey found 89% of Paddlefish anglers surveyed are satisfied with the current season structure. Anglers surveyed liked having the option to catch-and-release in addition to, but not in place of a harvest opportunity and would not be in favor of a lottery style draw for Paddlefish tags. The survey results also indicate anglers would support mandatory reporting of harvest if it provided more efficient population management. Mandatory reporting became a requirement for harvested Paddlefish in 2016. In the 2016 phone survey several questions were used to gauge the use and importance of gaffs for Paddlefish harvest. The intent was to determine if eliminating gaffs (i.e. eliminating the risk of incidental gaffing of Pallid Sturgeon) could be done without infringing on the opportunity of Paddlefish anglers. Thousands of Paddlefish are landed during catch and release fishing annually without the use of gaffs (Table 1). The 2016 phone survey indicated that 60% of Paddlefish anglers use a gaff while harvest fishing and believe their harvest ability would be reduced if gaffs were eliminated. While catch-and-release fishing suggests gaffs are not necessary to land Paddlefish the 2016 phone creel results strongly demonstrate that the opportunity to use a gaff is important to harvest anglers. Since the risk of incidental gaffing is quite low at this time, the benefit of eliminating the use of gaffs is outweighed by the cost to angler opportunity.

Tag sales for the Lower Yellowstone Paddlefish fishery suggest more participation prior to the last bundle of regulation changes in 2007 than from 2007 to 2019 (Figure 3). In 2006 anglers could purchase both a yellow and white tag giving them the opportunity to harvest two fish in Montana. Beginning in 2007, anglers had to choose one area, this eliminated everyone that preferred the Fort Peck fishery but were previously in the habit of buying the yellow tag purely as second opportunity. Monitoring tag sales for this Paddlefish population in Montana demonstrates license sales have responded to management of the Intake fishery and reinforces a continued need to strive for ways to increase angler satisfaction when taking biologically necessary measures to maintain a healthy Yellowstone/Sakakawea Paddlefish stock.

The change to harvest days and catch-and-release days in 2007 sought to maintain opportunity without increasing harvest. Phone creel results demonstrate anglers have responded to the increased catch-and-release fishing opportunity that has been available three days a week since 2007 (Figure 4). Since catch-and-release is only allowed at Intake FAS angler participation is strongly influenced by how available Paddlefish are at Intake. In good water years (e.g. 2010, 2017) phone creel results demonstrate higher participation in catch-and-release than observed in a poor water year (e.g. 2012). An estimated 27.5% of anglers participated in catch-and-release fishing in 2019 and landed a cumulative total of 3,613 Paddlefish at a rate of 5.6 Paddlefish caught per angler and fished a total of 1,423 catch-and-release angler days (Table 1). Catch-and-release fishing has provided an opportunity for FWP staff to tag angler caught Paddlefish at Intake FAS three days a week during the harvest season and 10 days immediately after the season closure since 2008. During catch-and-release fishing at Intake FAS in 2019, FWP staff tagged 667 Paddlefish, which is near the 20-year average number of Paddlefish tagged per year of 656 (Figure 5). Additionally, the average number of tagged Paddlefish has been greater in the period 2007-2019 which included three full days of mandatory catch-and-release at Intake FAS during the harvest season plus 10 additional days after an in-season closure than either of the two previous management periods 1984-1994 or 1995-2006 (Figure 6). From 1984 to 1994 there was no consistent catch and release opportunity but on occasion anglers were used by FWP staff to catch-and-release fish to assist with staff jaw tagging fish. From 1995 to 2006 there were two catch-and-release periods per week during the harvest season on Sunday and Wednesday from 3 to 9pm. Single factor ANOVA identified a statistically significant difference in the number of Paddlefish tagged exists between the periods. A Tukeys HSD post hoc test identified that while the average number of Paddlefish tagged per year in the period 1984-1994 did not differ from the period 1995-2006, there was a higher average number of Paddlefish tagged per year in the period 2007-2019 than in either previous period (Figure 6).

The sex ratio of harvested Paddlefish during 2019 was 45 percent female and 55 percent male (Table 2). As expected when harvest is associated with a spawning run, harvested fish are mature and some individuals are of trophy size (Figure 7). A regression of relative weight against length gave a similar indication of the size distribution of the Yellowstone/Sakakawea stock compared to other populations across the range (Figure 8). Fish collected at Intake FAS demonstrated condition factor at or just slightly below other populations.

The 1995-year class continued to be the best represented single cohort in the Paddlefish harvest in 2019. Male Paddlefish from the 1995-year class had skewed the sex ratio of harvested Paddlefish toward male for much of the past decade (Figure 9). These male fish from the 1995-year class began showing up in 2003, at age eight, and were the dominant year class in male harvest by 2005 (Scarnecchia 2017). The sex ratio began to shift back toward one to one in 2013 as the 1995-year class females became sexually mature and joined spawning runs. From 2014 to 2018 the harvest of Paddlefish has been skewed toward females (Figure 9). In 2019, the sex ratio was slightly skewed toward males due to the recruitment of 2011 cohort males. This 2011 cohort shows early signs of similar magnitude to the 1995 cohort and is expected to heavily skew the sex ratio of harvested fish toward males in the upcoming years.

Population estimates for the Yellowstone/Sakakawea stock developed by Dr. Dennis Scarnecchia of the University of Idaho using tagging information from Montana and North Dakota have been fairly consistent over 20 years (Figure 10). These closed population estimates represent a subset of the population of spawning adults. In any given year there are off-year spawners and sexually immature fish residing within Lake Sakakawea that are not estimated. A strong class of young-of-the-year (YOY) fish were documented during reservoir transects in 2011. Sakakawea transects in 2012 and 2013 suggested that little reproduction occurred during those years, but these surveys showed an unprecedented number of sub-adult fish assumed to be the 2011-year class (Fred Ryckman, personal communication). During the 2017 season several small male Paddlefish were harvested that were suspected to be leading edge fish from the 2011year class. Age analysis confirmed this and in 2018 the 2011-year class males comprised 15% of the male catch in Montana (Photo 2). The 2011-year class males accounted for 33% of male harvest in 2019 and caused a shift back towards a 1:1 sex ratio and will lead to male dominance in the catch until females from this year class begin to recruit 8-10 years after males (approx. 2026-2028). Recruitment of this 2011-year class continues to suggest this year class will be similar in magnitude to the 1995-year class. The 1995-year class has provided a buffer to the

harvest of other recruited year classes and allowed managers to maintain a consistent harvest cap for more than a decade.

Paddlefish have been a part of a native species telemetry study to evaluate the current level of fish passage at Intake Diversion Dam under existing conditions conducted jointly by the U.S. Bureau of Reclamation and Montana FWP since 2015. During the month of May in 2015, 40 adult Paddlefish were surgically implanted with radio telemetry transmitters in the 10-mile reach downstream of Intake FAS as part of this study. The movements of telemetered Paddlefish in 2015 demonstrate passage over or around Intake Diversion Dam (Figure 11). Five Paddlefish migrated upstream of Glendive. Four continued upstream to the Powder River area, with one male Paddlefish migrating as far as Rosebud, MT. During the month of May in 2016, 58 adult Paddlefish were surgically implanted with radio telemetry transmitters in the 10-mile reach downstream of Intake FAS. Newly tagged and previously tagged (2015) Paddlefish were relocated during 2016 telemetry and ground station tracking (Figure 12). In 2016, 0 of 53 Paddlefish that encountered Intake Diversion Dam passed over or around as flows were likely inadequate to make passage available. During the month of May in 2017, 13 adult Paddlefish were surgically implanted with radio telemetry transmitters in the 10-mile reach downstream of Intake FAS. Newly tagged and previously tagged (2015, 2016) Paddlefish were relocated during 2017 telemetry and ground station tracking (Figure 13). Forty-nine telemetered Paddlefish encountered Intake Diversion Dam in 2017 with just 12 passing (24%) upstream, mostly through the side channel (9 Paddlefish) but also over the dam (3 Paddlefish). During the month of May in 2018, 10 adult Paddlefish were surgically implanted with radio telemetry transmitters in the 10mile reach downstream of Intake FAS. Newly tagged and previously tagged (2015, 2016, 2017) Paddlefish were relocated during 2018 telemetry and ground station tracking (Figure 14). Forty telemetered Paddlefish encountered Intake Diversion Dam in 2018 with 19 passing (48%) upstream, mostly through the side channel (14 Paddlefish) but also over the dam (5 Paddlefish). Thirty-three Paddlefish from a native species radio telemetry study migrated up to Intake in 2019. Of those Paddlefish that reached Intake Diversion Dam six migrated past by going over the diversion dam between May 28<sup>th</sup> and July 2<sup>nd</sup> and five migrated through Joes Island side channel during June after a temporary construction culvert crossing blew out with the high water (Table 3). The Joes Island side channel passage route will not be available to fish in the coming season as the upper end of it was filled during the ongoing construction of the Intake Bypass Channel. Ten of the 11 telemetered Paddlefish that migrated past Intake Diversion Dam continued to the Powder River with six of these fish observed going into the Powder River (Figure 15).

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Prepared by:

Caleb Bollman Date Prepared: <u>March 20, 2020</u> Waters Referred to: <u>Yellowstone River Sec. 1 21-1350-02</u>

Key Words:

Catch-and-release Harvest Paddlefish sex ratio Paddlefish caviar Phone creel survey Paddlefish tagging

Table 1. Yellow Paddlefish tags sold by year (Automated License System Data) and number of anglers fished, number of Paddlefish harvested, angler days (harvest fishing), percent of yellow tag holders participating in catch and release, number of catch and release anglers, angler days (catch and release fishing), number of Paddlefish landed during catch and release, and number of Paddlefish landed per angler during catch and release estimated by phone creel by year 2008-2019.

		_	Harvest Fishing		Catch and Release Fishing				
Year	Yellow Tags Sold	Anglers Fished	Harvest	Angler Days	% PF Anglers	Anglers Fished	Angler Days	Total Landed	PF per Angler
2008	3017	2481	1102	4474	19.4	481	1123	4180	8.7
2009	3189	2704	967	1823	29.7	949	1889	3474	3.7
2010	2508	2125	1027	3126	42.6	1069	2189	8116	7.6
2011	2772	2173	949	3535	25.7	712	1326	2738	3.8
2012	2931	2261	599	6070	14.4	408	779	330	0.8
2013	2515	2015	770	6194	23.4	568	1279	5217	9.2
2014	2535	2063	788	3940	28	699	3113	4431	6.3
2015	2778	2397	995	5561	19.3	530	6398	3990	7.5
2016	2841	2441	945	5523	27.1	760	1955	4317	5.7
2017	2473	2031	972	2577	35.8	866	1891	4744	5.5
2018	2571	2257	890	4806	21.1	537	1175	2476	4.6
2019	2417	2035	758	3482	27.5	648	1423	3613	5.6

Year	Ν	%Females	%Male
2005	1051	26.8	73.2
2006	1194	29.3	70.7
2007	867	20.3	79.7
2008	946	28.9	71.1
2009	800	32.5	67.5
2010	821	23.6	76.4
2011	713	35.1	64.9
2012	468	35.6	64.4
2013	747	48.7	51.3
2014	699	70.5	29.5
2015	766	68.0	32.0
2016	752	58.8	41.2
2017	804	72.3	27.7
2018	709	66.1	33.9
2019	719	45.2	54.8

Table 2. Sex Ratio by year for Paddlefish of the Yellowstone Sakakawea stock.

		Farthest Upstream	
Upstream Movements	Total	Extent (RM)	Date Range
Recorded in Yellowstone River	57		
To Intake	33		
Move Past Intake	11		
Via Joe's Island Side Channel	5		6/4/2019 - 6/23/2019
Over Dam	6		5/28/2019 - 7/2/2019
To Powder River	10		
Into Powder River	6	14.7	6/4/2019 - 6/17/2019
Move Past Powder River	0	146.8	

Table 3. Summary of movements of telemetered Paddlefish in Yellowstone River and tributaries during 2019.



Photo 1. Example of Paddlefish surgery, abominal insertion on fishes left of Lotek MCFT2-3L radio transmitter on frequency 148.480, closure with silk sutures.



Photo 2. Example of dentary section from male Paddlefish MT\_4594 harvested in 2018 in Montana, aged at 7 years old (2011-year class) from Dr. Dennis Scarnecchia, University of Idaho.



Figure 1. Observed Paddlefish harvest at Intake, upstream of Intake, and downstream of Intake, and catch and release at Intake during the 2019 Paddlefish season. Discharge (flow measured in cubic feet per second) recorded at USGS gauging stations; Yellowstone River at Sidney during the 2019 Paddlefish season.



Figure 2. Number of harvest days per season for the Lower Missouri and Yellowstone Rivers.



Figure 3. Number of Paddlefish tags sold for the Lower Missouri River and Yellowstone River in Montana by year with mean tag sales from 2003 to 2006 indicated by the blue line and mean tag sales from 2007 to 2019 indicated by the red line.



Figure 4. Phone creel catch-and-release (C&R) data by year including anglers fished, angler days, total fish landed and percent anglers participating in catch-and-release for Paddlefish of the Lower Missouri River and Yellowstone River in Montana from 2003 to 2019.



Figure 5. Number of Paddlefish tagged by year from 2000 to 2019, catch-and-release opportunity has been available since 1995, 3 days/week during the harvest season and an additional 10 days post harvest closure of catch-and-release only fishing has been available since 2007.



Period

Figure 6. Number of Paddlefish tagged by period pre catch-and-release fishing (1984-1994), C&R Sundays and Wednesdays 3-9pm (1995-2006), and Sunday, Monday, Thursday and 10 days post harvest season 6am-9pm (2007-2018).



Figure 7. Length frequency histogram with proportion size distribution of Lower Missouri River and Yellowstone River Paddlefish harvested in Montana during 2018, blue bars represent male Paddlefish and pink bars represent female Paddlefish.



Figure 8. Relative weight by eye-fork-length (in) of Lower Missouri River and Yellowstone River Paddlefish harvested in Montana during 2018 season.



Figure 9. Percent of 1995 cohorts in male and female harvest in the Montana Paddlefish data, 2000-2018 (from Scarnecchia 2018)



Figure 10. Petersen-Lincoln estimates of paddlefish population size with 95% confidence intervals, using scheme M1(*t*) with R12(*t*) and C12(*t*), where M1(*t*) = Count of: (1) ND-tagged paddlefish in Spring of year *t*, and (2) ND-tagged paddlefish from previous years (*t*-1, *t*-2, ...) which were recaptured and released in Spring of year *t*, and the number of ND-tagged fish randomly recaptured from both ND and Montana (MT) water (R12(*t*)), and the number of paddlefish in combined ND and MT harvest in year *t* (i.e., C12(*t*)). (from Scarnecchia 2013)



Figure 11. Movements of 40 telemetered Paddlefish in the Yellowstone River by sex during 2015. Yellowstone river mile on the y-axis and date on the x-axis with reference markers for test reach (Intake), control reach (Glendive), Powder River, and Tongue River (by Mat Rugg from Native Species Telemetry presentation to Upper Basin Pallid Sturgeon Workgroup 2015)



Figure 12. Movements of 58 telemetered Paddlefish in the Yellowstone and Missouri Rivers during 2016. Yellowstone river mile on the primary y-axis, Missouri river mile on the secondary y-axis, river discharge (CFS) on tertiary y-axis, and date on the x-axis with reference marker for test reach (Intake) shown in gray (by Mat Rugg from Native Species Telemetry presentation to Upper Basin Pallid Sturgeon Workgroup 2016)



Figure 13. Movements of 49 telemetered Paddlefish in the Yellowstone and Missouri Rivers during 2017. Yellowstone river mile on the primary y-axis, Yellowstone River discharge (CFS) on the secondary y-axis, and date on the x-axis with reference marker for control reach and test reach (Intake) shown in gray (by Mat Rugg from Native Species Telemetry presentation to Upper Basin Pallid Sturgeon Workgroup 2017)



Figure 14. Movements of 52 telemetered Paddlefish in the Yellowstone River during 2018. Yellowstone river mile on the primary y-axis, Yellowstone River discharge (CFS) on the secondary y-axis, and date on the x-axis with reference marker for control reach (Gibbs Station) and test reach (Intake Dam) shown in gray (by Mat Rugg from Native Species Telemetry presentation to Upper Basin Pallid Sturgeon Workgroup 2018)



Figure 15. Movements of 57 telemetered Paddlefish in the Yellowstone and Powder Rivers during 2019. Yellowstone and Powder river miles on the primary y-axis, Yellowstone and Powder River discharge (CFS) on the secondary y-axis, and date on the x-axis (by Mat Rugg from Native Species Telemetry presentation to Upper Basin Pallid Sturgeon Workgroup 2019)

## **APPENDIX A**

# Yellowstone/Missouri River (Yellow Tag) Paddlefish Phone Survey – 2019

Compiled by Don Skaar and Corrine Selby, March 16, 2020

Number of tags sold: Number tag holders sampled: Number respondents: Response rate:	<b>2,417</b> <b>846 (62 non-deliverable)</b> <b>456</b> 456/784 = <b>58.16%</b>
Percent respondents fished Percent fished on Yellowstone Percent fished on Missouri	384/456 = <b>84.2%</b> 376/384 = <b>97.9%</b> 3/384 = <b>0.8%</b>
Total Anglers Fished	(.8421)(2,417) = <b>2,035</b> anglers
Harvest Fishing	
Fish harvested:	(2,035)(143/384) = <b>758 paddlefish</b>
Average days fished to harvest: Average days fished to no harvest:	274/143 = <b>1.92 days</b> 383/244 <b>= 1.57 days</b>
Average hrs/day harvest fishing: -Yellowstone River -Missouri River	2.45 hr/day 2.50 hr/day
Total Angler Days (harvest fishing):	(1.71)(2,635) = <b>3,482 days</b>
Catch rate (harvested fish):	143/657 = <b>0.22 pf/day</b>
Percent cleaned at chamber:	121/131 = <b>92.4%</b>

## **Catch and Release Fishing**

Percent anglers c/r fishing:	103/375 = <b>27.5%</b>
Total anglers c/r fishing	(.275)(.9788)(2,417) = <b>648</b> anglers
Average days c/r fishing	226/103 = <b>2.19 days</b>

only license	38.5%
Catch rate c/r fishing	3,612/1,423 = <b>2.54 pf/day</b>
Average number of fish landed Total fish landed	574/103 = <b>5.57 pf/angler</b> (5.57)(648) = <b>3,613 paddlefish</b>
Total days c/r fishing	(2.19)(648) = <b>1,423 days</b>

## **General Location of Harvest**

Intake	77
7 miles downstream from Intake	2
Elk Island	1
Savage	4
Seven Sisters	4
1 mile North of Sidney Bridge (near	
water treatment lagoons)	2
Sidney Bridge	38
Private land downstream of Sidney	1
Richland Park	12
State Line	1