Examination of pallid sturgeon use, migrations and spawning in Milk River and Missouri River below Fort Peck Dam during 2012

Prepared by:

David B. Fuller and Tyler M. Haddix

Montana Department of Fish, Wildlife and Parks

East Kansas Street

Fort Peck, MT 59223

Prepared for:

Upper Basin Pallid Sturgeon Workgroup

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Background

In 2011, record setting snowfall coupled with record spring rains resulted in rapid filling of Fort Peck Reservoir above full pool and subsequent, releasing water over the Fort Peck Spillway. The hydrologic regime in the Missouri River downstream Fort Peck Dam during 2011 was unique among the last several years due to these spillway releases, increased discharge from the Fort Peck Powerhouses and elevated discharge conditions during spring and early summer from the Milk River. This resulted in an increased use of adult pallid sturgeon (Fuller and Haddix 2012) and hatchery reared juvenile pallid sturgeon (Haddix et al. 2012) in the reach of the Missouri River from Fort Peck Dam to Wolf Point. Additionally, an aggregation of adult pallid sturgeon was located just downstream of the Milk River and the first genetically confirmed wild produced pallid sturgeon larvae was collected in this reach as a result of these flows (Fuller and Haddix 2012). In 2012, no spillway releases were conducted and discharge was much lower in the Milk River than in 2011. Thus, 2012 served as a "post treatment" to the epic events of 2011 as Fort Peck Dam resumed "normal" operations.

Scope and Objectives

The Objectives of this work were to (1) assess pallid sturgeon migrations and use of the Milk River and Missouri River between Fort Peck Dam and the Yellowstone River confluence; (2) quantify reproductive products (eggs, free embryos, larvae) and potential spawning reaches in the Milk River and Missouri River below Fort Peck Dam; and (3) assess and quantify settlement of pallid sturgeon larvae from the drift based on collections of young-of-year pallid sturgeon in lower reaches of the Missouri River.

Study Area

The Missouri River study area extended from Fort Peck Dam located at river mile (RM)1770 (rkm 2,850) downstream to RM 1553.5 (rkm 2,500) (near Williston, North Dakota; Figure 1). The study area also included the lower 115 miles of the Milk River from Vandalia Dam to its confluence with the Missouri River.

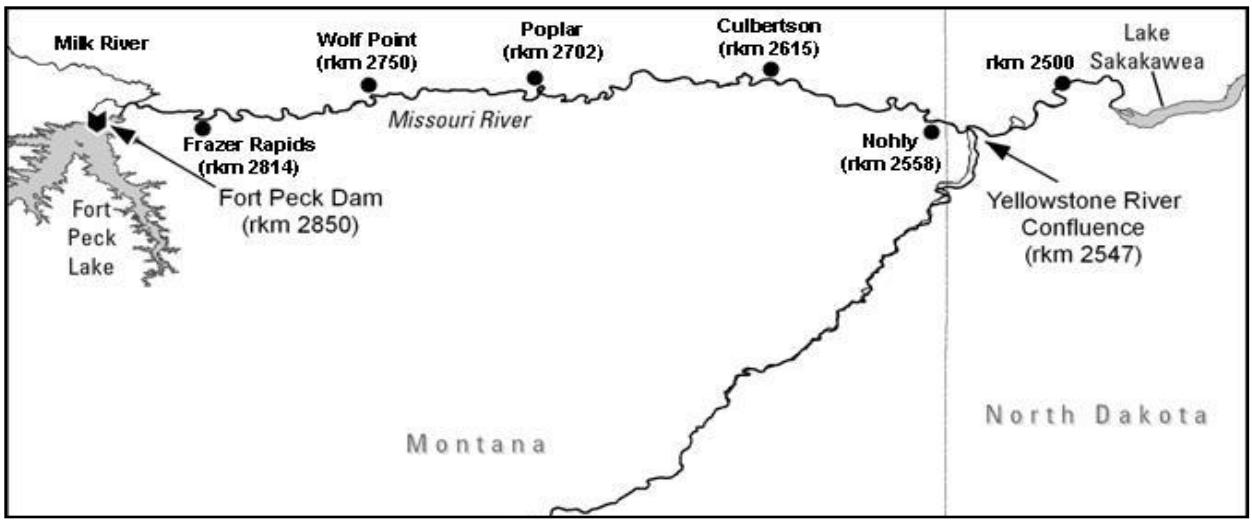

Figure 1. Study area of the Missouri River, Milk River and lower Yellowstone River.

Methods

Pallid sturgeon were sampled using drifted trammel nets and were implanted with radio tags (MCFT-3L tags, 16 mm x 73 mm, air weight = 26 g, 2,929-day longevity, 5-second pulse interval, 149.760 Mhz, Lotek Wireless Incorporated, New Market, Ontario). The coded signal emitted by each tag is unique to facilitate identification of individual fish. Surgical procedures followed methods outlined in Braaten and Fuller (2005). Most fish were collected in prior years during brood stock collection near the confluence of the Missouri and Yellowstone rivers.

Manual tracking of fish by boat during 2012 was initiated in April. The Missouri River between Fort Peck Dam and Wolf Point (70 m) was tracked from April through October. The Milk River was not manually tracked in 2012 (see results). One radio frequency (149.760 MHz) was monitored during the boat-tracking run using a 4-element Yagi antennae. Several variables (e.g, radio frequency, fish code, latitude, longitude, time-of-day) were recorded at fish locations.

Stationary telemetry logging stations were deployed in April 2012 at four sites on the Missouri River (Nickels, rm 1,760; near Wolf Point, rm 1,720; near Culbertson, rm 1,620; at rm 1,584 just upstream from the Yellowstone River confluence) and one site on the Milk River (rm 2.5). Additionally, there were several sites on the Yellowstone River which are mentioned in a separate report. The logging stations were placed on shore with two 4-element Yagi antennae. Each logging station was equipped with a battery powered receiver (Lotek SRX- 400), solar panel, an environmental enclosure kit containing dual 12-volt batteries, and an antenna switchbox. Data recorded by the logging stations were downloaded to a laptop computer two times per month between April and October. Coupled with manual tracking efforts, the array of

telemetry logging stations facilitated detection of dates and times of movement events between and within rivers and river reaches.

Sampling for free embryos and larvae was conducted in the lower Milk River and Missouri River near Wolf Point following methods outlined in Braaten et al. (2010). Sampling was conducted two times per week at multiple replicate locations. After sampling was completed, net contents were transferred to black rubber trays where Acipenseriformes larvae (sturgeon and paddlefish) were extracted from the detritus. Extracted Acipenseriformes larvae were placed immediately in 95% non-denatured ethanol for genetic analysis. After extracting these larvae, the remaining sample was placed in a 10% formalin solution containing phloxine-B dye and contents were separated and identified in the lab.

Targeted sampling for young-of-year pallid sturgeon followed trawling methods outlined in Braaten and Fuller (2007) and was conducted every week from mid-July through mid-September. Sampling for young-of-year sturgeon (*Scaphirhynchus* spp.) was conducted with a benthic (beam) trawl in the Missouri River above the Yellowstone River confluence (i.e., ATC) and Missouri River below the Yellowstone River confluence (i.e., BTC). Four replicate sampling locations were established at each site where each replicate was comprised of an inside bend, outside bend, and channel crossover habitat complex (IOCX) associated with a river bend. Fin clips were obtained for all *Scaphirhynchus* spp. collected, stored in 95% ethanol, and genetically processed by Ed Heist at Southern Illinois University to distinguish individuals as pallid sturgeon or shovelnose sturgeon. If identified as a pallid sturgeon, further analysis to determine parentage was performed.

Results

For task 1, telemetered wild adult pallid sturgeon (n=41) were manually tracked in the Missouri River ATC to Fort Peck Dam. There was no use of the Milk River by telemetered pallid sturgeon in 2012. Similar to 2005-2010, use of the Missouri River ATC by adult pallid sturgeon in 2012 declined through the spring and reached a low during the spawning season (<10% from late May to July; Figure 2). There were only two fish that were located upstream of Wolf Point in 2012 prior to the spawning season; however, both emigrated out of this reach and into the Yellowstone River by late May. Use of this reach increased in July as fish completed spawning in the Yellowstone River and migrated to post-spawn areas in the Missouri River above and below the confluence of the Yellowstone River where most would eventually over-winter.

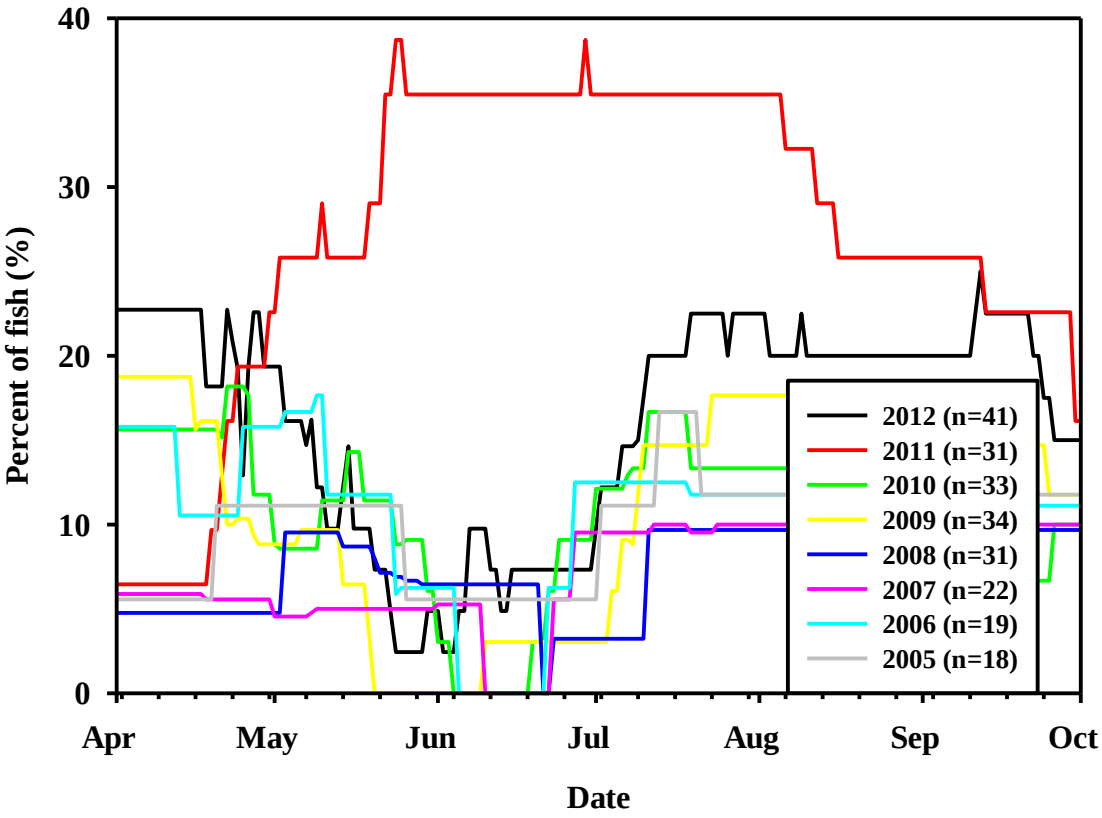

Figure 2. Percentage (%) of telemetered adult pallid sturgeon located in the Missouri River above the confluence of the Yellowstone River by date from 2005 – 2012.

For task 2, sampling for larvae was conducted in the Milk River during 16 events spanning from 22-May through 17-July, 2012. No sturgeon or paddlefish larvae were collected during this time.

Larval sampling was conducted on the Missouri River near Wolf Point during 20 events from 23-May through 26-July. A total of 109 paddlefish larvae and 31 *Scaphirynchus* larvae was collected (Table 1). Genetic analysis of the *Scaphirhynchus* larvae indicated that they were all shovelnose sturgeon.

Table 1. Sampling dates and paddlefish (pdfh), shovelnose sturgeon (snsg), and pallid sturgeon (pdsg) larvae collected in the Missouri River near Wolf Point in 2012.

	May			June									July								Total
Date	23	25	29	1	6	7	11	14	18	21	26	28	2	5	11	13	16	19	22	26	
pdfh	0	0	0	0	0	0	0	13	13	1	7	2	7	29	21	12	3	0	1	0	109
snsg	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	2	11	3	7	2	31
pdsg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

For task 3, beam trawling for young-of-year sturgeon was conducted weekly from 24-July through 11-September, 2012. Channel catfish (*Ictaluris punctatus*) and sturgeon chub (*Macrohybopsis gelida*) made up 64% and 19% of the catch, respectively (Table 2). A total of 156 young-of-year sturgeon were collected in the MRBTC while one was collected in the MRATC. All were determined to be shovelnose sturgeon through genetic analysis (Southern Illinois University, Carbondale).

Based on the small size of these shovelnose sturgeon (Table 3), spawning was very prolonged in 2012. This was most likely due to sustained high discharge(~12,000 ft^3/s) from Fort Peck Dam and cool water temperatures associated with hypolimnetic releases from the dam. Although larval sampling ceased on 26-July, it is likely shovelnose sturgeon embryos were likely hatching into mid-August based on growth models developed by Braaten and Fuller (2007).

Table 2. Total catch of fish by the benthic trawl in the Missouri River above the confluence of the Yellowstone River (MRATC), Missouri River below the confluence of the Yellowstone River (MRBTC), and total catch from 24-July to 11-Sept, 2012.

Species	(MRATC)	(MRBTC)	Total
Blue sucker		2	2
Common carp		3	3
Channel catfish	26	1635	1661
Emerald shiner	4	12	16
Flathead chub	19	25	44
Freshwater drum	1	23	24
Goldeye		1	1
Hybognathus spp.		9	9
Longnose dace		4	4
No fish	26	10	36
Paddlefish		1	1
Pallid sturgeon (Hatchery-reared)	3	7	10
River carpsucker		5	5
Sicklefin chub	19	18	37
Sturgeon chub	92	396	488
Sauger		25	25
Shovelnose sturgeon	4	17	21
Shovelnose sturgeon (YOY)	1	156	157
Stonecat	1	55	56
Unidentified Cyprinid		1	1
Walleye		3	3
White bass		1	1
White crappie		3	3
White sucker		1	1

Table 3. Number of young-of-year shovelnose sturgeon collected in standard trawls, targeted trawls, minimum length (mm), maximum length (mm), and mean length (mm) in 2012 by date.

Date	Total (n)	Standard (n)	Targeted (n)	Min. Length	Max Length	Mean Length
7-24-12	5	1	4	18	45	29.0
7-30-12	13	4	9	13	67	29.8
8-8-12	37	8	29	20	112	38.0
8-14-12	39	8	31	27	63	34.8
8-22-12	7	5	2	33	76	53.1
8-28-12	18	8	10	26	135	50.8
9-5-12	12	5	7	34	152	71.6
9-11-12	26	4	22	38	98	66.1

Discussion

During 2012, there was very little use of wild adult pallid sturgeon in the Missouri River above the confluence of the Yellowstone River and no use of the Milk River. These results are very similar to every other year in which no flow enhancements were implemented i.e., spillway releases.

Documentation of use, spawning and reproduction in the Missouri River in 2011 indicates that the Missouri River is used by pallid sturgeon when flow regimes are suitable regardless of temperature. Results of the 2011 study added substantial new information on pallid sturgeon movement, river use, and behavior. Verification of successful reproduction by wild pallid sturgeon has provided information that shows spawning, fertilization, egg survival, and hatch can occur in the Missouri River when flows deviate from baseline operations.

To recap, the one year that flows deviated from "normal" operations in the Missouri River and spillway operations were a necessity; 1) adult pallid sturgeon migrated 180 miles up the Missouri River from the confluence of the Yellowstone River, 2) several used the Milk

River, 3) wild adult pallid sturgeon formed and aggregation in the Missouri River just downstream of the Milk River, 4) successfully spawned, as evidenced by the collection of a wild produced pallid sturgeon larvae and, 5) increased suitable rearing habitat for hatchery-reared juvenile pallid sturgeon. All other years, wild adult pallid sturgeon are rarely located in upper reaches of the Missouri River and thus; there are no aggregations, there is little to no use of the Milk River, no spawning, no recruitment, and majority of hatchery-reared pallid sturgeon migrate to downstream reaches of the Missouri River after 2-3 years of being stocked in these upstream reaches.

Successful spawning of shovelnose sturgeon has been documented in the Missouri River below Fort Peck Dam every year since 2001 (Fuller and Braaten 2012, Fuller and Haddix 2012, this report). These spawning events are likely from a population that resides year-round in areas of the Missouri River above Wolf Point. Therefore, unlike pallid sturgeon, traditional migration cues are not required to draw these fish to upstream spawning reaches.

Further studies on trigger flows required to cue pallid sturgeon to migrate into the Missouri River and to spawn are essential. Since very few sexually mature adult pallid sturgeon have been observed in the Missouri River with the exception of 2011, limited data exists that details the flow parameters required to stimulate wild pallid sturgeon migrations and spawning.

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