2015 Field-based Biotic Assessments of Migration and Spawning – Upper Missouri River and Milk River

Background

The lower Yellowstone River and Missouri River between Fort Peck Dam and Lake Sakakawea is inhabited by a wild adult population of pallid sturgeon. Over the last two decades, pallid sturgeon in this section of the upper Missouri River Basin have been the focus of several studies examining movements, migrations and habitat use (for example, Bramblett and White, 2001; Fuller and others, 2008; Fuller and Braaten, 2012).

The USGS and MTFWP collaborated on studies during 2011–2015 which focused on examining migrations, habitat use, and spawning of pallid sturgeon in the Yellowstone River. A similar approach is used for the upper Missouri River and Milk River area. Information is collected to determine what flows are associated with migrations and spawning of pallid sturgeon in the Missouri River downstream from Fort Peck Dam. This study will evaluate use, migrations, and spawning of pallid sturgeon in the Milk River and Missouri River downstream from Fort Peck Dam.

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. Methods

The Missouri River study area extends from Fort Peck Dam located at RM1,770.0 downstream to RM 1,553.5 (near Williston, North Dakota; fig 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.

Pallid sturgeon were sampled using drifted trammel nets and were implanted with radiotelemetry transmitters (MCFT-3L tags, 16 mm x 73 mm, air weight = 26 g, 2,929-day longevity, 5-second pulse interval, 149.760 megahertz (Mhz), Lotek Wireless Incorporated, New Market, Ontario). The coded signal emitted by each transmitter is unique to facilitate identification of individual fish. The signal from each transmitter is encoded with a digital identification code (code). New transmitters used at reimplantation may have a different code than the expired tags they replace. Sturgeon reimplanted will multiple times could have multiple codes through time. Surgical procedures followed methods outlined in Braaten and Fuller (2005). Most fish were collected in prior years during broodstock collection near the confluence of the Missouri and Yellowstone Rivers.

Manual tracking of fish by boat during 2015 was initiated in April. The Missouri River between Fort Peck Dam and Wolf Point (70 miles) was tracked from April through October. The Milk River was only manually tracked when the ground-based telemetry station, located near the mouth, detected a pallid sturgeon. One radio frequency (149.760 MHz) was monitored during the boat-tracking run using a 4-element Yagi antennae. Several variables including, radio frequency, code, latitude, longitude, and time-of-day were recorded when a fish was located.

Stationary telemetry logging stations were deployed in April 2015 at four sites on the Missouri River (Nickels, RM 1,760; near Wolf Point, RM 1,720; near Culbertson, RM 1,618; 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 discussed in the previous section of this report. The logging stations were placed on shore with two 4element Yagi antennae, one facing upstream and one downstream. 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.

The lower Milk River and Missouri River near Wolf Point was sampled for *Acipensiformes* free embryos and larvae following methods outlined in Braaten and others (2010). Samples were collected two times per week at multiple locations. After sampling was completed, net contents were transferred to black rubber trays where *Acipensiformes* free embryos (sturgeon and paddlefish) were extracted from the detritus. Extracted *Acipensiformes* free embryos were then placed immediately in 95 percent nondenatured ethanol in preparation for genetic analysis. Specimens were sent for genetic analysis following methods outlined in Eichelberger and others (2014).

Targeted sampling for larval and young-of-year pallid sturgeon followed trawling methods outlined in Braaten and others (2007). Samples were collected every week from late-July through early-September. Sampling for young-of-year sturgeon (*Scaphirhynchus* spp.) were collected using a benthic (beam) trawl in the Missouri River upstream from the Yellowstone River confluence and in the Missouri River downstream of the Yellowstone River confluence. 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 associated with a river bend. Fin clips were obtained for all sturgeon species collected, and stored in 95 percent ethanol. The larvae and young-of-year samples were sent for genetic analysis to distinguish individuals as pallid sturgeon or shovelnose sturgeon. If identified a specimen was a pallid sturgeon, further analysis was done to determine parentage.

Progress

Discharge and temperature

Although discharge from the Yellowstone River averaged only 12,664 ft³/s in the April– May pre-spawn migration season, this was still much greater than the Missouri River at Culbertson (8,028 ft³/s) during this same time (fig. 2). There was minimal contribution from the Milk River during this time as discharge averaged less than 400 ft³/s. Discharge from the Milk River never reached 1,000 ft³/s anytime during the 2015 season. Water temperature warmed with increasing distance from Fort Peck Dam due to tributary inputs and increased exposure to ambient temperature (fig. 3). Water temperature at Wolf Point averaged 4.4 °C warmer than at a site five miles downstream from Fort Peck Dam (School Trust site) from April 20–Aug 31 and averaged 8.3 °C warmer at above the Yellowstone River confluence compared to School Trust during this same time frame. However, thermal suppression from the Dam remained evident as temperatures remained about 1.1 °C cooler in the Missouri River above the Yellowstone River confluence compared to the Yellowstone River. Temperature in Fort Peck Reservoir averaged 19.4 °C from June 15–July 15 (time of spawning and larval drift) which is 9.3 °C warmer than the School Trust temperature during this time.



Figure 2. Mean daily discharge (in cubic feet per second) in the Missouri River at Culbertson, Montana (streamgage 06185500), Missouri River at Wolf Point, Montana (streamgage 06177000), in the Milk River

at Nashua, Montana (streamgage 06174500) and in the Lower Yellowstone River at Sidney, Montana (streamgage 06329500) during 2015.



Figure 3. Water temperature (in degrees Celsius) for Missouri River sites (below Ft. Peck Dam, Wolf Point, Culbertson, Missouri River below the Yellowstone River confluence (MRBTC), Milk River, Lower Yellowstone River and Ft. Peck Reservoir during 2015.

Migration Patterns

Telemetered wild adult pallid sturgeon (n=49) were manually tracked in the Missouri River ATC to Fort Peck Dam. Of these fish, 2 were gravid females, 4 were non-gravid females and 43 were males. The Missouri River ATC had minimal use during 2015 (figs. 4 and 5).

Similar to most years, very little use occurred in the Missouri River ATC during the spawning season. Only two fish were located above Wolf Point (RM 1,700; about 140 miles

upstream) in 2015. This included a male that over-winters below Fort Peck Dam, which migrated to areas below the confluence of the Yellowstone River in July and another male that migrated above the station in late-July. Most forays into the Missouri River ATC were in lower portions of the river. A total of five fish migrated beyond the Culbertson ground station (about 25 miles). One male remained in the Missouri River in the Culbertson area (RM 1,618) for the entire year while the other four fish made their upstream migration late in the season, after spawning occurred in the Yellowstone River (see Yellowstone River report).

Use of the Missouri River increased in July, similar to other years, 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 overwinter.



Figure 4. Percentage of telemetered adult pallid sturgeon located in the Missouri River upstream of the confluence with the Yellowstone River by date from 2005–2015. N = number of implanted individuals.





There are approximately 110 hatchery-reared pallid sturgeon equipped with transmitters in RPMA2. The vast majority of these fish are from the 1997-2002 year class and should be reaching sexual maturity. In 2015, a female with black eggs was captured at river mile 1695 on July 1, 2015 and weighed 2,700g. This fish was recaptured at river mile 1687 on July 16 and weighed 2690g and no eggs were found. However, blood results indicated that this fish was not reproductively active having testosterone levels of 7.88 ng/ml and estradiol level of 0.11 ng/ml

on July 1 and a testosterone level of 19.18 ng/ml and estradiol level of 0.07 ng/ml on July 16. It is therefore, unclear if this fish spawned.

Free-embryo sampling

The Milk River was sampled for free embryos during 8 events spanning from June 4 through July 7, 2015. No *Acipensiiformes* free-embryos were collected from the Milk River in 2015.

The Missouri River near Wolf Point was sampled for free-embryos during 16 events from June 8 through August 6, 2015. A total of 18 paddlefish and 9 sturgeon free embryos were collected (table 1).

 Table 1.
 Numbers of Acipensiformes free embryos collected by date in the Missouri River near Wolf

 Point in 2015.

Larvae and young-of-year sampling

Beam trawling for young-of-year sturgeon was done weekly from July 22 through September 9, 2015. Channel catfish (*Ictalurus punctatus*), sturgeon chub (*Macrhybopsis gelida*), and sicklefin chub (*Macrhybopsis meeki*) made up 35.3, 21.4 and 20.3 percent of the catch, respectively (table 2). A total of 46 young-of-year sturgeon was collected in the Missouri River downstream of the Yellowstone River confluence (N= 271 trawls) and none were collected in the Missouri River upstream of the confluence (N=100 trawls.) There was a wide range of cohorts indicating that there was a prolonged spawn, likely from the Missouri River (table 3). Additionally, several large, earlier spawned individuals were collected and are likely of Yellowstone River or Powder River origin. All 46 sturgeon (*Scaphirhynchus* sp.) samples were sent to Southern Illinois University for genetic analysis.

- Table 2.
 Fish collected with the benthic trawl in the Missouri River above the confluence of the

 Yellowstone River (ATC), Missouri River below the confluence of the Yellowstone River (BTC), and

 total catch from July 22 to September 9, 2015.
- Table 3.Number of larval and young-of-year sturgeon collected in standard trawls, targeted trawls,minimum length, maximum length, and mean length by date in 2014.

Genetic results from 2014

Genetic analysis of free embryos (n=18), larvae and young-of-year sturgeon (n=141) collected from the Missouri River in 2014 was completed during 2015. No specimens were identified as pallid sturgeon (Dr. Edward Heist, University of Illinois Carbondale, written commun., 2015).

Discussion

Under present hydrologic conditions in the Upper Missouri River, very few wild adult pallid sturgeon use the Missouri River downstream from Fort Peck Dam, particularly during the spawning season. As in most previous years, higher flows in the Yellowstone River triggered pre-spawn migrations upstream into the Yellowstone River and fish maintained residency there throughout May and June in 2015. Milk River discharge was low and there was no use of the Milk River by adult pallid sturgeon or paddlefish this year. Given the low number of *Acipensiformes* free embryos collected, the lack of warm, turbid inputs of the Milk River likely had a negative effect on paddlefish and shovelnose production as well.

Documentation of use, spawning and reproduction in the Missouri River in 2011 indicates that the Missouri River may be used by pallid sturgeon under some hydrologic conditions regardless of water temperature (DeLonay and others, in press-p). Temperature is still a very important variable as it would shorten embryonic development time, resulting in shorter drift distance, as well as increase the overall productivity of this dam-affected section of the Missouri River. Verification of successful reproduction by wild pallid sturgeon in 2011 demonstrated that spawning, fertilization, egg survival, and hatch can occur in the Missouri River when flows deviate from conventional reservoir operations (DeLonay and others, in press-a). Additional information may develop understanding of how flow releases from Fort Peck Dam could be managed to increase attraction and retention of pallid sturgeon into this section, without flooding. Since very few sexually mature adult pallid sturgeon have been observed in the Upper Missouri River to date (2015), limited data exist to specify the flow parameters required to stimulate wild pallid sturgeon migrations and spawning.