



MISSISSIPPI INTERSTATE COOPERATIVE RESOURCE ASSOCIATION

PADDLEFISH & STURGEON COMMITTEE

MEETING MINUTES

13-14 February 2018

Powder Valley Nature Center, St. Louis, Missouri

13 February 2018

WELCOME/INTRODUCTIONS/OPENING REMARKS

The meeting was called to order at 9:00 am by Eric Ganus (Committee Chair) who introduced himself and welcomed the MICRA Paddlefish & Sturgeon Committee to the meeting. A roll call of state representatives was conducted; it was determined that a quorum was not met. In the absence of a chair-elect, Joe McMullen volunteered to take meeting notes. The agenda was distributed and finalized, and the meeting was called to order. ***Eric will send out the 2017 (Oklahoma City) meeting minutes to state representatives for approval.** Participant introductions ensued.

PARTICIPATION

MICRA Paddlefish & Sturgeon Committee Chair and Representative from Tennessee: Eric Ganus

State Representatives: Ryan Hupfeld (IA), Craig Jansen (IN), Bobby Reed (LA), Joe McMullen (MO), Gerald Mestl (NE), Jason Schooley (OK), Jason Sorensen (SD), Eric Ganus (TN)

MICRA Coordinator: Greg Conover (USFWS)

Guests: Kendall Moles (AR), Sara Tripp (MO), Trish Yasger (MO), Travis Moore (MO), Sarah Peper (MO), Thomas Devine (MO), Dustin Broaddus (MO), Adam Geik (OK), Aaron Delonay (USGS)

CHAIR ELECT NOMINATIONS:

Eric Ganus asked the group for volunteers to assume the role of chair-elect. The group determined that a sub-basin rotation has been used to alternate chair responsibilities. Eric assumed the chair as a representative of the Ohio River sub-basin; the lower Mississippi River

(LMR) sub-basin is currently due up in the rotation. LMR sub-basin, state representatives participating in the meeting included Joe McMullen (MO), Bobby Reed (LA), and Jason Schooley (OK). No one volunteered to serve as chair-elect. ***Eric will contact LMR sub-basin state representatives and nominate a chair-elect to serve during his term.**

CITES UPDATE

Paddlefish and Sturgeon Exports – Marie Maltese: cancelled

OLD BUISNESS

MICRA Coordinator's Report - Greg Conover:

- Formation of a Mississippi River Basin Commission has been discussed among MICRA state fish chiefs.
- New website is almost finished – ***All - send Greg items (meeting minutes, lists of state representatives, past chairs, etc.) to be posted on the website or archived in committee records.**

Paddlefish Tagging Database - Jason Schooley:

- Oklahoma tags paddlefish and updates the database but there is little participation from other states.
- Information already submitted/entered may be incomplete and in need of updates.
- Gerald Mestl - Nebraska and Iowa are partnering and will continue to submit data to Jason.
- Greg Conover – suggested querying the states to see if there is backlog of data. MICRA may be able to fund data entry; if needed we should work toward an RFP and get an estimated cost for external assistance.
- ***Eric will ensure that this information regarding sampling, tagging, stocking, and data sharing is requested annually moving forward via an updated state report template.**

Paddlefish Tagging Database Restructuring: The group discussed the need for an updated/restructured database.

- Jason suggested an online application like those used for other projects (e.g., LTRM) but believed the cost would be high.
- Greg Conover – potential for funding availability through USFWS or state donations.
- Gerald Mestl – the original database was designed to assess mark-recapture and is therefore complicated; if mark-recapture is no longer the primary need the database could be simplified.
- ***Eric will identify and document sub-basin database coordinators and state representatives, and relay that information to Jason.**

- ***Jason will send an email query to all state representatives to determine 1) which states are sampling/tagging/stocking/etc., 2) if there is a data backlog, 3) a need for data entry assistance, and 4) how the database is used.**
- ***There is a need to identify the database's designers and determine the objectives its configuration was meant to accomplish.**
- There is the potential for a follow-up meeting on tagging database matters and action items at the 2018 Annual Meeting of North American Sturgeon and Paddlefish Society (NASP) – 22-25 October, 2018 – Columbia, MO.

Paddlefish Symposium Book – Jason Schooley:

- Some chapters have been submitted and reviewed, others have languished; the deadline for submissions has been pushed back.
- The book has been approved by AFS as a stand-alone text and fund raising has begun; there is a need to secure funding from MICRA, state agencies, AFS chapters, etc.; a second call for funding is forthcoming.
- ***Eric will send out an email to state representatives asking that they remind their fish chiefs of the need to support publication of the book.**
- The cost of publication is \$25,000; the committee will need to raise and contribute \$12,500; \$7,000 - \$8,000 has been raised so far from contributions from Miller Net, NASP, NCD-AFS, and SD-AFS.
- If more than \$12,500 is raised and contributed the retail cost of the book will be decreased.

Paddlefish Basin Management Plans:

- A basin-wide framework document is an objective in the Saltonstall-Kennedy (S-K) Grant proposal and will be drafted by Dr. Scarnecchia if funding is secured.
- Lower Mississippi River sub-basin – Eric Ganus – currently in draft; waiting for ageing and data analysis to finalize.
- Tennessee/Cumberland Rivers sub-basin – Eric Ganus – waiting for LMR to be finalized.
- Missouri River sub-basin – Gerald Mestl & Ryan Hupfeld – may need to update plan in 1-2 years due to realized and anticipated changes.
 - o IA added a snagging season; NE moved the archery season; silver carp populations in the upper Missouri River have increased drastically after recent floods; funds may become available after the Missouri River Asian Carp Framework is finalized (MICRA is looking for a congressional champion for the Missouri River).
- Ohio River sub-basin – Craig Jensen – early planning stages.

Saltonstall-Kennedy Grant Update – Greg Conover

- Dr. Scarnecchia is ageing Oklahoma, Montana, and North Dakota paddlefish first and will then age lower Mississippi River paddlefish; ***Dr. Scarnecchia will deliver photos and age estimates by 30 April 2018.**
- If states need funds to pay for paddlefish ageing contact Greg; funding is available through MICRA.

- All states have either paid for their own ageing (MO, TN) or MICRA has paid for their ageing (AL, AR, MS, IN), with the possible exception of MS; ***Greg will contact MS to determine the need for funding.**

Commercial Paddlefish Sampling and Aging Project Update – Eric Ganus:

- Tennessee hired Dr. Wilberg (U. of Maryland) for analysis of their commercial paddlefish data from 2015-2017 – this information will be presented at the NASP 2018 meeting.
- Greg Conover indicated that there may be funding available through MICRA to fund further data analysis if needed. If the committee identifies a specific need it could be brought to the Executive Board by the committee chairman for consideration. Joe McMullen suggested that MICRA funding go toward funding a sub-basin data analysis.
- ***Eric will ask for an agenda item at the 2018 LMRCC meeting (paddlefish ages from Dr. Scarnecchia; data analysis needs).**
- ***Eric will discuss the potential for funding at the March 2018 MICRA Executive Board meeting.**

Paddlefish Modeling Workshop Update – Eric Ganus:

- Considered a funding request to MICRA to host Dr. Wilberg at a future committee meeting to give an overview of data analysis techniques.
- ***Eric will request paddlefish data from Kentucky and compile it with TN and MO data once received.**
- ***TN/MO/KY will present LMR data to the committee at the next meeting.**

Commercial Working Group Updates:

- Indiana – Craig Jansen – plans to collect ≈150 jaw bones from paddlefish during spring 2018; may start ageing fish in-house.
- Missouri will continue to collect samples from the MMR/LMR during spring 2018.
- Tennessee will not collect samples; working on data analysis and report writing.
 - o New commercial harvest report form will require species specific reporting.
- Group Conversation: There is disagreement between ages from Dr. Scarnecchia and from states (Missouri and Tennessee). ***Should a group of river biologists age the same fish to see if more consistent results can be achieved?**
- Greg Conover asked how the group should move forward with age validation in the absence of S-K Grant funding.
 - o Missouri released ≈80,000 paddlefish into the Missouri River in 2008 which could be helpful in age determination if recaptured and reported.
 - o MO and OK already have many known age fish that can be utilized.
 - o The group discussed obtaining samples from a variety of locations: Red River (OK), White River (AR), Missouri River (NE), Ozark/Truman Lakes (MO), Francis Case Reservoir (SD), and Grand Lake (OK).
- ***Jason Schooly will include in the email query 1) is everyone still wandering fish?, 2) do you know what to do if you catch a tagged fish?**

- ***Eric will make a request to states/USFWS/LMRCC/UMRCC/etc. to 1) sample and age all tagged fish that are encountered, 2) ask about the availability of known-age fish samples, 3) who would be interested in serving on an ageing committee?**

Lake Sturgeon in Missouri – Travis Moore

- Travis presented on lake sturgeon management and research in Missouri (summary in the Missouri state report).

14 February 2018

Coded Wire Tag Detectors: Trish Yasger

- Trish asked the group about experiences with different types of CWT detectors (Blue Wand vs. T-Wand (yellow)). ***Trish will test the two types of detectors and report back to the group.**
- Jason Schooly thought the T-Wand was tougher, had more modern hardware, and adjustable sensitivity.

Lake Sturgeon in Missouri: Group Discussion

- Eric Ganus indicated that commercial fishers in TN had been regularly catching lake sturgeon near short dikes on the Mississippi River; interested in standardized data collection and PIT tagging but may need tags to do so.
- Travis Moore indicated that Missouri would like to start collecting lower Mississippi River basin broodstock – after which Missouri may be in a position to share basin-native strain fish to lower basin states. Travis is currently trying to identify waters for holding broodstock.
- PIT tags currently being used on lake sturgeon are the FDX-A (older version); once the supply of older tags is exhausted, Missouri will be switching to FDX-B (new version); new PIT tag readers will read both types of tags; USACE may be switching to the newer tags for pallid sturgeon.
- ***Sara Tripp will send out a tagging list to the group for reference.**

State Reports:

Written (attached) and/or verbal summaries of paddlefish and sturgeon related activities were submitted by AR, IA, IN, LA, MO, NE, SD, and TN.

Adjourn:

Eric Ganus adjourned the meeting.

Indiana State Report

2018 MICRA Paddlefish and Sturgeon Committee

Powder Valley Conservation Nature Center. February 2018

Submitted by Craig Jansen

Wabash River Shovelnose Sturgeon Monitoring – Upper Wabash River, April and May 2017.

- Captured 563 Shovelnose Sturgeon, tagged 500 individuals.
- 35 fish (6%) were confirmed gravid or spent females, 424 confirmed males.
 - o Lower than previous years (usually between ~10-18%) but timing of one sampling trip may have been just after spawning event and many females may have already left the area.
- 12 recaptures, ranged in length from 590 to 688mm – virtually no growth between recaptures
 - o Most recaptured in same general area of original tagging.
 - 4 fish from 2016 tagging
 - 1 fish tagged 5 years prior → grew -3mm
 - 2 tagged 7 years prior → grew 3mm and 0mm
 - 1 tagged 8 years prior → grew -5mm
 - 1 tagged 9 years prior → grew -2mm
 - 1 tagged 13 years prior → grew 7mm and still sublegal
 - o 1 recaptured fish originally tagged 117 miles downstream
 - Tagged 5.8 years prior → grew 27mm
- A student from Eastern Illinois University is summarizing IL and IN long-term data, along with some commercial harvest data, and working on some publications now. The size of gravid females has been slowly declining since 2008, and it appears females are maturing at younger ages.

Ohio River Paddlefish Monitoring – No sampling conducted fall '16 or spring '17

- Dec '17 and Jan '18 – three sampling trips on lower Ohio River
 - o 117 Paddlefish sampled, jawbone clips taken from all fish.
 - o Only two gravid females (one sublegal <32"), four F2 females
- Will attempt to collect more fish from upper Ohio River if time allows.

Commercial Fishing

- 2016: sold 3 roe dealer licenses, and 8 roe harvester licenses (2 inland SNS, 6 Ohio River PF)
 - o Inland Shovelnose Sturgeon harvest:
 - 99 fish, 36.38 lbs roe
 - An additional 47 fish reported by other commercial fishers without proper roe harvester permit. This prompted revisions to the monthly report to clarify sturgeon could only be harvested with valid roe harvester permit...but we still get folks illegally reporting them.
 - o Ohio River harvest
 - 97 Paddlefish, 235.49 lbs roe
- 2017: sold 2 roe dealer licenses, and 4 roe harvester licenses (0 inland SNS, 2 Ohio River PF)
 - o Zero Indiana reported Shovelnose Sturgeon roe harvest
 - o Ohio River harvest
 - 165 Paddlefish, 533.13 lbs roe
- General decreasing trend in roe dealer and harvester licenses since established in 2012. We've heard complaints from commercial fishers in 2015-16 regarding the lack of Ohio River Paddlefish. This, along with heavy enforcement presence on the rivers over the past couple years has partially attributed to decrease in license sales.

White River Lake Sturgeon – Biologist continues to annually monitor spring spawning, pinpointing ideal spawning conditions if a need for hatchery rearing would be necessary in the future. Annual fall monitoring continues, new fish are PIT tagged when encountered. Occasional active tracking occurs; fish seem to all stay in a relatively short section of the White River. Population appears stable with some recruitment.

Iowa MICRA Paddlefish and Sturgeon Committee Meeting Update

Missouri River:

Habitat Assessment and Monitoring Program (HAMP) at Deer Island and Middle Little Sioux Bend:

A major channel top widening project was constructed on the Missouri River by the U.S. Army Corps of Engineers at the Deer Island State Wildlife Management Area to create shallow water habitat (~135 acres) for early life stages of federally endangered Pallid Sturgeon and other native fishes (Figure 1). Construction was completed in 2014. Deer Island and a nearby control site (Middle Little Sioux) were sampled with a sixteen foot small mesh otter trawl and push trawl to evaluate fish community response to the constructed habitat. Fish collected were categorized as Larval, Young of Year, or \geq Age-1 based on length. Simpson's Diversity Index and the Shannon-Wiener Function were calculated to assess species diversity. Catch per unit effort (CPUE) was calculated as fish per 100 meters trawled. CPUE normality was assessed with the Shapiro-Wilk Test. The normal approximation to the Mann-Whitney U Test was used to detect differences in catch rates between sample sites. Statistical significance was determined at $\alpha < 0.05$ for all analyses. The objective of this monitoring work is to provide information regarding the biological responses to the shallow water habitat creation that occurred at Deer Island Wildlife Management Area. More specifically, to focus on the effects of this shallow water habitat creation on larval and young of year *Scaphirhynchus* sturgeon. This will be accomplished by comparing catch rates between Deer Island at river mile 672 and a control site at the Little Middle Sioux Bend at river mile 674.

Sampling began May 4th, 2017 and was completed on September 30, 2017 with a total of 323 trawls conducted. Data analysis of this data set is currently underway. Preliminary results are presented below. Overall, 1,942 fish were collected representing 30 species with OTO4 otter trawl catch greatly exceeding POTO2 push trawl catch. Overall catch at Deer Island was slightly less ($n = 832$) than Middle Little Sioux Bend ($n = 1,106$). On the basis of these catches, Deer Island exhibited slightly higher diversity indices than did Middle Little Sioux (Figures 2, 3, and 4).

The majority of fish collected were Red Shiner, Sand Shiner, Shovelnose Sturgeon, Emerald Shiner, River Shiner, Channel Catfish Spotfin Shiner, Silver Chub, and Shoal Chub. Catch per unit effort of \geq Age-1 Shovelnose Sturgeon and Channel Catfish with OTO4 otter trawl were significantly greater at Deer Island, while CPUE of Red Shiner, Spotfin Shiner, Sand Shiner, River Shiner, and Silver Chub were significantly greater at Middle Little Sioux (Figure 5). Additionally, a young of year *Scaphirhynchus* Sturgeon (Figure 6) and likely age-1 Shovelnose Sturgeon were collected at Deer Island suggesting there is suitable habitat for smaller size classes of sturgeon available. Other notable catches at Deer Island include an adult Pallid Sturgeon (Figure 7) and Sturgeon Chub.

Additionally, alterations were undertaken at Deer Island this past summer to reduce the size of multiple sandbars to help prevent the creation of a chute. The effects of these alterations on fish usage should continue to be evaluated in the future.

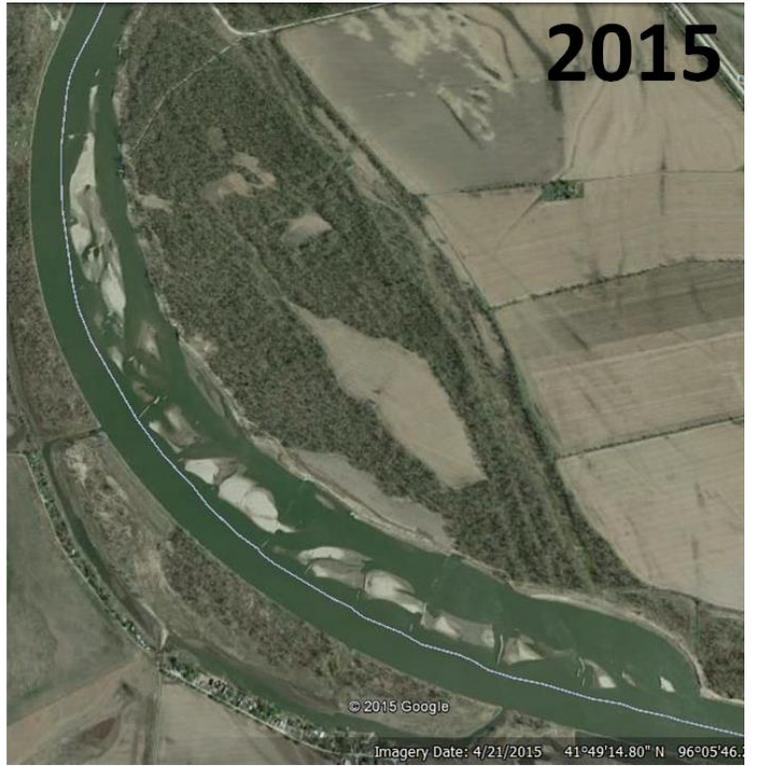
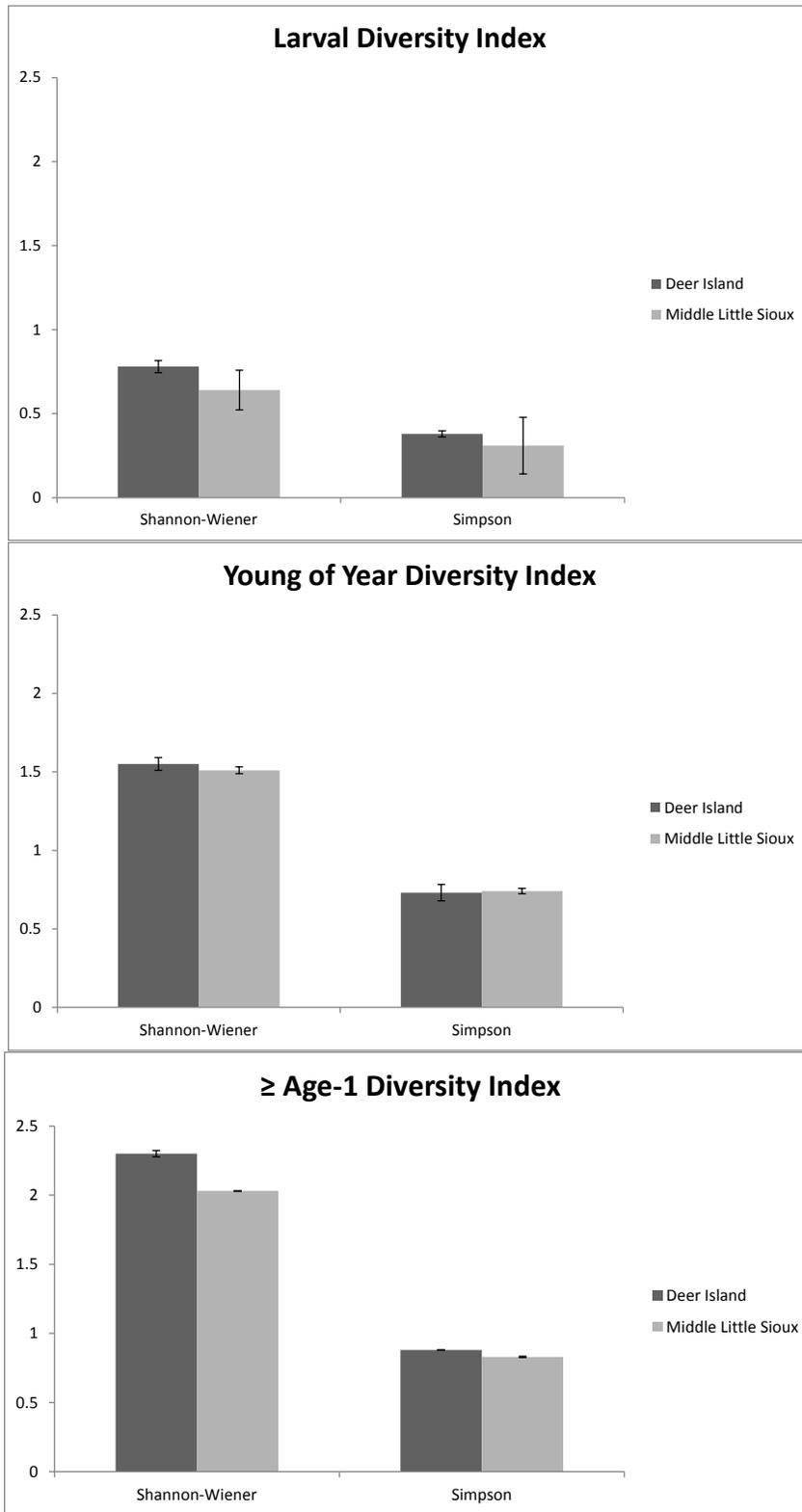


Figure 1. Aerial photos of Deer Island top width widening project pre (2009) and post construction (2015).



Figures 2, 3, and 4. Shannon-Wiener and Simpson Diversity Indices for Larval, Young of Year, and \geq Age-1 fish captured at Deer Island and Middle Little Sioux Bend.

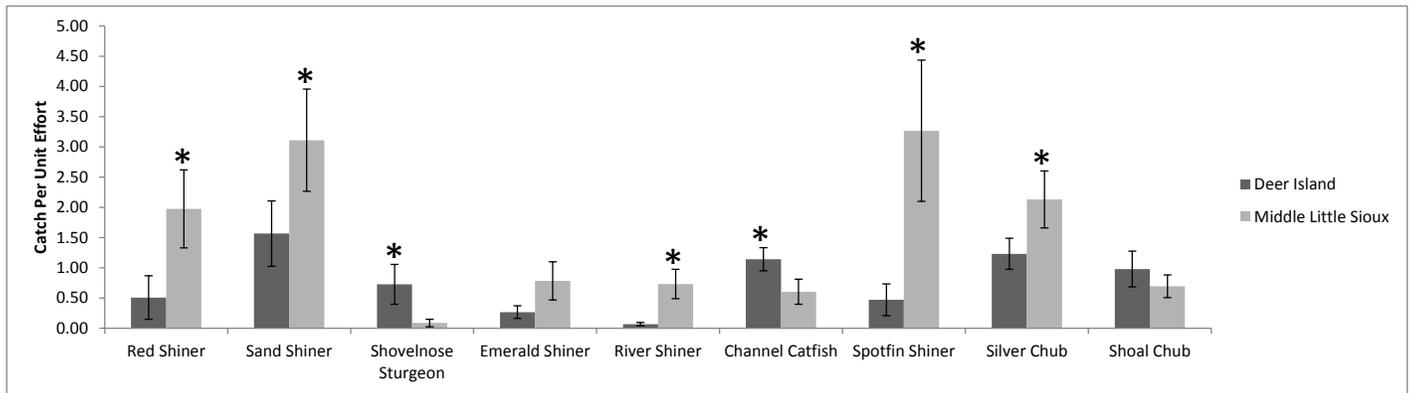


Figure 5. Catch per unit effort of \geq Age- 1 fish using the OTO4 otter trawl conducted at Deer Island and Middle Little Sioux Bend during 2017 field season. Asterisk (*) indicate a statistically significant result ($p < 0.05$).



Figures 6 and 7. Young of year *Scaphirhynchus* Sturgeon and adult Pallid Sturgeon captured at Deer Island during 2017 sampling season.

Paddlefish:

The Missouri River Paddlefish recreational snagging season in Iowa has declined in popularity and success rate since its reopening in 2015 (Table 1). Survey cards sent out to anglers suggest some of the primary reasons for decline could be: 1) the state regulations/border between Nebraska and Iowa is very confusing and should be more consistent between states (no harvest is currently allowed in the Nebraska waters south of Sioux City), 2) no harvest of Asian Carp was allowed, and 3) season start dates were too late.

New to the 2018 season rules to help increase popularity and success include:

- Anglers can buy up to two tags – one from Dec. 15 to Dec. 31 and an additional tag from Jan. 1 to Jan. 7, or two tags if you didn't buy one in December.
- The season has been extended, opening Feb. 4 and running through April 30.
- Rough fish, including Asian Carp, can be harvested during the paddlefish snagging season.

Paddlefish Survey Card Results				
Year	2015	2016	2017	2018
# Tags Sold	740	407	336	400
# Survey Cards Returned	107	51	61	
Survey Card Return Rate	0.14	0.13	0.18	
# who snagged for pdfh	95	33	44	
% who snagged for pdfh	88.79%	64.71%	72.13%	
# of harvested fish reported	53	10	7	
Success Rate	55.79%	30.30%	15.91%	
Avg. Length Harvested (inches)	32	33.25	33	
Max size harvested (inches)	34.75	34.5	34	
# of paddlefish released less than 35"		36	15	
# of paddlefish released 35-45"		24	8	
# of paddlefish released larger than 45"		0	3	
Avg. # of trips	3.8	3.75	3.7	
Total Estimated # of tag buyers who snagge	657	263	242	
Total Estimated # of fish harvested	367	80	39	

Table 1. Missouri River Paddlefish Season returned angler survey card results from 2015-2017.

Mississippi River:

STUDY 7047

Assessment of Iowa's Shovelnose Sturgeon sport fisheries

OBJECTIVE

By the year 2019, assess shovelnose sturgeon sampling methods, population dynamics (size structure, age, growth, mortality, spawning periodicity), and movement in Iowa rivers and provide management recommendations.

APPROACH 1

Standard sampling protocols for Shovelnose Sturgeon

OBJECTIVE

Assess different gear types and review pertinent literature to develop a standard sampling protocol for Iowa's Shovelnose Sturgeon fisheries.

APPROACH 2

Evaluate Shovelnose Sturgeon population demographics

OBJECTIVE

Determine size structure, age, growth, mortality, spawning periodicity, and movement of Shovelnose Sturgeon populations in Iowa rivers.

STUDY 7047 ANNUAL REPORT**Approach 1: Standard sampling protocols for Shovelnose Sturgeon**

Efficiency and size selectivity of boat electrofishing, drifted trammel netting, and trawling were assessed on the Cedar River during annual Shovelnose Sturgeon (*Scaphirhynchus platyrhynchus*) sampling 1-16 May 2017. Boat electrofishing has been utilized to sample spawning populations of Shovelnose Sturgeon in similar shallow rivers (Kennedy et al. 2007), drifted trammel nets are a standard gear for sampling Shovelnose Sturgeon on the upper Mississippi River (Koch et al. 2009), and trawling has been used in previous studies to sample Shovelnose Sturgeon on a variety of rivers (Herzog et al. 2005; Kennedy et al. 2007; Doyle et al. 2008).

Boat electrofishing units traveled downstream occasionally varying their speed in relation to current. Output settings varied to maintain operation within the appropriate power goal depending on water conductivity (Miranda 2009). Pedal time was recorded for each electrofishing run. Drifted trammel nets were 100-ft in length by 6-ft deep with ½-inch Foamcore float lines and 30-lb. Leadcore lead lines. Outer wallings were constructed of number 9 multifilament nylon and were 6-ft deep with 12-in bar mesh. Inner wallings were constructed of number 139 multifilament nylon and were 8-ft deep (hobbled to 6-ft) with 2-in bar mesh. Wooden mules were attached to the ends of nets while drifting to pull them downstream and help prevent them from closing. Drifted trammel nets were set perpendicular to flow and allowed to drift downstream. Time and distance of each drift was recorded with a watch and GPS unit. Trawling was conducted with a modified (Missouri) trawl (Herzog et al. 2005). Trawls were deployed and pulled in a downstream direction, typically for three minutes, but time was recorded for each trawl. All captured fish were enumerated and measured to the nearest 1-mm fork length (FL), weighed to the nearest gram, and tagged on a pectoral fin with an individually numbered Monel bird wing tag (Model 1000-3). Sex of each fish was recorded as female (flowing eggs or obvious distended abdomen with large black stripe), male (flowing milt), or unknown.

Mean FL of Shovelnose Sturgeon captured significantly differed between all gears with trammel nets capturing having the largest mean FL and electrofishing having the smallest (Figure 1; ANOVA; $F = 160.23$; $df = 2, 2,203$; $p < 0.0001$; Tukey). Efficiency of each gear was compared by dividing the number of Shovelnose Sturgeon captured by each gear type by the number of boat days the gear was utilized (i.e. three electrofishing boats sampling for two days = 6 boat days). Trawling and trammel netting crews captured on average 72 and 81 more Shovelnose Sturgeon per sampling day than crews electrofishing, respectively (Table 1). The percentage of female Shovelnose Sturgeon captured in each gear was significantly different with electrofishing capturing a smaller percentage than trammel netting or trawling, which did not differ (Table 2; $\chi^2 = 78.8$; $d.f. = 2$; $p < 0.0001$). These gear types will continue to be evaluated in future segments and this information will be used to develop standard sampling protocols for Shovelnose Sturgeon.

Study Recommendations: Continue with this study as designed.

Literature Cited:

- Doyle, W., C. Paukert, A. Starostka, and T. Hill. 2008. A comparison of four types of sampling gear used to collect shovelnose sturgeon in the lower Missouri River. *Journal of Applied Ichthyology* 24:637-642.
- Herzog, D.P, V.A. Barko, J.S. Scheibe, R.A. Hrabik, and D.E. Ostendorf. 2005. Efficacy of a benthic trawl for sampling small-bodied fishes in large river systems. *North American Journal of Fisheries Management* 25:594-603.

Miranda, L. E. 2009. Standardizing electrofishing power for boat electrofishing. Pages 223-230 in S. A. Bonar, W. A. Hubert, and D. W. Willis, editors. Standard methods for sampling North American freshwater fishes. American Fisheries Society, Bethesda, Maryland.

Kennedy, A.J., D.J. Daugherty, and T.M. Sutton. 2007. Population characteristics of Shovelnose Sturgeon in the Upper Wabash River, Indiana. North American Journal of Fisheries Management 27:52-62.

Koch, J.D., M.C. Quist, C.L. Pierce, K.A. Hansen, and M.J. Steuck. 2009. Effects of commercial harvest on Shovelnose Sturgeon populations in the upper Mississippi River. North American Journal of Fisheries Management 29:84-100.

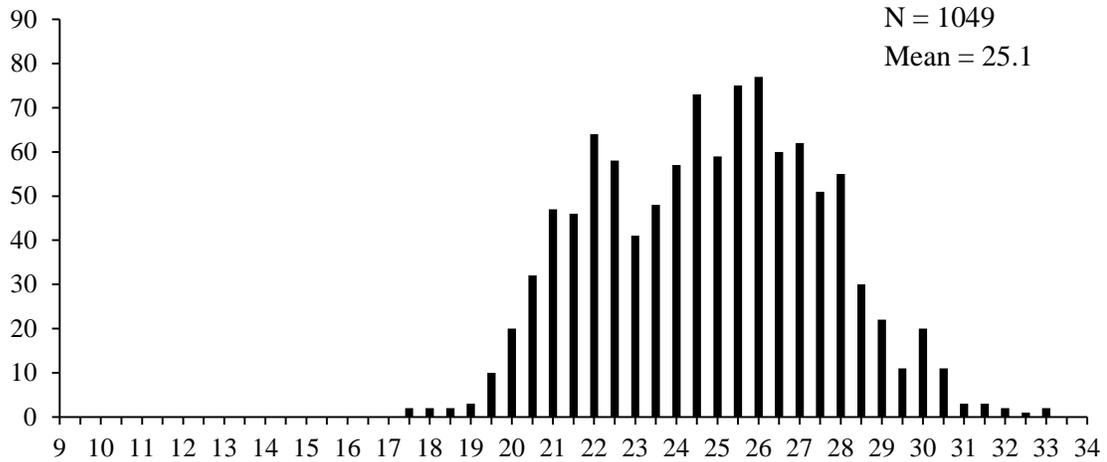
Table 1. Sample size, mean length (in), standard error, size range, effort, and catch per boat per day of Shovelnose Sturgeon captured via electrofishing, drifted trammel net, and modified (Missouri) trawl on the Cedar River, May 2017.

Gear	EF	Trawl	TN
N	828	329	1049
Mean (in)	22.3	23.5	25.1
SE	0.09	0.15	0.08
Min (in)	16.4	16.3	17.6
Max (in)	32.8	31.6	33.5
Boat Days	6.0	1.5	5
Catch/day	138	219	210

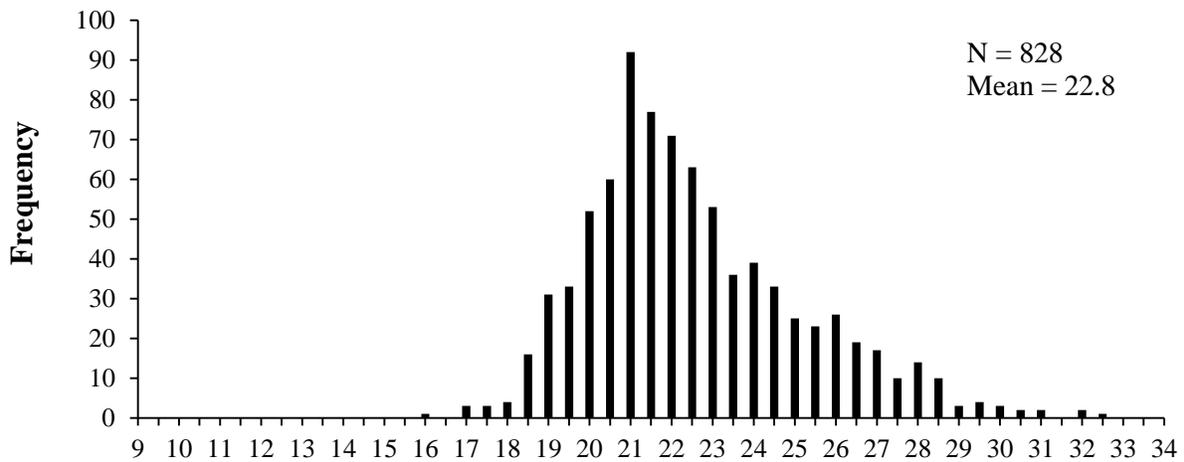
Table 2. Proportion of Shovelnose Sturgeon identified as female or male/unknown sex captured via electrofishing, drifted trammel net, and modified (Missouri) trawl on the Cedar River, May 2017.

Gear	Female	Male/Unknown
Electrofishing	0.27	0.73
Trammel Net	0.47	0.53
Trawling	0.41	0.59

Trammel Net



Electrofishing



Trawl

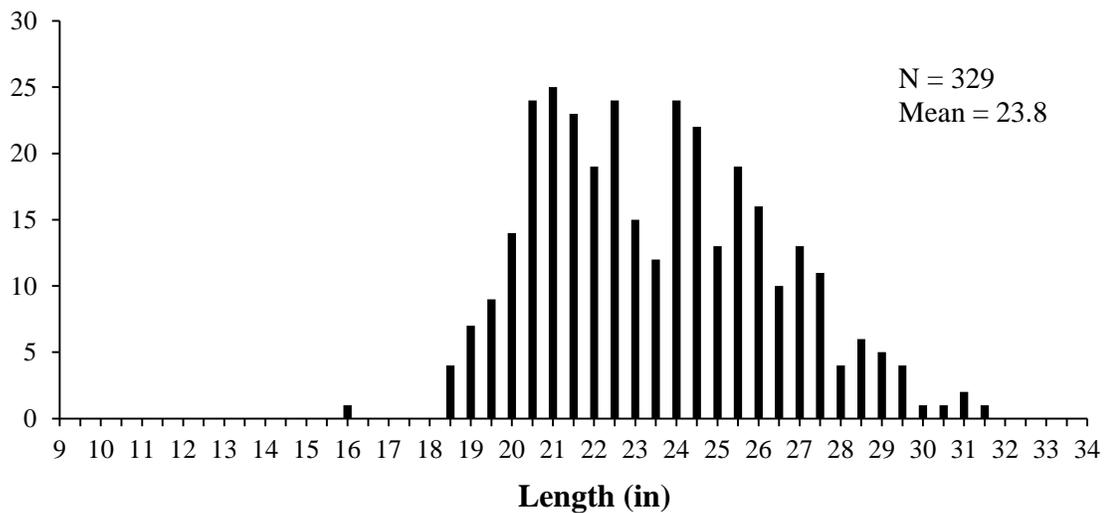


Figure 1. Shovelnose Sturgeon length frequency graphs sampled with boat electrofishing, drifted trammel nets, and trawling at the Cedar River, May 2017.

STUDY 7047 ANNUAL REPORT

Approach 2: Evaluate Shovelnose Sturgeon population demographics

Shovelnose Sturgeon migrate into the Des Moines and Cedar rivers from the Mississippi River to spawn every spring and support popular recreational fisheries. Fisheries managers were concerned that inadequate commercial regulations and increased harvest on the Mississippi River may adversely affect these recreational fisheries. The Cedar and Des Moines rivers enter the Mississippi River in pools 18 and 20, respectively. Despite more stringent regulations (i.e., 27-inch minimum size limit) in Iowa waters, Mississippi River Shovelnose Sturgeon commercial fisheries in the pools along Iowa's border are effectively regulated with Illinois and Missouri's 24-32 inch (Fork Length; FL) harvest slot. The lower end of this harvest slot limit was deemed to be inadequate to sustain Shovelnose Sturgeon populations in the Mississippi River (Colombo et al. 2007; Koch et al. 2009; Tripp et al. 2009). Additionally, a summer Shovelnose Sturgeon kill, numbering in the tens of thousands, occurred in the Des Moines River in 2012 raising concerns for the status of the sturgeon population in this river (Hupfeld et al. 2014).

Shovelnose Sturgeon were sampled with boat electrofishing on the Des Moines River, downstream of Ottumwa, IA, 17 and 24-25 April 2017 and with boat electrofishing, drifted trammel nets, and trawling on the Cedar River near Mt. Vernon, IA, 1-16 May 2017. All fish captured from these interior rivers were measured fork length (mm), weighed (g), and tagged on the leading edge of the pectoral fin with an individually numbered Monel self-piercing ear tag (Model 1000-3). Sex of each fish was recorded as female (flowing eggs or obvious distended abdomen with large black stripe), male (extruding milt), or unknown.

On the Des Moines River, 664 Shovelnose Sturgeon were collected at a mean catch rate of 111 fish/hr (SE 17.7). Mean length was 24.3-inches (Figure 1; Range 18.3-30.1 in). Females and male/unknown sex fish comprised 6 and 84 percent of fish sampled, respectively. On the Cedar River, 828 Shovelnose Sturgeon were collected via electrofishing with a mean catch rate of 61 fish/hr (SE 6.64). Mean length of Shovelnose Sturgeon captured with electrofishing was 22.8-inches (Figure 1; Range 16.4-32.8 in). Females and male/unknown sex fish comprised 27 and 73 percent of fish sampled, respectively. Shovelnose Sturgeon mean length was larger on the Des Moines River which was the opposite of what was observed in FY2016 samples (Figure 1; ANOVA, $p < 0.0001$).

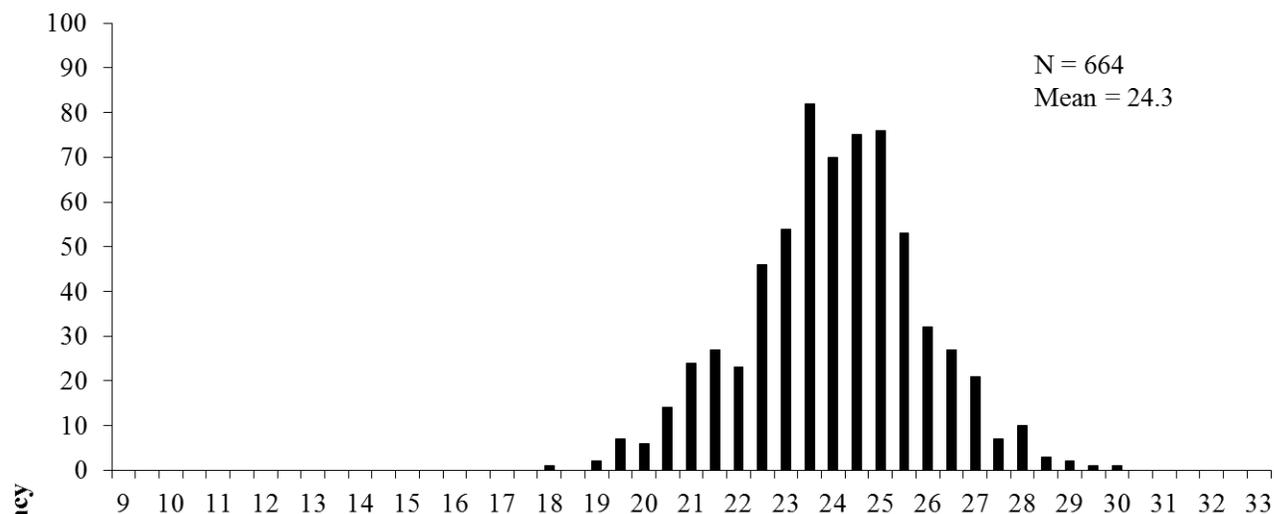
Spawning periodicity was studied at the Cedar River by measuring years between tagging and recapture for gravid females. To date, 104 gravid female Shovelnose Sturgeon have been recaptured, including 9 in 2017. Peak recoveries occurred at 2, 4, and 6 years at large indicating a two year spawning periodicity (Figure 2). However, high recoveries at years 3 and 5 indicated periodicity was likely variable. Scarnecchia et al. (2007) found spawning periodicity decreased as Paddlefish (*Polyodon spathula*) aged. Evidence of this in shovelnose sturgeon should be investigated in future study segments.

Study Recommendations: Continue with this study as designed.

Literature Cited:

- Colombo, R.E., J.E. Garvey, N.D. Jackson, R. Brooks, D.P. Herzog, R.A. Hrabik, and T.W. Spier. 2007. Harvest of Mississippi River sturgeon drives abundance and reproductive success: a harbinger of collapse? *Journal of Applied Ichthyology* 23:444-451.
- Hamel, M.J., J.D. Koch, K.D. Steffensen, M.A. Pegg, J.L. Hammen, and M.L. Rugg. 2014. Using mark-recapture information to validate and assess age and growth of long-lived fish species. *Canadian Journal of Fisheries and Aquatic Sciences* 71:1-8.
- Hamel, M.J., M.A. Pegg, R.R. Goforth, Q.E. Phelps, K.D. Steffensen, J.J. Hammen, and M.L. Rugg. 2015. Range-wide age and growth characteristics of Shovelnose Sturgeon from mark-recapture data: implications for conservation and management. *Canadian Journal of Fisheries and Aquatic Sciences* 72:1-12.
- Koch, J.D., M.C. Quist, C.L. Pierce, K.A. Hansen, and M.J. Steuck. 2009. Effects of commercial harvest on Shovelnose Sturgeon populations in the upper Mississippi River. *North American Journal of Fisheries Management* 29:84-100.
- Hupfeld, R.N., Q.E. Phelps, M.K. Flammand, and G.W. Whitledge. 2014. Assessment of the effects of high summer water temperatures on Shovelnose Sturgeon and potential implications of climate change. *River Research and Applications*. Published online in Wiley Online Library (wileyonlinelibrary.com)
- Scarnecchia, D.L, L.F. Ryckman, Y. Lim, G.J. Power, B.J. Schmitz, and F.A. Firehammer. 2007. Life history and the costs of reproduction in northern great plains Paddlefish (*Polyodon spathula*) as a potential framework for other Acipenseriform fishes. *Reviews in Fisheries Science* 15:211-263.
- Tripp, S.J., R.E. Colombo, and J.E. Garvey. 2009. Declining recruitment and growth of Shovelnose Sturgeon in the middle Mississippi River: Implications for Conservation. *Transactions of the American Fisheries Society* 138:416-422.

Des Moines River



Cedar River

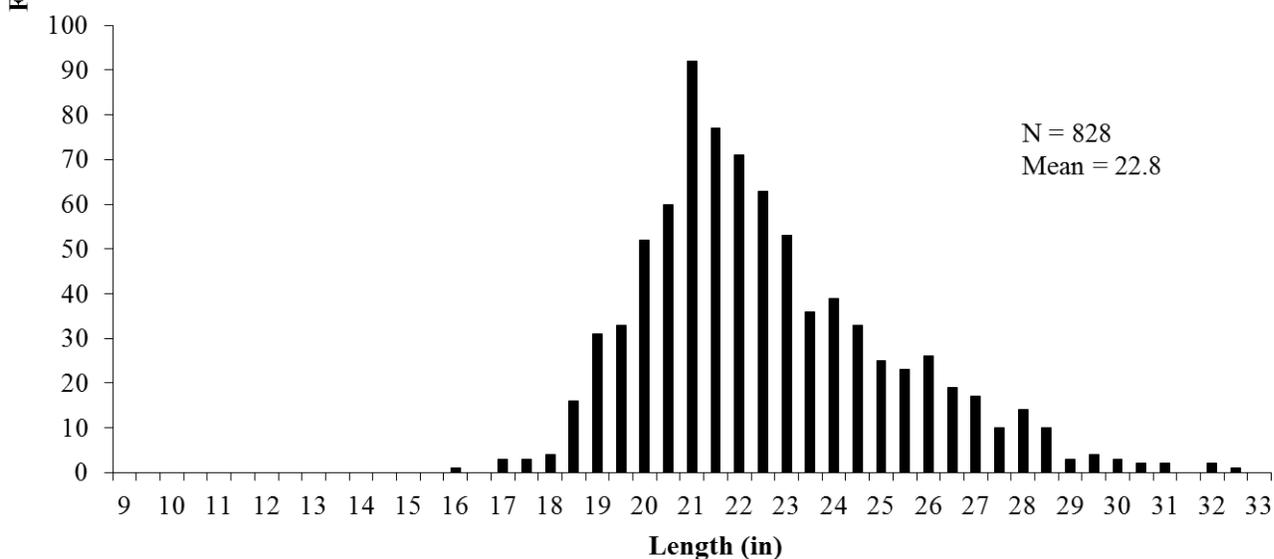


Figure 1. Length frequency distribution of Shovelnose Sturgeon captured with boat electrofishing at the Des Moines and Cedar rivers, Iowa, May 2017.

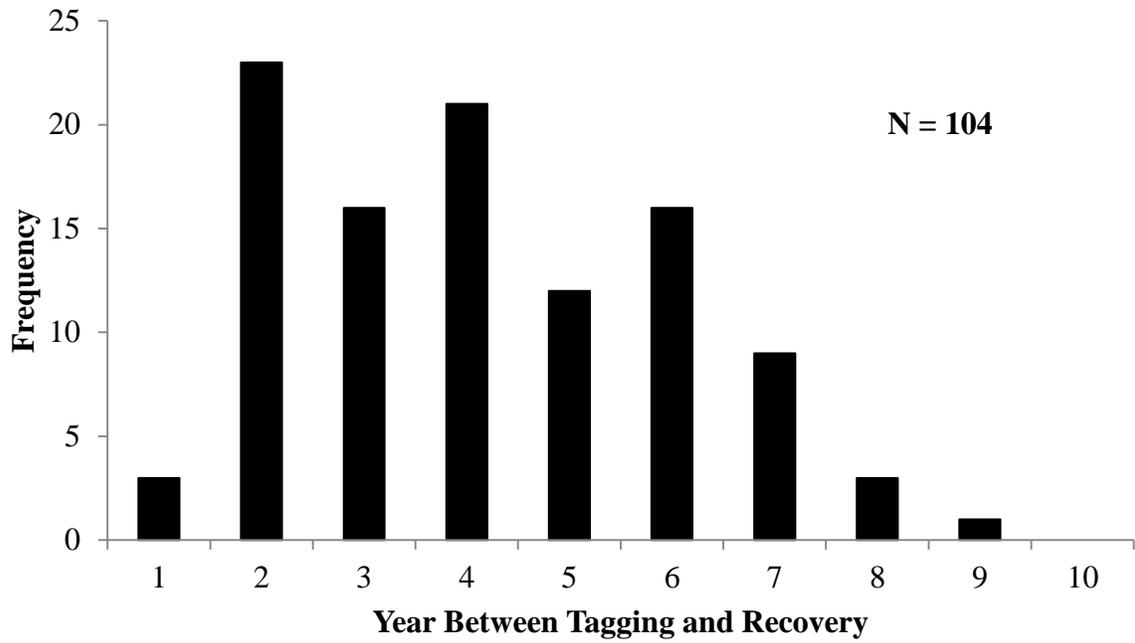


Figure 2. Frequency distribution of years between tagging and recovery of gravid female Shovelnose Sturgeon tagged and recaptured on the Cedar River, Iowa from 2006-2017.

MICRA Paddlefish and Sturgeon Committee 2017 Report from
Kentucky Department of Fish and Wildlife Resources

Lake Sturgeon

Culture—Eggs were received from Wild Rose Hatchery on May 13, 2017. They were in great condition. There was an estimated 12,222 eggs from the Menominee River. The early rearing tanks are 20 gallon round tanks with a running volume of 15 gallons then on June 22nd fish were moved to 6ft circular tanks and are reared to 7.5 – 10.0 in. We continued to use the same culture methods that we have used in previous years. Starting the fry off with artemia and then transitioning to other foods: Otohime and Rangen semi-moist, frozen bloodworms (BW), and frozen krill. Our overall survival was ~40.3%. Prior to stocking, fish are marked for year class identification by removing scutes. Since 2008, a total of 42,742 lake sturgeon fingerlings have been stocked; 23,670 in the Cumberland River and 19,072 in the Big South Fork of the Cumberland River. No lake sturgeon fingerlings were stocked in 2012 or 2013 due to production issues

Management—Lake sturgeon sampling is conducted annually using trotlines (250.0 ft long with 50 hooks baited with nightcrawlers). Prior to 2017 the Cumberland River and Big South Fork were sampled in alternating years. Sampling was increased in 2017 and new sampling sites were added to collect additional data and attempt to decrease variability in catch rates. During December 2017 a total of 46 trotlines were successfully set and retrieved; 25 in the Cumberland River and 21 in the Big South Fork. A total of 72 lake sturgeon were collected with a CPUE of 1.6 fish/line. Fifty-five lake sturgeon were collected from the Cumberland River (CPUE=2.2 fish/line), and 17 fish were collected from the Big South Fork (CPUE=0.8 fish/line). CPUE in the Cumberland River was identical to 2016, and this was the first year that any fish were collected on the Big South Fork through two years of sampling. Sturgeon ranged from 13.5 – 41.3 in fork-length with a mean fork-length of 21.8 in in the Cumberland River and ranged from 14.5 – 42.7 in fork-length with a mean fork-length of 29.4 in in the Big South Fork. Fish at both sites were in great condition as relative weight in the Cumberland River and Big South Fork was 104 and 108, respectively.

CPUE by year class was also examined. Eight of nine possible year classes were observed in the Cumberland River. The 2015 year class (Age-2 fish) were the most prevalent in the Cumberland River (CPUE=1.2 fish/line) followed by the 2014 year class (CPUE=0.4 fish/line). Only four year classes were observed in the Big South Fork with the 2009 year class being the most prevalent (CPUE 0.3 fish/line). No lake sturgeon were stocked in 2012 or 2013, and as a result no fish from those year classes were present in the sample. Reasons for different year-class composition between systems are not known, but catch rate variability may be a result of available habitat. The Cumberland River displays good habitat heterogeneity and has a large amount of muddy and silty benthic habitat that provides optimum foraging areas for lake sturgeon. The Big South Fork is predominately rock and cobble. While that is preferable spawning habitat it may not be as suitable for foraging.

Mean fork-length at age of capture indicates that growth of stocked lake sturgeon appears to be good. Although sample size from the Big South Fork is somewhat limited, no obvious differences in growth

between the Cumberland River and Big South Fork were apparent. On average, fish reached 25.9 in by age-4, and were near 40.0 in by age-10.

Contacts:

Matt Thomas
matthomas@ky.gov
(502) 562-7109 x4463

Stephanie Brandt
stephaniebrandt@ky.gov
(502) 564-7109 x 4463

Jay Herrala
jason.herrala@ky.gov
(502) 564-7109 x4468

Shovelnose Sturgeon

Commercial harvest—Currently, commercial harvest of shovelnose sturgeon in Kentucky is permitted in the Ohio River basin. The season runs from October 15 – May 15 and fish must be 24.0 – 32.0 in fork length to be harvested. Licensed commercial fishermen must report harvest monthly via a mail-in harvest log system. Hoop nets are the primary gear used to capture shovelnose sturgeon, with a minimal amount of harvest occurring using gill nets and trotlines. During the 2016 – 2017 season 6,191 shovelnose sturgeon were harvested accounting for 18,008 lbs of flesh and 2,487 lbs of roe. This was the third highest harvest in the past decade. The 2017 - 2018 season has not concluded but at this point a total of 3,496 shovelnose sturgeon have been harvested accounting for 9,760 lbs of flesh and 1,439 lbs of roe.

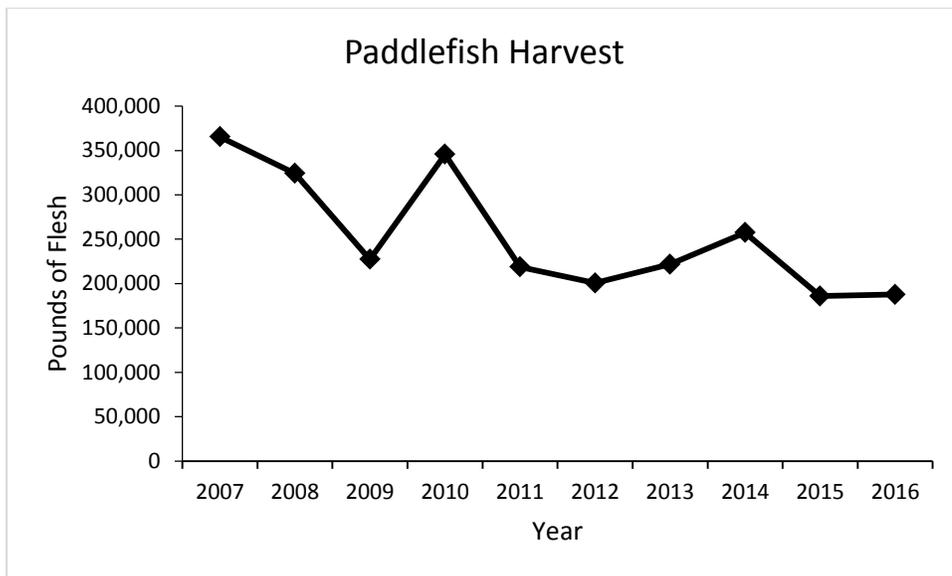
Contact:

Jay Herrala
jason.herrala@ky.gov
(502) 564-7109 x4468

Paddlefish

Commercial Harvest – Currently commercial harvest of Paddlefish is permitted statewide in Kentucky. The season for commercial harvest of paddlefish with gill nets is November 1 through April 30 in all waters open to commercial fishing, except Barkley and Kentucky Lakes where the season extends from November 1 through March 31. Harvest of paddlefish via trotlines is permitted November 1 through May 31 in all waters open to commercial fishing, except the Ohio and Mississippi Rivers. Paddlefish must have a fork-length of 32 inches or greater to be harvested, except in Kentucky and Barkley lakes where they must be 38 inches in fork-length or larger. The majority of paddlefish harvest is conducted with gill nets (93% during 2016 license year). During the 2016 - 2017 commercial fishing season 67 roe harvesters were licensed in Kentucky and harvested 10,167 paddlefish accounting for 187,742 lbs of flesh and 14,278 lbs of eggs. The number of paddlefish harvested in the 2016 license year was higher than the previous year (8,765 paddlefish) and close to the average for the last 8 years. The majority of paddlefish harvest occurs from the Ohio River. The 2017 - 2018 season has not concluded but at this point a total of 8,623 paddlefish have been harvested accounting for 151,006 lbs of flesh and 12,122 lbs of roe.

Management – Paddlefish are designated as a rough fish species by Kentucky Department of Fish and Wildlife Resources. Harvest of paddlefish is allowed through snagging, gigging, and bowfishing. The daily creel limit for paddlefish harvested by bowfishing or gigging is two. The statewide creel limit for snagging paddlefish is also two, except for the lower Tennessee River (below Kentucky Lake Dam) and lower Cumberland River (below Lake Barkley Dam) where the daily creel limit is 8 paddlefish. During the most recent creel survey conducted in the tailwaters of Kentucky Lake and Lake Barkley, anglers reported catching an estimated 1,629 and 742 paddlefish respectively. The number of paddlefish harvested from Kentucky tailwaters was slightly less than during the previous creel survey in 2007. The average paddlefish harvested in 2016 (29.4inches total length, 3.3 lbs) was smaller than the average paddlefish harvested in 2007 (34.0inches total length, 8.8 lbs). Paddlefish harvested from Barkley tailwaters were also smaller on average in 2016 (31.6inches total length, 4.2lbs) than those harvested during the last creel survey in 2001 (39.0inches total length, 9.0 lbs). This decrease in harvest number and size may be due in part to the increasing number of Asian carp present in both tailwaters; resulting in increased competition for food and space in these localized areas.



Contact:

Jessica Morris
jessica.morris@ky.gov
(270) 759-5295

Louisiana State Report for 2017 – MICRA Paddlefish/sturgeon Committee Mtg., Powder Valley Conservation Center, MO

Prepared by Bobby Reed

Paddlefish activities:

During 2017 Louisiana Dept. Wildlife and Fisheries (LDWF) captured 17 paddlefish in standardized fisheries samples (gillnets) throughout the state. An additional 25 paddlefish were collected for brood stock purposes for LDWF's Native Fish in the Classroom project. Five female paddlefish were spawned to obtain fertilized eggs for teachers to take to their classrooms and hatch and rear with student involvement.

Sturgeon activities:

No sturgeon were captured by LDWF fisheries crews in 2017. One pallid sturgeon was captured by a recreational angler in Morgan City, LA in May of 2017, photographed and released unharmed.

Report to the MICRA Paddlefish and Sturgeon Committee

2017

Missouri Department of Conservation (MDC)

Lake Sturgeon (LKSG)

Management

There were two main lake sturgeon efforts occurring over the course of the past year. The first was a project on lake sturgeon habitat use and movement on the tributaries of the Missouri River. University of Missouri PhD candidate Michael Moore is working on that project. He is telemetry-tagging, tracking, and collecting site data on approximately 80 juvenile, sub-adult, and adult lake sturgeon in the Osage and Gasconade rivers of central Missouri. Michael also has remote telemetry receivers in other tributaries and the Missouri River mainstem in an attempt to detect movement between the Missouri River and the other tributaries in the region.

Initial results show high site fidelity to a couple of deepwater habitats in the Osage River, especially during the warmer summer months when flow volume is also at its lowest. Site-specific data is still being analyzed. Initial catch rates of lake sturgeon in the Gasconade River were low, but Michael captured more fish during the fall by altering locations and capture methods. He is confident that he will be able to implant the remaining Gasconade River transmitters this coming spring.

Future plans are to continue to tag and track wild-caught lake sturgeon and to telemetry-tag, stock, and collect data on fingerling lake sturgeon habitat selection and movement in these same streams.

The other lake sturgeon effort has been to update our lake sturgeon recovery plan, the third such edition since 1984. The new draft plan is still being reviewed and edited by MDC staff and will be submitted to Fisheries Administration in the coming months.

In recent years, lake sturgeon sightings by the public have continued to increase, both on our big rivers and our interior streams. Sightings and captures have been documented over 30, 50, and 80 miles up some of our smallest tributaries. So, any barrier-free water connected to either of our big rivers could produce lake sturgeon in the future.

The size of fish being caught and released by anglers continues to increase as well. A fish reportedly weighing 105 pounds was caught near Kansas City, MO in 2015 and a photo of another potential 100+ pound fish was shared from the Osage River in 2017. Interest in a catch-and-release fishery will likely increase in the coming years, as photos and stories of 100+ pound fish continue to be shared.

Contact Information:

- Name: Travis Moore (Lake Sturgeon Recovery Team Leader)

- Email: travis.moore@mdc.mo.gov
- Phone: 573-248-2530

Pallid Sturgeon (PDSG)

Culture & Stocking

Blind Pony State Fish Hatchery (BPSFH) transported and held no potential PDSG broodstock during the 2017 production year. Due to the concerns of ranavirus it was decided that no fish for the restoration program would come through Blind Pony. No PDSG were stocked from BPSFH in 2016.

Literature Available: *Blind Pony State Fish Hatchery Report 2015*

Contact Information:

- Name: Nathan Storts
- Email: nathan.storts@mdc.mo.gov
- Phone: 660-335-4531

Research

Pallid Sturgeon Monitoring: Sampling season 2017 resulted in 100 pallid sturgeon sampled with over half being known hatchery fish. Five pallid sturgeon were confirmed genetically to be wild and 27 are still awaiting genetic determination.

The field station conducted a non-random targeted pallid sturgeon broodstock collection effort in a 50 mile stretch near St. Joseph, MO from March 27th to April 13th. During the three-week effort, three crews deployed 357 trotlines and 14,247 hooks, resulting in 3,448 total fish captured. Sixty-two pallid sturgeon were captured (45 hatchery-reared origin, 3 “Wild” and 14 unknown origin awaiting genetic analysis. Six fish were identified as potential broodstock. Five of the potential broodstock fish were hauled to Gavins Point NFH; two were determined to be reproductive females with black eggs and one was a reproductive male. The sixth potential broodstock fish was hauled to Neosho NFH and determined to be a reproductive male.

Pallid sturgeon captured in the effort had fork lengths that ranged from 343 to 1,052 mm and the mean fork length was 680 mm. Adult pallid sturgeon (>800 mm) comprised 29% of the total pallid captured.

Two pallid sturgeon sampled in June were from the 2002-year class, however, one of the hatchery-reared pallid sturgeon was originally stocked in RPMA 3 at the Standing Bear stocking site above Gavins Point dam. The two hatchery-reared pallid sturgeon measured 645 and 601 mm in fork length which is considerably smaller than the mean fork length of 922 mm for 2002-year class fish that were captured during 2017 broodstock efforts in March and April.

Several reports in recent years have come in from recreational anglers catching large pallid sturgeon in the Missouri River and its tributaries. Several of these confirmed fish are larger than what has been captured in our long-term monitoring program. The picture below is an example of such a catch from an angler on the Missouri River near St. Joseph, MO. Those reporting catching a pallid sturgeon have all said they released the fish and had knowledge of what species it was.



Pallid Sturgeon Monitoring (Segment 10, MO RM 250-367): This past year marked the 13th year of Pallid Sturgeon Population Assessment monitoring in the stretch of the Missouri River between the confluence of the Kansas River (RM 367.5) and the Grand River (RM 250.0). During 2017 standard sampling, 13 Pallid Sturgeon (PDSG) and 2 Shovelnose x. Pallid Sturgeon hybrids (SNPD) were captured in Segment 10. This is similar to the number of PDSG captured in previous years standard sampling from 2005 through 2016 (N = 4, 11, 10, 12, 9, 30, 22, 13, 23, 20, 18 and 17 respectively), however, slightly lower than the average catch of all years' sampling of 15.5 PDSG.

In 2017, PDSG caught during standard sampling were 77% hatchery-origin (N=10), 15% wild origin (N=2) and 8% unknown origin (N=1) awaiting genetic analysis results. For all sample years, the overall ratio of hatchery to wild origin fish in Segment 10 is 83:15. The high ratio of hatchery to wild fish is probably due to continued stocking efforts and survival of hatchery reared PDSG into the river system. Hatchery year classes represented in 2017 sampling included; 2001 (N=2), 2002 (N=2), 2003 (N=1), 2006 (N=1) and 2011 (N=1) year classes. Relative condition (Kn) for stock (330 – 629mm), quality (630 - 839mm) and preferred (840 – 1039mm) size class PDSG increased slightly in 2017 (0.888, 0.861, and 0.851, respectively) from 2016 (0.849, 0.837, 0.829, respectively) in all three size classes.

Also, seventy-two Young of Year (<170 mm) sturgeon were sampled in 2017, however, all were genetically confirmed to be SNSG. This is a slight increase in YOY sturgeon from last year (N=42) and

above the average for all years sampling (N=45). The highest catch of YOY sturgeon in Segment 10 occurred in 2009 (N =81).

Literature Available: *Pallid Sturgeon Population Assessment Program Segment 10 Annual Report*

Contact Information:

- Name: Adam McDaniel and Kasey Whiteman
- Email: adam.mcdaniel@mdc.mo.gov and kasey.whiteman@mdc.mo.gov
- Phone: 660-646-3140 and 816-271-3100

Pallid Sturgeon Monitoring (Segment 11, KS RM 0-52): In 2017, the twelfth year of sampling (2006-2017) was completed for the Pallid Sturgeon Population Assessment Program in Segment 11, the Kansas River. Sampling occurred, per standard protocol, in three randomly selected river bends, which were located between river miles 1.8 and 11.0. During the spring, one wild origin PDSG was captured using trot lines; the same individual was last captured in 2016 in the Missouri River, 202.6 river miles upstream and has been genetically confirmed as a wild origin fish. This is only the second potentially wild origin PDSG captured in the Kansas River since standardized sampling was implemented in 2006. Overall, twenty PDSG have been captured in the Kansas River since 2007, though no PDSG have been stocked into that tributary. Hatchery-reared origin pallid sturgeon captured in the Kansas River (n=18) include the following hatchery year classes; 2001 (N=1), 2002 (N=9), 2003 (N=6), 2005 (N=1) and 2008 (N=1). Two young-of-year sturgeon (<170 mm) were collected in the Kansas River in 2017. Genetic samples were collected from those small sturgeon to accurately identify species; all genetic results identified the small fish as SNSG.

Contact Information:

- Name: Corinne Wellemeyer, Joshua Bruegge and Kasey Whiteman
- Email: corinne.wellemeyer@mdc.mo.gov, josh.bruegge@mdc.mo.gov, and kasey.whiteman@mdc.mo.gov
- Phone: 660-446-3371 and 816-271-3100

Habitat Assessment and Monitoring Program – Interception and Rearing Complexes Evaluation at Searcy Bend: The objective of this study is to evaluate the construction and modification of inside bend habitats to facilitate interception and rearing of drifting pallid sturgeon larvae. The MDC HAMP crew collected 219 unidentified *Scaphirhynchus* sturgeons (USGs), 114 from the control site (Wilhoite Bend) and 106 from the experimental site (Searcy Bend). Captured USGs ranged from 14 mm total length (TL) to 168 mm fork length (FL). Catch per unit area (CPUA) of USGs was higher at the control site during 2017 than in 2016, while CPUA values were comparable at the experimental site between 2016 (pre-IRC construction) and 2017 (post-IRC construction). All USGs were sent in for genetic confirmation and all were determined to be Shovelnose sturgeon, *Scaphirhynchus platyrhynchus*.

Four fluvial specialist species of interest (sturgeon chub, shovelnose sturgeon, shoal chub, and sicklefin chub) constituted ≥ 1% of the fish community at both control and experimental bends during 2017 field

sampling. Catch per unit area of sicklefin and sturgeon chubs was significantly greater in 2017 than 2016 for both control and experimental bends. Additional taxa of interest collected during 2017, which could be resolved to species, include silver chub (n= 13; eight from Searcy bend and five from Wilhoite Bend), blue sucker (n= 11; six from Searcy bend and five from Wilhoite bend), river shiner (n=6, all from Wilhoite Bend), and sand shiner (n=6, all from Wilhoite Bend).

Twenty species were collected from Searcy Bend in 2017 (1727 fish collected and resolved to species (including USGs). Fish community was dominated by blue and channel catfish (each contributing >30% of relative abundance at Searcy Bend). *Macrhybopsis* chubs made up >20% of the fish community at Searcy Bend (sicklefin chub = 11.8%, shoal chub = 6.25%, sturgeon chub= 2.08%). Thirty-four species were collected from Wilhoite Bend in 2017 (2359 fish resolved to species including USGs). Sicklefin chubs were the most abundant species (32.6% of catch), with ictalurid catfishes making up 44% of relative abundance.

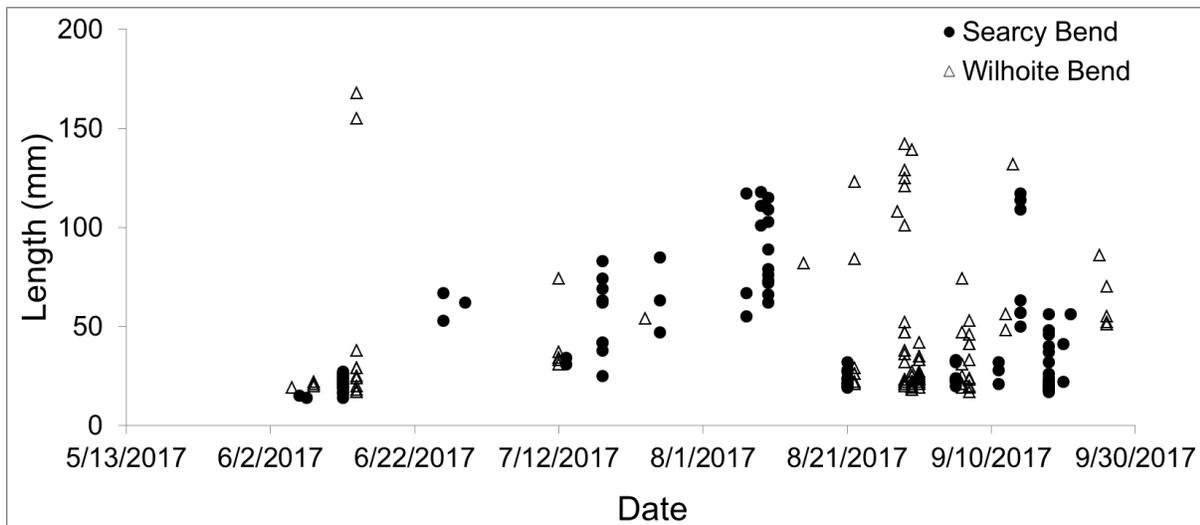


Figure 1. Length of unidentified *Scaphirhynchus* sturgeons collected from Searcy Bend (black circles) and Wilhoite Bend (white triangles) during the 2017 field season. N= 219 fish, 106 from Searcy Bend and 113 from Wilhoite Bend. The individual collected from New Haven Bend on 7/11/2017 is not included in this dataset.

Contact Information:

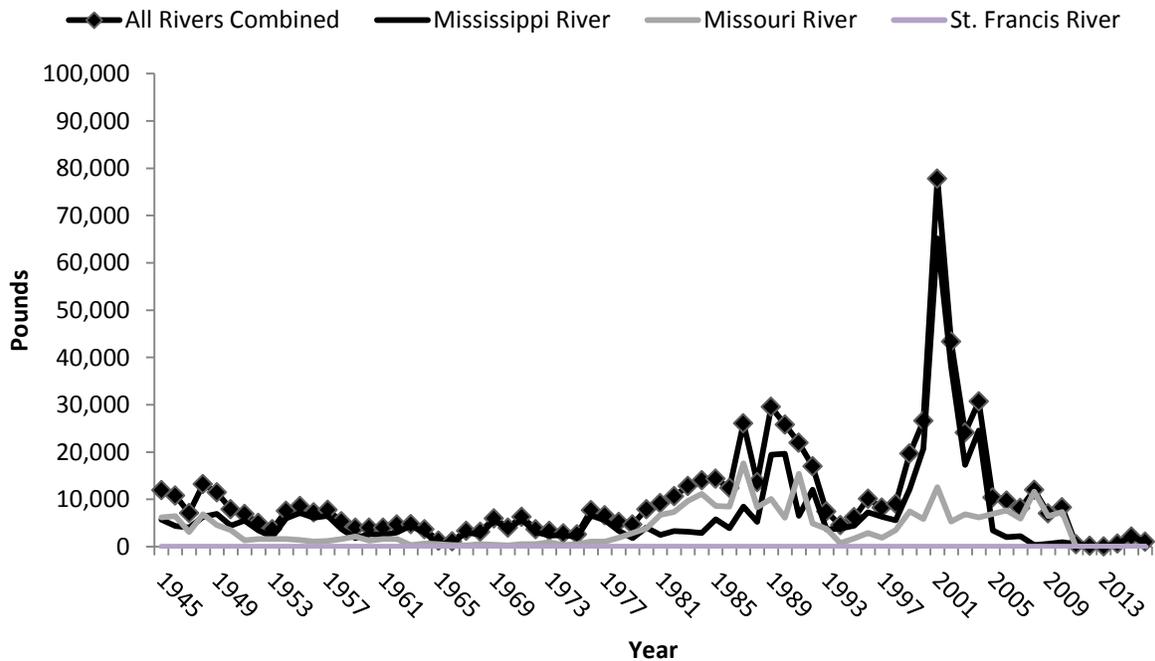
- Name: Thomas Boersig, Jacob McQuaid and Kasey Whiteman
- Email: thomas.boersig@mdc.mo.gov, jacob.mcquaid@mdc.mo.gov and kasey.whiteman@mdc.mo.gov
- Phone: 573-815-7901 and 816-271-3100

Shovelnose Sturgeon (SNSG)

Commercial Fishing Program

Mississippi River SNSG harvest decreased from 2,136 lbs. in 2015 (the highest harvest since 2010) to 1,045 lbs. in 2016. The 2016 commercial shovelnose sturgeon harvest consisted of 382 fish (average weight 2.7 lbs./fish), produced 169.9 lbs. of roe, and was highest from Pool 24 (551 lbs.) and Pool 22 (370 lbs.) of the UMR. SNSG were primarily harvested with trammel nets (522 lbs.) and gill nets (480 lbs.); few fish were taken by hooks (36 lbs.) and hoop nets (7 lbs.). In 2016, the average, live-weight, wholesale price paid for SNSG flesh was \$0.30/lb.; SNSG roe sold for \$55.40/lb. The value of the 2016 commercial SNSG harvest was estimated to be \$9,731.52 (\$313.52 in flesh and \$9,418.00 in roe).

Sturgeons



Literature Available: *Missouri Commercial Fish Harvest Report 2016*

Contact Information:

- Name: Joe McMullen
- Email: joseph.mcmullen@mdc.mo.gov
- Phone: 606-451-3512 x6048

Paddlefish (PDFH)

Management

Reservoir Snag Fisheries: The 2017 snagging season was a good, despite low flows and the ever-changing weather conditions. Snaggers had good luck on the three reservoirs (Lake of the Ozarks, Harry S. Truman Lake and Table Rock Lake) and we're continuing to see snaggers out on the Mississippi and Missouri rivers and some of their tributaries. The 2018 snagging season should be good. The extremely large 2008-year class of fish is now 10 years old, and will continue to provide good numbers of fish for snaggers to harvest.

In May through June, the US Army Corps of Engineers released large amounts of water through the spill gates at Truman Dam which resulted in a fish kill. Primarily PDFH were affected – killed by blunt force trauma (spinal fracture, decapitation) from force of spill gate flows.

Contact Information:

- Name: Trish Yasger
- Email: trish.yasger@mdc.mo.gov
- Phone: 660-530-5500 x224

Black River Paddlefish Monitoring: The Black River downstream of Clearwater Dam supports a significant PDFH sport fishery. Trammel nets and angler use surveys in the large pool below Clearwater Dam have been used to monitor the fishery since 1994. In 2017, a total of 81 new PDFH were captured and jaw tagged. In addition, 24 PDFH were implanted with an acoustic tag. Assuming 20% non-compliance and zero tag loss, annual exploitation was estimated to be 28.1%. Using the same assumptions, the exploitation rate for the acoustically tagged fish was 25.0%.

PDFH movement in the Black River is substantial. The acoustic tags were implanted in PDFH captured just downstream of Clearwater Dam. Seven PDFH have been found multiple times in the Hendrickson Access area, which is 30 river miles downstream from Clearwater Dam. Two PHDF were detected at the Black River and White River confluence, which is ~250 miles downstream of Clearwater Dam. Two other PDFH have not been located in over six months. The remaining PDFH have been located multiple times in the pool below Clearwater Dam.

Contact Information:

- Name: Paul Cieslewicz
- Email: paul.cieslewicz@mdc.mo.gov
- Phone: 573-290-5858 x4431

Culture & Stocking

Broodstock:

- 11 females collected from Table Rock
- 6 males collected from Table Rock
- 9 female collected from Truman
- 16 males collected from Osage River
- 2 females collected from Osage River

Spawn:

Sperm was collected from 3 males. 14 males did not produce viable gametes.

Sperm was ranked by appearance, relative density, %activate, and forward motility and given a score to determine grade, if score was too low sperm was not used

Eggs were collected from 10 females. 3 females did not produce viable gametes.

One pan of eggs was fertilized with one male as opposed to a cocktail of multiples males in the past. The amount of sperm to be used on the eggs was based on weight and determined by using a chart from the USGS that they use for pallid sturgeon spawning. The sperm was activated with a determined amount of water (from the chart) prior to being poured over the eggs for fertilization. However, one male was used for multiple females due to a lack of producing males.

- 1,776,288 eggs were collected
- 525,824 hatched
- 30% Hatch

Production:

- Ponds 29-35 used for production.
- Ponds 29-34 stocked at 50,000/acre
- Ponds 35 stocked at 33,000/acre
- Pond 29 drained 6/20/2017 and 1,270 fish transferred to Pond 30

519,594 fry were stocked into Blind Pony ponds.

6,630 fry were put into start tanks ranging from 500 to 1,100 per tank. We tried to convert them to a commercial diet and had little success. Of these fish 715 converted to pellet feed and survived. These fish were stocked out into the ponds with the other PDFH.

Harvest:

- 11,002 fish harvested
- 2% survival
- 3,600 LOZ
- 4,450 Truman
- 2,451 Table Rock

- 501 Black River

Pond Prep/Maintenance:

- Ponds were started filling 2 weeks prior to expected stocking.
- Ponds were fertilized with cottonseed meal, alfalfa meal, and chicken manure.
- Aquashade (Mirage) was used to help minimize the growth of vegetation.
- **NEW:** Grass carp were used in all ponds and effectively kept vegetation to a minimum. This method will not be continued in the future due to unknown effect on PDFH. Also, handling and sorting the Grass carp was difficult during harvest of PDFH.

Contact Information:

- Name: Nathan Storts
- Email: nathan.storts@mdc.mo.gov
- Phone: 660-335-4531

Research

Statewide Paddlefish Reproduction and Exploitation in Missouri’s Large Rivers and Reservoirs: We have completed the third year of the five year study and started tagging for the fourth year.

Jaw Tagging & Exploitation:

Reservoir	Year 1 Tagged	Year 1 Returns	Year 2 Tagged	Year 2 Returns	Year 3 Tagged	Year 3 Returns	Total Returned	Total Harvested
Table Rock	644	58	841	80	487	160	298	272
Truman	1269	129	263	90	626	130	349	275
Lake of the Ozarks	555	29	804	61	436	123	213	187
Mississippi River	300	19	307	26	275	21	66	45

*Year-1 – 2015; Year-2 – 2016; Year-3 – 2017

In 2017 we continued to track and monitor the movement of implanted PDFH with stationary receivers in the Mississippi River (71), Black River (25), St. Francis River (25), Lake of the Ozarks (100), Truman (100) and Table Rock Lake (100).

The transmitter fish have served a dual purpose: 1) measure of non-reporting and 2) track reproductive movement patterns. We documented successful reproduction in the Mississippi River again in year 3. We did not focus on finding reproduction on the reservoirs this year.

Movement Information:

- Truman Lake
 - o Fish were caught by anglers on the Marais des Cygnes River below Osawatomie Dam KS.
 - o Fish passed through Truman Dam and were detected in Lake of the Ozarks and Bagnell Dam and were detected in the Osage River.
 - o Fish were snagged by anglers below Gavins Point Dam.
- Lake of the Ozarks
 - o Fish passed through Bagnell Dam and was snagged below Clinton Dam near Lawrence, KS on the Wakarusa River (tributary to Kansas River).
 - o Others passed through Bagnell and were caught below Gavins Point Dam or were detected on stationary receivers throughout the Mississippi and Missouri River Basin.
- Table Rock
 - o Fish snagged below Bull Shoals Power Site Dam in Forsyth, MO.
- Mississippi River
 - o 552 river miles – Tagged near Cape Girardeau, MO, swam down the Mississippi River, up the White River, AR, up the Cache River, AR, and caught/released near Fredonia, AR.
 - o 519 river miles – Tagged near Cape Girardeau, MO, swam this distance downstream over a two month period before being harvested in Northern Louisiana.
 - o ~438 river miles – Three PDFH, all implanted in different locations, swam ~218 miles up the Mississippi River, 220 miles up the Illinois River, and detected at Starved Rock Lock and Dam in Illinois by the USFWS. One of those PDFH then swam back to the Mississippi River and was detected again just below the confluence of the Des Moines River near Keokuk, Iowa; an additional distance of 366 miles, totaling at least 804 river miles.
 - o 393 river miles – Two PDFH, implanted downstream of Thebes, IL swam 196 miles up the Mississippi River, 197 miles up the Missouri River, and detected at Boonville, MO.
 - o Almost 2000 miles – one PDFH tagged near the mouth of the Ohio River was detected near Mississippi River mile 3 in the Delta National Wildlife Refuge stationary receiver array and then detected again back at the mouth of the Ohio River.
 - o 32 tagged or implanted PDFH were recaptured or detected in the Ohio River or tributaries of the Ohio River (i.e., Tennessee and Cumberland River).
 - o Two of these PDFH managed to utilize the lock chamber to move into Kentucky Lake and be recaptured 8.5 and 12.5 miles above the lock chamber.
 - o 10 fish recaptured within 6 miles of original tagging location.

Information Link: <https://huntfish.mdc.mo.gov/fishing/protect-missouri-fishing/help-improve-paddlefishing>

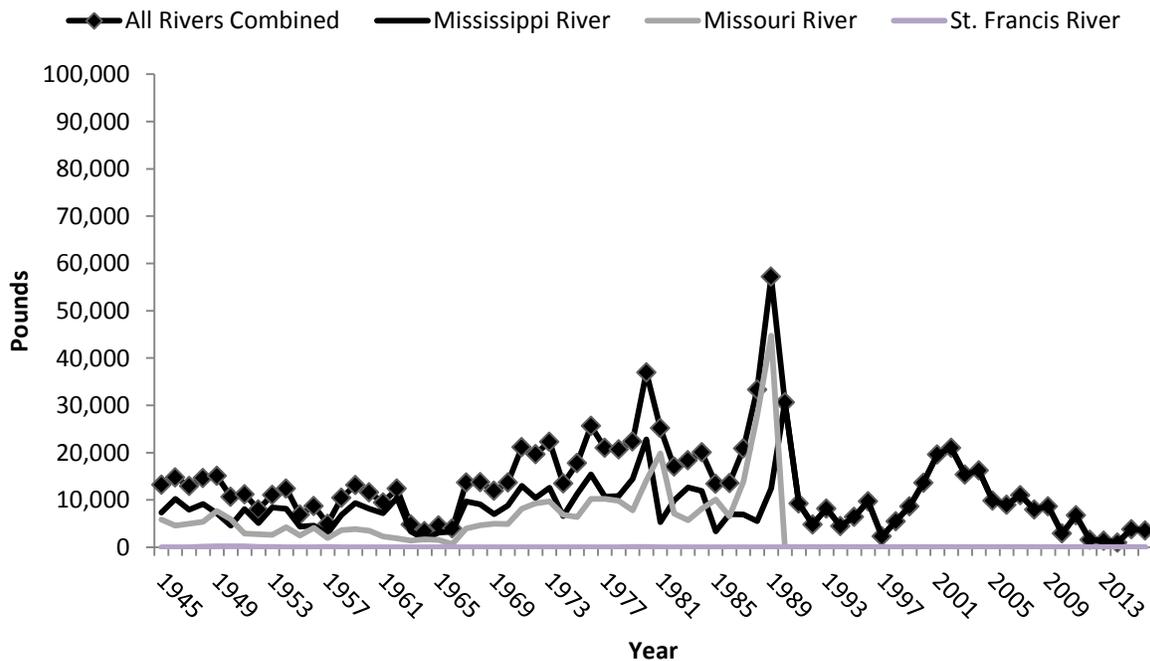
Contact Information:

- | | |
|----------------------------------|--------------------------------|
| - Name: Trish Yasger | - Name: Sara Tripp |
| - Email: trish.yasger@mdc.mo.gov | - Email: sara.tripp@mdc.mo.gov |
| - Phone: 660-530-5500 x224 | - Phone: 573-243-2659 x1041 |

Commercial Fishing Program

Mississippi River PDFH harvest decreased from 3,843 lbs. in 2015 to 3,567 lbs. in 2016. The 2016 harvest consisted of 163 fish (average weight 21.9 lbs./fish) and produced 223.6 lbs. of roe. PDFH harvest was highest on the LMR (2,652 lbs.), specifically RM 828-878 (2,652 lbs.) near the Arkansas border. PDFH were captured exclusively with gill nets. In 2016, the average, live-weight, wholesale price paid for PDFH flesh was \$0.30/lb.; PDFH roe sold for \$78.75/lb. The value of the 2016 commercial PDFH harvest was estimated to be \$18,710.10 (\$1,070.10 in flesh and \$17,640.00 in roe).

Paddlefish



Literature Available: *Missouri Commercial Fish Harvest Report 2016*

Contact Information:

- Name: Joe McMullen
- Email: joseph.mcmullen@mdc.mo.gov
- Phone: 606-451-3512 x6048

2018 MICRA Nebraska update

Paddlefish

Several hundred adult Paddlefish were tagged from the Gavins Point Dam tailwater in 2018. With a large increase in the numbers of invasive carp in this reach of Missouri River since 2010 there are increasing concerns of impacts to Paddlefish. Preliminary analysis indicates that relative weights, especially for larger Paddlefish, have been declining. Sampling in 2019 will be expanded beyond the Gavins Point Dam tailwater and include looking at impacts to growth rates.

Since 1965 various agencies have conducted an annual trawl survey on Lewis and Clark Lake, formed by Gavins Point Dam, to monitor Paddlefish reproduction. Since the flood of 2011 there have been two complete year class failures, notably the only two since the project began. While reproduction was documented in 2017, it was the lowest level of successful reproduction ever reported. Fortunately, there has been one strong year class since the flood, in 2016.

A draft chapter on sport fishing was prepared along with the coauthors and submitted.

In 2016, Nebraska and South Dakota moved up the start date of our 30 day archery Paddlefish season on the Missouri River downstream of Gavins Point Dam from the second Saturday of July to the first of June. The intent was to provide archers a better opportunity to harvest a Paddlefish. Overall the change in season dates has achieved the goal and harvest increased by 75%. Unfortunately, most of this increased harvest has been fish from 35 to 45 inches eye to fork which are potential broodstock protected during our snagging season. This protected slot was implemented to protect reproductive size fish for multiple years while still allowing anglers the opportunity to a harvest trophy fish. We will be looking at the impacts on our populations reproductive potential of this increased harvest and our overall program goals. Gerald.Mestl@Nebraska.Gov

Sturgeon

Nebraska Game and Parks participates in the U.S. Army Corps of Engineers (USACE) Pallid Sturgeon Population Assessment Program, a basin wide standardized monitoring program. We sample the upper channelized Missouri River from Ponca, Nebraska downstream to approximately the Nebraska Kansas border. Standard gears are run throughout the year to collect Pallid and Shovelnose Sturgeon and a targeted suite of native species. During 2017 we sampled a total of 75 Pallid Sturgeon. Condition which had dropped significantly following the 2011 flood has increased slightly over the past two years. It is not yet clear if this is an actual rebound in condition or the result of the mortality of the fish that had been in very poor condition.

Nebraska conducted its 10th large scale spring broodstock effort and its third smaller fall broodstock effort. While conditions were favorable in the spring and similar to 2016 the overall numbers of Pallid Sturgeon collected, 104 and number shipped to the hatchery 19, were only about half of the long term averages. Again, one possible explanation is that we have lost the fish that were in poor condition. We

also are not seeing the expected numbers from hatchery fish stocked from 2010 to 2015 that should be fully recruited to the trot lines. In addition, we have documented declining growth rates in all year classes stocked since 2004. During our fall broodstock effort we captured an additional 42 Pallid Sturgeon and shipped four. Kirk.Steffensen@Nebraska.Gov

Nebraska also participates in the USACE's Habitat Assessment and Monitoring Program. We are in the second of a three year project that is documenting the distribution of age-0 sturgeon. Intensive trawling during the summer of 2017 resulted in 1,248 age-0 Shovelnose Sturgeon (0 Pallid Sturgeon) up from the 216 sampled in 2016. This effort will be used to inform the refinement of habitat definitions being used to design, construct and monitor Interception and Rearing Complexes being built to improve Pallid Sturgeon recruitment on the lower channelized Missouri River. Jerrod.Hall@Nebraska.Gov

Nebraska Game and Parks along with the U.S. Geological Survey Columbia Environmental Research Center have been conducting telemetry studies of adult Pallid Sturgeon on the lower Missouri River for over a decade. Telemetry has been identified in the new Missouri River management plan, currently being finalized, as an important tool planned to be used to answer a variety of questions in both the upper and lower Missouri River. While there are currently no studies in progress, our staff has been recapturing previously tagged adult Pallid Sturgeon and recovering Data Storage Tags, containing temperature and pressure data, and replacing expiring telemetry tags. After the new management plan is adopted, telemetry studies are planned to begin immediately utilizing this resource of approximately 100 tagged fish, many with extended histories of movement, growth, reproductive cycling and habitat use. Justin.Haas@Nebraska.Gov

Finally in conjunction with Sarah Gaughan, a PhD student at the University of Nebraska, Lincoln we have started compiling a mDNA database of all fish species in Nebraska. Ten individuals of 70 different fish species found in the Missouri River and Nebraska's waters were collected and the mDNA is being extracted. In addition, samples were collected from 10 Pallid Sturgeon using colonic irrigation and preserved. Dr. Quoqing Lu of the University of Nebraska, Omaha will be exploring the practicability of conducting dietary analyses on these Pallid Sturgeon samples using the mDNA library being developed. Gerald.Mestl@Nebraska.Gov

MICRA State Report – February 2018
Oklahoma Department of Wildlife Conservation

1) Paddlefish Collections

- a) The endless search for juveniles
 - i) Age-1 and 2 fish are everywhere. Confirmed recruitment in 2015, 2016, and possibly 2017.
 - ii) Light-trapping protocol (2017) didn't catch any larval Paddlefish
- b) Winter netting (2017)
 - i) RS Kerr Lake, variable catch, poor condition
 - ii) Grand Lake low catch (but lots of age-1&2)
 - iii) Webber's Falls stock assessment (w/ creel)



2) Angler Harvest (Spring 2017 Grand/Neosho)

- a) 3,265 fish were harvested and checked at the Paddlefish Research Center (PRC)
 - i) 1999 cohort possibly depleted
- b) Caviar: the PRC produced 12,668.9 lbs, avg. 11.8 lbs per female
 - i) increase in production from 2016
 - ii) 20.8% gonadosomatic index for females (2% decline)



3) Stock/Harvest Management

- a) New regulation prohibits night snagging

4) Restoration Stocks

- a) Texoma, Eufaula, Oologah, and Kaw. Stocking has ended.
- b) Examining factors influencing recruitment/lack of recruitment in restoration lakes.
- c) Considering future restoration sites (Tenkiller).

5) Research

- a) Recent research findings
 - i) Economic impact of paddlefish angling in Oklahoma (approx. \$18.2M)
 - (1) Economic value (willingness to pay) is \$12.7M (with \$4.7M @ Grand Lake/Neosho and \$3.3M @ Ft. Gibson)
 - (2) Residents spent an average of \$180 per trip; Nonresidents spent \$500
 - (3) Supports 193 jobs and provides \$450,000 in state sales tax revenue
- b) Future research 2018
 - i) Nat. Hist. Museum London, Kings College- continue Polypodium infection rates study
 - ii) Otolith / jaw microchemistry; river recruitment contribution
 - iii) Sonar assessment of headwater rivers for restoration stocks

Deep Hole Cast Nets

Made with Webbing

- Holds the net open better and longer for deeper targets.
- Made as part of the original net when the net is made, not an add-on feature.
- Last as long as the net.
- True woven webbing sewn to the net.
- Very durable compared to tape.
- All nets have extra long hand line.
- Packed in heavy vinyl bag with webbing shown to increase consumer viability.

Durable webbing is sewn into the net to last for the life of the net.

Lead Weights




Shovelnose Sturgeon

Shovelnose are rare in Oklahoma, therefore management is largely restricted to policies and meetings. Current challenges lie in plans by the Tulsa-metro to install multiple low-head dams on the Arkansas River. We have opposed the dam construction due to fish passage and habitat quality. For all intents and purposes, the Arkansas River is critical habitat for Shovelnose. Funding has been approved for the dams; however the USACE has yet to issue the 404 permits (despite having issued 401 permits). Discussions are ongoing.

MICRA Paddlefish/Sturgeon Committee
South Dakota State Report – February 13, 2018
Jason Sorensen, SDGFP

Paddlefish Tagging/Stocking

South Dakota Game, Fish and Parks personnel conducted paddlefish tagging operations on the Missouri River below Gavins Point Dam. A total of 234 adult paddlefish were tagged with monel jaw tags in June, 2017. Tagged fish had an average length and weight of 838 mm and 7.9 kg respectively.

During May, 2017 broodstock paddlefish were collected from Lake Francis Case, a mainstem Missouri River reservoir. Fish were collected near the White River confluence and transported to American Creek Fisheries Station in Chamberlain, SD. At the conclusion of fish collection, the fish were transported to Gavins Point National Fish Hatchery for artificial propagation and rearing. Adult fish used for propagation were returned to Lake Francis Case. This joint effort between South Dakota Game Fish & Parks and the United States Fish & Wildlife Service resulted in 44,470 large fingerling paddlefish stocked in Lake Sharpe and 35,603 large fingerling paddlefish stocked in Lake Francis Case in late August/early September 2017. All fingerlings were tagged with 1.5 length decimal coded wire tags during August 2017 as per MICRA stocking/tagging protocols.

Lake Sharpe Paddlefish Research

In October, US Fish and Wildlife Service biologists surgically implanted acoustic telemetry tags (*Vemco V8-4x*) into 50 juvenile paddlefish to better understand dispersal, entrainment, and habitat use within Lake Sharpe. Three locations were chosen to stock these 50 individuals; Bad River (16), Hipple Lake (17), and the Oahe Dam tailrace (17). An additional 20 juvenile paddlefish had dummy tags (*Vemco V8 Dummy Tag*) surgically implanted and were held at Gavins Point National Fish Hatchery to test tag retention over a three month period (estimated life of telemetry tags). After three months, Paddlefish implanted with dummy transmitters had a 95% tag retention rate and zero mortality. Initial dispersion results showed a majority of stocked paddlefish moved away from their stocking location within the first month and utilized a large portion of the reservoir.

Paddlefish Sport Fisheries

South Dakota currently has three sport fisheries for paddlefish. A spring snagging season occurs in May on Lake Francis Case, a mainstem Missouri River reservoir. Additionally, a summer archery season (June) and a fall snag fishery (October) take place in the Missouri River below Gavins Point Dam. Both Gavins seasons are jointly managed with the Nebraska Game and Parks Commission.

Lake Francis Case Paddlefish Snagging: Snagging for paddlefish on Lake Francis Case resumed in 2012 after being closed for nearly 30 years. Annual large fingerling stocking initiated in the early 1990's resulted in a paddlefish population capable of supporting limited sport harvest. Three hundred fifty resident-only permits are issued by the State of South Dakota while the Lower Brule and Crow Creek Sioux Tribes each offer 25 permits for a total of 400 permits. South Dakota Game, Fish & Parks has received an average of 1,816 applicants for its 350 permits. The season runs from May 1-31 and is open reservoir-wide. During May 2017 anglers snagged an estimated 2,801 hours and experienced a catch rate of 0.472 paddlefish/hour. Snaggers harvested an estimated 206 paddlefish while releasing an estimated 1,116 paddlefish in 2017.

Gavins Point Dam Archery and Snagging Paddlefish Seasons: South Dakota Game, Fish and Parks and the Nebraska Game and Parks Commission jointly manage archery and snag fisheries for paddlefish in the Missouri River below Gavins Point Dam. The 30-day archery season runs June 1-30 while the snag fishery is open for the month of October. South Dakota issues 255 resident and 20 non-resident archery permits and 1,550 resident and 50 non-resident snagging permits. During 2017, paddlefish archers spent an estimated 3,021 hours pursuing paddlefish with each archer spending an average of 12.9 hours hunting paddlefish. Estimated archery harvest for 2017 was 156 paddlefish, with 54 percent of those fish being between 35 and 45 inches in length (protected harvest slot for the paddlefish snagging season). Paddlefish anglers spent an estimated 12,647 hours snagging for paddlefish during October 2017. Anglers harvested an estimated 585 paddlefish with 93 percent of those being under the 35-45 inch eye-fork protected slot. Anglers released an estimated 11,536 paddlefish with 56 percent of those being in the protected slot and 42 percent under the slot. Paddlefish anglers in 2017 experienced an overall catch rate of 0.96 paddlefish/hour of snagging.

Lake Sturgeon

South Dakota Game, Fish and Parks is helping fund a lake sturgeon reintroduction project in Big Stone Lake (SD/MN borderwater) and the Minnesota River. The project is a cooperative effort with the Minnesota Department of Natural Resources. Lake Sturgeon were stocked in 2014 (6,500 fish), 2015 (7,570 fish), 2016 (3,036 fish), and 2017 (4,068 fish). Sturgeon were produced at Genoa National Fish Hatchery, Wisconsin. Plans call to stock annually for up to 20 years. Anglers have been catching lake sturgeon incidental to other species. Lake sturgeon have been commonly observed during annual gill net surveys conducted by the Minnesota Department of Natural Resources. A commercial fisherman reported catching 30 lake sturgeon in a single seine haul.

Shovelnose Sturgeon

South Dakota Game, Fish and Parks (SDGFP) initiated a research project to examine the dynamic rate functions (growth, recruitment and mortality), movement patterns, and habitat use of Shovelnose Sturgeon in Lake Sharpe, a small Missouri River impoundment in Central South Dakota.

During March 2017, SDGFP fisheries biologists began capturing and tagging Shovelnose Sturgeon on Lake Sharpe. All Shovelnose Sturgeon captured were measured (FL; mm), weighed (g) and marked with floy tags. Pectoral fin rays, to be used for age estimation, were collected from all sturgeon. To date, 457 Shovelnose Sturgeon have been captured and tagged in Lake Sharpe. Information on recaptured Shovelnose Sturgeon will be collected over the next three years. This data will be used to estimate mortality, conduct a population estimate, and monitor growth of Shovelnose Sturgeon in Lake Sharpe.

In addition to collecting information on population dynamics of Shovelnose Sturgeon, SDGFP also plans to use a combination of passive and active telemetry to track seasonal movement patterns and habitat use. In May of 2017 and 2018, SDGFP will implant a total of 50 Shovelnose Sturgeon (25 per year) with Vemco V13 acoustic telemetry tags. Twelve to sixteen VEMCO VR2W passive receivers will be deployed in Lake Sharpe throughout the duration of this study to monitor key habitat locations such as backwater areas, main lake locations, Oahe Dam tailrace and tributaries. Active tracking will take place every two to three weeks from May through October. The V13 transmitters will be programmed to have a battery life of two years. We hope that this study will answer important questions regarding basic Shovelnose Sturgeon population demographics in Lake Sharpe. It is likely Shovelnose Sturgeon recruit (in the Missouri River reservoir system in

South Dakota, as evidenced by the minimum dam age of 50 years and the average Shovelnose Sturgeon lifespan of between 15 and 20 years. However, the dynamic rate functions of this species have never been documented in the impounded section of the Missouri River. This project will provide valuable information about the growth, recruitment and mortality of Shovelnose Sturgeon in Lake Sharpe, which will help direct future research projects and ultimately inform future management and restoration strategies. It is our hope to extend this research to the remaining Missouri River impoundments (i.e Francis Case, Lewis and Clark) to better understand the status of Shovelnose Sturgeon in South Dakota.

Tennessee

The majority of paddlefish harvested (93.8%) came from the Mississippi River, Barkley, Kentucky and Chickamauga reservoirs (Table 6). Reported annual statewide harvest of paddlefish roe was 6,782 lbs with 52% (3,529 lbs) of the total from Kentucky Reservoir. Roe harvest for Kentucky reservoir remains well below the high in 2006 of 20,036 lbs.

Table 6. Annual statewide commercial paddlefish harvest in FY 2017 based on Daily Commercial Roe Fish Harvest Reports (WR-0896).

<u>Waterbody</u>	<u>Roe Weight (lbs)</u>
Kentucky Reservoir	3,529
Mississippi River	1,322
Chickamauga Reservoir	764
Barkley Reservoir	746
Old Hickory Reservoir	175
Ft. Loudoun Reservoir	125
Guntersville Reservoir	45
Nickajack Reservoir	23
Cheatham Reservoir	13
Pickwick Reservoir	10
<u>Not Provided</u>	<u>29</u>
Total	6,782