

Mississippi River Unit Newsletter

Spring 2025



Upcoming Activities:

- FY27 Science Concepts
- “A-Team” Meeting
- Sauger and Skipjack Herring
- Upper Mississippi River Restoration Program-LTRM Spring WQ SRS



Missouri/Mississippi Confluence



Skipjack Herring (photo: Ted Goetz)

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What’s inside?

Shovelnose Sturgeon Joe.McMullen@mdc.mo.gov

- Declines in populations documented
- The SOA (Similarity of Appearance) rule prohibited commercial harvest
- Goal of maintaining sustainable harvest into the future.

Long Term Resource Monitoring-Fish Andrew.Glen@mdc.mo.gov

- Standardized monitoring for fish populations and community
- Most fish recorded during more than 30 years sampling
- Silver Carp spawn likely limited by low water/timing

Long Term Resource Monitoring-WQ Kathryn.Smith@mdc.mo.gov

- Parameters used for determining habitat quality and ecosystem function
- Discharge influential in water quality
- 5-year comparisons: notable differences

Age-0 Pallid Sturgeon Joshua.Abner@mdc.mo.gov

- Standardized gear on big river sampling
- Age-0 Pallid Sturgeon capture supports evidence of reproduction!!
- Pallid sturgeon ‘spawns’ habitat improvement

Gizzard Shad Andrew.Glen@mdc.mo.gov

- Impact of invasive carp on native filter feeders
- Data collected from over 3000 Gizzard Shad during 2023-2024
- Catch and condition due, in part, to invasive carp

Lower Mississippi Fish Theodore.Goetz@mdc.mo.gov

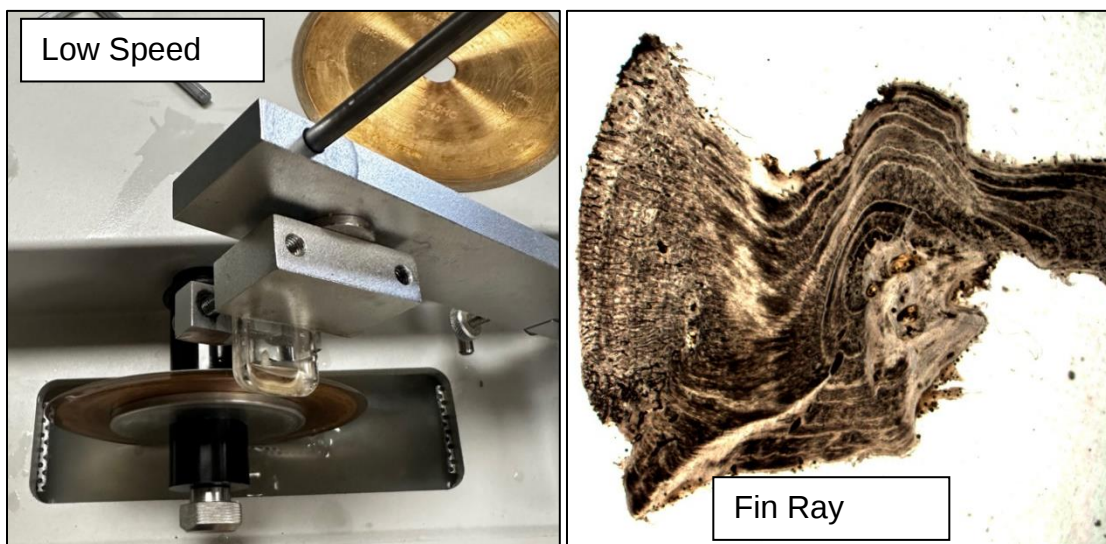
- Measuring response to invasive carp removal efforts
- Entering year 4 of sampling: LTRM comparable for Middle Mississippi
- Evaluations of fish community and Species of Conservation Concern

Big Rivers Shovelnose Sturgeon Assessment

Concern regarding the status of Shovelnose Sturgeon (*Scaphirhynchus platyrhynchus*) in the Mississippi River basin has increased as declines in populations have been documented and attributed to habitat alterations and overfishing. Historically, sturgeon supported important commercial fisheries in Missouri. However, in 2010 Shovelnose Sturgeon were listed as Threatened under the Similarity of Appearance (SOA) provision of the Endangered Species Act, prohibiting commercial harvest where Pallid Sturgeon coexist. In Missouri, the SOA rule prohibited commercial harvest from the entirety of the Missouri River and from the Mississippi River downstream of Mel Price Locks and Dam. Commercial harvest is now limited to the upper Mississippi River pools, increasing the potential for overharvest there.

In the fall of 2024 MDC staff and partner agencies began the first of three years of sampling to assess Shovelnose Sturgeon populations. Gill netting at 18 sites on the Missouri and Mississippi rivers is currently wrapping up. Thousands of Shovelnose Sturgeon have been captured, and a variety of metrics and samples are collected from fish to characterize their populations. Ultimately, this information will be used to guide management and regulation of fisheries with the goal of maintaining sustainable harvest into the future.

Mississippi River Unit staff are also working diligently to determine the ages of channel catfish collected during a separate Missouri River project. Catfish otoliths are staged in resin before slicing to allow cuts with more precision near the nucleus using a low-speed saw. This process results in a very thin slice of the structure which can be photographed and archived. The images are used to determine the age of individual fish by counting the annuli present. This summer, a similar process will be used to determine the ages of Shovelnose Sturgeon by preparing and examining pectoral fin ray sections.



View of low-speed saw set up for sectioning (left) and example fin ray cross section (right).

Long Term Resource Monitoring-Fish Update

The Mississippi River Science Unit conducts annual community fish monitoring on river miles 30-80 of the Mississippi River near Cape Girardeau as part of the Upper Mississippi River Restoration (UMRR) Program's Long Term Resource Monitoring (LTRM) element. This monitoring has occurred in Missouri since 1991 and follows the same protocol as five other field stations located on the Upper Mississippi River and Illinois River. The LTRM element is the research and monitoring component of the UMRR, and combines environmental monitoring, research, systemic data acquisition, and modeling in an effort to provide a solid scientific foundation upon which management actions and environmental policy on the Upper Mississippi River system can be based on. The fishes of the Upper Mississippi River system have recreational and commercial value, conservation potential, and can be used to assess the ecological integrity of the aquatic ecosystem. The objective of the standardized monitoring is to quantify the status and trends of fish populations and communities and identify relations with various other ecological attributes. The findings can be used to address fisheries management concerns.

Long term resource monitoring fish component sampling occurs annually from June 15th to October 31st and is broken up into three six-week time periods. Sampling occurs at a variety of habitat types including unstructured main channel, main channel wing dam, unstructured side channel, and two tributaries. Gears utilized include daytime electrofishing, large and small hoop nets, fyke nets, and mini fyke nets. A total of 50,986 fish were recorded for the 2023 LTRM fish component season and included a total of 59 unique species. This is the most fish recorded in the Open River Reach during the more than 30 years sampling. Side channel sites accounted for 66% of all captures and encompassed 83% of all species recorded. Two tributaries (Big Muddy River and Castor River Diversion Channel) are included in the LTRM fish sampling as fixed sites and are sampled with all methods during each time period. These tributary sites made up 3% of total captures during the 2023 season, however 64% of all species found were represented in these two sites. Pirate Perch were only found in the tributary sites and were not collected on the main channel or side channel. A Banded Sculpin was recorded at a main channel site, and this is the first instance of Banded Sculpin being recorded in LTRM fish sampling on the Open River Reach.

During the previous 5 years of sampling, the average number of captures was 19,612 individuals. The 2023 season was an outlier with more than double than average number of captures. Specifically, Bullhead Minnows, Channel Shiners, Emerald Shiners, were particularly abundant in the 2023 samples when looking at the five-year averages. Notably, invasive Silver Carp numbers were down significantly from the five-year average. Low water and only minor pulses in the hydrograph likely limited their ability to successfully spawn leading to little to no young of year captures. Total invasive carp (Bighead Carp, Silver Carp, Grass Carp, and Common Carp) biomass, measured during electrofishing runs of the last sampling period, accounted for 42% of the total biomass during the 2023 season. This mirrors the five-year average of 41% and is well within the range of those years (33-52%). We have successfully completed sampling for the 2024 LTRM fish component season and have completed QA/QC procedures with USGS.

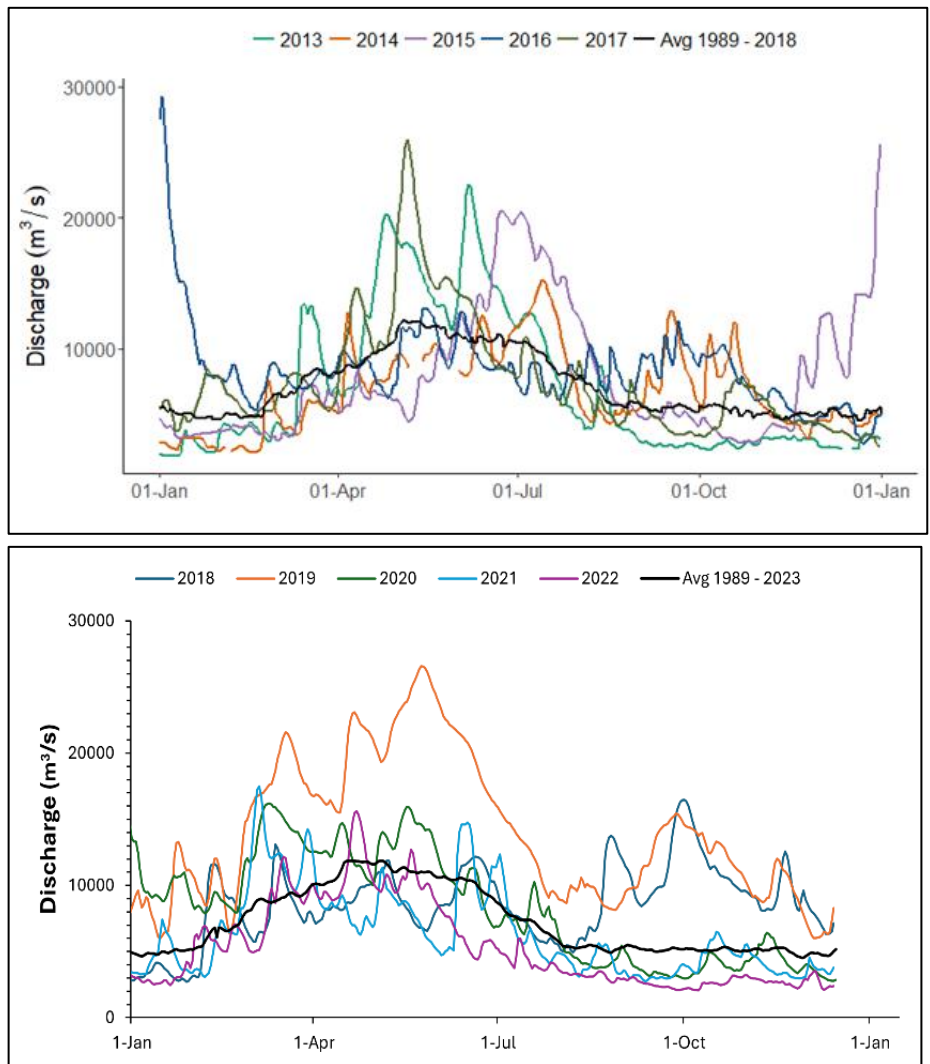


Mississippi River Science Unit staff member Tyler Bening holding a Mirror Carp captured during the LTRM fish component sampling in 2024.

Long Term Resource Monitoring-Water Quality Update

The Mississippi River Science Unit conducts water quality monitoring on the Open River reach of the Mississippi River on river miles 30 to 80 near Cape Girardeau. The monitoring effort is part of the Upper Mississippi River Restoration Program's Long Term Resource Monitoring (LTRM) element. The program was authorized in 1986 in response to the need for comprehensive and coordinated data collection and restoration project design on the Upper Mississippi River System. The research and monitoring component of LTRM has been ongoing in Missouri since 1991. Five additional field stations follow the same LTRM protocol for gathering and analyzing fish, vegetation, and water quality data on the Upper Mississippi and Illinois Rivers. The water quality component collects data on physical, biological and chemical parameters used for determining habitat quality and ecosystem function.

The Mississippi River's water quality can be understood through looking at changes in water quality parameters. Discharge plays an influential role in water quality measurements varying among seasons and across the years. The graphs display the annual daily discharge (2013-2017 and 2018-2022) for the Open River Reach created for reoccurring 5-year summary reports for the Mississippi River Science Unit. High peaks in discharge can result from heavy rain events frequently seen in the spring, increasing nutrient and sediment loads. Low discharge events occur during periods of less rainfall, typically occurring during the fall season and carrying over into the winter months. During this time a decrease in nutrient and sediment concentrations can be observed along with an increase in water clarity and dissolved oxygen concentrations. Comparing the two graphs and their study periods, 2018-2022 had a greater number of flood days, less total rainfall within the study period, and lower peak discharge events compared to the 2013-2017 study period. This resulted in a 5-year mean decrease of suspended solids, total phosphorous, total nitrogen, and chlorophyll, and an increase in dissolved oxygen from the 2013-2017 study period.



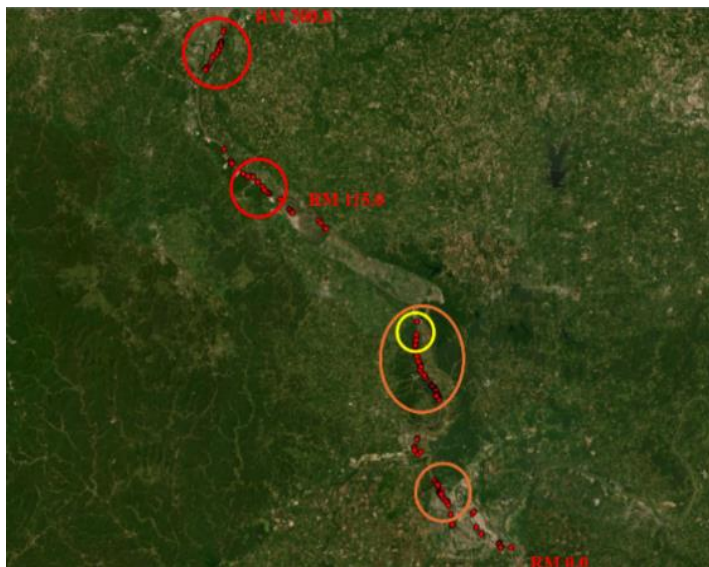
Daily discharge graphs for the Mississippi River at Thebes from 2013-2017 (top) and 2018-2022 (bottom)

Age-0 Pallid Sturgeon sampling

Pallid Sturgeon Population Assessment Program

The Mississippi River Unit has been conducting age-0 sturgeon sampling for many years with the goal of collecting larval specimens for genetic analysis to determine Pallid Sturgeon reproductive contribution in the Middle Mississippi River. Prior to 2020, the mini-Missouri benthic trawl was utilized for this sampling; however, the Pallid Sturgeon Population Assessment Program's (PSPAP) OT04 benthic otter trawl was adopted in 2020 for standardization with the Missouri River Unit. This sampling occurs every year between May and July and consists of both random and targeted sampling events.

The 2024 sampling season was completed on time and produced 1,289 age-0 sturgeon, which is close to average over the last five years if you exclude the 2023 sampling season where extreme low water conditions resulted in lower than average catches. 795 specimens were obtained through random sampling (192 trawls) while the remaining 494 specimens were obtained through targeted sampling (69 trawls). The figure shows individual capture locations (red dots) with those within the yellow circle representing 25% of the total captures, those within the yellow and orange circles representing 50% of the total captures, and those within the yellow, orange, and red circles representing 75% of the total captures.



Genetic analysis confirmed one Pallid Sturgeon and two hybrid sturgeon in 2020, three Pallid Sturgeon and one hybrid sturgeon in 2021, five Pallid Sturgeon in 2022, and zero in 2023; 2024 results pending.

Island Creation Pilot

The Mississippi River Unit was tasked with fish community sampling via benthic trawling for pre-habitat improvement projects in the Middle Mississippi River located near Mosenstein and Rockwood Islands. Future habitat improvements include the addition of river training and island building structures, as well as modifications to existing structures. Sampling took place in the summer and fall of 2023 and 2024 to establish baseline community fish data. The number of trawls completed were dependent on habitat availability, size of the area, and water level. Sampling gear and protocol mirrored PSPAP protocol utilizing the OT04 benthic otter trawl. All age-0 sturgeon captured were preserved for genetic analysis. Sampling will also occur after habitat improvements are made to monitor potential changes in the fish community.

The 2023 and 2024 sampling efforts produced 15,322 fish from 90 trawls at the Mosenstein focal area and 2,393 fish from 52 trawls at the Rockwood focal area. The total catch so far is 17,715 fish comprising 46 species. Additionally, 41 age-0 sturgeon were captured from the Mosenstein focal area while 93 age-0 sturgeon were captured from the Rockwood focal area for a total of 134 age-0 sturgeon captured to date. Genetic analysis of age-0 sturgeon are pending for species identification.



Age-0 unidentified sturgeon captured in the Mississippi River.

Gizzard Shad Assessment

Invasive Bighead Carp (*Hypophthalmichthys nobilis*) and Silver Carp (*Hypophthalmichthys molitrix*) are efficient filter feeders that have established in the Mississippi River system and have been shown to alter the planktonic resources and negatively impact native filter feeders. Missouri has an invasive carp management program that includes tagging and tracking fish acoustically, targeted removal programs, and recently the program added an incentivized harvest program throughout the Mississippi River. Long Term Resource Monitoring (LTRM) through the Upper Mississippi River Restoration program has been surveying the river for over 30 years and has documented the emergence and establishment of invasive carp throughout this time period. The Mississippi River Unit has started a project to understand the impacts that these invasive carp have on our native filter feeders. Gizzard Shad (*Dorosoma cepedianum*) has been chosen for study due to its overlap in diet with invasive carp and previous research that shows declines in condition when carp invade. Our research is focusing on the following population characteristics and metrics: catch per unit effort (CPUE), age and growth, mortality, relative weight, proportional stock density, and relative fecundity. These metrics can be used as a benchmark for future sampling to understand how native species are responding to changing carp dynamics, help us understand how our management practices are working, and help guide future management objectives.

Gizzard Shad were collected in 2023 and 2024 by the Mississippi River unit on the Mississippi River near Cape Girardeau during the annual LTRM fish sampling season (June 15 – October 31), spring spawning season, and during the fall after growth had stopped for the year. Sampling was done using LTRM standardized 15-minute boat electrofishing runs, which uses a Wisconsin-style electrofishing box, has a standardized power output, and covers about 200 meters in length. All sampled fish were weighed and measured, and some were collected for further analysis. Collected fish were separated into different size categories to ensure representative sampling. For each fish kept, the team collected length, weight, otoliths, sex, and gonad weight. Otoliths from fish greater than 200mm were mounted in epoxy resin and cross-sectioned for aging, while otoliths from fish less than 200mm were aged whole. Catch per unit effort was calculated based on Gizzard Shad per 15 minute electrofishing run, mortality was calculated using a catch curve analysis, gonadosomatic index was calculated to determine relative fecundity, a von Bertalanffy growth curve was used to look at age and growth, and an age at length key was generated.

In 2023, the total sample size was 883 fish and in 2024 it was 2288 fish. Relative weights show that the condition of Gizzard Shad that we recorded was generally poor, and 2023 and 2024 condition was worse than the previous 5 years. The CPUE for Gizzard Shad was examined using historic LTRM fish data and was shown to be steadily declining with 10.3 shad per 15-minute electrofishing run in 2023, and 24.3 shad per 15 minutes in 2024. The previous 5-year average for CPUE was 16.7 shad per 15 minutes. The size class distribution was heavily skewed toward small-bodied individuals but included an appropriate number of large-bodied individuals, which indicates that reproduction is likely not limiting to the population. The growth curve indicated that shad grow very rapidly in the first 3 years, then their growth rate slows greatly around 4 years. The theoretical maximum length for shad was 461 mm, and they achieved 42% of their growth by age 1. Gonadosomatic Index, a measure of percent body weight contributing to reproduction, was calculated for male and females and we saw that overall females put more energy into reproduction than males. Spawning appeared to begin when water temperatures reached 10° C and peaked when temperatures were around 15° C in April. Annual mortality in 2023 was 35%, and 57.3% in 2024. Overall results indicate a decline in Gizzard Shad catch and body condition in the open river, and this likely due in-part to competition for resources with invasive carp. Another year of sampling will be completed in 2025.



A 460mm (18.1 inch) Gizzard Shad collected from the Open River Reach of the Mississippi River (2024).

Fish Assemblage Monitoring in the Lower Mississippi River

The Lower Mississippi River (LMR) is a wide and free-flowing reach of the Mississippi River which begins at the confluence of the Ohio and Mississippi rivers in Cairo, IL. In 2022, 2023, and 2024, electrofishing sampling efforts of the Mississippi River Unit near New Madrid, MO aimed to monitor fish assemblages and determine the response to invasive carp removal efforts.

Fish assemblage monitoring was conducted at a total of 49 randomly selected sites. This included 15 sites in 2022, 10 sites in 2023, and 24 sites in 2024. Sampling was conducted to collect baseline data, in turn investigating any potential effects of invasive carp removals on native fish. Sampling was standardized using electrofishing protocol of Long Term Resource Monitoring (LTRM) sampling effort on the Upper Mississippi River (Ratcliff et al., 2014). All fish captured were identified and measured, with some fish weighed before being released. Water quality and habitat data were collected and recorded at each site. This included Secchi disk measurement, dissolved oxygen, water conductivity, water temperature, water depth, and substrate type.

Throughout this sampling effort on the Lower Mississippi River, a total of 4,937 fish were collected, including 47 unique species of fish (Table 1) from a total of 49 sites (Figure 1).



Figure 1. Fish assemblage sampling sites on the Lower Mississippi River from 2022-2024.

Common Name	Number of Fish	Common Name	Number of Fish
Emerald Shiner	1777	Goldeye	14
Gizzard Shad	1247	Blue Sucker	13
Threadfin Shad	376	Silver Carp	13
Channel Shiner	270	Smallmouth Bass	7
Freshwater Drum	220	Bigmouth Buffalo	4
Smallmouth Buffalo	95	Silver Chub	4
Blacktail Shiner	89	Logperch	3
Bullhead Minnow	84	Mooneye	3
Shortnose Gar	79	Shoal Chub	3
Flathead Catfish	57	Spotted Gar	3
White bass	55	Brook Silverside	2
Longnose Gar	54	Freckled Madtom	2
Common Carp	46	River Darter*	2
Channel Catfish	44	Silverband Shiner	2
Striped Bass	43	Sauger	2
Bluegill	41	Yellow Bass	2
Orangespotted Sunfish	39	American Eel*	1
Blue Catfish	34	Dusky Darter	1
River Carpsucker	34	Largemouth Bass	1
Red Shiner	34	Shorthead Redhorse	1
Longear Sunfish	33	Warmouth	1
River Shiner	33	White Crappie	1
Skipjack Herring*	25	Ohio Shrimp	2
Black Buffalo	18		
Green Sunfish	18	Total Fish	4937

Table 1. Number of fish caught by species in the Lower Mississippi River during all sampling periods, 2022-2024.

There was a total of 13 Silver Carp collected, but no Bighead, Grass, or Black Carp. These sampling efforts also led to the encounter of four Missouri Species of Conservation Concern, including Skipjack Herring, River Darter, American Eel, and Ohio Shrimp. Efforts in 2024 had a catch per hour of 452.3, greater than both 2023 (308.0) and 2022 (387.5). Further sampling will continue to add context to these results, better quantifying the potential impacts of invasive carp removal on the Lower Mississippi River.

Mississippi River Unit Staff

Dave Herzog - Mississippi River Unit Supervisor	ext. 4481
Molly Sobotka - LTRM Program Coordinator/Systems Ecologist	ext. 4483
Kathryn Smith - LTRM Water quality component specialist	ext. 4486
Tyler Bening - LTRM component crew leader	
Andrew Glen - LTRM Fisheries component specialist	ext. 4484
Kamryn Wittkop - LTRM component assistant	
Dave Ostendorf - Large River Ecologist	ext. 4482
Matthew Miller - Pallid Sturgeon crew leader	
Josh Abner - Fisheries Scientist	ext. 4485
Ted Goetz - Invasive carp crew leader	
Joe McMullen - Scientist – Big Rivers Specialist	ext. 4215
Brian Welch - Pallid sturgeon assistant	
Doug Lewis - Commercial Fisheries program assistant	



Questions?

