Strategy for eDNA Sampling in the Upper Mississippi River 2020 Report

Geographic Locations: Upper Mississippi River, Pools 8, 13, and 14

Participating Agencies: U.S. Fish and Wildlife Service Midwest Fisheries Center

Statement of Need:

In the surveillance and detection of a species in areas where it is rare, using multiple detection methods provides a balanced and more complete monitoring program. Most efforts to monitor and remove Silver and Bighead Carp from the Upper Mississippi River occur below Lock and Dam 15. Using eDNA upstream of this area as a long-term monitoring tool could provide early evidence to changes in the Asian carp presence in those pools where traditional capture gears are not heavily utilized and inform future redirection of effort. Recommendations from the latest research aimed at refining eDNA use for Bighead and Silver Carp DNA detection are being implemented in the UMR each year and annual eDNA results in the UMR contribute to better understanding and utilization of eDNA technology for this purpose. The eDNA program is intended to be adaptive and to look at trends of positive detections over time. Each year of collection may make these data more meaningful.

Project Objectives:

1) Determine if Asian carp eDNA is present in targeted backwaters in the pools immediately upstream of the Intensive Management Zone

2) Inform managers of potential trends in Asian carp presence and provide data to support the prioritization of new backwaters to target with traditional capture methods

3) Refine detection probability and optimal sampling design of eDNA in the UMR

Project Highlights:

- Due to Covid-19, the 2020 work plan was not completed due to the travel and logistical restrictions put in place by the US Fish and Wildlife Service Region 3 Fisheries Program,
- 264 eDNA samples were collected between Pools 13 and 14 in October 2020,
- 550 samples were collected from targeted backwaters in Pool 8 in November 2020.

Methods:

In 2020, eDNA sampling scheduled in the spring in Pools 13, 14, and 16 was cancelled due to Covid-19. In the fall, however, limited sampling was conducted. Due to travel restictions and the limitations those restrictions imposed on sampling effort, only 1 of the proposed 3 backwaters was sampled in Pool 13 and 2 of the proposed 6 backwaters in Pool 14 were sampled. Backwaters were prioritized to sample those where positive eDNA detections had occurred in past years. The sampling was conducted over a two week time period in October.

Eighty samples and eight blanks (field controls) were collected from each backwater in a uniform grid. All samples were collected and processed according to methods detailed in the Quality Assurance Project Plan (QAPP; USFWS 2019).

In November 2020, an additional eDNA sample collection event took place in Pool 8 of the UMR at the request fo Minnesota Department of Natural Resources (MNDNR). Sampling sites were chosen with input from MNDNR biologists and are a subset of backwater and off-channel habitats in the pool where MNDNR plans to conduct a Modified Unified Method (MUM) event. Sampling occurred over the couse of one week and 100 eDNA water samples and 10 blanks (field controls) were collected in each of the five backwaters. Similar to other collection events, all samples were collected and processed according to methods detailed in the QAPP.

Results and Discussion:

No positive detections of Silver and/or Bighead Carp eDNA occurred during the October sampling of Pools 13 and 14 (Figures 1-2). It is difficult to compare 2020 results in Pool 13 to those of 2019 and 2018 due to the lack of sampling in both 2020 and 2019. Sampling in 2019 was limited due to prolonged flooding. However looking at the one backwater site that was sampled all three years, Crooked Slough, results appear to be similar with zero positive detections in that location in 2018 and one in 2019.

The 2020 results in Pool 14 are also difficult to compare with 2019 and 2018 results due to the limited effort in 2020. However when comparing the three backwaters that were sampled during all three years, 2020 sampling detected no Silver or Bighead Carp DNA whereas detections had occurred in the past in two of the three locations, Clinton Marina and the north pit. The states of Illinois and Iowa were notified of these results following our Communication Protocol after sample processing is complete and then results were posted online (https://www.fws.gov/midwest/fisheries/eDNA.html).

In Pool 8, Silver and Bighead Carp DNA was detected in one of the five backwaters sampled (Figure 3). Sampling to this extent has not been conducted in Pool 8, by the USFWS in the past, so there is not a lot of data for comparison. Telemetry detections of tagged Silver Carp in Pool 8 indicate that there was one tagged fish present at two of the targeted sites at the time of eDNA sample collection. Occupancy depth of that individual and the number of fish to water volume ratio at these sites may have contributed to the lack of detection of Asian carp DNA in those two areas. This reinforces that it is advantageous to use multiple gears in the surveillance and detections of rare species occurrences. MNDNR has requested additional eDNA sampling ahead of the spring MUM event. The 2020 data and data from future sampling efforts can provide evidence of changing Asian carp presence in Pool 8. The states of Minnesota and Wisconsin were notified of these results following our Communication Protocol after sample processing was complete and then results were posted online.

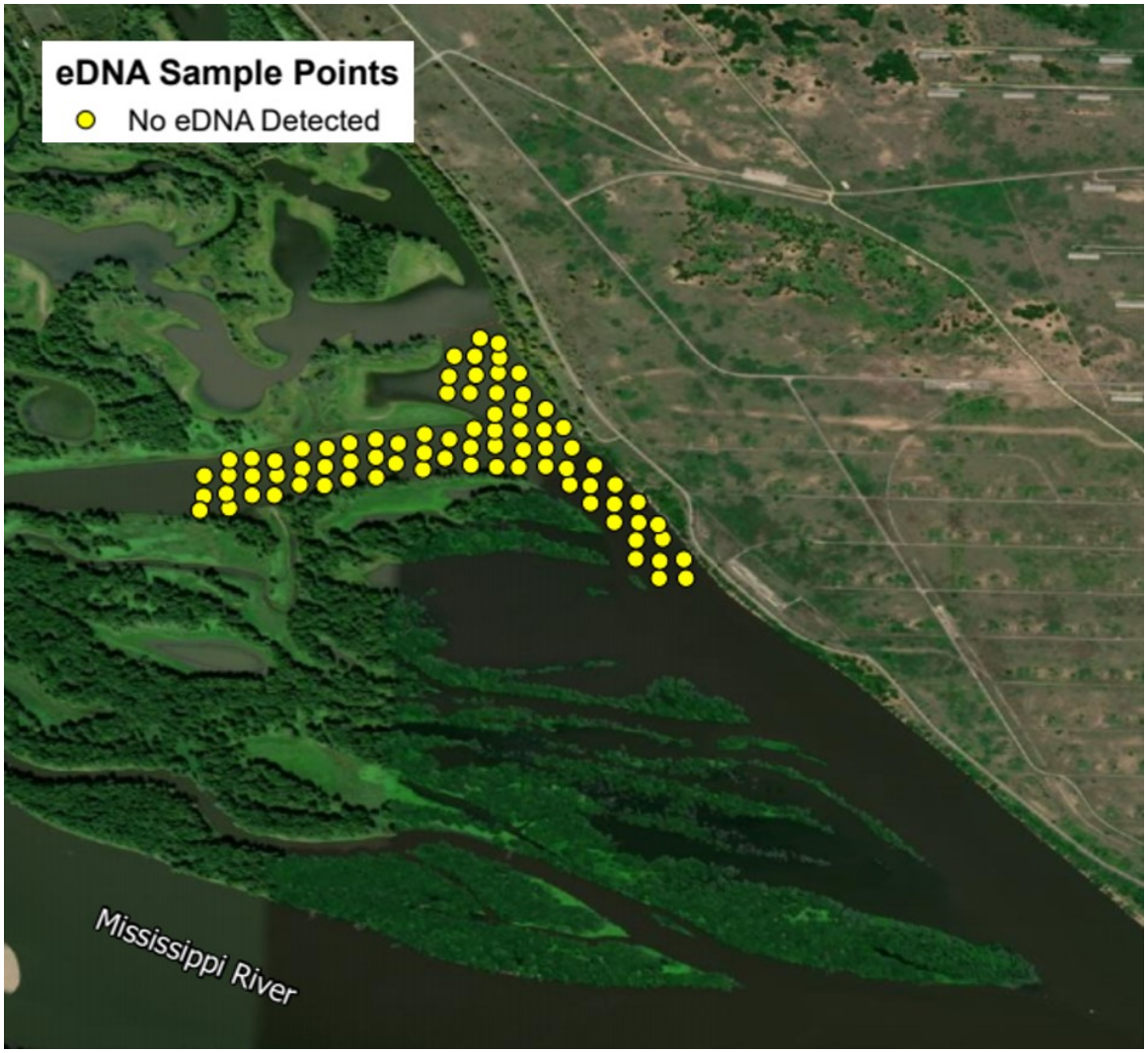

Figure 1. Results of the October 2020 eDNA sampling effort in a backwater habitat in Pool 13 of the Upper Mississippi River.

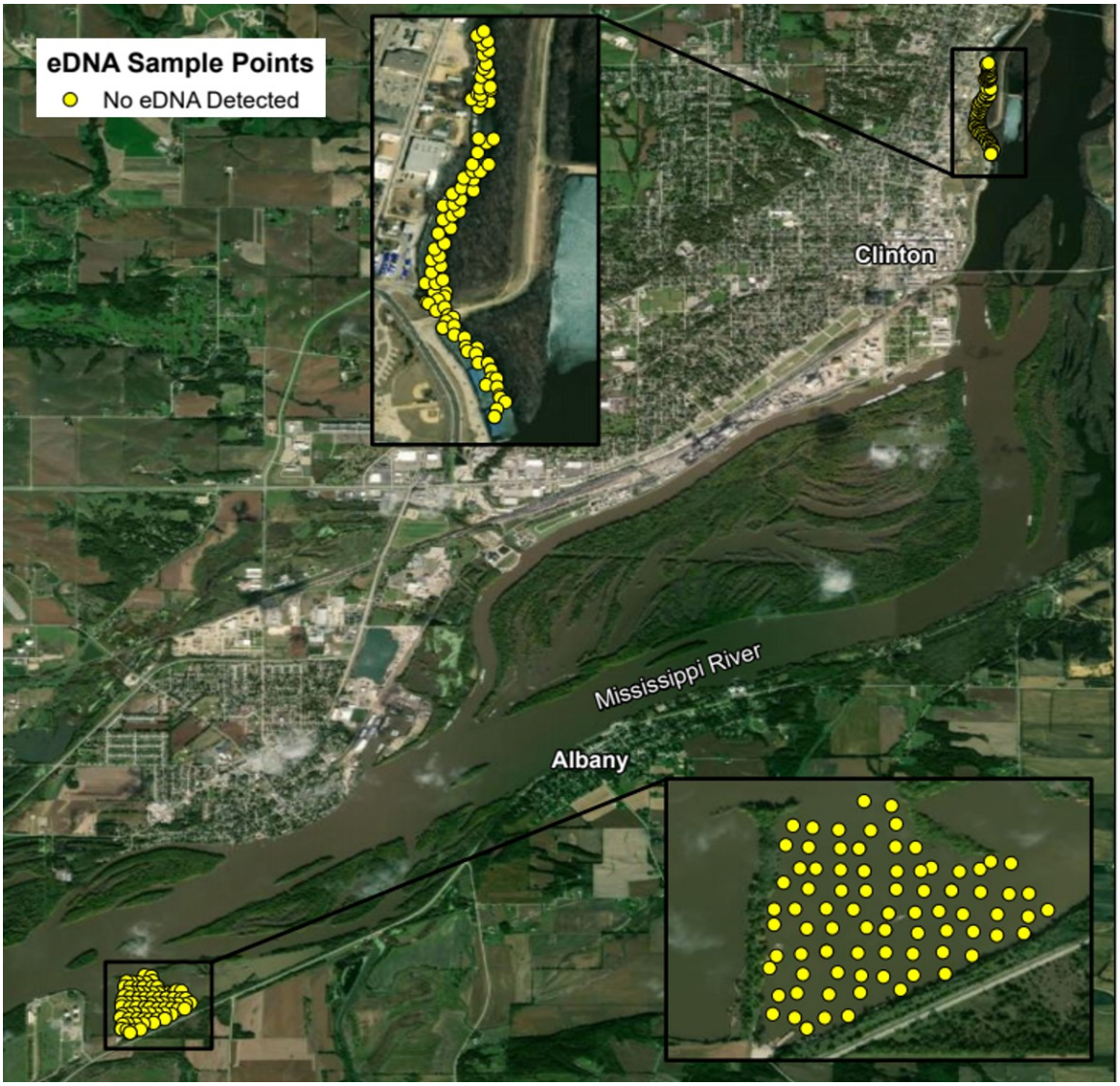

Figure 2. Results of the October 2020 eDNA sampling effort in two backwater habitats in Pool 14 of the Upper Mississippi River.

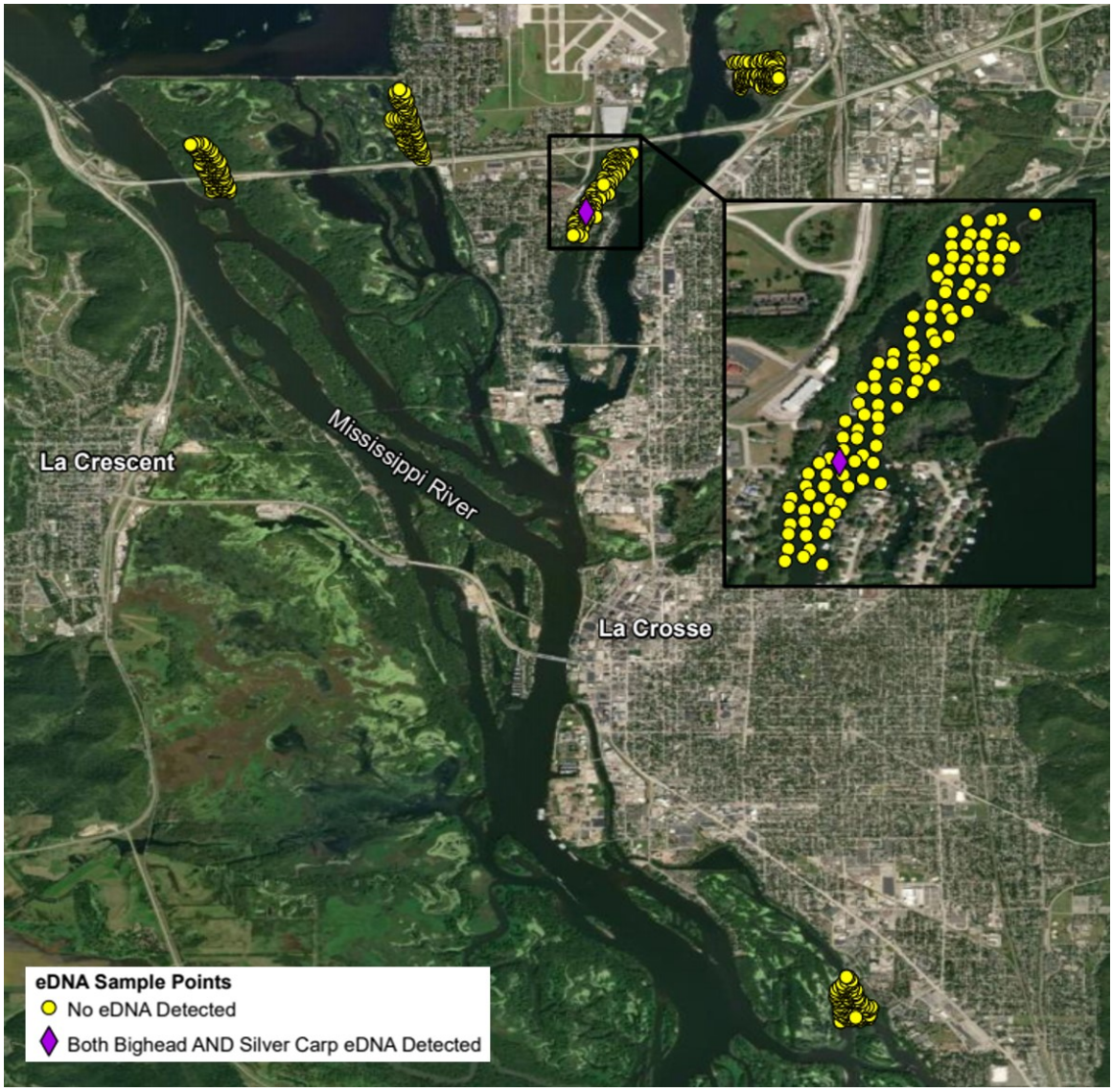

Figure 3. Results of the November 2020 eDNA sampling effort in backwater habitats in Pool 8 of the Upper Mississippi River.

Recommendations:
While adult Asian carp are known to be present in these pools, they may not be at a population density that easily or consistently recruits to physical sampling gears like gill nets and electrofishing. Given the past reoccurring presence of Asian carp DNA in several backwater locations in Pool 13 and 14, those results may indicate areas where carp are resident or congregating at certain times of the year. It may be to the advantage of removal or tagging efforts to prioritize those areas with future efforts when deploying gears in those pools. Additionally this gives evidence to the need for consistent annual sampling and long-term data sets when inferring trends about population presence.

References:

U.S. Fish and Wildlife Service (USFWS). 2019. Quality Assurance Project Plan (QAPP) eDNA monitoring of bighead and silver carps. Midwest Region Bloomington, MN. Available: http://www.fws.gov/midwest/fisheries/eDNA/documents/QAPP.pdf