



# 2023 Annual Report

July 2022 — June 2023

Iowa Cooperative Fish &  
Wildlife Research Unit

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# **Iowa Cooperative Fish & Wildlife Research Unit Annual Report**

**2023**

## **Cooperating Agencies:**

**U.S. Geological Survey  
Iowa Department of Natural Resources  
Iowa State University  
U.S. Fish & Wildlife Service  
Wildlife Management Institute**

## **Photo Acknowledgements:**

Cover: Dr. Gregory W. Courtney, PPEM Iowa State University

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# Personnel and Cooperators

## Unit Coordinating Committee

### **Cyndy Loftin**

Units Supervisor Cooperative Research Units  
U.S. Geological Survey, Ecosystems

### **Stephen Dinsmore**

Department Chair  
Natural Resource Ecology & Management  
Iowa State University

### **Pete Hildreth**

Division Administrator  
Iowa Department of Natural Resources

### **Bill Moritz**

Midwest Representative  
The Wildlife Management Institute

### **Todd Bishop**

Wildlife Bureau Chief  
Iowa Department of Natural Resources

### **Kelley Myers**

Senior Advisor for Landscape Conservation  
U.S. Fish & Wildlife Service

### **Joe Larscheid**

Fisheries Bureau Chief  
Iowa Department of Natural Resources

## Unit Faculty & Staff

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<b>Robert W. Klaver</b>	Unit Leader and Professor of Natural Resource Ecology & Management
<b>Michael Moore</b>	Assistant Unit Leader, Fisheries, Professor of Natural Resource Ecology & Management
<b>Anna Tucker</b>	Assistant Unit Leader, Wildlife, Professor of Natural Resource Ecology & Management
<b>Jennifer McGill</b>	Administrative Specialist, Department of Natural Resource Ecology & Management

## Faculty Collaborators

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Julie Blanchong	NREM	Timothy Stewart	NREM
Miranda Curzon	NREM	Amy Toth	EEOB
Stephen Dinsmore	NREM	Weber, Michael J.	NREM
Adam Janke	NREM	Brian Wilsey	EEOB
Clay Pierce	NREM	Grace Wilkinson	EEOB
Kevin Roe	NREM/EEOB		

## Graduate Students

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Bridget Nixon, PhD	Jo Ford, MS	Katelyn Miller, MS
Anne-Utelie Poicon, PhD	Lindsey Gapinski, MS	Annika Richards, MS
Rachel Siller, PhD	Erik Griffen, MS	Kelsey Shepherd, MS
Nathan Soley, PhD	Sarah Hoepfner, MS	Riggs Wilson, MS
Sidney Brenkus, MS	Erika Ibarra-Garibay, MS	Aaron Yappert, MS
Dalton Clayton, MS	Kaloczi, Juliana, MS	Tayah Lande, Undergraduate
Daniel Deever, MS	Elizabeth Lang, MS	Kristi Brede, Undergraduate
Victoria Fasbender, MS	Simmons Lord, MS	

## **Additional Collaborators**

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### **Iowa DNR**

Kim Bogenschutz  
Vince Evelsizer  
Paul Freese  
Katy Fullin  
Tyler Harms

Ryan Hupfeld  
Orrin Jones  
Dan Kaminski  
Karen E. Kinhead  
Jonathan Meerbeek

Kelly Poole  
George Scholten  
Stephanie Shepherd  
Ben Wallace

### **Iowa State University**

Emma Buckardt  
David Delaney  
Michael French  
Jimena Golcher-Benavides  
Jonathan Harris

### **Memphis University**

Jim Adelman  
Cassandra Nuñez

### **University of Georgia**

Marty Hamel

### **Southern Illinois University**

Gregory Whitlege

### **Illinois Natural History Survey (INHS)**

Jim Lamer  
Zachary Witzel  
Emily Szott

### **Fish & Wildlife Service**

Tamara Smith  
Ryan Drum  
Andrew DiAlessandro

# **New Projects**

## **Habitat Associations and Biotic Interactions of Invasive Rusty Crayfish to Inform Risk Assessment and Management of Shallow Glacial Lakes at the Invasion Front**

**Principal Investigator:** Dr. Michael Weber, Dr. Michael Moore  
**Student Investigator(s):** Dalton Clayton  
**Collaborators:** Kim Bogenschutz (IDNR)  
Ben Wallace (IDNR)  
Jonathan Meerbeek (IDNR)  
Paul Freese (IDNR)  
**Duration:** January 2023-August 2025  
**Funding Source(s):** USGS Water Resources Research Act 104 G AIS Program grants  
**Worktag #:** GR-026843-00001

### **Goals and Objectives:**

Goal: To understand the biotic and abiotic factors influencing invasive and non-invasive crayfish distribution and abundance in agriculturally dominated natural lakes of the Upper Mississippi Basin at multiple spatial scales.

Objective 1: Determine which abiotic variables and biotic interactions including the influence of active habitat management affect the presence/absence of crayfish species at the lake scale (within Storm Lake).

Objective 2: Determine what abiotic variables and potentially biotic interactions influence presence/absence of crayfish species at the landscape scale (among lakes).

### **Progress:**

Dalton Clayton began his graduate program in January 2023. He has developed a draft research proposal. The proposal includes a literature review covering effects and management of invasive crayfish in North America and the role of the degraded prairie pothole ecosystems in Iowa as well as data collection and analysis methods for both objectives. We have identified 25 natural lakes and wetlands in the Upper Mississippi watershed to sample crayfish with a spatially randomized design using minnow traps. Dalton began fieldwork in May 2023.

### **Future Plans:**

Crayfish sampling and habitat assessments will continue in Storm and other natural lakes will continue. Additionally, some reservoirs and stream segments near Storm Lake may be sampled if there is time. These data will be analyzed using generalized linear models to determine habitat effects on crayfish relative abundance across Storm Lake. Single- and multi-species occupancy models will be used to determine the effects of lake characteristics on Rusty Crayfish and other species occupancy and the potential biotic effects of Rusty Crayfish on native crayfish communities. We will use this information to provide recommendations that can guide a variety of management decisions from outreach and education, bait use regulations, habitat management, and early detection monitoring to contain the expansion of invasive Rusty Crayfish in Iowa. Information on all species collected will also inform the update of crayfish distribution and status information in the Iowa State Wildlife Action plan that currently lists most crayfish species as “data deficient” in the state.

## **Estimating Age, Growth, and Mortality in a Tributary-Spawning Population of Shovelnose Sturgeon Using a Long-term Mark-Recapture Dataset**

**Principal Investigator:** Dr. Michael J. Moore  
**Student Investigator(s):** Juliana Kaloczi  
**Collaborators:** George Scholten (IDNR)  
Ryan Hupfeld (IDNR)  
Marty Hamel (University of Georgia)  
**Duration:** June 2023–April 2026  
**Funding Source(s):** Iowa Department of Natural Resources  
**Worktag #:** 026827-00001

### **Goals and Objectives:**

Goal: To utilize a long-term mark-recapture dataset of Shovelnose Sturgeon in the Cedar River to better understand the population dynamics to guide management and conservation of the species.

Objective 1: Develop incremental growth models to estimate age-specific growth rates

Objective 2: Develop mark-recapture models to estimate annual survival rates.

### **Progress:**

The Iowa DNR has assembled a 17-year dataset mark-recapture dataset on Shovelnose Sturgeon during spring spawning aggregations on the Cedar River near Pallasades Kepler State Park, Iowa.

Juliana Kaloczi has been brought on to complete a master's thesis to develop sophisticated mark-recapture models that can help managers better understand the population dynamics of this population of the species that has been designated a species of greatest conservation need in Iowa. She officially started on June 1, 2023 and has begun working with the dataset.

### **Future Plans:**

Juliana will continue working on a detailed thesis proposal that will include a literature review of shovelnose sturgeon ecology, conservation, and management and analytical approaches for mark-recapture datasets. We will then develop analytical approaches to overcome several of the challenges with this dataset including, periodic reproduction, complex movement dynamics, tag loss, etc. We will use these approaches to analyze the data and develop management alternatives for Iowa DNR to consider.



## Historical Assessment of Invasive Carp Reproduction Upstream of Lock and Dam 19 in the UMR

<b>Principal Investigator:</b>	Dr. Michael J. Weber, Dr. Michael J. Moore
<b>Post-Doctoral Investigator(s):</b>	Dr. Jimena Golcher-Benavides
<b>Collaborators:</b>	Kim Bogenschutz (IDNR) Dr. Gregory Whitledge (Southern Illinois University) Dr. Jim Lamer (Illinois Natural History Survey, INHS) Zachary Witzel (INHS) Emily Szott (INHS)
<b>Duration:</b>	October 2022 – October 2023
<b>Funding Source(s):</b>	Iowa Department of Natural Resources, US Fish and Wildlife Service
<b>Worktag #:</b>	GR-026843-00001

### Goals and Objectives:

Goal: Assess the historical occurrence and magnitude of Invasive Carp recruitment upstream of LD 19 in relation to environmental conditions.

Objective 1: To determine age and annual variation in natal origins of Silver Carp using otolith microchemistry and stable isotope techniques.

Objective 2: To assess annual variation in recruitment dynamics of invasive Silver Carp in association with environmental conditions.

### Progress:

We collected otoliths from a total of 505 Silver Carp (664-1088 mm TL), 16 Bighead Carp (925-1300 mm TL), and 5 morphologically distinguishable hybrids between Silver Carp and Bighead Carp (831-1100 mm TL). All otoliths have been sectioned for downstream age determination and microchemistry analyses. We analyzed a published data set in Anderson et al. (2021), to explore results of a preliminary catch-curve analysis for fish caught in 2016 upstream of LD 19 with associated estimates of age and natal origin. Preliminary data indicated that during the years 2010-2012 reproduction resulted in successful recruitment of fish that were born downstream of LD 19 but were caught upstream of LD 19 in 2016. Fish born in 2010 and 2011 upstream of LD 19 also successfully recruited producing strong year-classes (mean June discharge at USGS 05474500 Mississippi River at Keokuk, IA: 2010: 148,000 ft<sup>3</sup>/s; 2011: 171,100 ft<sup>3</sup>/s). Years with the lowest (2012: 90,940 ft<sup>3</sup>/s) or highest (2013: 211,400 ft<sup>3</sup>/s) mean June discharge in this same area of the Upper Mississippi river did not produce strong year-classes upstream of LD 19. However, these data and preliminary analyses are characterized by a very small sample size. Our analyses will overcome this issue by including more individuals (n= 505 Silver Carp individuals) caught upstream of LD 19 with known age and natal origin relative to LD 19. Our results will contribute to the development of a robust stock assessment program by informing fisheries management actions on the complex interaction of harvest efforts and invasive carp movement and reproductive dynamics in the UMR through the estimation of key parameters driving invasive carp population growth. In May, 2023 elemental composition analyses were performed using mass spectrometry at Southern Illinois University- Carbondale and carbonate samples extracted from the otolith core of each fish were sent to the Environmental Isotope Laboratory at University of Arizona for additional oxygen isotope analyses.

### Future Plans:

Next, we will determine natal origin of all fish from microchemical values (elemental ratios and isotopic compositions) and age sectioned otoliths with the assistance of biologists at the Illinois Natural History Survey. Catch curve residual analyses will be used to determine the environmental conditions associated with strong and weak year classes. We will present the results of this research at the 153<sup>rd</sup> American Fisheries Society Annual Meeting in Grand Rapids, Michigan (August 20-24, 2023)?

## **Sustainable Rivers Program: Waterbird and Invertebrate Responses to Reservoir Management in Central Iowa**

**Principal Investigator:** Stephen J. Dinsmore  
**Student Investigator(s):** Victoria Fasbender  
**Collaborators:** U.S. Army Corps of Engineers and Iowa Department of Natural Resources  
**Duration:** 1/1/2023-12/31/2025  
**Funding Source(s):** U.S. Army Corps of Engineers (SRP Program)  
**Worktag #:** GR-027039-00001

### **Goals and Objectives:**

The objectives of this study are to:

1. Sample the invertebrate community (benthos and water column) to determine the diversity and relative abundance of shorebird prey items.
2. Continue existing waterbird surveys during fall migration (mid-July to early September, adding to work done in 2021 and 2022).
3. Continue shorebird stopover ecology work to document residency times and site use in response to pool level and other environmental factors.

### **Progress:**

In January 2023 I hired M.S. student Victoria Fasbender and she completed classes at ISU in spring 2023. She has also begun work on her research proposal and is planning for a 2023 field season beginning in July.

### **Future Plans:**

Plans are to complete the first of two field seasons by early September 2023. During the 2023-2024 academic year Victoria will complete most of her coursework and finish sorting and i.d. of all 2023 invertebrate samples.

## **Blanding's Turtle Response to Habitat and Water Management**

**Principal Investigator:** Stephen J. Dinsmore and Anna M. Tucker  
**Student Investigator(s):** Elizabeth Lang  
**Collaborators:** Iowa Department of Natural Resources and U.S. Fish and Wildlife Service  
**Duration:** 6/30/2022-3/31/2025  
**Funding Source(s):** U.S. Fish and Wildlife Service  
**Worktag #:** GR-026264-00001

### **Goals and Objectives:**

The objectives of this study are to:

1. Determine turtle response to management actions using radio-telemetry and a larger mark-recapture study to attempt to quantify population size at a local scale. This portion of the study may include hatchlings and juveniles if we can find them or head-starting turtles where available.
2. Conduct surveys to update the status of historic Blanding's Turtle element occurrences at locations that have not been surveyed in the last 10 years and assess the viability of the site to maintain the turtle population under current conditions.

### **Progress:**

In summer 2022 we hired M.S. student Elizabeth Lang for this project. Lizzy completed coursework during the 2022-2023 academic year and also completed boat safety and CPR training. She completed her research proposal and began initial fieldwork in spring 2023.

### **Future Plans:**

Plans are to complete the first full field season in summer/fall 2023. This will include trapping adult Blanding's Turtles, fitting them with VHF telemetry tags, tracking their movements, and monitoring females for nesting activity. If possible we will collect eggs from nests for a head-starting program at Blank Park Zoo, which hopefully will allow us to release and track hatchling turtles at a later date.

## Density of White-tailed Deer in Iowa

<b>Principal Investigator:</b>	Stephen J. Dinsmore
<b>Post-Doctoral Investigator(s):</b>	David Delaney
<b>Collaborators:</b>	Tyler Harms, Iowa Department of Natural Resources
<b>Duration:</b>	10/1/2022-6/30/2024
<b>Funding Source(s):</b>	Iowa Department of Natural Resources
<b>Worktag #:</b>	GR-026785-00001

### Goals and Objectives:

The project has three primary goals as follows:

1. Evaluate spotlight survey design considerations for estimating county-specific densities of white-tailed deer.
2. Investigate approaches for integrating multiple available data sets for estimating long-term population trends of white-tailed deer in Iowa.
3. Evaluate the economic and environmental impact of white-tailed deer on various stakeholder interests in Iowa.

### Progress:

A position for a post doc to complete this work was posted on 4 November 2022, closed in December, and a candidate was hired in late December. The post doc is David Delaney and he began work on 27 February 2023. The main progress to date has been exploring Iowa spotlight deer survey data and developing preliminary hierarchical models to estimate county-specific deer densities (objective 1 above).

### Future Plans:

Plans are to continue to refine models of deer density at the county level by including covariates such as viewshed and environmental conditions. We are also exploring the need to collect additional deer survey data in 2024 such as a drone study to assess deer availability during the survey period. The team is also planning to discuss strategies for evaluating the economic and environmental impacts of deer (objective 3) by working with a natural resource economist at Iowa State University.

# **Continuing Projects**

## Monitoring Iowa's Grey Fox Populations

**Principal Investigator:** Robert W. Klaver  
**Collaborators:** Vince Evelsizer, Iowa DNR  
**Duration:** April 2022 – December 2023  
**Funding Source(s):** Iowa DNR

### Goals and Objectives:

Gray fox are a valuable and understudied furbearer in North America. Since the 1980s, several indices strongly suggest a dramatic decline in the gray fox population throughout the Midwest, although, little research has been conducted in the region. The cause of this decline is unknown, but may be linked to habitat loss and fragmentation, changing mesocarnivore (e.g., coyote) community structure, disease, and other factors. It could also be a combination of these factors. We propose to implement a large-scale, comprehensive study at multiple study sites in Iowa, Illinois, and Ohio. This study would be a collaborative effort between the Iowa Department of Natural Resources (Iowa DNR), the Ohio Department of Natural Resources (Ohio DNR), and the Illinois Department of Natural Resources (Illinois DNR). The goals of this project are to determine causes for the regional population decline of gray fox in the Midwest and provide management recommendations that can be applied as part of this multi-state effort to promote gray fox conservation in the region. Specific objectives are as follows:

### Objectives:

1. Determine factors influencing survival and cause-specific mortality of gray fox.
2. Develop landscape-scale spatial habitat models of resource selection for gray fox in 3 Midwest states.
3. Determine the prevalence of various canid diseases using GPS-collared and uncollared foxes.
4. Determine the genetic structure of the gray fox population and identify potential barriers to gene flow in the Midwest

### Progress:

We attempted to capture foxes with cage traps without success then transitioned to foothold traps. No foxes were captured to date.

### Future Plans:

We will continue trapping to deploy the GPS collars.

## **Wetland Reserve Program Properties: Importance for Iowa Breeding Birds in the Prairie Pothole Landform**

**Principal Investigator:** Anna Tucker  
**Student Investigator(s):** Lindsey Gapinski  
**Collaborators:** Iowa DNR  
**Duration:** 8/1/21 – 5/30/24  
**Funding Source(s):** U.S. Fish and Wildlife Service State Wildlife Grant  
**Worktag #:** GR-025148-00001

### **Goals and Objectives:**

The Wetland Reserve Program (WRP) is one of the most significant habitat restoration programs in Iowa and has added more acres of wetland habitat than any other program since 1993. Providing habitat to benefit wildlife, with an emphasis on migratory birds, is the primary objective of the WRP program. Previous work has shown that WRP sites are used by at least 14 Species of Greatest Conservation Need. With this project, we aim to describe the use of WRP sites by SGCN and non-game birds in Iowa and evaluate the site characteristics that are associated with the greatest diversity and abundance of breeding birds. Additionally, we will compare the use of WRP sites by breeding birds in 2022-2023 to use of the same sites in 2007-2009.

### **Progress:**

During spring 2022 we secured site permissions, finalized sampling protocols, and hired technicians. Lindsey Gapinski's M.S. thesis proposal has been reviewed and approved by her committee. During summer 2022, we completed bird point count and vegetation surveys at 52 WRP properties in the Prairie Pothole Region of Iowa. An annual report was provided to the DNR in fall 2022. We have conducted preliminary analyses using data from 2007-2009 and 2022. One field season remains, which will begin in May 2023.

### **Future Plans:**

During summer 2023, we will conduct a second year of avian point counts and vegetation surveys at the same WRP properties surveyed in 2022 and 2007-2009. Final analyses will be conducted in fall 2023. An annual report will be provided to the DNR in fall 2023. Lindsey Gapinski's M.S. thesis and final report will be completed by May 2024.

## Using New Transmitter Technology to Evaluate the Effects of Environmental Change and Disturbance on Shorebird Breeding Phenology, Behavior, and Nest Success

<b>Principal Investigator:</b>	Anna Tucker, Steve Dinsmore
<b>Student Investigator(s):</b>	Aaron Yappert, Sarah Hoepfner
<b>Collaborators:</b>	U.S. Fish and Wildlife Service
<b>Duration:</b>	1/1/22 – 9/30/24
<b>Funding Source(s):</b>	USGS Science Support Partnership
<b>Worktag #:</b>	GR-025675-00001

### Goals and Objectives:

Arctic-breeding shorebirds have experienced large population declines in the past several decades, which have been largely attributed to the effects of climate change in the Arctic. Climate change has led to changes in vegetation structure, the timing of insect prey availability, and the density of nest predators. However, it has also been suggested that increased nest predation observed over the past 20 years could be explained by research methods that involve frequent visits to active nests. Understanding the effect of human disturbance on nest success is critical for interpreting the results of many studies and identifying the key drivers of nest failure and the effects of climate on Arctic-breeding shorebirds. This study will use GPS tags deployed on dunlin (*Calidris alpina*) to understand movements and behaviors of breeding birds and to estimate nest success without human disturbance at the nest. Specifically, our objectives are:

- To obtain the first true estimates of nest survival in a shorebird species;
- To assess how conventional, human intensive monitoring techniques affect nest survival under different environmental conditions;
- To develop a best practice guide for accounting for human disturbance effects on shorebird nest survival; and
- To evaluate how adult behavior prior to and during nesting varies with environmental and ecological conditions.

### Progress:

Aaron Yappert and Sarah Hoepfner had a successful 2022 field season, with GPS transmitters deployed on 28 dunlin. Aaron also deployed GPS collars on 8 Arctic fox for a companion project evaluating movements and behaviors of this dunlin nest predator. Sarah Hoepfner defended her M.S. thesis in April 2023, including estimates of nest survival from GPS data and a comparison of nest survival between human-monitored and remotely-monitored nests. Aaron worked on preliminary data analysis of fox and dunlin location data. The 2023 field season is currently underway, with dunlin trapping beginning in late May 2023.

### Future Plans:

We will continue to capture dunlin in 2023 to attach GPS transmitters and collect more movement data during the pre-breeding, nesting, and fledgling stages. Aaron Yappert's anticipated M.S. defense date is in the Summer/Fall of 2024. We will continue to provide progress reports to the FWS.



## Evaluating the Benefits of Practices Implemented Under the Working Lands for Wildlife Program (WLFW) Targeting Northern Bobwhites

**Principal Investigator:** Anna Tucker, Adam Janke  
**Student Investigator(s):** Jo Ford, Riggs Wilson  
**Collaborators:** USDA NRCS, Iowa DNR  
**Duration:** 9/25/21 – 9/29/24  
**Funding Source(s):** USDA NRCS  
**Worktag #:** GR-024790-00001

### Goals and Objectives:

The purpose of this agreement is to enable NRCS and Iowa State University to work cooperatively to evaluate the benefits of the practices implemented under the Working Lands for Wildlife Program (WLFW) targeting northern bobwhite (*Colinus virginianus*) and avian biodiversity in midwestern working landscapes. WLFW in Iowa seeks to target Environmental Quality Incentives Program (EQIP) practices to improve habitat on working farms and ranches for northern bobwhites and a range of other wildlife species that benefit from comparable early successional ecosystems. The objectives of this project are to:

1. Describe bobwhite occurrence on sites employing EQIP or comparable CRP practices implemented under the WLFW program.
2. Evaluate the local- and landscape-scale mediating factors that influence the effects of WLFW practices on bobwhite occurrence, and
3. Assess co-occurrence of nongame SGCN bird species with bobwhite to test the umbrella species hypothesis.

### Progress:

In spring 2022, we hired graduate students and technicians, finalized sampling protocols, and selected sites for sampling. During summer 2022, we conducted bird point count and vegetation surveys at 34 public land sites. 17 sites we focused on edge feathering practice and 17 sites we focused on native grass seeding practice. During fall 2022, we deployed 81 autonomous recording units and conducted roadside vegetation surveys across southern Iowa to measure northern bobwhite occupancy across their range. Preliminary analyses are underway and we are working with NRCS to secure site access permissions for the second field season conducting bird point count surveys.

### Future Plans:

During summer 2023, we will conduct point counts and vegetation surveys on properties using select habitat management practices in 8 counties in south-central Iowa on a mix of public and private land. These surveys will be used to assess the effect of different management practices on occupancy of bobwhite and other avian SGCN. Analyses are ongoing to process ARU recordings and inform future surveys for fall occupancy surveys. We will repeat fall sampling efforts again in Fall 2023 and plan to complete 2 MS student theses by Summer 2024.

## Evaluating Rusty Patched Bumble Bee Conservation Efforts to Inform Site-Specific Management Actions

<b>Principal Investigators:</b>	Amy Toth (EEOB), Anna Tucker (USGS Iowa Cooperative Fish and Wildlife Research Unit)
<b>Student Investigator(s):</b>	Erika Ibarra-Garibay (EEOB), Kelsey Shepherd (NREM)
<b>Collaborators:</b>	Tamara Smith, Ryan Drum, and Andrew DiAlessandro (FWS)
<b>Duration:</b>	May 1, 2022 – December 30, 2024
<b>Funding Source(s):</b>	US Fish and Wildlife Service
<b>Worktag #:</b>	GR-025759-00001

### Goals and Objectives:

The rusty patched bumble bee (*Bombus affinis*) is a federally Endangered species that was once widespread across the eastern U.S. and Upper Midwest. While *B. affinis* is the only species in this region currently protected under the ESA, many other bumble bee species have been documented to be in decline as well, including the American bumble bee, *Bombus pensylvanicus*. Creation, restoration and maintenance of habitat in the Midwestern region, therefore, may be crucial for threatened species' recovery, and will also support priorities for conservation of pollinators more broadly. This project will use structured surveys of sites throughout Iowa to estimate the effect of local and landscape characteristics on occupancy of *B. affinis* and *B. pensylvanicus*, as well as intensive surveys of occupied sites to measure metrics related to individual bee health. The proposed project will also contribute samples to several ongoing efforts to monitor *B. affinis* population genetic structure and threats to resilience (e.g., pesticides, pathogens). This work will inform habitat management strategies for the Partners for Fish and Wildlife Program as well as targets for *B. affinis* recovery planning.

- Using the established USFWS protocol, survey sites and measure bumble bee occupancy and density at multiple locations in Iowa, with particular focus on *B. affinis* and *B. pensylvanicus*
- Non-destructively collect and release individuals, assess individual condition (health metrics) and take a minimally invasive tissue samples for DNA analysis of population genetic structure
- Evaluate the effect of local and landscape habitat factors on variables related to individual and population health, e.g. health indicators, density, and genetic diversity within Iowa

### Progress:

Our team performed two 30-minute rapid surveys and habitat assessments for *B. affinis* and *B. pensylvanicus* at each of the 43 sites across central and Northeast Iowa throughout June-August. Rapid surveys were completed using a double-observer method, where observers searched a 100m radius for 30 minutes independently. If *B. affinis* or *B. pensylvanicus* were detected, the site was revisited for an intensive survey, in which the area was searched for 2.5 person-hours, all bumble bees are recorded, and morphometric measurements were taken of target species individuals. At each survey a habitat assessment was also completed.

Sites were selected from a list of Iowa DNR properties and Partners for Fish and Wildlife properties via stratified random sampling, with strata defined as the majority land cover within a 1.6km buffer (agriculture, forest, shrub/grassland, or developed). We initially began with 50 sites and visited each during our first round of rapid surveys, but dropped 7 sites for varying reasons, such as lack of suitable foraging habitat and inaccessibility.

We used GPS units (Garmin eTrex 22x) to record the location of each site and measured various site-level habitat variables, including the percent of the site in natural/seminatural habitat, percent vegetation cover consisting of flowers, number of flowering species, presence of preferred forage species, and presence of suitable nesting habitat. We also recorded abiotic variables such as temperature, cloud cover, wind speed, and humidity.

*B. pensylvanicus* was detected at 16 sites (37%), with abundances ranging from 1-19 individuals per site. *B. affinis* was detected at 4 sites (9%), with abundances ranging from 1-10 individuals per site. A formal analysis on habitat and landscape features has not yet been conducted, thus, we cannot make any firm conclusions about the types of sites that are

occupied by *B. affinis* or *B. pensylvanicus*. However, we can note that all the sites in which we detected *B. affinis* had proximity to river valleys, suggesting that riparian areas may be important habitat for these bees in Iowa.

We have done some preliminary modeling (with results from the first year of our project) to assess occupancy of *B. pensylvanicus* based on some of the site variables measured in 2022. Preliminary results suggest higher occupancy at sites with higher percent of vegetation that contains forbs, and higher cover of natura/semi-natural habitat. We also analyzed size and wing wear/symmetry for both bee species; preliminary analyses suggest higher levels of wing asymmetry in *B. pensylvanicus* compared to more common species. Another year of data from *B. affinis* (planned in 2023) will be necessary to perform statistically meaningful comparisons for this rare species. Finally, we have been in contact with collaborators at USGS and USFWS, and offered to share pollen and tarsal samples from the rare bees we collected in 2022.

#### **Future Plans:**

Our team will be conducting our second year of sampling in Summer 2023, and have generated a list of sites, we plan to use a combination of new (n=25) and old (i.e., sampled in 2022, n=25) sites. We have lined up and are now hiring technicians for the summer and ordering field supplies. We also plan to conduct rapid and habitat surveys at least 3 times throughout the 2023 field season and adjust the duration of our field season to give us the best chance of *B. affinis* and *B. pensylvanicus* detection (June/July-September/October). Both years of data will help to provide robust statistical analysis and will allow us to make stronger conclusions about habitat types and preferences of *B. affinis* and *B. pensylvanicus*.

#### **Conclusions and Recommendations:**

Project is not yet complete.

## Acoustic Monitoring of Iowa Bats

<b>Principal Investigator:</b>	Julie Blanchong
<b>Student Investigator(s):</b>	Tayah Lande, Kristi Brede
<b>Collaborators:</b>	Kelly Poole, Stephanie Shepherd, Michael French
<b>Duration:</b>	Continuing, contracts below end 12-31-2023
<b>Funding Source(s):</b>	Iowa DNR (USFWS flow through)
<b>Worktag #:</b>	# GR-025454-00001, GR-027038-0001

### Goals and Objectives:

1. Develop new drive transect and stationary survey sites in accordance with the North American Bat Monitoring Program (NABAT) design framework.
2. Conduct acoustic surveys for bats in Iowa to document bat activity, abundance, and distribution.

### Progress:

White-Nose Syndrome (WNS), a devastating disease associated with the mortality of millions of bats, was first documented in New York during the winter of 2005-2006, and is now confirmed in Iowa. The loss of large numbers of bats due to WNS is expected to have enormous economic impacts to agriculture. Knowledge of the abundance and distribution of bat species in Iowa is critically needed to understand the potential ramifications of WNS to Iowa. To gather data on bat abundance and distribution in Iowa, acoustic monitoring has been conducted for several summers along transects in eastern, central, northwest, and southern Iowa.

As in previous summers, the Iowa Department of Natural Resources (IDNR) will recruit volunteers to conduct the acoustic surveys. We will train volunteers to collect bat acoustic data. Relying on well-trained local volunteers to conduct drive transects and survey stationary sites is efficient and cost effective. It also increases public engagement with the project and public awareness of bats and the threat of WNS. In July, citizen scientists will collect bat echolocation calls on >25 drive transects and at >20 stationary survey sites on public and private land in central, eastern, southern, and northwest Iowa. We will process bat echolocation calls using automated bat call identification software and analyze the data for spatial and temporal trends in bat activity across Iowa.

### Future Plans:

We will upload bat echolocation calls and associated species identification data to the North American Bat Monitoring Program (NABAT) database, provide a final report of findings to the Iowa DNR, and prepare summary reports to all volunteers and landowner participants.

## Ecology of Canada Geese in Urban Areas of Iowa

**Principal Investigator:** Robert W. Klaver  
**Collaborators:** Orrin Jones, Iowa DNR  
**Duration:** June 2018 – December 2023  
**Funding Source(s):** PR funds through Iowa DNR  
**Worktag #:**

### Goals and Objectives:

- Evaluate the movement of Canada geese captured in urban areas. Compare movements of the urban geese to the movements of geese captured in rural locations where the goose hunting season is closed.
- Determine the susceptibility of Canada geese captured in urban areas to hunting during the Special September Canada Goose season and the conventional Canada goose hunting season.
- Estimate annual harvest and survival rates for Canada geese captured in urban areas.
- Evaluate a three age-class model to estimate harvest and survival rates of Canada geese in Iowa.
- Where possible incorporate both live recaptures and dead recoveries to improve statistical precision and accuracy to band recovery models.

### Progress:

We continued to monitor the surviving geese. We placed five transmitters on geese in Des Moines and two near Spirit Lake, Iowa.

### Future Plans:

We plan on deploying the remaining three transmitters this summer at Rice Lake. We will continue monitoring movements of the geese with transmitters.

## Developing Capture Techniques and Monitoring the Movement of Sandhill Cranes Breeding in Iowa

**Principal Investigator:** Robert W. Klaver  
**Student Investigator(s):**  
**Collaborators:** Orrin Jones  
**Duration:** July 2019 – December 2023  
**Funding Source(s):** PR funds through Iowa DNR  
**Worktag #:**

### Goals and Objectives:

Sandhill cranes (*Antigone canadensis*) are recolonizing Iowa; however, their population affinity is uncertain. Sandhill cranes are assumed to be affiliated with the Eastern Population, which are primarily found in the Great Lakes states of eastern Minnesota, Wisconsin and Michigan. However, recent research in Minnesota discovered that cranes on the western periphery of the EP might overlap with mid-continent population sandhill cranes (MCP) thereby calling into question the affiliation of Iowa's cranes. It is increasingly important to improve our understanding of Iowa's breeding cranes. The most direct way to do so is through a field research project. However, cranes are a novel species in the modern-day Iowa landscape and there is very little previous work to rely upon. This is a pilot project to assess the feasibility of capturing sandhill cranes in Iowa.

### Objectives:

1. Assess the feasibility of capturing breeding sandhill cranes in Iowa.
2. Monitor the habitat use and migration of captured cranes via GPS transmitters.

### Progress:

The original 3 adults and 1 colt all completed migration and returned to Iowa. Ten colts were captured in 2022, six of which survived to migrate and return to Iowa. These six colts are making extensive movements throughout Iowa and Minnesota.

### Future Plans:

We purchased 20 additional GPS/GSM transmitters and plan on capturing and attaching them on colts during the summer of 2023.

## Cause-Specific Mortality Factors Affecting Eastern Wild Turkey in Iowa

**Principal Investigator:** Robert W. Klaver  
**Student Investigator(s):**  
**Collaborators:** Dan Kaminski, Iowa DNR  
**Duration:** March 2020 – December 2023  
**Funding Source(s):** U.S. Geological Survey and Iowa DNR  
**Worktag #:**

### Goals and Objectives:

Spring wild turkey harvest in Iowa peaked in 2004 and declined in subsequent years. Poult-to-hen ratios declined in Iowa since the late 1980s and the recent 5-year average equaled 2.0 poults/hen, suggesting population decline. We will determine mortality factors affecting wild turkey fecundity by tracking adult females and poults marked with telemetry devices from nest initiation until fall. The primary goal for this study is to determine cause-specific mortality factors (e.g., predation, disease, etc.) affecting poult survival after 4 weeks of age. Because past studies focused on determining mortality factors for poults prior to 4 weeks of age, there is a gap in our understanding of wild turkey life history between 4 weeks of age and recruitment into the population. This study will provide information important for understanding apparent changes in wild turkey fecundity and populations declines in Iowa and the Midwest.

### Progress:

Iowa DNR staff captured and placed transmitters on 93 turkeys in 2023 in four Wildlife Management Areas (Odessa, Maquoketa, Rathbun, and Sugema) in southeast Iowa.

### Future Plans:

The birds will be monitored for reproduction, movements, survival and habitat use. The status of the offspring will be monitored throughout the summer.

## **Effects of Experimental Reservoir Releases on Downstream Riverine Aquatic Biota Sustainable Rivers Program: Downstream Ecological Responses to Experimental Flow Releases from Red Rock Dam**

**Principal Investigators:** Michael J. Weber, Kevin Roe  
**Student Investigator:** Erik Griffen and Annika Richards  
**Collaborators:** Iowa DNR, US Army Corps of Engineers  
**Duration:** April 2021 - December 2023  
**Funding Source(s):** US Army Corps of Engineers

### **Goals and Objectives:**

Assess fish reproduction and mussel communities in the Des Moines River in relation to experimental flows from Red Rock Dam.

### **Progress to date:**

Many riverine systems in North America have been altered by human actions in the last 200 years. The creation of barriers such as dams have disrupted fish migration, natural flow regimes, and physical characteristics of the rivers to the detriment of downstream fish communities. Recently, reservoir have begun implementing spring experimental releases to mimic historical flow conditions for the benefit of downstream organisms. Our objectives were to assess fish reproduction and mussel communities in the Des Moines River. An experimental flows from Red Rock Dam was conducted in mid-May 2021 and 2022 where the Iowa River served as a reference site and did not have experimental releases. Zooplankton and ichthyoplankton sampling occurred from April through June on both rivers. Otoliths were extracted from larval fish to calculate hatch dates in relation to experimental flows. Catostomidae, Percidae, Clupeidae, Moronidae, and Sciaenidae densities were generally highest during and right after the experimental flow releases. We also collected *Lampsilis cardium* from the Des Moines River upstream (n=105) and downstream (n=108) of Red Rock Dam during 2022. We thin-sectioned shells and estimated ages to assess historical variation in recruitment over time. Moving forward, recruitment and age-class structure above and below Red Rock Dam will be analyzed along with historical flow data from monitoring stations on the Des Moines River to assess any differences between free-flowing and impounded reaches and the effects of flow volume and timing on recruitment. The results provide valuable information for reservoir water control efforts and benefits to downstream fish communities.

### **Future work**

We have completed two years of fish reproduction field work and are currently completing analyses and manuscript writing. We have conduct one full year of sampling for freshwater mussel abundance, diversity, recruitment, growth, and survival in summer 2022 and are currently sampling additional sites in 2023.



## Iowa's Multiple Species Inventory and Monitoring (MSIM) Program

<b>Principal Investigator:</b>	Stephen J. Dinsmore, Karen E. Kinkead
<b>Student Investigator(s):</b>	~25 seasonal field technicians
<b>Collaborators:</b>	U.S. Fish and Wildlife Service and Iowa Department of Natural Resources
<b>Duration:</b>	1 January 2023-31 December 2024
<b>Funding Source(s):</b>	U.S. Fish and Wildlife Service and Iowa State University
<b>Worktag #:</b>	GR-026926-00001

### Goals and Objectives:

Project goals include the following:

- Conduct MSIM surveys for birds, mammals, amphibians, reptiles, fish, mussels, butterflies, odonates, and crayfish on 50 Wildlife Management Areas annually during 2015-2018.
- Conduct MSIM surveys on 10-20 additional properties in 2016, 2017, and 2018.
- Enter collected data into the MSIM on-line database, submit county occurrence records to the appropriate Iowa WAP taxonomic subcommittee, provide additionally requested information to the IWAP subcommittees as requested, and change database records as advised.
- Analyze data using (but not limited to): Proportion of area occupied and species density (where applicable) using habitat variables from the field and/or GIS where applicable.

### Progress:

In 2022 the MSIM program employed 5 field crews of 4-5 technicians each (31 technicians in total) stationed in Boone, Chariton, Ruthven, Tripoli, and Iowa City. Fieldwork for this project began with training in late March and ended on 14 October 2022. The field season began with a virtual training session in late March 2022 to prepare field technicians for the field season and familiarize them with the MSIM protocols; additional trainings occurred regularly through May 2022 as we slowly added crew members. We completed surveys implementing MSIM protocols at 72 study sites across Iowa. This total includes the traditionally surveyed "permanent" MSIM sites, additional public lands sites, and private lands sites in an effort to expand MSIM data coverage beyond only public lands sites. All species observed during surveys were recorded with special focus given the Species of Greatest Conservation Need (SGCN). All collected data were entered into the MSIM online database.

This effort includes >1800 wildlife surveys conducted on these study sites and approximately 125 survey-related tasks such as site setup and teardown. A summary of species seen by taxa includes 37 mammals (7 SGCN), 200 birds (62 SGCN), 40 herpetofauna (26 SGCN), 76 odonates (9 SGCN), 69 lepidoptera (13 SGCN), 86 fish (22 SGCN), and 8 crayfish (5 SGCN). We encountered many noteworthy sightings in several taxonomic groups as is usual for this program.

### Future Plans:

Plans are to complete another field season in 2023 and work on additional publications on bats and other taxa with a recently hired post doc.

## **Integrated Population Model for the Mountain Plover in Montana**

**Principal Investigator:** Stephen J. Dinsmore  
**Student Investigator(s):** Rachel Siller  
**Collaborators:** U.S. Fish and Wildlife Service  
**Duration:** 1 Feb 2021-31 Jan 2025  
**Funding Source(s):** U.S. Fish and Wildlife Service and Iowa State University  
**Worktag #:** GR-023898-00001

### **Goals and Objectives:**

The proposed landscape-scale collaborative research project will provide the first assessment of annual cycle movements and population limiting factors of the Mountain Plover, a species that according to the Breeding Bird Survey appears is experiencing significant long-term declines. The results of this project will provide land management agencies critical information about where the species population may be limited and identify important areas for conservation throughout the annual cycle. The information will allow conservation planners and land managers to develop effective conservation strategies for the species. Without this information, we'll continue to lack critical information to most effectively conserve and manage priority landscapes, and ultimately slow or reverse the declines of the Mountain Plover and the larger suite of focal grassland birds.

### **Progress:**

The second field season was in summer 2022. The weather in 2022 followed the pattern of 2021 with unusually hot and dry conditions prevailing; the temperature was consistently  $>37^{\circ}\text{C}$  throughout July. During that effort we placed GPS tags on 13 adult plovers and received movement data from 11 of those individuals. We also monitored 22 plover nests, of which 7 were successful. On campus we continued to collate data to be used in an integrated population model.

### **Future Plans:**

Plans are to wrap up fieldwork in the summers of 2023. After that the graduate student will be working on data analyses, completing her preliminary exams, and presenting initial study results at one national professional meeting.

## Evaluation of Forest and Wildlife Responses to Aerial Applications of Glyphosate

<b>Principal Investigator:</b>	Miranda Curzon
<b>Student Investigator(s):</b>	Katrina Fernald, Anne-Utelie Poicon
<b>Collaborators:</b>	Tyler Harms (IDNR)
<b>Duration:</b>	November, 2018- September, 2023
<b>Funding Source(s):</b>	U.S. Fish and Wildlife Service's Wildlife Restoration Program, Iowa DNR Fish and Wildlife Trust Fund
<b>Worktag #:</b>	GR-019981-00001 DD07617

### Goals and Objectives:

Objective 1. Quantify forest vegetation response to fall aerial glyphosate application and invasive honeysuckle removal. This will include an assessment of impacts to understory herbaceous plants, shrub species, tree seedlings and saplings, and mature overstory trees.

Objective 2. Evaluate the impact of spray timing on the effectiveness of aerial glyphosate treatment of invasive honeysuckle.

### Progress:

We established permanent plots and completed pre-treatment vegetation sampling at all three sites (Red Rock, Rathbun, and Mount Ayr WMAs) during summer 2019. This included sampling herbaceous and woody vegetation in all strata. Additionally, the forest breeding bird community was sampled with bird counts. We also installed deer exclosures to enable assessment of the potential interactive effects of honeysuckle and deer browse on tree regeneration. Weather conditions prevented spray treatments from being applied in November, 2019. So, in 2020 we sampled vegetation and the forest bird community in additional areas that had been treated in 2014 and 2015 identified within each WMA to allow a more timely comparison of treated and untreated areas. Aerial treatment of all three sites went as planned in November, 2020.

Vegetation for the first post-treatment growing season was completed June-August, 2021. Katie Fernald defended her MS thesis reporting how aerial treatment influenced forest vegetation, the forest bird community, and individual forest birds. Anne-Ult elie Poincon, PhD graduate student recruited to complete this stage of the project, started her program in January, 2022.

A second post-treatment season of vegetation sampling focused on the shrub and seedling layer was completed June-August, 2022. Post-treatment sampling of overstory trees and tree regeneration was conducted May-June 2023.

### Future Plans:

Analysis of the vegetation data collected in 2022 and 2023 and associated writing will conclude the work funded under this grant and be completed by September 2023. Other funds, including a USDA Forest Service Forest Health Protection Grant will allow a continuation of the project and leverage the investment made by the Iowa DNR and the USFWS Wildlife Restoration Program.

# **Completed Projects**

## Behavioral and Physiological Responses to Anthropogenic Disturbance in Bighorn Sheep

**Principal Investigator:** Robert W, Klaver  
**Student Investigator(s):** Sidney Brenkus  
**Collaborators:** Cassandra Nuñez, James Adelman  
**Duration:** August 2018 – December 2023  
**Funding Source(s):** Bureau of Land Management and University of Memphis  
**Worktag #:**

### Goals and Objectives:

This project covers two studies. Benjamin Johnson conducted a survey of how visitors to Glacier National Park, Montana perceived their interactions with wildlife and how they saw their presence affected resident species. In the second phase of this project we are developing a respiratory disease monitoring program for bighorn sheep by comparing the behavior of bighorn sheep in the Park compared to populations outside of the Park with recent exposure to disease.

Glacier National Park provides refuge to iconic North American species, including bighorn sheep (*Ovis canadensis*), whose range covers diverse Department of Interior lands. Across this range, bighorns face the ongoing threat of a polymicrobial infection, Bighorn Sheep Respiratory Disease, which can reduce juvenile survival for many years, decimate populations, and lead to local extinctions. Although Glacier's bighorns are thought to be free of the disease, a corridor of contiguous wilderness connects Glacier to populations that have tested positive for the most critical pathogen associated with this disease, *Mycoplasma ovipneumoniae*. As such, efficient biosurveillance programs are essential to anticipating and mitigating the effects of Bighorn Sheep Respiratory Disease outbreaks in Glacier National Park.

However, molecular screening for Bighorn Sheep Respiratory Disease is financially and logistically challenging, requiring physical capture and multiple lab assays. Such costs preclude large-scale, continuous biosurveillance, potentially missing detections and hindering risk assessment. We will address this issue by developing an animal behavior-based, citizen-driven biosurveillance program for Bighorn Sheep Respiratory Disease in Glacier National Park. We are cooperating with Glacier National Park, U.S. Forest Service, and Montana Fish, Wildlife, and Parks staff on this project. We will provide the NPS with a tool to detect Bighorn Sheep Respiratory Disease and thus determine when mitigation strategies are necessary.

### Progress:

Sidney Brenkus completed fieldwork October 2022 and defended her thesis May 2023

### Conclusions and Recommendations:

These data showed that the Little Belts lambs spent more time inactive than did Sun River lambs in 2021, but not 2022. Further, the Little Belts lambs spent proportionally less time playing than did Sun River lambs in 2022, the year in which sufficient data were collected to assess this behavior. In both years, clinical signs (coughing, panting, lip-licking) were more prevalent among animals in the Little Belts herd.

Biologists and volunteers demonstrated similar ability to detect lamb inactivity, while other behaviors (feeding, walking, standing) and clinical signs (coughing, and lip-licking) were more variable. There were no strong effects of volunteer demographics on the accuracy of data collection.

## Evaluating Restored Mussel Population Genetics and Survivorship

<b>Principal Investigator:</b>	Kevin J. Roe
<b>Student Investigator(s):</b>	Katie Miller
<b>Collaborators:</b>	MN DNR
<b>Duration:</b>	Summer 2018 – Summer 2022
<b>Funding Source(s):</b>	SWG-C
<b>Worktag #:</b>	GR-019532-00001

### Goals and Objectives:

1. Monitor released mussels to establish survival percentages at 3 release sites in Iowa.
  - a. We expect to be able to document annual growth for any individuals captured in more than one year of follow-up monitoring.
  - b. Analyze genetic diversity of source population for at least one target species

### Progress:

Graduate Student Katie Miller has successfully completed the study and defended her thesis.

In Summary: Three gravid female Threeridge mussels (*Amblema plicata*) were collected from a population in the Upper Cedar River Watershed and used to propagate a population of juveniles. Genetic samples were taken from a) the source population, b) the juvenile mussels directly after transformation from glochidia (larvae), and c) the juveniles after a year of growth in the hatchery. Samples were genotyped at 10 microsatellite loci. All three sample sets were significantly differentiated, indicating released juveniles were not representative of the source population. Multiple paternity was detected, with the three different maternal broods of 56, 19, and 14 juveniles being fertilized by 33, 15, and 10 sires, respectively, increasing genetic variability in the cohort. After a year in the hatchery, extensive mortality was found to have reduced genetic variability, with 94% of the surviving juveniles having been produced from only one dam. In this experiment, three dams and the contribution of alleles from upstream males initially produced a juvenile population that were as diverse as the source population, but not genetically representative of the source population. Non-random mortality in the hatchery resulted in a biased population of juveniles that were not representative of the source population.

Juveniles were placed in rivers in mussel silos (enclosures) at four different sites. Juvenile growth was measured biweekly along with physical environmental conditions, water chemistry, and measures of organic matter availability over two open-water seasons. Juvenile growth was found to be strongly positively influenced by daily minimum water temperature and turbidity, which was the most explanatory food-indicating variable in this experiment. Chlorophyll *a* and total nitrogen were found to have the strongest negative impacts on growth. Phytoplankton blooms likely inhibited growth, but further research is needed to study the mechanisms of phytoplankton blooms and nitrogen exhibited on mussel growth. Juvenile mussels were tagged with uniquely numbered shellfish tags and passive integrated transponders, released into substrate in one site on the Cedar River in Iowa, and their growth and survival will continue to be monitored.

### Future Plans:

The project is completed. However, if conditions allow a search for released juveniles will be conducted at the release site on the Cedar River.

### Conclusions and Recommendations:

Analysis revealed that the genetics of the source population and the released juveniles were significantly different, indicating that the juveniles were not representative of the source population.

A high degree of multiple paternity was observed in each brood, which greatly increased the genetic variability of each brood.

Parentage analysis of the Juv-1Y sample set showed that after the first year in the hatchery during which over 50% of juveniles died, the remaining juveniles were mainly from one brood. Dam D191 contributed to 94% of the Juv-1Y sample set (N=48 juveniles), while dam D231 contributed 4% and dam D185 contributed 2%. This finding of nonrandom mortality was unexpected and implies that the juveniles produced by some dams were less fit overall or less suited to the hatchery setting specifically.

Recommend greater efforts made at improving juvenile survival in the hatchery and producing juvenile cohorts that minimize bias in terms of maternal representation.

The most explanatory model for Threeridge juvenile growth included daily minimum water temperature, turbidity, chlorophyll a, and total nitrogen. Although differences in growth were observed between sites, there was no statistical support for keeping site as a fixed effect, so it was dropped from the model. Temperature and turbidity had positive effects on growth, while chlorophyll a and total nitrogen had negative effects on growth. The variable survival rates between the sites, (45% in Cedar River sites and 5% in the tributary sites), illustrates the importance of suitable site selection to a reintroduction effort.

## Evaluating Floral and Faunal Response to Incorporation of Early Season Forbs into Prairie Restorations

<b>Principal Investigator:</b>	Brian Wilsey
<b>Student Investigator(s):</b>	Daniel Deever, Nathan Soley, Simone Lord
<b>Collaborators:</b>	Katy Fullin (Iowa DNR)
<b>Duration:</b>	1/2019 – 12/2021 (no-cost extension to 5/30/2022)
<b>Funding Source(s):</b>	USGS, CS Wildlife Grant
<b>Worktag #:</b>	GR-020317-00001

### Goals and Objectives:

Remnant tallgrass prairies include many early and late-flowering forb species that are often missing in restoration mixes, and adding them to new plantings may extend the flowering phenology in a way that will benefit pollinators. We completed a forb addition experiment at three sites in NW Iowa and S. Minnesota to test the following hypotheses: 1) recruitment limitation is stronger than seed limitation in early and late-flowering forbs, 2) early-flowering forbs show stronger differences in recruitment limitation than late-flowering forbs, 3) mowing increases recruitment of early and late-flowering forbs, 4) plant and pollinator diversity increases with early and late flowering forb additions. A randomized split-plot design was used with a mowing treatment (mowed during the first two growing seasons vs. not mowed) applied to main plots, and a forb addition treatment of 1, 3, or 6 species either as seeds or small seedling transplants applied to subplots. Three early flowering species (Pasqueflower, prairie phlox and wood betony) and three late flowering species (silky aster, New England aster and gray goldenrod) were used in the study. Plant survivorship and biomass, flower production, and plant and pollinator species abundance and diversity were sampled in September 2019 and through the 2021 growing seasons. A greenhouse experiment on seed germination rate varied smoke exposure to seeds either in fall or spring, before and after cold treatments.

### Progress:

The objectives of the project were completed successfully. Survivorship and biomass of target forbs were much higher in transplanted plots than in seeded plots ( $P < 0.01$ ), suggesting that forbs were more limited by recruitment than by seed limitation. Early-flowering species benefited more from transplanting than did late-flowering species (transplant x forb addition interaction,  $P < 0.01$ ). Adding forbs as transplants and mowing increased flowering niche breadth (i.e. they extended the flowering season,  $P < 0.05$ ), and all species except wood betony produced flowers during the study. Adding a greater number of forb species linearly increased plant diversity of restorations ( $P < 0.05$ ), and also extended the flowering season ( $P < 0.05$ ). Pollinator composition differed among early, mid, and later parts of the season ( $P < 0.01$ ). Smoke exposure increased germination in 2 of 9 forb species, and only if it was applied in Fall before cold periods. Cold stratification increased seed germination in prairie violets, the host plant for regal fritillary butterflies.

### Future Plans:

The project was completed in July 2022.

### Conclusions and Recommendations:

Our results indicate that early and late-flowering forbs in restorations can be increased by adding small transplants in the first year, that adding a greater number of species is better than adding a single target species, and that mowing and forb additions can extend the flowering season for pollinators. Smoke additions to seeds in the fall before the cold dormant season will increase germination in some hard to establish forbs.



# Professional Activities

## Teaching/Learning Opportunities

### Michael Moore

- Instructor (Fisheries Science)- Iowa State University Department of Natural Resources Ecology and Management Ames, IA: January 2023–May 2023.

## Graduate Committee Service

### Robert W. Klaver

#### Advisor/Co-Advisor

- Karri Folks (Ph.D., Department of NREM, Iowa State University)
- Bridget Nixon (Ph.D., Department of NREM, Iowa State University)
- Matt Stephenson (Ph.D., Department of NREM, Iowa State University)

#### Committee Member

- Jordan Giese (Ph.D., Department of NREM, Iowa State University)
- Ámbar Meléndez-Pérez (Ph.D., Department of NREM, Iowa State University)
- Tom Miles (M.S., Department of NREM, Iowa State University)
- Eli Lagacy (M.S., Department of NREM, Iowa State University)
- Christian Slone (M.S., Department of NREM, Iowa State University)
- Sidney Brenkus (M.S., Department of Biology, University of Memphis)

### Anna Tucker

#### Advisor/Co-Advisor

- Jo Ford (M.S., Department of NREM, Iowa State University)
- Lindsey Gapinski (M.S., Department of NREM, Iowa State University)
- Lizzy Lang (M.S., Department of NREM, Iowa State University)
- Kelsey Shepherd (M.S., Department of NREM, Iowa State University)
- Aaron Yappert (M.S., Department of NREM, Iowa State University)

#### Committee Member:

- Evangeline von Boeckman (M.S., Department of NREM, Iowa State University)
- Bobby Cope (Ph.D., Department of NREM, Iowa State University)
- Rachel Siller (Ph.D., Department of NREM, Iowa State University)
- Bridie Nixon (Ph.D., Department of NREM, Iowa State University)
- Jordan Giese (Ph.D., Department of NREM, Iowa State University)
- Eli Lagacy (M.S., Department of NREM, Iowa State University)
- Claire Rude (M.S., Department of NREM, Iowa State University)
- Erika Ibarra-Garibay (M.S., Department of EEB, Iowa State University)
- Andres Vargas (M.S., Department of Entomology, Iowa State University)
- Riggs Wilson (M.S., Department of NREM, Iowa State University)

### Michael J. Moore

#### Advisor/Co-Advisor

- Juliana Kaloczi (M.S., Department of NREM, Iowa State University)
- Dalton Clayton (M.S., Department of NREM, Iowa State University)

#### Committee Member:

- Maddie Lewis
- Brandt Boekhout

- Eli Legacy
- Erik Griffen
- Claire Rude
- Seth Renner

## **Professional Service & Outreach**

### **Robert Klaver**

- Peer review articles for multiple scientific journals
- American Society of Mammalogists, Member, 1996 –present
- Great Plains Natural History Society, Member, 2010 –present
- Iowa Action Plan Implementation Committee, Member, 2012 –present
- Technical Assistance to Grand Portage Band of Lake Superior Chippewa
- The Wildlife Society
  - Member, 1974 - Present
  - Iowa Chapter, Member, 2012 – present
  - North Central Section, Member, 2012 – present

### **Anna Tucker**

- Member, The Wildlife Society and Biometrics Working Group (2018 – present)
- Member, American Ornithological Society (2014 – present)
- Leader, Powell Center Working Group on Time-dependent Decisions
- External reviewer for USFWS Species Status Assessment for the Pinaleño Talussnail (*Sonorella grahamensis*) and the San Xavier Talussnail (*Sonorella eremita*)

### **Michael J. Moore**

- American Fisheries Society Member
- North American Sturgeon and Paddlefish Society Member
- Lead author for chapter on effects of agriculture on inland fish. For AFS's Inland fisheries Managements in North America Fourth Edition (in progress)
- Member Prairie Fishes and Streams Collaborative
- Chair of the Mississippi-Yangtze River Interbasin Symposium for the 2022 Annual Meeting of the American Fisheries Society in Spokane, WA and associate editor for upcoming special issue for symposia proceedings in Ecological Processes.

# Honors and Awards – Graduate Students

## Lindsey Gapinski

- Janice Lee Fenske Memorial Award for Outstanding Students in Memory of Janice Lee Fenske from the American Fisheries Society, The Wildlife Society, and the Midwest Fish and Wildlife Conference

# Presentations

## Robert Klaver

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- Schulte, L.A., J.C. Giese, M. Stephenson, and **R.W. Klaver**. 2022. The habitat quality of CP43: Prairie strips and other conservation features for birds in Corn Belt agricultural landscapes. Farm Service Agency CRP Outcomes Webinar.
- Giese, J.C., L.A. Schulte, and **Robert W. Klaver**. 2022. Grassland bird response to prairie strips in agricultural landscapes. American Ornithological Society Conference, San Juan, Puerto Rico. 27 June – 2 July 2022.
- Brenkus, S., **R.W. Klaver**, C.M.V. Nuñez, J.S. Adelman. 2022. Bighorn Sheep Respiratory Disease via Animal Behavior and Community Science. The Wildlife Society Annual Conference. Spokane, Washington. 6 – 10 November 2022.
- Brenkus, S., **R.W. Klaver**, C.M.V. Nuñez, J.S. Adelman. 2022. Community Science: Bighorn Sheep. Lewis and Clark Library, Augusta MT. September 2022.
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- Brenkus, S., **R.W. Klaver**, C.M.V. Nuñez, J.S. Adelman. 2022. Citizen Scientists help record bighorn sheep behavior in Glacier National Park. KPAX Missoula and Western Montana News Article. September 2022.
- Brenkus, S., **R.W. Klaver**, C.M.V. Nuñez, J.S. Adelman. 2022. Why people are switching from bird watching to sheep watching. Nerd Night, University of Memphis. November 2022.
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- Brenkus, S., **R.W. Klaver**, C.M.V. Nuñez, J.S. Adelman. 2023. Community Science as a Tool to Detect Bighorn Sheep Respiratory Disease. MT Wild Sheep Foundation Newsletter. Spring 2023
- Hatch, A.M., E.J. Isaac, M.B. Agee, N. Bosco, L.A.W. Gapinski, S.A. Hoepfner, R.S. Siller, **R.W. Klaver**, and S.A. Moore. 2023. Movement and mortality of GPS collared moose on the Grand Portage Reservation. The 55<sup>th</sup> North American Moose Conference and Workshop, Grand Portage, Minnesota. 22 – 26 May 2023.

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- Nuse, B.L., **A.M. Tucker**, J. Sweka, K. Anstead, C.T. Moore, J.E. Lyons, D.R. Smith, and C.P. McGowan. 2022. Updating the adaptive management plan for horseshoe crab harvest and red knot conservation in Delaware Bay. Joint Meeting of the American Ornithological Society and Birds Caribbean. San Juan, PR.
- Ashander, J.D., **A.M. Tucker**, M.C. Runge. 2022. Managing Waterfowl Harvest Under Climate Change: Assessing the Value of Information About Future Climate for Time-Dependent Optimal Management. The Wildlife Society Annual Conference. Spokane, WA.
- Tucker, A.M.**, T.M. Harms, and A. Buckhardt-Thomas. 2022. Assessing reintroduction efforts and evaluating recovery goals of trumpeter swans in Iowa using an integrated population model. The Wildlife Society Annual Conference. Spokane, WA.
- Gapinski, L.A., **A.M. Tucker**, and K.E. Kinkead. 2022. Breeding bird use of restored WRP properties in Iowa's Prairie Pothole Region over a 15-year time span. Midwest Fish and Wildlife Conference, Overland Park, KS.

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- Golcher-Benavides, J., **M. J. Moore**, and M. J. Weber. 2023. Research updates on the natal origin and recruitment dynamics of Silver Carp (*Hypophthalmichthys molitrix*) in the Upper Mississippi River. Poster presentation at the Iowa Chapter of the American Fisheries Society Meeting in Ames, IA.
- Moore, M. J.**, A. H. Hyman. 2023. What Google Trends can and can't tell us about factors driving public interest in aquatic endangered species. Oral presentation at the Midwest Fish and Wildlife Conference in Overland Park, KS.

# Publications

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Giese, J. C., M. Agee, C. G. Campbell, A. Hatch, C. Mitsdarfer, A. U. Poincon, R. C. Russell, H. N. Chamberlain-Irwin, M. Kastner, D. Franklin, and **R. W. Klaver**. 2023. Restoring the Balance: What Wolves Tell Us About Our Relationship with Nature. *Journal of Mammalogy* 104:425-427.

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**Tucker, A.M.**, C.P. McGowan, J.E. Lyons, A. DeRose-Wilson, and N.A. Clark. 2022. Species- specific demographic and behavioral responses to food availability during migratory stopover. *Population Ecology*, 64 (1): 19-34.

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**Tucker, A.M.**, C.P. McGowan, B.L. Nuse, J.E. Lyons, and C.T. Moore. 2022. Integrated population model for red knot in Delaware Bay. Version v1.0.0. U.S. Geological Survey Software Release. Reston, VA.

**Tucker, A.M.**, M.R. Runge, J.D. Ashander, J.R. Reimer, R.E.W. Berl, et al. *In review*. Natural resource management under global change: Time-dependent optimal policies for non-stationary systems. *Nature Sustainability*.

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Bouska, K.L., B.D. Healy, **M.J. Moore**, C.G. Dunn, J.J. Spurgeon, and C.P. Paukert, 2023. Diverse portfolios: Investing in tributaries for restoration of large river fishes in the Anthropocene. *Frontiers in Environmental Science* 11:01-18

