2023 Iowa TWS-AFS Joint Meeting

Quality Inn & Suites Starlight Village Conference Center
2601 E 13th Street, Ames, Iowa
March 1-2, 2023

2 Day Registration - $80.00
Student 1 Day - March 1 - $40.00
Student 1 Day - March 2 - $20.00
Student/Retired 2 Day Registration - $50.00

Wednesday, March 1, 2023

12:00 - 1:00	Check-in/Registration (in Lobby)
1:00 - 1:10	Welcome and Housekeeping

Joint Session AFS/TWS (Rooms A/B/C)		
		Moderator: Kim Bogenschutz
1:10 - 1:30	A Year in Review: Highly Pathogenic Avian Influenza in Iowa	Rachel Ruden, Iowa DNR
1:30 - 1:50	Fifty Years of Conservation Work in the Iowa Great Lakes Watershed	Mike Hawkins, Iowa DNR
1:50 – 2:10	Decapods of Iowa Revisited	Paul W. Frese, Iowa DNR
2:10 - 2:30	Five Steps To Better Slides	Keith Hurley, Nebraska Game and Parks Commission
2:30 - 2:50	***Afternoon Break***	

Iowa's Sustainable Rivers Program Joint Session (Rooms A/B/C)		
		Moderator: Ryan Hupfeld
2:50 - 3:10	Sustainable Rivers Program Overview	Perry M. Thostenson, USACE
3:10 - 3:30	Fall Stopover Ecology of the Least Sandpiper (*Calidris minutilla*) in Central Iowa	Nicole Bosco, Iowa State University
3:30 - 3:50	Effects of Flow Release Volume and Timing on Freshwater Mussel Recruitment	Annika L. Richards, Iowa State University
3:50 - 4:10	Effects of Experimental Flows on Downstream Lotic Fish Reproduction	Erik M. Griffen, Iowa State University
4:10 - 4:30	Sustainable Rivers Program: A Collaborative Effort and Potential Tool for Management of Our River Fisheries	Ryan Hupfeld, Iowa DNR
4:30 - 5:00	***Break*** *(on your own)*	
5:00 - 5:45	Iowa AFS Annual Business Meeting (Room D)	Iowa TWS Annual Business Meeting (Room A/B)
5:45 - 6:30	Poster Session (S & W walls - Rooms A/B/C/D)	
6:30 - 7:30	Banquet (Dinner and Awards) and Panel Discussion	
6:00 - 9:00	Social, Auction, and Raffle	

Thursday, March 2, 2023

7:00 - 7:45	Breakfast buffet located in hallway with seating in rooms A/B/C/D (hotel continental breakfast also available).

Concurrent Session A (Wildlife; Rooms B/C)		
		Moderator: Matt Dollison
8:00 - 8:20	An Overview of Recent Canada Goose Research in Iowa.	Orrin Jones, Iowa DNR
8:20 - 8:40	Sandhill Cranes in Iowa	Taylor Shirley, Iowa DNR
8:40 - 9:00	Occupancy, Health, and Habitat Associations of Rusty Patched and American Bumble Bees in Iowa	Kelsey N. Shepherd and Erika J. Ibarra-Garibay, Iowa State Univ.
9:00 - 9:20	The Search for *Bombus affinis* - What's up with Bumble Bees in Iowa	Stephanie Shepherd, Iowa DNR
9:20 - 9:40	Deer Recovery: Research and Education Efforts to Reduce Wounding Rates and Increase Recovery Rates.	David D. Hoffman, Iowa DNR
9:40 - 10:00	An Update of Mountain Lion, Black Bear, and Gray Wolf Populations in Iowa and the Midwest.	Vincent D. Evelsizer, Iowa DNR
10:00 - 10:20	***Morning Break***	

Concurrent Session B (Fisheries; Room A)		
		Moderator: Jordan Vetter
8:00 - 8:20	Evaluation of Mudpuppy (*Necturus maculosus*) Populations in the Mississippi River Upper	Kevin J. Hanson, Iowa DNR
8:20 - 8:40	Silver Carp Movement Dynamics within Upper Mississippi River Basin Tributaries	Brandt N. Boekhout, Iowa State University
8:40 - 9:00	Invasion Highway or Ecological Trap? Use of Small Streams by Invasive Carp	Seth M. Renner, Iowa State University
9:00 - 9:20	Identifying suitable habitat for invasive carp spawning in the Big Sioux River using habitat suitability models	Britney M. Hall, Iowa State University
9:20 - 9:40	Reproductive Phenology of Native and Invasive Fishes in Northwestern Iowa Tributaries	Annika Preheim, Iowa State University
9:40 - 10:00	Conditions Associated with the Occupancy of Four Fishes of Greatest Conservation Need in Wadeable Streams and Rivers of Western Iowa	Eli J. Lagacy, Iowa State University
10:00 - 10:20	***Morning Break***	

Concurrent Session C (Fisheries; Room D)		
		Moderator: Josh Goff
8:00 - 8:20	Using Anonymous Location Data to Measure Changes in Natural Resource Usage	Tommy D. Johnson, Iowa DNR/University of Florida
8:20 - 8:40	Quantifying Angler Pressure on Urban Lakes Utilizing Time-lapsed Photography	John Lorenzen, Iowa DNR
8:40 - 9:00	Renovation and Pandemic Effects on Anglersheds and Fisheries of a Three-lake Complex	Rebecca Krogman, Iowa DNR
9:00 - 9:20	Iowa Walleye Challenge – Using a Statewide Fishing Tournament to Address Gaps in the Fisheries Surveys Targeting Walleyes	Jeff Kopaska, Iowa DNR
9:20 - 9:40	Importance of Fisheries Programs and Services According to Anglers and Fisheries Biologists	Susan Steffen, Kansas Department of Wildlife and Parks
9:40 - 10:00	Rubbing Salt into Wounded Ecosystems: A Global Synthesis of Animal Responses to Freshwater Salinization	Rich H. Walker, Upper Iowa University
10:00 - 10:20	***Morning Break***	

Concurrent Session D (Wildlife; Room B/C)		
		Moderator: Dan Kaminski
10:20 - 10:40	Winter Resource Selection Modeling for 3 Bat Species of Conservation Concern in the Midwest, USA	Dan J. Kaminski, Iowa DNR
10:40 - 11:00	Smaller Wind Facilities are Located in More Heterogeneous Landscapes, Which Present a Higher Risk for Bat Fatalities	Katie Fetting, Luther College
11:00 - 11:20	The Motus Wildlife Tracking Network in Iowa	Anna Buckardt Thomas, Iowa DNR
11:20 - 11:40	Genetic Data Reveal Patterns of Population Structure and Disease in Gray Foxes	Dawn M. Reding, Luther College
11:40 - 12:00	Using Occupancy Models to Inform Harvest Management Decisions for Bobcats	Tyler M. Harms, Iowa DNR

Concurrent Session E (Fisheries; Room A)		
		Moderator: Tyler Stubbs
10:20 - 10:40	Assessing Survival, Escapement, and Movement of Stocked Walleye in Rathbun Lake	William R. Cope, Iowa State University
10:40 - 11:00	Understanding and Mitigating Walleye and Muskellunge Reservoir Spillway Escapement	Thomas P. Miles, Iowa State University
11:00 - 11:20	Walleye and Muskellunge Movement and Residency Indices in Iowa Reservoirs	Madeline C. Lewis, Iowa State University
11:20 - 11:40	Effects of Chemical Versus Electro Anesthesia on Hybrid Striped Bass Recovery, Growth, and Survival Following Acoustic Transmitter Surgery	Connor R. Fiolek, Iowa State University
11:40 - 12:00	Aquatic Vegetation in Pool 13 and What is Being Done About Them	Seth Fopma, Iowa DNR

Wednesday, March 1, 2023
Joint Session AFS/TWS

A Year in Review: Highly Pathogenic Avian Influenza in Iowa
Rachel Ruden (Iowa DNR)

Since the first detections of H5N1 highly pathogenic avian influenza (HPAI) in commercial poultry, backyard flocks, and wildlife in March 2022, the Iowa Department of Natural Resources has been monitoring morbidity and mortality events affecting a range of wildlife species. We are also engaged in several collaborative research and surveillance projects. HPAI has been detected or implicated in at least 16 species of wild bird, including 6 species of raptor and 7 species of waterfowl, as well as two species of mesocarnivore. With one year of active response under our belt, this talk will provide a broad overview of the patterns observed during the spring and late fall into winter peaks, when most detections occurred.

Fifty Years of Conservation Work in the Iowa Great Lakes Watershed
Mike Hawkins (Iowa DNR)

The lakes, wetlands, and public lands in the Iowa Great Lakes Watershed are some of Iowa's premier natural resources. The region's economy, recreational opportunities, and growth are dependent on the quality of the lakes, wetlands, public lands, and the opportunities they provide. The region has often led the state in local fundraising, adoption of new technology and conservation practices, and generating support for conservation efforts. Myriad partnerships have developed, especially over the past fifty years, to plan and implement conservation and water quality improvement projects. Extensive permanent land protection, wetland restoration, shallow lake restoration, invasive species management, urban conservation, and sanitary sewer systems have all worked to protect and improve water quality. Volunteer water quality monitoring data collected since 1999 suggests that the water clarity in Iowa's Great Lakes has been improving and nutrient levels have been decreasing. Biological monitoring indicates shifts in aquatic plant life and

fisheries assemblages are occurring as well. The long-term efforts in the Iowa Great Lakes can serve as a model for aggressive conservation work and partnership building in lake and stream watersheds throughout the state.

Decapods of Iowa Revisited
Paul Frese* (Iowa DNR), Karen Kinkead (Iowa DNR), Carolyn Moore (Iowa State University), and Stephen Dinsmore (Iowa State University)

The last statewide survey for decapod crustaceans in Iowa was published in 1980 by Gary S. Phillips. These common, but little known invertebrates didn't receive much attention until 2013, when the Multiple Species Inventory and Monitoring (MSIM) Program initiated surveys for crayfish in Iowa. Crayfish were collected throughout the state on public and private lands using aquatic trapping, burrow net traps, and hand capture. We will discuss the results of our survey through 2021.

Five Steps To Better Slides
Keith Hurley (Nebraska Game and Parks Commission)

Can you remember the last professional presentation that you found engaging, entertaining, or something other than mind-numbingly tedious? Giving great talks is hard, and it's not a skill that many of us have developed or practiced. There is so much that goes into giving a "best-paper" talk during a professional meeting – even though we continually set a low bar for that honor. While it is well beyond the scope of a 15-minute talk to resolve the issue, join me today to learn 5 tips to create better visuals for your next talk. While great slides can't make a great presentation, they are the first step into becoming the speaker that you have always wanted to be!

Wednesday, March 1, 2023
Iowa's Sustainable Rivers Program (Joint Session)

Sustainable Rivers Program Overview
Perry M. Thostenson (USACE)

The Sustainable Rivers Program is a nationwide partnership of The Nature Conservancy and the Corps of Engineers. The partnership works collaboratively among stakeholders and scientists to determine the environmental flow requirements for rivers to restore critical ecological function and habitat for aquatic dependent species. There are also opportunities for reservoir pool management that can benefit fish and wildlife. Efforts are focused on implementing water management at Corps dams without compromising primary purposes, such as flood risk management. SRP projects within the Rock Island District include Saylorville and Red Rock Dams on the Des Moines River, Coralville Dam on the Iowa River, and the Farm Creek dry reservoir on the Illinois River. The SRP program has provided funding to support research on how environmental flows or environmental pool management can enhance fish and wildlife management. Perry Thostenson is the Rock Island District lead person for the Sustainable Rivers Program. He will present an overview of the Sustainable Rivers Program nationally and in the Rock Island District.

Fall Stopover Ecology of the Least Sandpiper (*Calidris minutilla*) in Central Iowa
Nicole Bosco* (Iowa State University) and Stephen Dinsmore (Iowa State University)

The Sustainable Rivers Program (SRP), a cooperative effort between the U.S. Army Corps of Engineers and The Nature Conservancy, aims to better develop comprehensive water level management strategies at flood-control reservoirs. A main area of interest is manipulating water to benefit wildlife, especially migratory birds. Controlled water drawdowns were initiated in July 2021 and 2022 at Red Rock Reservoir along the Des Moines River in central Iowa. Our objective was to estimate daily local residency time of Least Sandpipers (*Calidris minutilla*) and see how it is influenced by individual body condition and reservoir water level. We used VHF radio transmitters to monitor local survival as new habitat was continuously exposed. We tagged 60 sandpipers in 2021 and 80 in 2022 and monitored them for 688 exposure days (2021 n = 390, 2022 n = 298). Daily local survival increased across the sampling period in 2021 (range was 0.44 to 0.99) but declined during the 2022 sampling period (range was 0.56 to 0.92). A less supported model of constant survival by year produced local survival rates of 0.91 (SE = 0.01) in 2021 and 0.85 (SE = 0.02) in 2022, for an estimated residency time of 10.6 and 6.2 days (2021 and 2022, respectively). Exploratory models suggest an effect of age on local survival (adults > juveniles); there was a minimal difference in body condition indices between study years. Understanding the effects of time of season and water levels on their daily local residency during the migration period will help guide the timing-structure of the draw down to be most

productive. Our findings will ultimately contribute to adjustments in environmental flows at Red Rock to optimize benefits for all wildlife during late summer and early fall.

Effects of Flow Release Volume and Timing on Freshwater Mussel (Unionidae) Recruitment
Annika L. Richards* (Iowa State University), Michael J. Weber (Iowa State University), and Kevin J. Roe (Iowa State University)

Stream hydrology is one of many factors responsible for the abundance and diversity of organisms in freshwater ecosystems. Impoundments can alter these seasonal flows which can be detrimental to the ecology of the stream. Freshwater mussels are sensitive to variation in flows and habitat where the timing and volume of peak flows can affect recruitment. This study aims to determine any differences in age-class structure between free-flowing and impounded systems as well as to assess the effects of flow volume and timing on freshwater mussel recruitment. We collected *Lampsilis cardium* from the Des Moines River upstream (n=105) and downstream (n=108) of Red Rock Dam, which is a medium-sized dam with a hydroelectric facility managed by the U.S. Army Corps of Engineers. We then 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. A multiple linear regression will be used to determine what aspects of flow volume and release timing affect recruitment as well as how they specifically influence freshwater mussel populations. We hypothesize recruitment will be higher during years with extended periods of high-flow throughout the spring and summer which is a critical period in the reproductive process of *Lampsilis cardium*. We also hypothesize recruitment variability will be higher below Red Rock Dam than above the dam due to disruption in seasonal flows downstream of the impoundment. Our results will provide guidance on the management of flow release volume and timing for the benefit of freshwater mussel recruitment.

Effects of Experimental Flows on Downstream Lotic Fish Reproduction
Erik M. Griffen* (Iowa State University) and Michael J. Weber (Iowa State University)

Large rivers have been extensively altered to accommodate anthropogenic uses. Dam construction on large rivers remodels flow and temperature regimes that are important for lotic fish reproduction. Some reservoirs have begun implementing experimental flows to provide adequate discharge to assist fish reproductive success. Our objective was to evaluate how environmental factors, such as water temperature and discharge, influence larval Catostomidae and Scianeidae production in response to water releases downstream of a reservoir. We sampled ichthyoplankton every two to seven days from April through June on Des Moines and Iowa rivers during 2014, 2015, 2021, and 2022. Peak May discharge across years ranged from 57 to 594 m3/s. Peak Sciaenidae abundance occurred between late May and mid-June with water temperatures 18-26°C and discharge 100-733 m3/s. Sciaenidae catches were highest at the furthest upstream and downstream sites. Across the four years, Catostomidae larval abundances were highest in 2022 with abundances peaking from mid-May through late-June with water temperatures 16-25°C and discharge 87-412 m3/s. Across the four sampling years, Sciaenidae and Catostomidae abundances were highest in 2022 with higher average discharge and lowest in 2014 with lower average discharge. Catostomidae catches were highest at further downstream sites on the Des Moines River, but highest at sites furthest upstream on the Iowa River. Water temperature in conjunction with discharge may influence Catostomidae and Sciaenidae reproductive success as the highest catches occur during years with higher average river discharge coupled with adequate spawning temperatures. Conversely, years with lower average discharge yielded lower catches and limited reproduction. Our results provide valuable information regarding the timing and magnitude of water releases to benefit downstream fish reproduction.

Sustainable Rivers Program: A collaborative effort and potential tool for management of our river fisheries
Ryan Hupfeld* (Iowa DNR), Gene Jones (Iowa DNR), and Royce Bowman (Iowa DNR)

Shovelnose Sturgeon and Paddlefish support recreational fisheries on the Mississippi River and its major tributaries, including the Cedar, Iowa, and Des Moines rivers. These are generally spring to early summer fisheries that occur when large numbers of Shovelnose Sturgeon and Paddlefish run up tributary rivers to spawn. Previous sampling and tagging efforts have documented this movement of Shovelnose Sturgeon between the Mississippi River and these tributaries. However, little is known on the success or amount of reproduction that is occurring in these rivers. Thus, evaluating natural reproduction in Iowa's tributaries of Shovelnose Sturgeon and Paddlefish is imperative to properly understand and manage these potentially sensitive and fragile populations. The Sustainable Rivers Program has the potential to release environmental flow pulses in the Des Moines and Iowa rivers into the future. Understanding how these prospective flow pulses may influence natural reproduction of Shovelnose Sturgeon and Paddlefish is an important factor to consider to maintain healthy fisheries. Thus, determining the timing and magnitude of flow pulses for Shovelnose

Sturgeon and Paddlefish to be successful in producing larvae in the Des Moines River will be useful to guide manipulation of flow releases from dams.

Wednesday, March 1, 2023
Panel Discussion - Hiring Challenges in Natural Resources

Panel Members

- Moderator: Rebecca Krogman (Iowa DNR)
- Federal Perspective: Drew DiAllesandro (USFWS)
- Wildlife State Perspective: Kelsey Fleming (Iowa DNR)
- Fisheries State Perspective: Jason Euchner (Iowa DNR)
- University Program Perspective #1: Dr. Steve Dinsmore (Iowa State University)
- University Program Perspective #2: Justin Vandehey (University of Wisconsin - Stevens Point, AFS Professional Certification committee chair)

Thursday, March 2, 2023
Concurrent Session A (Wildlife)

An Overview of Recent Canada Goose Research in Iowa
Orrin Jones* (Iowa DNR), Taylor Shirley (Iowa DNR), Andrew Kellner (Iowa DNR), Chris Ensminger (Iowa DNR), Ben Luukkonen (Iowa State University), and Robert Klaver (Iowa Cooperative Fish and Wildlife Research Unit, Iowa State University)

The distribution and population dynamics of Canada geese have changed remarkably in the last 50 years. While the estimated population of Canada geese in Iowa has been relatively stable in the last 20 years, the nature of human-goose conflict and perhaps Iowan's cultural perception of Canada geese has shifted in response to the widespread abundance of Canada geese and their use of urban-suburban habitat in Iowa's metropolitan areas. We used GPS-GSM transmitters and banding data to improve our understanding of the ecology of Canada geese in modern day Iowa. This information provides a strong foundation for managers who seek to balance recreational opportunity and human-goose conflict.

Sandhill Cranes in Iowa
Taylor Shirley* (Iowa DNR), Orrin Jones (Iowa DNR), Erik Murray (Iowa State University), Matthew Garrick (Iowa DNR), and Robert Klaver (Iowa Cooperative Fish and Wildlife Research Unit, Iowa State University)

Sandhill cranes (*Antigone canidensis*) were extirpated from Iowa in the 19th century, but began to naturally recolonize nearly a hundred years later. Through anecdotal and photographic reports, we have documented Sandhill crane reproduction in 45 counties of Iowa, sightings in 43 counties, and 11 counties with no information. While Sandhill crane populations are monitored annually at the population-level by the U. S. Fish and Wildlife Service, little information is known about the Sandhill crane population in Iowa. The Iowa Department of Natural Resources began a pilot research project in 2020 to assess the feasibility of capturing Sandhill cranes in Iowa, and to monitor habitat use and migration through the use of GPS/GSM-transmitters. We have captured 17 (2020 n = 5; 2022 n = 12) Sandhill cranes in Iowa and deployed 15 (2020 n = 4, 2022 n = 11) GPS/GSM-transmitters. We will share recent results including survival, reproduction and migration of marked birds and discuss future plans for the project.

Occupancy, Health, and Habitat Associations of Rusty Patched and American Bumble Bees in Iowa
Kelsey N. Shepherd* and Erika J. Ibarra-Garibay* (Iowa State University), Anna M. Tucker (Iowa Cooperative Fish and Wildlife Research Unit, Iowa State University), and Amy L. Toth (Iowa State University)

Bees are vital to the persistence and stability of ecological communities and agricultural crop production. However, mass bee population declines jeopardize that stability and threaten our food supply. In 2017, the rusty patched bumble bee (*Bombus affinis*) became the first bee in the United States to be federally listed as endangered. At that time, *B. affinis* had experienced an 87% reduction in its historical range and population. In 2019, the American bumble bee (*Bombus pensylvanicus*) was petitioned to be listed

as endangered. It has also experienced a substantial reduction in its population and historical range, with declines estimated at 89% and 81%, respectively. Key components of *B. affinis* and *B. pensylvanicus* conservation include understanding their health, habitat needs, and occurrence. The broad objective of this multi-year project is to evaluate the effect of local and landscape level habitat factors on *B. affinis* and *B. pensylvanicus* distribution, occupancy, and population health. We surveyed 43 sites across various Iowa landscape types from June to August 2022. During initial surveys, 100-meter radius areas were surveyed to assess site-specific habitat features and detect the presence of target species. Positively detected sites were revisited to collect bee health measurements, including body size, wing wear, and wing symmetry. Although data analysis is currently ongoing, preliminary results show that *B. pensylvanicus* was detected at 37% of sites, while *B. affinis* was detected at 9% of sites. Furthermore, all sites where *B. affinis* was detected were located within proximity to river valleys, suggesting these areas may be important habitat for these bees. This work may inform habitat management strategies for the Partners for Fish and Wildlife Program as well as targets for *B. affinis* recovery planning.

The Search for *Bombus affinis* - What's Up with Bumble Bees in Iowa
Stephanie Shepherd* (Iowa DNR), Seth Moore (Iowa DNR), and Kelly Poole (Iowa DNR)

During the summers of 2018 to 2021, the Iowa DNR received funding through the U.S. Fish and Wildlife Service to assess the distribution and status of the Rusty-patched Bumblebee in Iowa. In 2017, the rusty-patched bumble bee (*B. affinis*) became the first bumblebee listed under the federal Endangered Species Act. Surveys were conducted on 119 properties throughout the northeastern 2/3rds of Iowa for all bumblebees resulting in almost 6,000 bumble bees representing 13 species being recorded. This survey gave us a much fuller picture of bumble bees in Iowa and helped define future steps to conserve these important pollinators.

Deer Recovery: Research and Education Efforts to Reduce Wounding Rates and Increase Recovery Rates
David D. Hoffman (Iowa DNR)

Wounding rates of white-tailed deer (*Odocoileus virginianus*) have been a topic of study since the 1950s. These studies report data from multiple regions and include data on wounding rates using a variety of hunting tackle. Gladfelter et al (1982) reported a 17% wounding rate by Iowa bowhunters. Obviously, we all wish wounding rates were zero. But even though most deer hunters possess high ethical standards and do everything in their power to ensure a quick, clean kill, wounding deer is unavoidable. The use of tracking dogs originated in Europe in the 1800's. Recovering wounded deer with the aid of a leashed dog became a legal method in Iowa in 2020. Data is being collected on spot placement, penetration, wait times, shot angle, shot distance, and broadhead/arrow setups. Results show a 35% greater chance of a recovery with a full pass-through. Lethality guidelines and tables are being developed.
"The goal of every bowhunter should be to achieve the most penetration possible on an animal, with the intent of a full passthrough." Dr. Ed Ashby. A goal is to educate on ethical methods of take and promote development of woodmanship and recover skills. Blood tracking is new to the state and in demand, consequently resulting in new recruitment of non-hunters into the outdoors and into the field of tracking. What are our concerns and what does the future look like with the advances in technology and equipment for deer hunting and recovery? A common goal is to do everything in our power to reduce wounding rates and increase recovery rates.

An Update of Mountain Lion (*Puma concolor*), Black Bear (*Ursus americanus*), and Gray Wolf (*Canis lupus*) Populations in Iowa and the Midwest
Vincent D. Evelsizer (Iowa DNR)

Mountain lions, black bears, and gray wolves were all native to Iowa prior to European settlement. From the mid 1800s through the early 1900s all three species were extirpated from Iowa during European settlement mainly from habitat destruction and unregulated shootings. For the past 100 years, these large carnivores have been mostly absent from Iowa's landscape. However, populations of all three large carnivores have rebounded in many of Iowa's neighboring states. Over the past twenty years, there's been a slight increase of all three species of large carnivores showing up in Iowa again. This talk focuses on the current information we have on these three large carnivore species visiting Iowa, population trends in neighboring states, and management implications for the next ten years.

Evaluation of Mudpuppy (*Necturus maculosus*) Populations in the Upper Mississippi River
Kevin J. Hanson* (Iowa DNR) and Jennifer Fredrickson (Iowa DNR)

Mudpuppies (*Necturus maculosus*) are large bodied, fully aquatic salamanders listed in Iowa as Threatened and a Species of Greatest Conservation Need. They are also the obligate host of the salamander mussel (Simpsonaias ambigua), which is currently under consideration for listing by the U.S. Fish and Wildlife Service. Little is known about the life history of mudpuppies, largely due to their cryptic nature, which makes them difficult to capture and study. In 2008, a train derailment into the Mississippi River 5 miles south of Guttenberg, IA provided the Iowa Department of Natural Resources (IA DNR) the opportunity to monitor two populations of mudpuppies through the derailment reclamation process. Beginning in 2015, IA DNR Fisheries initiated a mark-recapture project to assess mudpuppy health, survival, and abundance in the Upper Mississippi River. From 2015 to 2021, 283 mudpuppies were captured, PIT-tagged, and released with 90 subsequent recaptures. We used individual capture-recapture history to estimate annual survival, capture probability, and population abundance with robust design closed capture Huggins models. To understand the influence of temporal and environmental factors on mudpuppy length and body condition we utilized a linear mixed effect regression model. We found differences in total length, body condition, survival, and abundance between the two monitored populations, and provide some of the only known demographic estimates for mudpuppy populations. Future work includes expanding capture-recapture efforts into Iowa interior streams and providing breeding structures to improve recruitment where mudpuppies are known to occur.

Silver Carp Movement Dynamics within Upper Mississippi River Basin Tributaries
Brandt N. Boekhout* (Iowa State University) and Michael J. Weber (Iowa State University)

Rivers are important movement corridors for fishes that allow for population connectivity. Within Iowa, Silver Carp (*Hypothalmichthys molitrix*) have been documented in tributaries of the Upper Mississippi River (UMR) including the Des Moines, Iowa, and Cedar rivers. However, the spatial and temporal extent Silver Carp use these systems is largely unknown, with implications for metapopulation dynamics and control strategies. Our objectives were to 1) identify individual-based movement patterns, 2) analyze population structure within the study area, and 3) identify trends in spatial and temporal use of tributaries. Between Fall 2021 and Spring 2022, we deployed 32 acoustic receivers and implanted 142 Silver Carp with acoustic transmitters throughout the Des Moines, Iowa, and Cedar rivers. In the Des Moines River, 46% of the individuals downstream of Ottumwa Dam moved downstream to the Mississippi River confluence. Of these fish, 44% transitioned back upstream to Ottumwa Dam and then downstream to the confluence a second time within 13 months. Conversely, only 8% of Silver Carp tagged upstream of Ottumwa Dam moved downstream passed the dam to the Mississippi River confluence. In the Iowa River, only 19% of Silver Carp transitioned to the Mississippi River confluence while 42% of Silver Carp in the Cedar River transitioned to the Mississippi River confluence. Downstream movement events occurred in the Des Moines River during late October - early November 2021, followed by upstream movement events in late March - early April and late April - early May 2022. In the Cedar River, a downstream movement event occurred between late August - early September 2022. All movements were associated with an increase in discharge. Our results demonstrate spatial and temporal variation in Silver Carp tributary movements and fidelity that will help improve control strategies in the Upper Mississippi River basin.

Invasion Highway or Ecological Trap? Use of Small Streams by Invasive Carp
Seth M. Renner* (Iowa State University) and Michael J. Weber (Iowa State University)

Small tributaries of river systems can serve as invasion corridors for fishes due to their lack of impoundments and high connectivity with various aquatic systems. However, movement within these systems may be limited due to the dynamic flow regimes and extreme environmental conditions that can be exhibited on a seasonal basis, resulting in ecological traps for fishes that use these systems. Silver and Bighead Carp are two highly mobile invasive fishes that have expanded their ranges to aquatic systems of various sizes by using adaptive movement behaviors and extreme environmental tolerances. Our objectives were to 1) assess seasonal and environmental effects on Silver and Bighead Carp movement in the Little Sioux River and 2) assess the seasonal use of small tributaries in the Little Sioux River Basin. We deployed an array of 26 acoustic receivers and tagged 67 Silver Carp and 14 Bighead Carp with acoustic transmitters in Spring 2022 to evaluate the effects of temporal, environmental, and biological variables on their movement patterns. Overall, movement was more apparent in June for Silver Carp and more frequent for Bighead Carp during July that coincided with higher discharge. Similarly, the percentage of tagged individuals detected within Little Sioux tributaries was highest during June and July (51%). Perceived time spent by individuals in a majority of the tributaries increased throughout Summer and Fall 2022 when water levels were low, suggesting movement between tributaries and the Little Sioux River may be limited due to the

reduction in habitat connectivity amongst these systems on a seasonal basis. Our results will provide critical information regarding the contribution of small tributaries to invasive carp range expansion and their potential to form ecological traps during various temporal periods. This information will help guide future containment efforts by directing attention to aquatic systems that are vulnerable to invasion.

Identifying suitable habitat for invasive carp spawning in the Big Sioux River using habitat suitability models
Britney M. Hall* (Iowa State University) and Michael J. Weber (Iowa State University)

Invasion of nonindigenous species is one of the leading threats affecting the decline of native species in the United States. Two of the most recent invaders are Bighead Carp (*Hypophthalmichthys nobilis*) and Silver Carp (*Hypophthalmichthys molitrix*), collectively known as invasive carp. Understanding where invasive carp reproduce could be useful for predicting population expansion and developing targeted management efforts. Thus, our objectives were to 1) estimate the spawning habitat suitability of invasive carp in the Big Sioux River using fuzzy logic based on habitat preferences of river length, sinuosity, presence of turbulent hardpoints, and water temperature and flow and 2) use larval data to ground truth our models by back calculating spawning dates to identify where reproduction likely occurred. We modeled the Big Sioux River by importing the 2021 National Agriculture Imagery Program (NAIP) color infrared imagery into Geographic Information Systems (GIS) to extract the main channel of the river. We divided the river into nine 25 km segments to represent the minimum length required for eggs to drift before hatching and used the imagery as a reference when digitizing turbulent hardpoints. Our results identified four segments that were highly suitable, two that were moderately suitable, two that were marginally suitable, and one that was not suitable. We collected invasive carp larvae in segment six of the Big Sioux River suggesting they were spawned in the previous segment that we identified as highly suitable reproductive habitat. We did not capture invasive carp larvae at two other sampling sites on the river that our model identified as not suitable and highly suitable. Our results demonstrate invasive carp spawning habitat is highly variable throughout the entirety of the Big Sioux River due to differences in geomorphic and hydrological characteristics. Future work will expand to model habitat suitability for invasive carp reproduction throughout Iowa.

Reproductive Phenology of Native and Invasive Fishes in Northwestern Iowa Tributaries
Annika Preheim* (Iowa State University) and Michael J. Weber (Iowa State University)

Anthropogenic modification of rivers in the Midwestern United States can favor tolerant native species and adaptable invaders such as invasive carps (*Hypophthalmichthys nobilis*, *H. molitrix*, and *Ctenopharyngodon idella*). It is not known if these assemblage shifts are due to reproductive limitations. Understanding the effects of habitat degradation on fish reproduction is vital for prioritizing restoration efforts. We sampled ichthyoplankton in four Missouri River tributaries (Big Sioux, Floyd, Little Sioux, and Boyer rivers) from April to August 2022 to assess the extent of native and invasive fish reproduction across a range of habitats. We collected 5,172 larvae, primarily invasive carp and native Cyprinidae, Catostomidae, and Percidae. We detected larvae in all rivers on all sampling dates, in flow between 0.30 m^3/sec and 149.50 m^3/sec and temperatures between 12.7 and 31.0°C. Native fish communities were homogenous among rivers but varied longitudinally within each river; Cyprinidae was associated with lower reaches, Catostomidae with middle reaches, and Percidae with upper reaches. We captured invasive carp larvae in the middle reach of the Big Sioux River on June 15th and the upper Little Sioux and lower Boyer River reaches on July 14th. Invasive carp larval densities varied by three orders of magnitude among these three detections, from 4 to 6,300 fish/100 m3. Our findings indicate northwestern Iowa rivers are suitable for invasive carp spawning and are used for reproduction. We did not detect invasive carp in the Floyd River, potentially due to habitat or water quality; however, the Floyd still supported spawning populations of four native fish families. The presence of native taxa at all sites indicates native fish reproduction may be more plastic than invasive carp and confirms the resilience of many prairie stream fishes in the face of disturbed habitat.

Conditions Associated with the Occupancy of Four Fishes of Greatest Conservation Need in Wadeable Streams and Rivers of Western Iowa
Eli J. Legacy* (Iowa State University) and Michael J. Weber (Iowa State University)

Stream fishes in the Missouri River basin of western Iowa have been exposed to significant levels of habitat degradation through channel modifications and land-use changes. These changes have resulted in population declines of many stream fishes with several being listed as Species of Greatest Conservation Need (SGCN). These species are rare and oftentimes cryptic, making them hard to study and limiting inference on where and under what conditions they occur, particularly given imperfect detection. Knowing how sampling methodologies and environmental variables affect detection and occupancy of these species is important for the subsequent management of these imperiled stream fishes. Between May–October 2022, we sampled 36 2nd–5th order stream sites in the Missouri River basin, Iowa using backpack electrofishing and seining. We captured 36,403 individuals of 43 species, including four SGCN's:

Suckermouth Minnow (*Phenacobius mirabilis*), Southern Redbelly Dace (*Chrosomus erythrogaster*), Blackside Darter (*Percina maculata*), and *Hybognathus* spp. We collected a total of 279 SGCNs at 11 sites. Occupancy (ψ) models indicated detection (p) was higher for SGCN's using electrofishing (p = 0.629) compared to seining (p = 0.317). Suckermouth Minnow occupancy probability increased with increasing stream order and decreasing stream depth indicating they were found more often in larger streams with available shallow habitat. Limited detection events hampered robust modeling for other species. However, preliminary models suggest Blackside Darter occupancy and detection may increase with increasing stream width and Southern Redbelly Dace detection may decrease with increasing turbidity. We plan to collect more data at additional sites in 2023 to obtain more robust occupancy estimates. Our results suggest electrofishing may be more efficient at detecting rare and/or cryptic fishes in western Iowa rivers than seining and identified possible habitat associations of imperiled fishes.

Thursday, March 2, 2023
Concurrent Session C (Fisheries)

Using Anonymous Location Data to Measure Changes in Natural Resource Usage
Tommy D. Johnson* (Iowa DNR) and Rebecca Krogman (Iowa DNR)

Anonymous Location Data (ALD) was investigated for use in measuring visitation and other behaviors at Iowa's significantly publicly-owned waters. ALD is collected when a smart device with location-based services enters a designated study area, and can include time spent within the area, home and work census block location, travel distance to the area, probable demographic characteristics, and weekday and time patterns. Raw ALD is able to be expanded, similar to a creel survey, to yield total estimates of visitation and effort. ALD may allow resource managers to understand how a resource is used across time and space for a relatively low cost. For instance, visitation patterns can show the importance of natural resources and how far people are willing to travel to recreate, even beyond the state's border. We conducted several case studies to better understand how people used Iowa's public natural resources and whether the ALD could measure known changes (e.g., renovations, stocking events) . Specifically, we present examples of using ALD to assess remote trout stream fishing efforts, urban river access and user demographics, visitation to a popular lake with multiple uses, visitation and behavior before and after a reservoir renovation, and response to the provision of specific trout stocking dates in an urban fishery. Each example will be compared to alternative data sources, and limitations and biases will be discussed.

Quantifying Angler Pressure on Urban Lakes Utilizing Time-lapsed Photography
Lewis Bruce* (Iowa DNR) and John Lorenzen (Iowa DNR)

A traditional creel survey consists of two components: 1) random counts of anglers to assess the level of use; and 2) angler interviews to determine more about the typical fishing trip (e.g., how long, what they are catching) and other information about the angler. Randomly counting anglers requires a creel clerk to be on site regularly and, therefore, limits the number of concurrent creel surveys that can be conducted using this traditional method. Supplementing a traditional creel with time-lapse photography (TLP) is a more efficient method to conduct creel surveys. Utilizing TLP reduces the amount of information a creel clerk would typically need to amass during a survey and in turn increases the number of interviews a clerk can collect. Using TLP also provides a complete picture of angling use by collecting data during all daylight hours throughout the year. By implementing a TLP creel survey, we were able to collect angling method, count information, and trip length at multiple lakes simultaneously throughout the year using limited staff resources.

Renovation and Pandemic Effects on Anglersheds and Fisheries of a Three-lake Complex
Rebecca Krogman (Iowa DNR)

The Creston area lake complex encompasses three large publicly-accessible reservoirs in southwestern Iowa: Three Mile Lake, Twelve Mile Lake, and Green Valley Lake. We conducted an angler intercept survey at all three lakes from 2015-2021, during which Three Mile Lake was renovated using drawdown and rotenone application and extensive habitat improvements. We hypothesized that angler use of the complex would shift to the available lakes during renovation, with more effort allocated to the more recently renovated-and-recovered Twelve Mile Lake. We examined effort, catch, harvest, angler satisfaction, expenditures, and origin at each lake. We found that the complex acted as a single destination with anglers constantly shifting among the three lakes within a trip, and that having one lake unavailable due to renovation affected the entire complex. We also found a significant increase in fishing pressure during 2020 as anglers practiced social fishtancing.

Iowa Walleye Challenge – Using a Statewide Fishing Tournament to Address Gaps in the Fisheries Surveys Targeting Walleyes

Jeff Kopaska* (Iowa DNR), Rebecca Krogman (Iowa DNR), and Sean Simmons (Anglers Atlas)

Each year, the Iowa Department of Natural Resources (DNR) invests significant resources to support its walleye fishery. Collection of broodstock for hatchery production dominates the appropriate timeframe for sampling and population monitoring, thus only a handful of the stocked waterbodies are ever surveyed. Creel surveys are conducted at a limited number of fisheries, not of all which are walleye fisheries. In 2022, Iowa DNR partnered with MyCatch, an app-based tournament platform, to conduct a statewide catch-photo-release fishing tournament to determine if angler reported data could provide a reasonable overview of walleye catch rates and length distributions for waterbodies across the state. Ongoing creel surveys and various sampling data results were used comparatively to evaluate how well the reporting from anglers matched the survey. Angler reported catches were consistent with some creel surveys, and with other management surveys. Plans for 2023 will also be presented, to further investigate this new, cost-effective way to develop a state-wide assessment of the walleye populations.

Importance of Fisheries Programs and Services According to Anglers and Fisheries Biologists

Susan Steffen (Kansas Department of Wildlife and Parks)

The general angling public of Kansas ("anglers") and Kansas Department of Wildlife and Parks Fisheries Division staff ("KDWP") were surveyed about the importance of 33 fisheries programs offered by the Department to enable the Department to efficiently direct resources to core programs and scrutinize programs that are rated least important. The programs were presented in an online survey with a response format ranging from "not at all important" to "extremely important." Responses were coded from 1 to 5 and means were calculated and compared between the two groups using t tests. Anglers rated 21 programs with mean importance 3.00 or greater (i.e., "moderately important" or higher): lake rehabilitation, stocking fish, improving fish habitat, etc. These programs are most important to anglers and those which they rely on for quality fishing experiences. Anglers rated 12 programs below moderately important: bathymetric maps, certified bait dealer program, family fishing clinics, etc. These programs are likely tangential to anglers' fishing experiences. However, KDWP rated some of these programs above moderately important: certified bait dealer program, family fishing clinics, and trout stocking. The discrepancy in importance represents an opportunity for KDWP to engage with anglers to fully understand their importance. Responsible stewardship of KDWP's resources should be evaluated to remain accountable, transparent, and relevant to anglers.

Rubbing Salt into Wounded Ecosystems: A Global Synthesis of Animal Responses to Freshwater Salinization

Rich H. Walker* (Upper Iowa University), Abigail C. Belvin (Virginia Polytechnic Institute and State University), Joshua B. Mouser (Virginia Polytechnic Institute and State University), Amanda Pennino (Virginia Polytechnic Institute and State University), Stephen Plont (Virginia Polytechnic Institute and State University), Christopher D. Robinson (University of Virginia), Lucy B. Smith (Virginia Department of Environmental Quality), Jyoti Thapa (Hollins University), Carl E. Zipper (Virginia Polytechnic Institute and State University), Paul L. Angermeier, Sally A. Entrekin (U. S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit, Virginia Polytechnic Institute and State University)

Salinization of freshwaters is accelerating globally, altering biotic communities and impairing ecosystem processes. A comprehensive review of animal responses is needed to identify current knowledge gaps in the science used to understand how animals respond to salinization across taxonomic, geographic, and ecological contexts, with the goal of identifying biological traits associated with tolerance to salinization that will better inform management and conservation. Information from 585 journal articles was used to characterize 5924 biological responses of freshwater mollusks, macro-crustaceans, zooplankton, non-arthropod invertebrates (NAI), insects, fishes, and amphibians to salinization. Revealing species tolerances related to invasiveness was a key motivation for mollusk, macro-crustacean, and fish studies, while other studies documented urbanization and road salts as key threats for NAI, zooplankton, and amphibians. Benthic insects were studied mostly in the context of how multiple land uses affect salinization-animal relationships. Laboratory responses predominated for all taxa except NAI and insects. Organismal- and population-level responses were more commonly evaluated in the laboratory, while population- and assemblage-level responses dominated field studies. Common focal ions for all groups included Na+ and Cl-. Mollusks, NAI, and macro-crustacean studies were conducted mostly on adults, while the juvenile life-stages of zooplankton, insects, fishes, and amphibians were commonly studied. Negative responses to salinization predominated within all taxonomic groups, but still positive and unimodal responses were apparent across all taxa and levels of biological organization. Candidate species traits that seem to be positively related to salinization sensitivity included gill-breathing, semi-permeable skin, multiple life stages, limited mobility, and dependence on invertebrates for food.

Winter Resource Selection Modeling for 3 Bat Species of Conservation Concern in the Midwest, USA
Dan J. Kaminski (Iowa DNR)

Understanding the spatial distribution of species and their habitats is an essential component of conservation planning for imperiled populations. Of the 45 bat species occurring in the USA and Canada, 18–31% were recently categorized as species at risk. Two landscape-level threats have emerged in North America, including *Pseudogymnoascus destructans* (the causative agent of white-nose syndrome) and wind energy development: WNS has resulted in a cumulative mortality of >6 million bats (since 2006) whereas estimated annual wind turbine-related fatalities exceeds 1.7 million bats per year. Several studies have estimated summer resource selection for bats; however, few have evaluated winter selection despite the continental importance of winter habitats in the propagation of WNS and high rates of wind turbine-caused mortality that occur during seasonal migrations. Using presence-only observations from historical datasets and recent bat surveys in the Midwest, USA, we estimated landscape-scale resource selection for three species of bats listed or petitioned for protection under the Endangered Species Act of 1973, including the Northern long-eared bat, little brown bat, and tri-colored bat. We developed a form of the Bayesian latent indicator selection (BLISS) model for use with presence-only data to predict winter resource selection for select species across 12 Midwest states. We produced a simulated dataset with known model parameters to evaluate the ability of BLISS to predict resource selection using presence-only data under common scenarios of data constraints. We then applied the model to predict spatially explicit resource selection functions (RSF) for each species based on five landscape predictors. Our model reliably estimated simulated model parameters under standard scenarios, indicating that RSF models for select bat species yield predictive maps of winter resource selection.

Smaller Wind Facilities are Located in More Heterogeneous Landscapes, Which Present a Higher Risk for Bat Fatalities
Katie Fetting* (Luther College), Phillip Iversen (Luther College), Jerry Roppe (Avangrid Renewables), Cassandra Peterson (Luther College), Nathaniel Hemming (Luther College), Magdeline Anderson (Luther College), and Dawn Reding (Luther College)

With the rise in wind energy facilities, it is important to consider how wind turbines affect the wildlife around them. Recent studies indicate that facilities with fewer turbines tend to have higher bat fatality rates, but the reasons for this pattern are still being explored. In this study, we investigate the idea that smaller facilities are located in different types of landscapes than larger facilities, making them riskier for bat collisions. We compare a variety of landscape metrics including elevation, distances to features of interest, proportional land cover types, and measures of land type configuration across four wind facility sizes (single, 2–14, 15–60, and more than 60 turbines) for 435 facilities in the Midwest U.S. We found facilities with a single turbine tended to be in more heterogeneous areas than larger facilities. Single-turbine facilities were closer to bodies of water, had higher diversity of land cover types, and for most land cover types had higher edge densities and more patches within 3 km of each turbine when compared to larger facilities. Since many bat species prefer heterogeneous habitat, these findings provide one explanation for higher fatality rates at smaller facilities. Most bat fatality research has been performed at large wind facilities, but our results show that small facilities are sited uniquely and should be further studied to understand and mitigate bat fatalities.

The Motus Wildlife Tracking Network in Iowa
Anna Buckardt Thomas (Iowa DNR)

Migration has long been difficult to study, yet it is an important phase of the full annual cycle where wildlife face unique challenges. The Iowa DNR, with support from U.S. Fish and Wildlife Service grant funding, initiated a network of automated radio telemetry receiver stations as part of the Motus Wildlife Tracking System (Motus.org) in summer 2021. These stations are part of a hemisphere-wide coordinated wildlife telemetry system focused on understanding long-distance movements of small migratory wildlife species, like birds, bats, and insects. Any wildlife tagged on the Motus system in the Western Hemisphere have the potential to be detected by the Iowa DNR's receiver stations if they come within range. Between August 2021 and September 2022, eight Motus stations were installed at DNR buildings across the state. Three additional stations were funded by partners and placed on County Conservation Board properties in fall 2022. Thus far, Iowa Motus stations have recorded 66 detections of 57 individuals from 17 bird species from as far away as Jamaica, Colombia, and the Arctic Circle. The Iowa Motus network helps expand our understanding of the full annual cycle of migratory wildlife which is critical for effective conservation of declining species.

Genetic Data Reveal Patterns of Population Structure and Disease in Gray Foxes
Dawn Reding (Luther College),

Gray foxes are a valuable and understudied furbearer across its range. Evidence suggests gray fox populations are declining throughout the Midwest, prompting a petition and status review to determine if listing the "prairie" subspecies under the Endangered Species Act (ESA) is warranted. It is unclear, however, why Midwest populations have declined or whether the "prairie" gray fox is a genetically distinct segment of the contiguous gray fox range. To better understand the causes and consequences of these losses, we are using genetic tools to study population structure and disease in this species. Mitochondrial DNA sequences from over 700 individuals sampled from throughout the country identified a deep (~0.8 million years) split between gray foxes in the eastern and western USA, with secondary contact occurring along the Great Plains (Texas, Oklahoma). The sequence data did not support distinct lineages within the eastern group, suggesting regional population structure is likely to be more recent. We are currently following up with nuclear DNA data to investigate regional and fine-scale patterns of genetic structure in the Midwest. Additionally, genetic and other testing methods are providing information on the prevalence of canine distemper, canine parvovirus, and other diseases in Indiana gray foxes.

Using Occupancy Models to Inform Harvest Management Decisions for Bobcats
Tyler M. Harms* (Iowa DNR), Jennifer E. Fredrickson (Iowa DNR), Vince D. Evelsizer (Iowa DNR)

Once listed as endangered in Iowa, bobcats (*Lynx rufus*) have gradually recolonized and expanded their distribution throughout much of the state. In 2007, Iowa's bobcat population had grown to a level that was deemed sufficient to support a limited harvest season, prompting the need for a robust monitoring program coupled with a data-driven approach to making harvest management decisions. Iowa's Bow Hunter Observation Survey was launched in 2004 to collect data on population trends of bobcats (as well as 11 other wildlife species) used to inform harvest management decisions to this day. In this study, we built models with 16 years of Bow Hunter Observation Survey data to estimate trends in the probability of occupancy of bobcats at the county scale, evaluate both landscape and harvest effects on bobcat occupancy dynamics, and establish occupancy thresholds for making harvest management decisions. Bobcat occupancy increased 3 percent per year on average from 2004 to 2019. County landscape characteristics, such as forest edge density and grassland patch density, significantly influenced bobcat occupancy dynamics. Mean bobcat occupancy was higher in counties open to harvest than in counties closed to harvest, although harvest did not significantly influence bobcat occupancy dynamics. Lastly, we will demonstrate how county-level occupancy estimates can be used to inform harvest management decisions for bobcats.

Thursday, March 2, 2023
Concurrent Session E (Fisheries)

Assessing Survival, Escapement, and Movement of Stocked Walleye in Rathbun Lake
William R. Cope* (Iowa State University), Michael J. Weber (Iowa State University), and Mark K. Flammang (Iowa DNR)

Stocking hatchery-raised fishes to augment fish populations for conservation and recreational fishing purposes is common practice across the United States. However, contribution of stocked fishes to the adult population is highly variable. In reservoirs, loss of stocked individuals can occur through mortality and escapement. Further, multiple hatchery products are commonly stocked (e.g., fry versus fingerlings) that may have different mortality and escapement probabilities, but the relative loss of individuals to each of these sources is unknown. Walleye are commonly stocked in North America, but are prone to reservoir escapement. Here, we developed an acoustic telemetry study to evaluate stocking success of juvenile Walleye in Rathbun Lake, Iowa to estimate 1) survival and escapement and 2) movement rates and patterns, home ranges, and usage distributions in relation to biotic and abiotic factors. We tagged spring-stocked fry (n = 79, 143-212 mm) and fall-stocked advanced fingerling (n = 120, 204-275 mm) Walleye during fall 2019-2021. Naïve estimates of cumulative annual natural mortality were similar among the three years. Conversely, naïve estimates of escapement were higher in 2019 (33%) compared to 2020 (3%), which greatly affected cumulative estimated population loss. Escapement between fry and advanced fingerlings was similar and was positively correlated with high discharges (> 28 m3/s). Walleye movement from release locations to the area around the Rathbun Dam outlet tower (radius = 1,200 m) was higher in 2019, as 100% of juveniles moved into the outlet tower within 9 months compared to 27.5% of juveniles moving into the area within 12 months in 2020. Walleye released closer to the dam arrived at the outlet tower area sooner. Cumulatively, our results provide managers with better knowledge of the behavior and fate of stocked reservoir Walleye and allow for potential alterations to stocking regimes to improve stocking success.

Understanding and Mitigating Walleye and Muskellunge Reservoir Spillway Escapement
Thomas P. Miles* (Iowa State University), Ben Dodd (Iowa DNR), Madeline C. Lewis (Iowa State University), Andy Otting (Iowa DNR), and Michael J. Weber (Iowa State University)

Reservoir fish escapement has been an overlooked source of population loss. Understanding when and under what conditions reservoir sportfish escapement occurs would help develop strategies to mitigate this important source of fish loss. Further, few field evaluations of physical spillway barriers designed to prevent fish escapement exist. Our objectives were to compare seasonal, diurnal, and spatial variation in Walleye and Muskellunge escapement in relation to water levels in a reservoir with and without a physical barrier. In 2016, we installed passive integrated transponder (PIT) antennas at Big Creek Lake (physical bar barrier) and Brushy Creek Lake (no barrier). We captured Walleye and Muskellunge from each lake semi-annually using boat electrofishing and gill netting and injected them with a 32 mm PIT tag. We also tagged juveniles of both species at the hatchery prior to stocking. From 2016-2020, we tagged 14,745 Walleye and 2,983 Muskellunge and we have detected 272 Walleye and 190 Muskellunge escaping Brushy Creek while we detected 88 Walleye and 8 Muskellunge escaping Big Creek. Adult fish were more likely to escape than their juvenile counterparts who rarely escaped before age-3. We documented escapement with as little as 5-cm flowing over the spillway, but increased water levels led to increased escapement, especially during spring. Fish tended to escape through the deeper parts of the spillway and primarily escaped during nighttime hours. Fish escapement past the physical barrier was rare but did occur under limited conditions, especially when it was damaged during rare high-water events. Due to the apparent success of the Big Creek barrier, we installed a barrier on Brushy Creek during summer 2020 and have not documented escapement since its completion. Our results suggest the addition of physical spillway bar barriers can be an effective method to reduce reservoir fish escapement.

Walleye and Muskellunge Movement and Residency Indices in Iowa Reservoirs
Madeline C. Lewis* (Iowa State University), Ben Dodd (Iowa DNR), Andy Otting (Iowa DNR), and Michael J. Weber (Iowa State University)

Fish escapement from reservoirs can present a challenge to the management of reservoir sport fisheries, necessitating an understanding of when fish occupy the habitat adjacent to spillways and are therefore vulnerable to escapement. Acoustic telemetry enables continuous monitoring of individuals, providing valuable insights into temporal variation in movements and habitat use. In the fall of 2021 we deployed acoustic telemetry receivers in two Iowa reservoirs, Big Creek Lake (n=9 receivers) and Brushy Creek Lake (n=10). We tagged 35 Walleye *Sanders Vitreus* and 15 Muskellunge *Esox masquinongy* per lake and evaluated residency indices and presence near spillways based on receiver detections through the fall of 2022. In Big Creek, 93% of tagged Muskellunge and 29% of tagged Walleye were detected adjacent to the spillway, with the highest number of individuals detected for both species occurring in April (Muskellunge: n=13; Walleye: n=7). In Brushy Creek, 87% of tagged Muskellunge and 94% of tagged Walleye were detected adjacent to the spillway, with the highest number of individuals detected for both species occurring in April (Muskellunge: n=13; Walleye: n=33). In Big Creek, the mean number of receivers that a fish was detected on per day was higher for Muskellunge (mean = 2.7) than Walleye (mean = 2.3), whereas in Brushy Creek the mean number of receivers per day was slightly higher for Walleye (mean = 2.9) than Muskellunge (mean = 2.7). Residency indices for all receivers in each reservoir indicated that some areas receive consistent use through time, whereas other areas of the reservoirs show distinct seasonal increases in fish presence. Continued analysis of the spatial and temporal distributions of Walleye and Muskellunge in reservoirs will enable a better understanding of when fish are most vulnerable to loss from systems, informing management actions to minimize the unintentional loss of sportfish from populations.

Effects of Chemical Versus Electro Anesthesia on Hybrid Striped Bass Recovery, Growth, and Survival Following Acoustic Transmitter Surgery
Connor R. Fiolek* (Iowa State University) and Michael J. Weber (Iowa State University)

Acoustic tagging is used by fisheries biologists to assess a wide variety of questions, including migrations, behaviors, and population. One assumption of acoustic telemetry is that tagging does not affect growth or survival. Electroanesthesia is a new option for acoustically tagging fish and is one of the few options available to immediately release tagged fish in the wild. However, the efficacy of electroanesthesia compared to traditional anesthetics is generally unknown. We compared the effects of surgery, tagging, and anesthesia on the recovery, growth, and survival of juvenile Hybrid Striped Bass *Morone chrysops* x *Morone saxatilis*. We randomly assigned 150 Hybrids (187-245 mm) to a control or one of four treatment groups: electroanesthesia tagging, electroanesthesia sham (surgery but no tag), MS-222 tagging, or MS-222 sham. After surgery was complete, we monitored fish recovery time and provided them with Fathead Minnows Pimephales promelas ad libitum. We monitored fish survival daily and assessed growth, tag retention, and wound healing 36- and 74-days post-treatment. Post-handling recovery time was lower in the electroanesthesia treatment groups compared to the MS-222 treatment groups. A month after tagging, tag retention was 100% across all treatment groups, incision sites

were at least partially closed (inner muscle layer closure) in 99% of fish, 90% of fish had some form of redness or inflammation around the incision site, and the single suture was still present in 70% of fish. Hybrid survival was similar among all treatments (mean = 83%). Our results indicate both chemical and electro anesthesia have similar effects on juvenile Hybrid Striped Bass healing and survival. However, recovery times are reduced with the use of electroanesthesia. Thus, fisheries biologists should consider using electroanesthesia, particularly for fishes that need to be immediately released in the wild.

Aquatic Vegetation in Pool 13, & What is Being Done About Them
Seth Fopma (Iowa DNR)

Aquatic vegetation in the Upper Mississippi River (UMR) provides food, spawning areas, and shelter to fish, wildlife, and invertebrates. As a vital component of this nationally significant ecosystem, aquatic vegetation has been systematically sampled in Pool 13 of the UMR annually since 1998. Sampling follows the Long Term Resource Monitoring (LTRM) stratified random sampling (SRS) design which has been developed to provide abundance assessments of submersed, emergent, rooted floating-leaved, non-rooted floating-leaved, and algae species at 450 random points in five different habitat strata (backwater contiguous, backwater isolated, impounded, main channel border, and side channel) between June and August. Trends Pool 13 indicate a general stability of aquatic vegetation with few exceptions: a notable decline in wild celery (*Vallisinareia americana*), an important food source for migrating waterfowl, and the explosion of several invasive species. A habitat restoration and enhancement project (HREP) has been designed to create suitable habitat in part of Pool 13 with project goals of improving water quality and reversing the decline of this important species. Chemical treatment of flowering rush (Butomus umbellatus), a recent and aggressive invader, is currently being evaluated in other portions of the UMR with preliminary results indicating potential application across the UMR.

Wednesday, March 1, 2023
Poster Session
(in alphabetical order)
5:45 - 6:30 PM (before the banquet)

Assessing Growth, Healing, and Survival of Juvenile Walleye from Acoustic Transmitter Implantation in Respect to the 2% Rule
William R. Cope (Iowa State University) and Michael J. Weber (Iowa State University)

Acoustic telemetry research is becoming increasingly common in fisheries science to assess fish survival and behavior. A key assumption of telemetry studies is tag implantation does not adversely affect fish. The widely accepted rule is not to burden fish with more than 2% body weight with transmitters. Here, we tested this rule on juvenile Walleye to assess their growth, healing, and survival across a range of tag burden ratios. Juvenile Walleye (n = 120) were separated into three treatment groups (control, surgery no tag, surgery with tag). We observed fish for 14 days post-treatment, removed mortalities, and inspected them for possible cause of mortality. After 14 days, we assessed growth and incision healing on remaining individuals. Mortality was mainly due to gas bladder deflation from tag implantation or laceration of organs and infection during surgery. Specific growth rate was lower in implantation surgeries (-0.753%) compared to controls (0.194%) and surgeries without tags (0.165%) and tended to decline with increasing tag burden. Healing scores were not significantly different between no tag surgeries and tag implantation surgeries, indicating tag implantation was not altering surgery healing. We found lower survival for Walleye implanted with acoustic transmitters (52.5%) compared to controls (80%) and surgeries without tags (77.5%). Logistic regression estimated 50% Walleye survival at a tag burden of 7.23% body weight, 75% survival at 5.96% body weight, and 98.9% survival at 2% body weight. Our results indicate juvenile Walleye may be able to handle increased tag burden from the accepted 2% body weight rule with minimal effects on survival and healing. However, growth of tagged individuals may be reduced short-term. The ability to use larger tag burdens will provide the option to tag Walleye of smaller body size and track them over longer durations, providing better insights into effects of body size on fish behavior and survival.

Distribution and Behavior of Walleye Near a Reservoir Outlet Tower in Relation to Biotic and Abiotic Factors
William R. Cope (Iowa State University), Michael J. Weber (Iowa State University), and Mark K. Flammang (Iowa DNR)

Knowledge of fish movement and behavior is essential for fisheries scientists to better manage populations. One important application is to study fish movement and behavior in relation to reservoir fish escapement. Walleye are prone to escapement which can be detrimental to reservoir populations. Yet, fine-scale Walleye behaviors adjacent to reservoir outlet structures that could result in

escapement are unknown. Our objectives are to 1) estimate kernel density usage distributions of Walleye adjacent to the Rathbun Lake dam outlet tower and 2) model Walleye behavior patterns (closest linear distance to outlet tower; depth at closest distance; elapsed time in area; home range size in area) in relation to reservoir discharge, water temperature, time of day, and Julian date. We found Walleye use distributions changed throughout the year. During spawning (February - May) Walleye almost exclusively used the riprap dam face. Post-spawning (June - September), use varied between the dam face and deeper water. Over-winter (October - January), Walleye used both shallow and deep water areas around the outlet tower and dam face. Generalized Additive Mixed Modeling indicated Walleye behavior near the outlet tower was related to discharge, temperature, day hour, and Julian date. Walleye moved closer to the outlet tower during high discharge, cooler temperatures, nighttime hours, and springtime dates. Walleye used deeper water during high discharges, warm temperatures, daytime hours, and winter months. Walleye also visited the outlet tower area for longer durations at cooler temperatures and during spring and summertime. Finally, home-range sizes were larger during high discharge, nighttime hours, springtime months, and during longer visits. Our results provide new insights into reservoir fish behaviors and will inform managers on reservoir Walleye escapement potential. Collectively, managers can use our results to guide management actions for reducing reservoir fish escapement.

Effect of Canine Distemper Virus (CDV) on the Gray Fox Gut Microbiome

Peter Edlund (Luther College), Nathan Anderson (Luther College), Charlie Heinecke (Luther College), Geriann Albers (Indiana Department of Natural Resources), Brandon Bernhardt (Wildlife Ecology Institute), Tim Hiller (Wildlife Ecology Institute), Julia Nawrocki (Wildlife Ecology Institute), and Dawn Reding (Luther College)

The gut microbiome contains a variety of microorganisms (e.g., bacteria, fungi), most of which are commensal and help the host with digestion, immune function, and other processes. The breakdown (dysbiosis) of this microbial community due to anthropogenic stressors such as land use change and infectious diseases can negatively impact the overall health and fitness of wildlife. Canine distemper virus (CDV), an RNA virus of the genus Morbillivirus, can infect a wide range of host species and is a potential driver of gray fox population declines. CDV suppresses the host immune system, potentially disrupting the gut microbiome and allowing for fatal secondary infections from opportunistic, pathogenic bacteria. To better understand the potential role of host-microbiome relationships in gray fox declines, we aimed to establish a baseline understanding of the gray fox gut microbiome and determine whether CDV infection alters this composition. We collected stomach samples from uninfected and CDV-positive gray foxes in Indiana from 2019-2022. Using metabarcoding of the 16S rRNA gene, we identified the bacteria taxa present and their relative abundances in each individual. Consistent with findings in other canid species, the most abundant bacteria phyla detected were Firmicutes and Proteobacteria. Samples from CDV-positive foxes contained fewer phyla. At the genus level, healthy samples were dominated by Firmicutes members Lactobacillus and Lactococcus, which are often recognized as “good” bacteria. In contrast, CDV-positive samples were dominated by potentially pathogenic bacteria such as Paeniclostridium, Helicobacter, Streptococcus, and Escherichia-Shigella. These data provide baseline information on the gut microbiome composition of the gray fox and indicate that CDV infection is associated with dysbiosis. Additional research should examine the role of factors such as land cover, diet, and coinfections on altering gut microbiome composition and CDV susceptibility.

Natal origin and recruitment dynamics of Silver Carp (*Hypophthalmichthys molitrix*) in the Upper Mississippi River

Jimena Golcher-Benavides (Iowa Cooperative Fish and Wildlife Research Unit, Iowa State University) and Michael J. Weber (Iowa State University)

The rapid Silver Carp (*Hypophthalmichthys molitrix*) expansion throughout the Upper Mississippi River (UMR) has prompted the need for a robust stock assessment program guiding invasive species control. Lock and Dam 19 (LD 19) near Keokuk, IA is a high-head dam that represents a barrier to upstream fish movement in the UMR and is of interest due to its positioning at the Silver Carp invasion front. Previous studies suggested that Silver Carp reproduction occurs regularly above the high-head LD19. However, when and under what conditions reproduction translates into successful recruitment remains unknown, yet needed to guide control strategies. Our objectives are to: (1) assess annual variation in natal origins of Silver Carp using hard-part microchemistry and stable isotope techniques and (2) assess annual variation in recruitment dynamics of invasive Silver Carp in association with environmental conditions. We will age otoliths and assess natal origins of Silver Carp using microchemistry analyses to evaluate the proportion of adults from each year-class that recruited upstream or downstream of LD19. We will then use residual year-class strength analyses on age-frequency distributions with distinct natal origins upstream or downstream of LD19 to describe recruitment patterns in relation to river discharge and water temperature. We collected otoliths from 505 Silver Carp (664-1088 mm TL) commercially harvested upstream of LD19 during Fall 2022. 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.

Walleye Size Structure in Mississippi River Pools 11 and 13 Relative to Harvest Regulations
Cody D. Hagloch (University of Wisconsin - Stevens Point) and Ryan Hupfeld (Iowa DNR)

Size structure provides managers with valuable information on recruitment, growth, and survival of fish populations that can be used to set regulations. Regulations can be used to reduce harvest or protect certain sizes, potentially improving size structure and angler satisfaction. Biologists create these regulations to improve size structures for anglers' preferences and prevent any future stunting of a population. This will give positive feedback to both the fishery and the anglers who benefit from it. Walleye Sander vitreus regulations in the Mississippi River Pool 11 and 13 were 15" minimum length and a daily bag limit of 6 with a possession limit of 12 until 2004, when a protected slot between 20-27" was included in Pool 13. My objectives were to determine if Walleye size structure increased in Pool 13 after the regulation change by comparing lengths pre and post regulation change and to Pool 11. Also, to see if the regulation change made a positive impact on the size structure on Pool 13 compared to Pool 11 that had no regulation change. Walleye were sampled in the pools from 1993 to 2014 using boat electrofishing, with upstream sides of wing dams targeted. Sampled Walleye were measured for total length (mm) and length frequency and t-tests were completed. Pool 13 had an improvement to the size structure (increase of 3% in the protected slot and 4% above the protected slot) after the new regulation took place. Pool 11 had shown no drastic change before nor after pool 13 had a change in regulations. Although, there was no significant difference (p-value = 0.79) between pools 11 and 13 average lengths before and after the regulation change. This study can conclude that a change in harvest regulations could create positive feedback of the fishery and the anglers.

Evaluation of Mudpuppy (*Necturus maculosus*) Populations in the Upper Mississippi River
Kevin J. Hanson (Iowa DNR) and Jennifer Fredrickson (Iowa DNR)

Mudpuppies (*Necturus maculosus*) are large bodied, fully aquatic salamanders listed in Iowa as Threatened and a Species of Greatest Conservation Need. They are also the obligate host of the salamander mussel (Simpsonaias ambigua), which is currently under consideration for listing by the U.S. Fish and Wildlife Service. Little is known about the life history of mudpuppies, largely due to their cryptic nature, which makes them difficult to capture and study. In 2008, a train derailment into the Mississippi River 5 miles south of Guttenberg, IA provided the Iowa Department of Natural Resources (IA DNR) the opportunity to monitor two populations of mudpuppies through the derailment reclamation process. Beginning in 2015, IA DNR Fisheries initiated a mark-recapture project to assess mudpuppy health, survival, and abundance in the Upper Mississippi River. From 2015 to 2021, 283 mudpuppies were captured, PIT-tagged, and released with 90 subsequent recaptures. We used individual capture-recapture history to estimate annual survival, capture probability, and population abundance with robust design closed capture Huggin's models. To understand the influence of temporal and environmental factors on mudpuppy length and body condition we utilized a linear mixed effect regression model. We found differences in total length, body condition, survival, and abundance between the two monitored populations, and provide some of the only known demographic estimates for mudpuppy populations. Future work includes expanding capture-recapture efforts into Iowa interior streams and providing breeding structures to improve recruitment where mudpuppies are known to occur.

Assessing the Diet of Gray Foxes Using DNA Metabarcoding of Stomach Contents
Ashley Karas (Luther College), Shannon Schultz (Luther College), Geriann Albers (Indiana Department of Natural Resources), Brandon Bernhardt (Wildlife Ecology Institute), Tim Hiller (Wildlife Ecology Institute), Julia Nawrocki (Wildlife Ecology Institute), and Dawn Reding (Luther College)

Gray fox populations have been declining in the Midwest. Causes of the decline are unknown but may be linked to anthropogenic disturbances, habitat loss and fragmentation, changing mesocarnivore community structure, and disease. Diet can influence and be influenced by each of these factors, so a better understanding of diet composition could give insight into gray fox declines. Specific food items can be difficult to identify visually from scat and stomach contents. DNA metabarcoding, an approach that generates sequence information at a standardized gene region from a pool of genetic material to make taxonomic identifications, can be used to precisely identify food items in a recent meal (e.g., diet metabarcoding). We used diet metabarcoding of stomach contents to assess the food items consumed by 53 gray foxes collected primarily in the fall/winter from Indiana in 2019-2022. We used PCR amplification and Illumina sequencing of the trnl region of the chloroplast to target plants, COI region of the mtDNA to target arthropods, and 12S region of the mtDNA to target vertebrate prey. We detected plant items in nearly all (49; 92%) stomachs and vertebrate prey in most (33; 62%), but arthropods were less common (13; 25%). Plants with the highest frequency of occurrence included American persimmon (*Diospyros virginiana*) and members of the Poaceae family (grasses). Mice (*Peromyscus* sp.) and voles (*Microtus* sp.) were the most common vertebrate prey items, and members of the Noctuidae family (moths) were the most common arthropod prey detected. Several individuals showed evidence of consuming anthropogenic food items such as pet food with complex signatures of livestock and poultry

(cow, chicken, pig, turkey), grains (corn, wheat, peanut, soybean), and vegetables. Ongoing analyses will provide a detailed understanding of the diverse food resources of this species and how diet varies with season, sex, and site-specific characteristics.

Multiple Paternity in Wild White-tailed Deer Detected Using High-throughput Sequencing
Adam Koller (Luther College), Gabrielle Blair (Luther College), Thomas Litchfield (Iowa DNR), Chloe Beck (Luther College), and Dawn Reding (Luther College)

Effective management of white-tailed deer (*Odocoileus virginianus*) requires understanding social behavior and breeding structure. Recent genetic studies in captive deer exhibiting multiple paternity within litters have challenged the view that deer exhibit a strict dominance-based breeding hierarchy with few males siring most offspring. To identify whether multiple paternity is occurring in wild populations, we performed genetic analyses on tissue from 63 road-killed does and their 136 fetuses from compound litters (twins or triplets) collected 2013-2017 in Iowa. We used 2bRAD-sequencing, a novel approach for single nucleotide polymorphism (SNP) identification and allele scoring that is suitable for degraded samples. After successfully genotyping individuals from 62 litters at approximately 3,400 SNPs, we calculated pairwise relatedness values and 95% bootstrap confidence intervals (10,000 replicates) using NgsRelate and performed pedigree analysis with COLONY to identify full- and half-siblings. We found evidence of multiple paternity in 13 of 58 litters (22.4%) for which we were able to confidently establish sibship assignment (likelihood cutoff of 95%). 2bRAD was a viable and cost-effective option for genotyping degraded DNA samples from large mammals. Multiple paternity appears to be prevalent in wild white-tailed deer, indicating that mating opportunities are more widespread for males than previously assumed. Management policies should consider this new information on the mating system, and additional research should investigate variables influencing rates of multiple paternity.

Juvenile Invasive Carp Occupy Missouri River Off-Channel Habitats but not Tributaries
Eli J. Legacy (Iowa State University) and Michael J. Weber (Iowa State University)

Invasive carp are established throughout the Missouri River basin. However, the source of these adults is unknown, as juvenile invasive carp are rarely detected in the basin and it is unknown recruitment occurs within these systems. Between May – October 2022, we sampled 36 2nd – 5th order stream sites in 12 HUC8 watersheds in the Missouri River basin, Iowa using backpack electrofishing and seining. We captured 36,403 individuals of 43 species but did not collect juvenile invasive carp. We did capture seven adult Silver Carp in the Little Rock River on August 11th, two adult Silver x Bighead Carp hybrids in the Boyer River on September 18th, and eight adult Grass Carp - four in Turkey Creek on July 15th, three in Wolf Creek Ditch on July 19th, and one in the Floyd River on September 25th. We also sampled eight off-channel habitats along the Missouri River using backpack electrofishing, seining, clover-leaf minnow traps, and mini-fyke nets. We collected 33 species in off-channel habitats, including seven juvenile Silver Carp (mean TL = 70 ± 12 mm SD) at three sites (Lower Hamburg Bend Conservation Area in Atkinson County, MO, Big Bear Park in Thurston County, NE, and Schilling Lake Wildlife Management Area in Cass County, NE) during October. We collected five juvenile Silver Carp seine netting, one backpack electrofishing, and one with a mini-fyke net. Juveniles were detected in water <0.5 m with silty-sand substrates, little to no velocity, and little macrophytes, woody debris, and canopy cover. While we did not detect juvenile invasive carp in tributaries during 2022, larvae were collected, suggesting potential recruitment bottlenecks within these tributaries. Instead, most recruitment may be occurring within the Missouri River. We will repeat these sampling efforts in new locations during 2023 to be better able to identify key habitats for management.

Economic evaluation of barriers to minimize escapement of reservoirs sportfishes
Madeline C. Lewis (Iowa State University), John C. Tyndall (Iowa State University), Ben Dodd (Iowa DNR), Andy Otting (Iowa DNR), and Michael J. Weber (Iowa State University)

Escapement of fish over reservoir spillways or other water release structures can have a substantial role in regulating reservoir sportfish populations. Losing stocked fish due to escapement can be detrimental to the fishery, reducing the number of catchable fish present for anglers, and can have financial ramifications, as the resources put into raising the fish are wasted when fish are lost. Barriers can be an effective method for reducing escapement of reservoir sportfish; however, it is necessary to evaluate whether the benefits of a barrier will outweigh the initial cost of barrier construction and ongoing costs associated with barrier maintenance and repairs. Using discounted cashflow analysis we compare the benefits and costs of barriers for reducing sportfish escapement. We used data from two barrier construction projects in Iowa to quantify the value of fish lost due to escapement over time while accounting for temporal variability in escapement rates. We then compared the value of escaped fish to the cost of barrier construction and maintenance over time. Finally, we developed an interactive Shiny application to enable comparison and visualization of the costs and benefits of physical barriers under varying levels of escapement, fish production costs, fish survival, and barrier costs. Initial results

indicate that barriers can be a cost-effective option, particularly when barriers prevent escapement of large adult fish. Quantifying the value of escaped fish and barrier construction on an economic scale will enable the use of formal decision-making tools to address complicated and multi-faceted issues associated with reservoir fisheries management.

Laboratory Assessment of Parallel-Bar Barrier Spacing Effects on Reservoir Fish Escapement
Thomas P. Miles (Iowa State University), Ben Dodd (Iowa DNR), Madeline C. Lewis (Iowa State University), Andy Otting (Iowa DNR), and Michael J. Weber (Iowa State University)

Escapement of sportfishes over reservoir spillways can have negative effects on in-lake populations. To prevent escapement, managers have implemented physical parallel-bar barriers with 51-mm gaps on spillways in multiple states. Parallel-bar barrier gap spacing is modifiable, although there are no evaluations of how spacing influences the number or sizes of fish that escape. We evaluated the effectiveness of multiple bar-spacings [no-barrier, 25-mm, 51-mm, 76-mm (fingerlings only), 102-mm, and 152-mm (adults only)] on escapement of adult and fingerling Walleye *Sander vitreus* and fingerling Muskellunge *Esox masquinongy* using a controlled experiment. We placed ten adult Walleye (267-726 mm) or ten fingerling Walleye (156-267 mm) and ten fingerling Muskellunge (217-338 mm) into the upstream end of flow-through raceways for two-hours to test the barrier. Adult Walleye escapement averaged 82% without a barrier (control) and was reduced to 2% with a 51-mm bar-spacing and 0% with a 25-mm bar-spacing whereas 76- and 102-mm bar spacing did not reduce escapement. Fingerling Walleye escapement averaged 74% without a barrier and was reduced to 20% with a 25-mm barrier while fingerling Muskellunge escapement averaged 76% without a barrier and was reduced to 42% with a 25-mm barrier. Fingerling escapement was not reduced with any other bar spacing. Adult Walleye escaping the 51-mm bar spacing tended to be smaller in total length and body depth than those that escaped other spacings, but the effect was not significant. Our results indicate 25-mm and 51-mm gap spacings are effective at preventing adult Walleye escapement whereas only the 25-mm barrier reduced fingerling escapement. Parallel-bar barriers with spacings <51-mm could provide a valuable tool for reducing reservoir escapement, but our results in the lab should be validated in the field.

Assessing the Power and Precision of a Multi-Year Invasive Carp Larval Monitoring Program in the Upper Mississippi River
Annika Preheim (Iowa State University) and Michael J. Weber (Iowa State University)

Detecting changes in the abundance of aquatic invasive species across time and space is valuable for assessing population trends and creating management plans. While many monitoring programs focus on adult abundance, assessing changes in early life stages can provide insights into reproductive success that could translate into increases in population abundance. However, catches during early life stages are often highly variable. Thus, guidelines are needed on the percent change in catches that can be detected with current sampling protocols, along with the number of samples required for a desired level of precision. We evaluated the precision of invasive carp (Silver Carp *Hypophthalmichthys molitrix* and Bighead Carp *Hypophthalmichthys nobilis*) larval surveys using a seven-year database in the Upper Mississippi River basin. We captured invasive carp larvae in 74 of 4,399 larval tows. When invasive carp were caught, mean larval densities ranged from 0.3 to 478 fish/100 m3 (mean = 19 fish/100 m3, median = 2 fish/100 m3), with a mean variance of 31,134 (minimum = 0.4, maximum = 1,372,200). The existing effort of three tows per sample returned a coefficient of variation of the mean (CV) of 1.94, indicating a very low precision. Increasing precision to CV < 0.30, a number often recognized as the upper limit of acceptable variation, required an average of 126 tows (minimum = 35, maximum = 390) per site. To detect a 25% change in mean larval densities with a power of 0.80, an average of 4,269 tows (minimum = 1,194, maximum = 13,242) would be needed per site per year over five years. In contrast, a more feasible effort of 15 larval tows per site could only detect a mean population difference of 509% (minimum = 138%, maximum = 997%). Our results quantify the potential challenges of sampling for invasive carp larvae in rivers.

Annual Changes in Water Quality and Fish Community Structure Following Biomanipulation of Common Carp and Bigmouth Buffalo
Martin Simonson (Iowa State University), Michael Weber (Iowa State University), Grace Wilkinson (Iowa State University/University of Wisconsin), and Andrew Annear (Iowa State University)

We examined how common carp (*Cyprinus carpio*; hereafter carp) and bigmouth buffalo (*Ictiobus cyprinellus*; hereafter buffalo) biomanipulation through commercial harvest affects limnological variables and fish community metrics across six shallow, natural lakes of northwest Iowa using mixed effects models. Annual commercial harvest of carp ranged from 0–71 kg/ha; annual harvest of buffalo ranged from 0–356 kg/ha. Biomanipulation of carp and buffalo populations had little detectable effect on shallow lake ecosystems. Carp harvest was associated with decreases in soluble phosphorus and nitrogen concentrations but not total phosphorus or nitrogen. Buffalo harvest was unrelated to annual changes in nutrient concentrations but was associated with reductions in chlorophyll a and

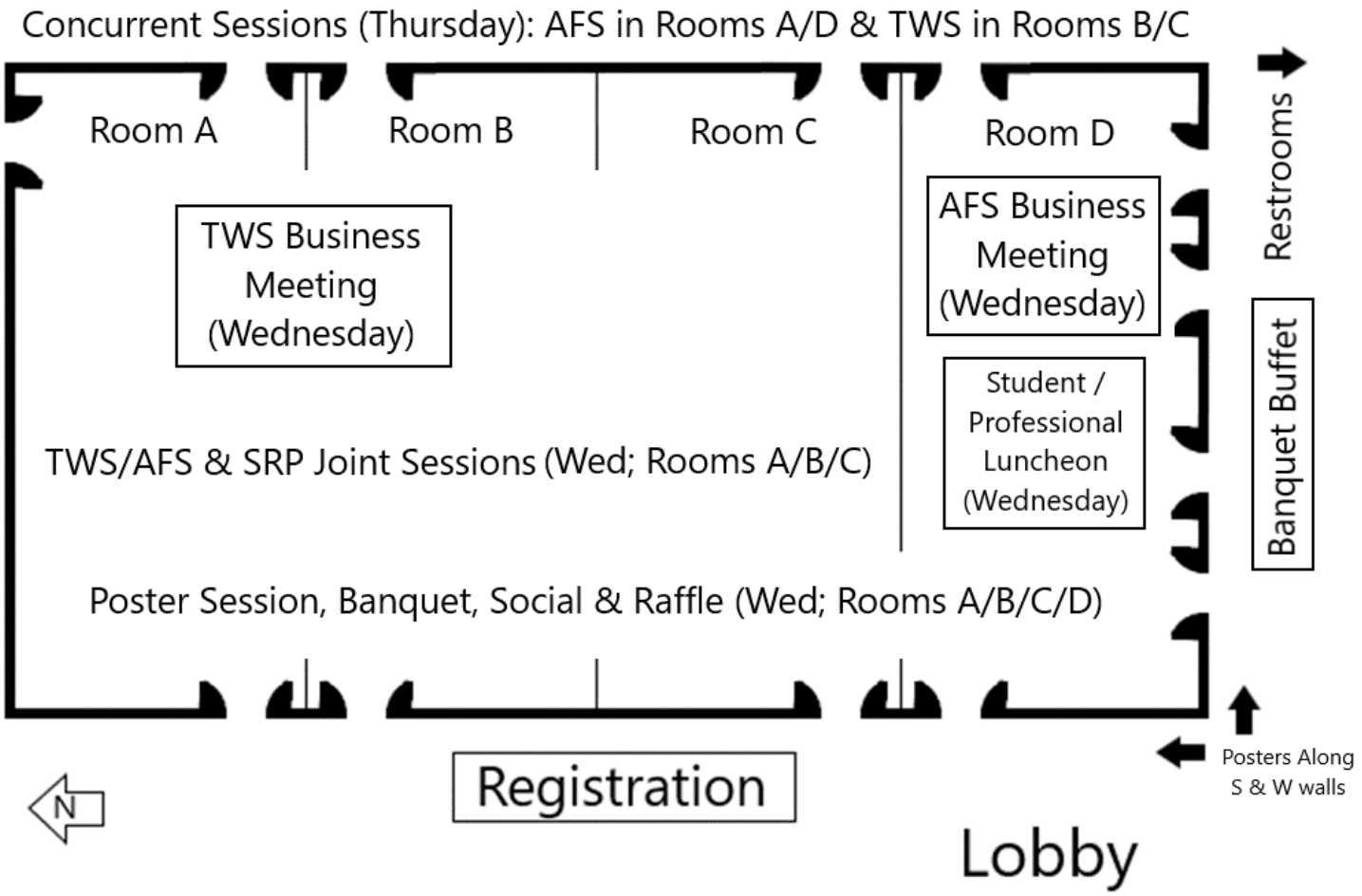
phycocyanin concentrations. Secchi disk transparency and total suspended solids were unrelated to carp and buffalo harvest. Carp harvest was associated with reduced biomass of large cladocerans but no other zooplankton biomass densities; buffalo harvest was unrelated to zooplankton biomass. Carp harvest was positively associated with black crappie (*Pomoxis nigromaculatus*) abundance but negatively associated with condition and unrelated to length; carp harvest was associated with increases in largemouth bass (*Micropterus salmoides*) condition. Buffalo harvest was negatively associated with black crappie abundance and unrelated to black crappie condition and length. Carp and buffalo harvest was unrelated to changes in all other indices of sportfish abundance, condition, and size distribution. Our results suggest harvest of carp and buffalo <71 kg/ha has little effect on abiotic and biotic ecosystem components on short timescales and highlights the challenges associated with shallow lake restoration.

A preliminary assessment of the chemical, physical, and biological condition of streams in the Volga River watershed
Rich H. Walker (Upper Iowa University)

Streams are inherently complex networks of interacting relationships among different environmental variables. By disentangling these interacting networks, stakeholders and managers can implement targeted conservation and best management practices geared towards protecting and enhancing the biological condition of streams. But this requires a comprehensive understanding of the chemical and physical factors that regulate populations and communities. The objective of this study was to evaluate the chemical (water quality and temperature), physical (substrates composition), and biological (fish and benthic macroinvertebrates) condition of streams throughout the Volga River watershed. My goal was to specifically focus on: 1) evaluating the status and trends of Slimy Sculpin (Cottus cognatus), Mottled Sculpin (Cottus bairdii), and Brook Trout (Salvelinus fontinalis) populations and 2) conducting an assessment of stream temperatures. Between July and October 2022, I conducted fish surveys at 9 locations in the Volga River Recreation Area and the Brush Creek sub-drainage. I collected ~1560 individuals across 33 unique fish species. Species richness ranged from 2 to 20 species across sites. The most abundant fishes were the Slimy Sculpin (200+ individuals; 1 site), Blacknose Dace (223; 2 sites), Central Stoneroller (173; 4 sites), Rainbow Darter (185; 5 sites), and Bluegill Sunfish (123; 1 site). I also deployed 64 HOBO® temperature loggers throughout the Volga River watershed between June and December 2022 with a data retrieval success rate of ~62%. My next goal will be to categorize each location into the different temperature classifications tiers (i.e., <65°F: very cold, 65°F¬–74°F: cold, 75°F¬–79°F: cool, >80°F: warm). These data will ultimately aid in: 1) better understanding the distributions of these fishes, 2) identifying the most important factors regulating fish and macroinvertebrates, and 3) stream temperature reclassification efforts in the Driftless region.

WhoseEgg: Classification software for invasive carp eggs
Michael J. Weber (Iowa State University), Katherine Goode (Iowa State University), and Philip Dixon (Iowa State University)

The collection of fish eggs is a commonly used technique for monitoring Silver, Bighead, and Grass Carp, collectively referred to as invasive carp. Genetic identification is the most trusted method for identifying fish eggs but is expensive and slow. Recent work suggests random forest models could provide an inexpensive method for identifying invasive carp eggs based on morphometric eggs characteristics. While random forests provide accurate predictions, they do not produce a simple formula for obtaining new predictions. Instead, biologists must have knowledge of the R coding language to manipulate the code to obtain new predictions, limiting the individuals who can use the random forests for resource management. We present WhoseEgg: a web-based point-and-click application that allows non-R users to access random forests via a point and click interface to rapidly identify fish eggs with an objective of detecting invasive carp in the Upper Mississippi River basin.



Breakfast buffet located in the hallway on Thursday morning 7:00-7:45 AM. Seating available in conference rooms A/B/C/D. Please take your breakfast to the room with the concurrent morning session you wish to attend or provide enough time to finish breakfast prior to talks beginning at 8:00 am.