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CHAPTERS OF AFS, SAF, & TWS

# BOOK OF ABSTRACTS

Conservation and Collaboration:  
Interdisciplinary Management of Natural Resources



**FEBRUARY 24-26, 2026**

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**10:40 AM Dylan Undlin**

Salmonid Movement and Habitat Use in Minnesota Tributaries to Lake Superior

**11:00 AM Jack Vannurden**

Acoustically conditioned bigheaded carp deter naïve fish from upstream passage

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Odibaabandamawaan odinawemaagana, Gaa-zagaskwaajimekaag adikamegwag “Looking in on our relatives, the Leech Lake Whitefish”

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Sturgeon Monitoring on the Lower St. Louis River

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**3:30 PM Greg Harris (Student)**

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**3:50 PM Spencer Rettler**

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**3:30 PM April Strzelczyk Haverstock (Student)**

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**3:50 PM Josh Bednar**

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**3:50 PM Grant Vagle**

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NOBODY SAID IT WAS EASY, NO ONE EVER SAID IT WOULD BE THIS HARD:  
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**3:30 PM Claire Rude**

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**3:50 PM Brian Herwig**

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**3:50 PM David Wilson**

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**Feb 26th Concurrent Session 4 (Thursday) 8:00-9:20 AM**

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**8:20 AM Logan Cutler**

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**8:40 AM Kamden Glade**

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**9:00 AM Calub Shavlik**

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**8:20 AM Keith Karnes**

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**8:40 AM Matt Petz Giguere**

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**8:20 AM Cam Mosley**

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**8:20 AM Devon Oliver**

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**8:40 AM Lynn Waterhouse**

Survival of the Fishes: Expanding the Poor-Recruitment Paradigm

**9:00 AM Peter Sorensen**

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**8:00 AM Katie Pfaff**

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**8:20 AM Charlotte Roy**  
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 When Conservation Becomes Overreach: Federal Natural Resources Acts as an affront to Indigenous Sovereignty

**8:40 AM Tim Mitchell**  
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**9:00 AM Dave Trauba**  
 Saving Wetlands, Shaping a Legacy: 75 Years of Minnesota’s WMA System

**Feb 26th Concurrent Session 5 (Thursday) 10:00-11:20 AM**

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**10:00 AM Anna Weesies**  
 Using Technology and Field Work to Identify and Describe Moose Use at Mineral Licks, Potential Ecological Traps

**10:20 AM James Forester**  
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**10:40 AM Michael McMahon**  
 Habitat Selection of Sympatric Bobcats and Fishers Contributing to Fisher Predation Risk

**11:00 AM Tyler Ahrenstorff**  
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**10:00 AM Alex Mehne**  
 One Tribe’s response to combat the threats of emerald ash borer and climate change to forested swamps around wild rice lakes

**10:20 AM Gabriel Miller**  
 A Tribe’s Climate-Adaptive Strategy for Emerald Ash Borer Mitigation of a Floodplain Forest within the Upper Mississippi River Basin

**10:40 AM Gene Mensch**  
 Untitled

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**10:00 AM Mike Reinikainen**

Adapting old tools for new challenges: silvicultural practices on Minnesota's state lands

**10:20 AM Marcella Windmuller-Campione**

Fire, Regeneration, and Stewardship of Minnesota's Northern Forests

**10:40 AM Michael Lynch**

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Connecticut Warbler at the Southern Edge: Population Declines, Range Retraction, and Conservation Priorities

**10:20 AM Stephen Nelson**

Golden-winged Warbler productivity and fledgling movement in young forest and shrub wetland habitats of northern Minnesota

**10:40 AM Michael North**

Woodpeckers and Their Aspen Habitat in Northern Minnesota

**11:00 AM Edmund Zlonis**

Status of Wood Duck Nesting Habitat in North-central Minnesota

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**10:00 AM Lisa Elliot**

Balancing Water Storage and Chinook Salmon Objectives Under Uncertainty: How Decision Analysis can Inform Resource Management Tradeoffs

**10:20 AM Brian Mason**

Reconnecting Rivers: Fish Barrier Removal and Culvert Assessment on the Pomme de Terre River

**10:40 AM Sean Gibbs**

A cost-effective approach using eDNA and habitat assessment to inform fish passage restoration in Sand Creek, Minnesota

**11:00 AM Tracey Anderson**

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30 Years of Blanding's Turtle (*Emydiodea blandingii*) Conservation Work at Camp Ripley Training Center

**10:20 AM Gaea Crozier**

Wood Turtle Conservation in Northeastern Minnesota

**10:40 AM Neil Slifka**

Wood Turtle (*Glyptemys insculpta*) Conservation Efforts in Southeastern Minnesota

**11:00 AM Heather Waye**

Patterns of variation in Western Painted Turtle body condition within and between years

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**10:00 AM Sue Colvin**

Mind the gap: Where Clean Water Act rulemaking fails to meet the science and legislative intent in defining waters of the United States.

**10:20 AM Andrew Gardon**

Taconite Mine Pit Water Discharges and Bioaccumulation of Methylmercury in Aeshnidae Larvae and Cyprinidae in the Dunka River (Babbitt MN)

**10:40 AM Paul Radomski**

Variation in Fish Mercury Contamination: Crafting Consumption Advisories

**11:00 AM Annie Bracey**

Use of Common Tern *Sterna hirundo* chick feathers and mercury isotopes to assess changes in methylmercury exposure and remediation effectiveness in an Area of Concern

## **Poster Session**

### **Methods Optimization for Identification of Pollinator Species**

Author(s): Madison Aberle and Sara Anderson

Presenter: Madison Aberle [dg3527iy@go.minnstate.edu](mailto:dg3527iy@go.minnstate.edu)

Affiliation: Minnesota State University Moorhead

The arthropod species native to Minnesota are vital for their pollination of wildflowers and agricultural crops and widespread contribution to our ecosystem. Typically, a taxonomist is required to identify these species, which limits monitoring efforts, but current technological advancements such as detecting genomes of pollinators, species can be identified by supplemental methods. This study aimed to optimize DNA barcoding to distinguish the bees and butterflies that are present at the MSUM Regional Science Center with aims to monitor arthropod presence and form a general understanding of pollinator biodiversity. Samples were collected from the MSUM Regional Science Center, along with local private gardens, to obtain DNA from various species of bees and butterflies. Flowers were collected at intervals during the growing season to create a greater picture of biodiversity. The samples were rinsed to remove insect cells from the flower's surface, then DNA was processed by two methods, one being full DNA extraction and purification followed by PCR, or two being direct PCR. The results of PCR and sequencing will be compared to determine the best method. We will compare species abundance, diversity, and presence of rare species among flower type and season. These results may be of interest to conservation and management agencies as a supplemental approach to monitoring species diversity.

### **Restoring the Land, Strengthening the Future: Tribal Strategies in Climate Resilience**

Author(s): Jerry BigEagle

Presenter: Jerry BigEagle [jerryb@uppersiouxcommunity-nsn.gov](mailto:jerryb@uppersiouxcommunity-nsn.gov)

Affiliation: Upper Sioux Community

Indigenous Tribes have long been stewards of the land, employing traditional ecological knowledge and modern conservation practices to build climate resilience. This presentation explores how Tribes are restoring ecosystems to mitigate the impacts of climate change through prairie restoration, oak savanna restoration, invasive species control, and habitat management. By revitalizing these critical landscapes, Tribes enhance biodiversity, improve carbon sequestration, and strengthen ecosystems against extreme weather events. Case studies will highlight successful restoration efforts, showcasing the integration of cultural values with science-driven approaches. Attendees will gain insight into the challenges, successes, and future directions of Tribal-led climate resiliency initiatives, emphasizing the importance of Indigenous leadership in environmental restoration and sustainability.

## **Evaluation of Grassland and Riparian Bird Population Trends at the MSUM Regional Science Center**

Author(s): Jayne Bucholz, Chloe Loch, and Chris Merkord  
Presenter: Jayne Bucholz [jayne.bucholz@go.mnstate.edu](mailto:jayne.bucholz@go.mnstate.edu)  
Affiliation: Minnesota State University Moorhead

Grassland and associated bird populations have experienced widespread declines across North America, yet locally relevant long-term datasets needed to inform management decisions remain limited. The Regional Science Center (RSC) in northwestern Minnesota is part of an actively managed conservation landscape of native and restored grassland and riparian forest that provides an opportunity to evaluate bird population trends at a management-relevant scale. The site was surveyed using standardized point count methods in 2018, 2019, 2020, and 2022, and this project proposes additional surveys during the 2026 breeding season, yielding an eight-year dataset suitable for trend analysis.

Previous work comparing RSC bird communities to a nearby remnant prairie surveyed in 1980 suggested substantial declines in several grassland and riparian-associated species, motivating a focused analysis of trends within the RSC itself. This study will assess population trends for three focal species: Grasshopper Sparrow (*Ammodramus savannarum*), a declining grassland specialist; Lark Sparrow (*Chondestes grammacus*), a species of conservation concern in Minnesota associated with oak savanna; and Baltimore Oriole (*Icterus galbula*), a riparian forest associate that is declining regionally.

Thirty-three established survey points will be resurveyed five times in spring 2026. Repeated visits allow estimation of detection probability and accommodate lower detection rates typical of undergraduate observers. Abundance will be estimated using binomial N-mixture models with year included as a covariate to assess population trends. Results will support ongoing management decisions by partners at the RSC, Minnesota Department of Natural Resources, and The Nature Conservancy, including prescribed fire, invasive species control, and habitat maintenance timing.

## **Ecological Effects of Commercial Spruce Top Harvesting in Minnesota's Boreal Forests**

Author(s): Sydney Bush, Dr. Sam Jones, Jeff Ueland  
Presenter: Sydney Bush [sydney.bush@live.bemidjistate.edu](mailto:sydney.bush@live.bemidjistate.edu)  
Affiliation: Bemidji State University

Abstract Commercial spruce top harvesting, the seasonal removal of terminal branches from black spruce (*Picea mariana*) for decorative greenery, has increased in northern Minnesota in response to a growing market demand. However, this practice is often considered low impact because trees are left standing and are assumed to be able to grow healthy tops again. Black spruce forests play a key role in Minnesota, supporting specialized plant communities, wildlife habitat, carbon storage, and hydrological regulation. These ecosystems may be particularly sensitive to repeated disturbance due to slow growth rates and site conditions. This study proposes to evaluate the ecological effects of commercial spruce top harvesting on black spruce stands in Minnesota through a comparative, field-based approach. Harvested sites will be compared with unharvested control sites to assess differences in tree growth, crown structure, regeneration, understory vegetation, and indicators of forest health. The research will also examine how harvest intensity, frequency, and site characteristics influence observed ecological outcomes. Data will be gathered and analyzed using drones and statistical methods that account for variability among sites and stand conditions. By addressing a lack in current literature regarding non-timber forest product extraction in boreal ecosystems, this research aims to clarify whether commercial spruce top harvesting constitutes a low impact practice or contributes to cumulative ecological change. Findings from this study will inform forest management and policy decisions in Minnesota and contribute to broader discussions of sustainable resource use in boreal forest landscapes.

## **Effect of Anthropogenic Masking Noise on Bluegill Sunfish Auditory Physiology**

Author(s): Drew Chilson, Brooke Vetter  
Presenter: Drew Chilson [chil5452@stthomas.edu](mailto:chil5452@stthomas.edu)  
Affiliation: University of St. Thomas

Anthropogenic noise is a pervasive feature of freshwater ecosystems and can mask biologically relevant acoustic signals, potentially altering sensory processing and behavior in fishes. Bluegill sunfish (*Lepomis macrochirus*), a common and ecologically important species in Minnesota lakes, frequently inhabit nearshore environments where motorboat noise is prevalent. This study used auditory evoked potentials (AEPs) to evaluate baseline hearing sensitivity and noise-induced masking effects in bluegill sunfish collected from lakes that differ in ambient noise levels. Bluegill sunfish were collected via angling from a lake with no motor use (Lake Sagatagan, Collegetown, MN), and a lake with frequent motor use (Upper Spunk Lake, Avon, MN). Thresholds were measured using the auditory evoked potential technique (AEP) in response to pure tones (80 – 600 Hz) under ambient conditions and in the presence of recorded motorboat noise (0.06–10 kHz at 150 dB re 1  $\mu$ Pa). AEP thresholds were defined as the minimum sound pressure level eliciting an evoked response exceeding background noise by two standard deviations. Baseline AEP tuning curves for bluegill sunfish showed greatest sensitivity at low to mid frequencies, with the lowest thresholds (~130–145 dB re 1  $\mu$ Pa) between ~200–400 Hz. Under masking conditions, AEP thresholds increased by 1 – 7 dB with the largest shifts between 200 – 300 Hz. These findings will improve our understanding of how anthropogenic noise alters auditory processing in freshwater fishes and may have implications for reproductive communication and population dynamics in heavily trafficked lakes.

## **Aspen Age Thresholds for Cavity-Nesting Wildlife**

Author(s): Samantha Jones, Brian Hiller, Michael R. North, Kaysie Maleski, Richa Dhakal  
Presenter: Richa Dhakal [richa.dhakal@live.bemidjistate.edu](mailto:richa.dhakal@live.bemidjistate.edu)  
Affiliation: Bemidji State University

Cavity-dependent wildlife, especially woodpeckers, merit special consideration in forest management. Quaking aspen is the most important nest tree for woodpeckers and in Minnesota it's typically managed on a 40-45 year rotation, yet its diameter growth rates are poorly known. A literature review and our own fieldwork found aspen in the 25-35 cm dbh range are particularly important for hairy woodpeckers, yellow-bellied sapsuckers and northern flickers, and aspen in the 40->50 cm dbh range are important for pileated woodpeckers, wood ducks, pine martens, and fishers. We cored 211 aspen trees from 18.2-63.5 cm dbh in the Agassiz Lowlands in the MHn44, FDn32, and FDn33 Native Plant Communities and read the cores in a lab under a microscope. Ages ranged from 30-104 years with numerous samples from trees 80-100 years old showing no heart rot at breast height. After 30 years, aspen grew at a rate of 0.41cm/year. Growth rates of these samples indicate that a 40-year rotation age would provide a minimal amount of aspen 25-30 cm dbh. A 45-year rotation age would not provide any trees over 40 cm dbh, while a 60-year rotation age would just begin to produce aspen suitable for fisher denning.

## **Surveying Tick Species and Associated Pathogens in Northwestern Minnesota**

Author(s): Riley Duppong, Gabriella Castro, Seema Mustafa, Dr. Emerson Towey

Presenter: Riley Duppong [bduppong@cord.edu](mailto:bduppong@cord.edu)

Affiliation: Concordia College

Tick-borne disease has tripled in the United States in the last decade. This increase is a concerning public health threat, especially in regions like northwestern Minnesota that are historically underserved by research and surveying. In Minnesota, the most common and medically relevant tick species is the American dog tick (*Dermacentor variabilis*). In the last half century, the black-legged tick (*Ixodes scapularis*), once confined to the southeast U.S., has been rapidly spreading northwest into Minnesota. Other species that present an increasing threat include the Brown Dog tick (*Rhipicephalus sanguineus*) and the Lone Star tick (*Amblyomma americanum*). This study aims to identify and map the most common tick species and tick-borne pathogens in northwestern Minnesota, with the end goal of communicating this data with the public. Ticks were collected from various field sites around northwest Minnesota or donated by locals. Each tick's species and pathogens were confirmed by qPCR, and data were tracked and analyzed using Excel and ArcGIS. This data will be publicly accessible through ArcGIS StoryMaps. Preliminary results show that in northwestern Minnesota, *D. variabilis* is the most common tick species, comprising over 75% of specimens. *I. scapularis* is also present, comprising the remaining 25% of specimens. So far, more than 50% of specimens tested positive for a variety of pathogens, including *Borrelia burgdorferi* (Lyme disease) and *Rickettsia rickettsii* (Rocky Mountain spotted fever). We anticipate this study will communicate crucial health data and help the public make informed decisions when participating in outdoor activities.

## **Exploration of the differences in larval thermal physiology and growth among populations of Coregonid fishes**

Author(s): Max Eagan, Ken Zillig, Gretchen Hansen

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Coregonines are essential fish in freshwater ecosystems, acting as indicator species for water temperature and dissolved oxygen (DO), and are a primary prey item for walleye, northern pike, and muskellunge. Seasonal changes and rising global temperatures negatively impact Coregonines. This raises the question of how varying temperatures and oxygen levels in rearing conditions affect growth rate and critical thermal maximum (CTMax). To test this question, larval fish from two populations, one from Lake Koronis, MN (KOR), and one from Jordan National Fish Hatchery (JNF), were placed into four different treatments: 12 °C Low Oxygen, 12 °C High Oxygen, 6 °C Low Oxygen, and 6 °C High Oxygen. Fish were removed from each treatment every week to test CTMax and measure fish length, and subsequently calculate growth rate. Within the JNF population, higher temperatures led to higher CTMax and a faster growth rate. Within the KOR population, the 12 °C Low Oxygen treatment had a significantly higher CTMax than the other treatments, suggesting that oxygen may play a role in CTMax performance. At the same time, the growth rate was conserved across treatments. Fishery managers can use this knowledge to understand how environmental change may stress local Coregonine populations, thereby mitigating its consequences and stocking lakes with the best populations for survival.

## **The flora and fauna of forested seasonal ponds of northern Minnesota, USA**

Author(s): Susan L. Eggert, Kathryn L. Hofmeister

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In northern Minnesota, seasonal ponds are overlooked ecosystems in northern forests due to their small size, variable hydrologic patterns, and close association with forested habitats. These characteristics along with the complexity of microhabitats within ponds allow a variety of microbes, plants, and animals to thrive. In northern Minnesota more than 120 species of trees, shrubs, perennial and annual forbs, sedges, and grasses are associated with ponds. Invertebrate taxa richness in ponds is high with more than 60 types of insects (dragonflies, damselflies, caddisflies, true flies, true bugs, and beetles), worms, leeches, clams, snails, mites, and other arthropods; a conservative estimate since most pond invertebrates are not identified to species. Three invertebrates (tadpole shrimp, clam shrimp, and fairy shrimp) are unique to seasonal ponds and are not found in any other aquatic habitat in Minnesota. Northern Minnesota ponds also serve as breeding habitat for six frog and salamander species and at least one waterfowl species (wood ducks). Species not yet rigorously documented include the algae, mosses, liverworts, fungi, microcrustaceans, reptiles, birds, and large mammals. Each species has a functional role in the interconnected terrestrial and aquatic food webs. Invertebrate species appear following a temporal succession and may not appear every year making the use of biological indicators an unreliable management tool. Since seasonal ponds are hotspots of life within forested landscapes, management decisions should consider the entire landscape as well as cumulative impacts that might affect the conservation of unique seasonal pond species.

## **Assessment of cellular repair mechanisms in slowly evolving gar fish exposed to ultraviolet radiation.**

Author(s): Luxia Feyereisen

Presenter: Luxia Feyereisen [lulu.feyereisen@gmail.com](mailto:lulu.feyereisen@gmail.com)

Affiliation: University of Minnesota - Twin Cities

DNA repair systems maintain genome stability, preventing the accumulation of harmful mutations and enabling species to adapt to environmental stressors such as ultraviolet radiation (UVR). Comparing repair dynamics across diverse taxa can help identify which lineages are more resilient to global disturbances and which are at greater risk. This information is useful for prioritizing conservation efforts and management interventions. Most conservation analyses focus on well-studied, visually attractive, or commercially important species, while disregarding undervalued or non-charismatic organisms. This bias creates knowledge gaps and increases the vulnerability of understudied species to environmental change, as they often receive less funding, management, and overall research. Researching cellular repair processes in genomically conserved, “ancient” species like gars (Lepisosteidae) provides a unique opportunity to understand how past and present lineages persist through changing environments. By studying the Shortnose Gar (*Lepisosteus platostomus*), a Minnesota native species, I will use controlled UVR exposure to (1) quantify DNA damage and repair kinetics of photoreactivation (PR) repair and nucleotide excision repair (NER) pathways, and (2) measure expression of key repair genes associated with each pathway. I will then compare these DNA repair patterns to existing data on other species. Understanding how these two systems operate in slow-evolving vertebrates could illuminate how different evolutionary pressures have shaped and modified repair mechanisms across time.

## **Roads to Atlantis: At the Intersection of Roads and Freshwater Mussels**

Author(s): Ryan Foley, Chris Smith, Jessie Schmidt  
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Affiliation: Minnesota Department of Transportation

The Minnesota Department of Transportation is responsible for managing and maintaining approximately 140,000 centerline miles of the State's roadways, including approximately 5,000 bridges. Occasionally, MnDOT projects requiring bridge maintenance or bridge replacements intersect with streams known to harbor state or federally listed freshwater mussel species. MnDOT biologists will share insights as to how MnDOT screens bridge projects for mussel survey needs, suggested improvements to the process, interesting survey results from past (2021 – 2025) mussel surveys, and upcoming (2026) MnDOT projects that will require mussel work.

## **Establishing a Baseline Inventory of Urban Sunburst Lichens as Indicators of Environmental Health in Moorhead, Minnesota**

Author(s): Kristina Barashkova, Lee Greve, Val Kukert, Lillian Ruhland, Chris Merkord  
Presenter: Lee Greve [oo1858op@go.minnstate.edu](mailto:oo1858op@go.minnstate.edu)  
Affiliation: Minnesota State University Moorhead

Lichens play a crucial role in the functioning of many terrestrial ecosystems, supporting complex food webs and pioneering harsh habitats. Baseline data on the diversity and distribution of urban lichens are limited in many regions, constraining the use of lichens as bioindicators. Lichens (Sunburst lichens (*Xanthomendoza* and *Xanthoria* spp.) are conspicuous and widespread in urban environments, yet their local occurrence and spatial patterns in Moorhead remain undocumented. This project proposes to create a systemic inventory of sunburst lichens in the parks and urban areas of Moorhead. This data will be critical for understanding local biodiversity and lays the basis for long-term population monitoring. Throughout the spring and summer, we will conduct meandering walk field surveys to document sunburst lichen occurrences in Moorhead's parks and urban areas. Observations will be recorded using a custom ArcGIS Field Maps application to capture precise geospatial locations and photographic records. Voucher specimens will be collected and curated in the Minnesota State University Moorhead herbarium to ensure accurate species identification and to provide permanent reference material. Project outcomes will include a georeferenced species inventory, distribution maps of sunburst lichens across the city, and curated herbarium specimens. The baseline inventory created will be a comprehensive record of the diversity and distribution of sunburst lichens in Moorhead, supporting future monitoring and the long-term goal of using lichen communities as proxies for environmental health in urban landscapes.

## **The Fall and Rise of a Richardson's Ground Squirrel Population: Using Translocation as a Supplement to Recovery**

Author(s): Caitlin E. Haasser, Maria C. Ramstad, Peter J. Weinzierl, Katie P. Waugh, and Joseph C. Whittaker

Presenter: Caitlin Haasser [chaasser@cord.edu](mailto:chaasser@cord.edu)

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Richardson's ground squirrel (*Urocitellus richardsonii*; RGS) is the second-largest ground squirrel in Minnesota. Living colonially, these squirrels play a significant ecological role as prey, and as ecosystem engineering through burrowing, soil cycling, and creating important habitat for a variety of species. Throughout Minnesota they have undergone significant population decline, and a large mortality event occurred during 2022 in one of the state's largest populations. Concerns regarding the long-term viability of this reduced and isolated population, has led to discussion of employing genetic rescue to help the population recover. Genetic rescue and translocation of individuals from outside the population are usually only considered with populations become critically low and endangered. However, recent research has supported the benefits of proactively using nearby populations, adapted to similar environmental conditions, to safely reinforce an at-risk population before they become critically endangered. To test the potential for translocation to help reestablish a healthy population, we live trapped two juvenile male ground squirrels at a private site and reintroduced them with radio collars to access the success of the translocation. After their translocation, their dispersal and establishment were tracked via radio telemetry. Location data were mapped to establish areas of movement for each squirrel. As a reference for these two relocated individuals, one resident squirrel was collared as well. The dispersal areas for the two relocated individuals were substantially larger than the area of the resident individual. In the future, we hope to conduct additional translocations, track movements, and monitor changes to the population.

## **EFFECTIVENESS OF WALLEYE STOCKING IN WINTER KILL LAKES**

Author(s): Tyler Haus, Andrew Hafs

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Affiliation: Bemidji State University

Winter kill events, marked by extensive fish mortality due to hypoxic conditions under the ice, are a common phenomenon in shallow eutrophic lakes, especially in the northern lakes in the northern United States. These events can drastically alter fish communities and often result in the elimination of top predators. Though these lakes will typically slowly bounce back to what they were in a couple of years. This study evaluates the effectiveness of walleye, *Sander vitreus*, stocking in lakes after a winter kill. For this study, four known winter kill lakes that are consistently stocked with walleye were studied. Pre- and post-winter kill walleye data were analyzed. Results showed that stocking did not significantly change the typical walleye dynamics in these lakes, walleye populations were not significantly affected by stocking after a winter kill. Further understanding of how every different ecological factor affects walleye stocking and walleye population dynamics will have a heavy influence on stocking decisions and how lakes are further managed. This study was to test a possible idea that could further improve these management decisions.

## **Wolf Conflict Prevention Methods in Minnesota**

Author(s): Bailey Hawkins, Dakota Bird  
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Affiliation: USDA APHIS Wildlife Services

U.S Department of Agriculture's Wildlife Services outlines nonlethal strategies for mitigating wolf-livestock conflicts in Minnesota, emphasizing proactive prevention to reduce livestock depredation while supporting wolf conservation.

Key methods highlighted include:

Permanent fencing, such as high tensile woven wire with ground aprons, proven effective in long-term operations enclosing thousands of acres.

Turbo fladry (electrified poly wire with flags) and scare devices (lights, noise maker) which can provide temporary deterrence.

Carcass compost enclosures, constructed of 6ft tall woven wire with a ground apron to prevent wolves and other predators from accessing livestock remains, reducing attraction/scavenging.

WS assistance available includes turbo fladry, permanent fencing, scare devices, composting enclosures, technical aid/assistance, loss prevention workshops, on-sight investigations, and recommendations tailored to producers.

These cost-effective, collaborative approaches demonstrate that proactive nonlethal implantation at problem sites can improve the coexistence between wolves and livestock producers.

The poster features MN WS forms of nonlethal assistance as well as a successful permanent fence example at Sheep Ranch which had over 20 years of verified livestock depredations due to wolves. There have been no depredations there since the fence was completed in 2024.

## **Bat Detection in Minnesota Urban and Rural Areas Using AudioMoth Recorders**

Author(s): Delia Denis, Makena Hedlund  
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Affiliation: Concordia College - Moorhead

With the rise in white-nose syndrome affecting the populations of bats, it is important to understand how frequently bats are being detected in an area. Knowing this frequency can aid in preserving and restoring habitats in which bats routinely use. This allows us to identify where bats live, hunt, and where white-nose syndrome would most likely spread. Mist netting is a common way to capture and identify bats in an area. However, this method is time consuming, stressful for bats, and requires specific, hard to get permits. Bat detectors, like mist netting, can also collect data regarding species richness. This method collects identification calls instead, and does not interfere with or distress the bats. This is achieved using AudioMoths, a recording device that detects bat echolocation. Bat echolocation has specific "swoops" that we can convert and visualize on spectrograms. Ultrasonic sound detectors collect bat call data, including social and feeding calls. This research helps to quantify bat calls in different landscapes in the greater Fargo/Moorhead areas. Acoustic recorders were placed at five locations, simultaneously, with differing landscapes across Clay County, Minnesota. They recorded from 8:30 p.m. to 7:00 a.m. for three nights for two weeks until frost occurred. The data collected suggests that location is a factor in determining the density of bat calls. The results suggest bat calls are denser in rural, forested areas near water in comparison to urban areas. This information provides insight into what environments to focus on in conservation to best help support bat populations.

## **Impacts of Eutrophication on Fish, Macroinvertebrate, and Mussel assemblages across aquatic ecosystems**

Author(s): Benjamin Hoover, Thomas Racette, Ruby Langr, Oluwafemi Oladejo, and Susan Colvin  
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Affiliation: Minnesota State University Mankato

Freshwater habitats occupy approximately 1% of Earth's surface, yet support 10% of all species. Eutrophication is one of the largest issues in aquatic ecosystems, it is the increase of primarily nitrogen and phosphorus, which can cause plant and algal blooms, and ultimately depletes oxygen. We will evaluate fish, macroinvertebrate, and freshwater mussel assemblages as they relate to each other and to water quality in headwater streams and rivers in southern Minnesota. Freshwater mussels are the most imperiled species group in North America due to habitat destruction, pollution, invasive species, and loss of host fish species. In Minnesota, 28 of 51 species are imperiled or of special concern. In this study, our objectives were to begin a resurvey of mussels in southern Minnesota rivers and identify possible locations for conservation and restoration. Dissolved oxygen, chlorophyll-a, and turbidity will be taken using a multiparameter sonde, while forms of nitrate and phosphorus will be analyzed in the lab. Macroinvertebrates will be sampled with a Hess sampler and D-nets. Fish will be collected with seines and electroshocking. Freshwater mussels will be collected with a thirty-minute search being done at each site. In Fall 2025 during pilot studies on the Le Sueur River we identified 7 species across 3 sites and found 1 active mussel bed. Live mussels present indicate a preponderance of highly tolerant species with one potential conservation site. A multi-taxa assessment will help us analyze the three different taxa groups and help to better comprehend stream health.

## **Crop Scouting Wheat and Soybeans in Northwest Minnesota**

Author(s): Jordan Hunnicutt  
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Crop scouting is a tool for assessing crops for potential risks and outcomes. Determining insect and disease presence, as well as overall plant health, in fields can guide decision making regarding insecticide and fungicide use. Scouting involved checking wheat and soybeans through observation and sweep netting. From May-July 2025, I scouted 25 wheat fields, volunteered by growers, and revisited each once in early August—a total of 125 visits, about 5 visits per field. From July-August 2025, I scouted 28 randomly selected soybean fields. Each field was visited on average once weekly. Scouting data was used to produce weekly maps that were posted online and farmers who volunteered fields received weekly emails. Aphids were the most common insect pest seen overall and were more abundant in soybeans than in wheat. However, they never exceeded the economic threshold of 250 aphids per soybean plant. The highest count was a field in Wilkin County with an average of 60 aphids per plant. This indicated to farmers that the aphid populations were a low risk and didn't require insecticide application in 2025. Tan spot and *Septoria* were the most prominent diseases in wheat. These fungal diseases thrive in the wet, warm weather that occurred during the scouting period. It is evident that scouting is a useful tool for gathering diverse data and information about crops. Crop scouting can be useful for recommending pesticides when needed and avoiding use when not justified. These results demonstrate the importance of routine scouting for Integrated Pest Management.

## **American Three-toed Woodpecker Nest Tree Selection in Black Spruce Dominated Forests of Northwestern Minnesota**

Author(s): Claire Jordahl

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Affiliation: Bemidji State University

The American Three-toed woodpecker is a somewhat inconspicuous bird that occurs in much of Canada, the Rocky Mountain range, and some parts of Eastern United States. Several detections have also been made in Northern Minnesota. The population abundance and trends of Three-toed woodpeckers are known to be relatively inaccurate and lack reliable data due to few confirmed sightings and inaccessible habitat. As part of ongoing woodpecker research, this study seeks to detect and monitor both individual Three-toed woodpeckers and breeding pairs that occur within the Red Lake Wildlife Management Area and Beltrami Island State Forest in Minnesota. This study will integrate data from previous confirmed sightings to paint a broader picture of the species' distribution in the northern parts of the state. One field season was completed in 2025, wherein two nesting pairs were detected and monitored to fledging. Following a second field season in 2026, data will be compiled and used to analyze nest tree selection characteristics (species, age, and diameter). The study also seeks to gain enhanced understanding of the quality and quantity of available habitat, considering that Three-toed woodpeckers tend to favor black spruce and other lowland conifer species for both foraging and nesting purposes in this area. Black spruce bogs occupied by these birds are highly susceptible to logging, climate change, and fire regime changes in northern Minnesota, and a better understanding of their use by Three-toed woodpeckers is needed to inform management techniques that will support their presence and ensure the longevity of their occurrences.

## **Effects of Latitude on Hybrid Sunfish Ratio Latitude**

Author(s): Maxwell Kattner, Dr. Andrew W. Hafs

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Hybrid sunfish of the *Lepomis* genus make up a generally small but notable portion of the population of sunfish in Minnesotan lakes. Hybrid sunfish play a significant role in freshwater ecosystems across the United States. They are both morphologically and behaviorally distinct in some ways and similar in other ways to their parent species, causing them to both fill and compete with their parent species for niches occupied by multiple *Lepomis* species. Despite this, the ratio of hybrid sunfish to their parent species has never been properly explored. This study observed if the ratio of hybrid sunfish to their parent species in over 900 lakes changed with latitude. The study gathered information from standard and targeted surveys performed by the Minnesota Department of Natural Resources. A regression test performed on the results found that there was not enough evidence to determine if changes in latitude led to a change in the hybrid ratio. Despite this, there was a significant rise in the hybrid ratio starting at the latitude of 44.6 before plateauing until 47.1 where it began to gradually fall. AIC scores provided evidence to suggest that the relationship between latitude and hybrid ratio was quadratic. Potential causes could be more spawning temperature overlaps or more suitable topography for hybridization in lakes between those latitudes.

## Space use and movement behavior among urban white-tailed deer during a controlled archery hunt

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Hunting is the primary management practice for limiting white-tailed deer (*Odocoileus virginianus*) population growth, but safety constraints in urban and exurban landscapes often restrict harvest to spatially isolated areas. Understanding how urban deer respond to the spatial and temporal distribution of hunting may improve the effectiveness of controlled archery hunting as a management strategy in urban areas. Our objective was to evaluate responses in movement metrics (home range composition, resource selection, and movement velocity) associated with hunting activity and determine whether responses change throughout the hunting season. We monitored GPS movement data from 20 female deer ( $\geq 6$  months old) during the 2024 hunting season and divided the study into 5 biologically and management-relevant periods: pre-hunt (15 Aug–14 Sep), early-hunt (15 Sep–19 Oct), mid-hunt (20 Oct–24 Nov), late-hunt (25 Nov–31 Dec), and post-hunt (1–31 Jan). We compared habitat composition of home ranges by constructing utilization distributions (UDs) during each temporal period using dynamic Brownian bridge movement models (DBBMMs). Differences in open and forested-habitat use were observed between hunted and non-hunted deer across periods. Similarly, we estimated resource use within the home range using step-selection models. We observed no differences among selection coefficients for habitat variables among the seasonal periods. Movement velocity differed between hunted and non-hunted deer across seasonal periods with hunted deer moving slower on average. Our results suggest urban white-tailed deer did not substantially alter their space use or movements in response to hunting, regardless of whether individuals were exposed to harvest within their home ranges.

## Largemouth Bass Diet Changes Through The Summer in Central Minnesota

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Largemouth Bass *Micropterus nigricans* is one of the most widespread fish species in the world, due in part to human introduction for angling. Largemouth Bass are opportunistic predators that will consume the largest prey they can often find; however, it has been shown that their diet mainly consists of invertebrates such as crayfish, with less focus on other fish species. This research aimed to determine what the Largemouth Bass diets in Central Minnesota consist of, and how they may change from the beginning of summer through the beginning of fall. A total of 174 Largemouth Bass were sampled from late May through late August from 19 lakes across Cass and Crow Wing County in Central Minnesota. There was not a significant change in overall fish and invertebrate consumption over the 3-month sampling period ( $p = 0.08$ ); however, there was a significant change in which fish species were consumed over time ( $p < 0.01$ ). Contrary to past research, Largemouth Bass in this study primarily consumed other fish species, especially Bluegill *Lepomis macrochirus* and Yellow Perch *Perca flavescens*, rather than invertebrates. These findings challenge previous studies, and the results provide greater insight into the diets of Largemouth Bass in a previously understudied region.

## Size Structure Comparison of Bluegill in Lakes With and Without Special Regulations

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Lots of individuals have mixed feelings about special regulations on certain lakes for all sorts of game fish species such as northern pike *Esox lucius*, crappie *Pomoxis* spp., largemouth bass *Micropterus nigricans*, sunfish *Lepomis* spp., and so on. One fish very commonly sought after by many across all of the United States are bluegill *Lepomis macrochirus*. For many people, whether professional, recreational, or simply the occasional angler, there is a likelihood they have kept a limit of sunfish, particularly bluegill, at least once in their lifetime. Bluegill are often deemed easy to find, catch, and clean. This study looks at three different categories of lakes, with each lake containing bluegill populations. One category is lakes with a 5 sunfish limit, another is lakes with a 10 sunfish limit, and lastly, lakes without any special regulations. This study provides valuable insight into the size structures of bluegill populations in ninety different Minnesota lakes. The observed differences in bluegill size structures in various lakes highlight the importance of considering the possibility of more implementation of special regulation for additional lakes statewide. Understanding the results illustrating bluegill size structures and special regulation efficacy can be important for informing management decisions and looking at implications of fisheries management in general.

### Characterizing the macroinvertebrate community in Crissy Lake, an impounded reach of the Pomme de Terre River prior to channel modification

Author(s): Max E. Lundgren, Tracey M. Anderson

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Affiliation: University of Minnesota Morris

The aging Crissy Lake Dam, on the Pomme de Terre River in Morris, has altered natural stream flow and impeded upstream passage of several fish species since 1939. The MNDNR intends to replace the dam with stone arch rapids and facilitate river channel formation upstream of the dam. In order to evaluate the river modification project, we characterized the macroinvertebrate community in Crissy Lake, the impoundment upstream of the dam before implementation of channel modification. In September 2025 we collected benthic macroinvertebrates from two sets of Ekman grab samples. We found 12 taxa (average richness = 5.9 per sample). Chironomids (51%), *Hyalella* (32%), and oligochaete worms (13%) were the most commonly collected group and comprised 96% of total abundance. These groups feed primarily on fine particulate organic matter (chironomids and oligochaetes) and coarse particulate organic matter (*Hyalella*), reflecting dominant food resources in Crissy Lake. Predators, mostly damselfly nymphs, comprised only 3.5% of abundance. The Crissy Lake macroinvertebrate community resembles that of prairie potholes in the area; few organisms characteristic of stream environments we collected. We predict that the community in this impounded stretch of the river will experience dramatic change after dam removal and associated channel modification, as it is eventually colonized by macroinvertebrates more adapted to lotic environments.

## **Chimney Swift Conservation in Minnesota: Using Community Engagement to Further Conservation Efforts**

Author(s): Mags Martin, Nicole Menard, Monica Bryand, Joanna Eckles, Mags Edwards

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Chimney Swifts (*Chaetura pelagica*) are an aerial insectivore bird that roosts and nests almost exclusively in human-made structures such as chimneys and smokestacks. Chimney swifts have experienced dramatic population declines in North America since the mid-20th century, likely due to chimney capping and removal of suitable nesting and roosting sites. The Twin Cities Urban Bird Chimney Swift group (CHSWG) (Minnesota) examined the suitability of free-standing towers (designed by the Kyles of Texas) for roosting and nesting habitat of Chimney Swifts. The Twin Cities hosts over 70 freestanding swift towers, built 10+ years ago during a conservation effort supported by Audubon chapters and civic groups. The CHSWG group examined if towers were still present, monitored, and used by Chimney Swifts. Nineteen towers were monitored in 2022 for nesting or roosting activity; no swifts were seen using these towers and landowners indicated they has seen no previous. Chimney swifts were seen during surveys and observed using masonry chimneys near free-standing swift towers. Our results were similar to findings by Wisconsin, Michigan, and Canada chimney swift studies. Based on these results, the CHSWG does not recommend construction of new free-standing towers and instead pivoted to focus on mapping and monitoring of known roosts and nests in the Twin Cities. We increased our focus on community engagement through community swift sits and developed a crowdsourcing survey tool to identify, map, and monitor existing nest and roost sites. We are engaging property owners to encourage preserving known roosts, recruiting volunteers to monitor new and historic roost sites, and expand public engagement of chimney swift conservation. By focusing our efforts in urban areas, we hope to reach new communities of birders engage communities in conservation where they live.

## **How Smart is a Smartphone? Comparative Accuracy of Camera Types Used in Morphometric Studies of Fishes**

Author(s): Grace McCullough, Dr. Cassandra Ford, Dr. Ken Zillig

Presenter: Grace McCullough [mccul332@umn.edu](mailto:mccul332@umn.edu)

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Morphometric research depends on accurate photographs, but it is unclear whether smartphone images are as reliable as those from standard DSLRs. The goal of this study was to determine if camera type affects morphometric measurements and whether photographer experience influences accuracy. Two fish species (n=10 of each) were photographed using five different cameras and multiple photographers with varying educational backgrounds. All images were landmarked in TPSdig and analyzed using a PCA and a test for morphological disparity. Camera type had no significant effect on the measurement of shape in our specimens, showing that smartphones performed as well as DSLR cameras. There were also no significant differences across individual photographers (regardless of familiarity with fish morphology), unless photographs were intentionally skewed. Finally, we were able to detect individual differences in morphology, specifically in the trout. These results show that smartphone cameras can reliably support morphometric research when basic image guidelines are followed, regardless of photographer experience or training. This finding highlights the potential for more community-science-based research and more accessible data collection in fisheries research.

## Protecting Coldwater Fish Habitat in Minnesota Lakes

Author(s): Michael McGuigan, Cam Mosley, Naomi Blinick, Denver Link, Kristen Blann, Gretchen Hansen

Presenter: Michael McGuigan [mogui622@umn.edu](mailto:mogui622@umn.edu)

Affiliation: University of Minnesota - Twin Cities

Coldwater habitat availability in lakes is critical for fish species like cisco, lake trout, lake whitefish, and other species that require cold, oxygenated waters to survive. Warming temperatures due to climate change and watershed disturbance from agriculture and urban development threaten the availability of suitable coldwater habitat in Minnesota lakes. There is high variability among lakes in their capacity to maintain coldwater habitat amidst these stressors, with some lakes being more resilient than others. Identifying and understanding the key factors that determine the effect of climate and land use change on coldwater habitat will allow scientists and resource managers to estimate habitat suitability and predict how it may change under future climate and land use change scenarios. This LCCMR-funded project will investigate coldwater habitat suitability and resilience in Minnesota lakes. I will develop a statistical model to predict coldwater habitat as a function of climate, lake, and watershed characteristics to identify lake-specific watershed protection targets, predict habitat suitability under future climate and land use change scenarios, and identify factors that influence the response of habitat suitability to these stressors. I will also monitor temperature and dissolved oxygen levels and conduct detailed assessments of lake and watershed characteristics on 16 Minnesota lakes to understand how coldwater habitat responds to precipitation events and to identify factors that drive climate resilience of this critical habitat in lakes. Lake-specific watershed protection targets which will be shared with resource managers and incorporated into an interactive web tool to display these targets across the landscape.

## Where the wild things are: A statewide survey for Minnesotan weasels

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Despite harvest data and winter track surveys indicating considerable population declines, little data exists about American ermine (*Mustela richardsonii*) and long-tailed weasel (*Mustela frenata*) spatial distributions and population density in Minnesota. Weasels are notably difficult to survey due to their small size, highly variable population densities, and high movement rates. As a result, there is little comprehensive information on site-specific habitat preferences and relative abundances of these species. Identifying both habitat associations and spatial distribution is a crucial first step in understanding the current status of Minnesotan weasels. We employed a statewide camera array to detect weasels across Minnesota. Specifically, our objectives are to determine the distribution of the 2 weasel species in Minnesota and identify biotic and abiotic factors affecting occurrence and relative abundances. We selected over 300 sites across all 10 ecological sections to survey for weasels. Each site consisted of two survey components: 1) external cameras and 2) camera survey boxes. We used image tagging software to identify weasel detections, and used tail length measurements to identify weasels to species. We surveyed 91 sites in Year 1, collecting ~780,000 image and video files, with weasel presence confirmed at ~20% of sites. Year 2 surveys are ongoing and include surveys at 184 sites. We will present summaries of weasels and other species detected, and provide a preliminary comparison of species-specific detection by camera survey method.

## **Examining the Suction Capabilities of Adult Sea Lamprey in Varying Water Velocities**

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Sea lamprey (*Petromyzon marinus*) are parasitic anadromous fish that have caused ecological harm to the Great Lakes since their introduction in the early 1900s (Shi et al., 2021; Morse et al., 2003). While physical barriers are the primary management tool used to restrict upstream spawning (Larson et al. 2003), Sea lampreys often bypass these obstacles by using oral suction to climb or stabilize themselves (Shi et al. 2021). Effective barrier design requires an understanding of lamprey attachment capabilities, yet the relationship between water velocity and suction strength remains under-researched. This study intended to characterize suction capabilities and duration of adult Sea lamprey in varying water velocities. Water velocity trials were conducted through test aquaria, under laminar and non-laminar flow types. Lampreys were monitored for detachment as water velocity incrementally increased, and suction duration was tested at velocities ranging from 0.85 m/s to 2.26 m/s. Results indicated no clear correlation between water velocity and attachment duration, suggesting suction persistence may be independent of velocities within this range. Similarly, body length, mouth diameter, and attachment orientation did not act as significant predictors of attachment duration. This suggests that Sea lamprey attachment tenacity may be governed more by individual physiological factors rather than by morphology or orientation. Establishing these suction capabilities of invasive Sea lamprey provides critical data to potentially aid future management efforts in the Great Lakes.

## **Arrowhead Collaborative: Shared stewardship for a healthier forest landscape**

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To address increasing challenges such as insect pest outbreaks, wildfire, shifting wildlife habitat, parcelization, and declining forest product markets at the landscape level across ownership boundaries, the Arrowhead Pilot Project was formed around 2016. As a result, multiple land management agencies, non-profit, tribal, and other organizations have partnered together to collaboratively manage an approximately 545,000-acre landscape Pilot Region in northwestern St. Louis County. Members of the Arrowhead Collaborative have delineated the Pilot Region, determined shared goals, selected two ~10,000-acre focal management blocks, developed detailed landscape management plans for each focal block, discussed and shared GIS data to coordinate cross-boundary management, and applied to and were successfully awarded a Conservation Partners Legacy (CPL) grant by the State of MN to perform wildlife habitat improvement and fuels reduction work near Crane Lake, MN, with another CPL grant application in the works. Collaborative members are also working to coordinate targeted outreach about woodland management, forest stewardship plans, and cost-share programs to private forest landowners including those with properties adjacent to planned projects on public lands.

## **The Importance of Museums for Education and Research**

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Natural history museums play a critical role in advancing wildlife education and scientific research by preserving biological specimens and making scientific knowledge accessible to students and the public. Museums' extensive collections provide opportunities for long-term records of biodiversity that enable researchers to investigate evolutionary change, species distributions, and environmental impacts across time. These collections serve as invaluable resources for understanding past and present ecological patterns and informing future conservation efforts.

In addition to their research value, museums function as important educational centers. Through exhibits, hands-on and experiential learning opportunities, museums enhance student understanding of ecology, evolution, conservation biology, and many other fields. Direct engagement with real specimens allows students to develop practical skills, strengthen critical thinking, and explore career pathways in wildlife science, conservation, and museum studies. Museums also play a key role in public education by translating complex scientific research into accessible exhibits, outreach programs, and community initiatives.

The Elsie Welter Natural History Museum at Concordia College exemplifies this mission through its extensive specimen collections, public outreach efforts, specimen salvage program in collaboration with the Bell Museum of Natural History, and contributions to the Minnesota Biodiversity Atlas. These initiatives support both student learning and public engagement while promoting regional and global biodiversity awareness. Public involvement through volunteering, internships, and citizen science is essential to sustaining museum research and educational programs. Together, museums, students, and community members contribute to long-term conservation efforts and the preservation of biodiversity for future generations.

### **Multi-taxa Responses of Fish and Birds to Water-Quality Gradients in Shallow Prairie Lakes of Southern Minnesota**

Author(s): Oluwafemi Oladejo, Dan Hart, Louis Magers, Ruby Langr, Bekalu Tiruneh, and Susan Colvin, PhD

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Shallow prairie lakes in southern Minnesota are prone to nutrient enrichment, reduced water clarity, and biological degradation due to intensive agricultural land use. The effects of these stressors can cascade through trophic levels within, yet multi-taxa responses to water quality are infrequently studied. During summer 2025, we evaluated relationships between water quality and fish assemblages across four lakes in southern Minnesota (Duck, George, Long, and Mills). We additionally began exploration of how these patterns may extend to avian communities. Dissolved oxygen, temperature, pH, chlorophyll a, conductivity, and turbidity were measured using a multiparameter sonde, while total phosphorus, orthophosphate, and nitrate were analyzed in the laboratory. Fish assemblages were sampled using gill and seine nets. Fish species richness ranged from 7 to 9 species across lakes, but preliminary data suggest assemblage structure differed across some water quality gradients. Bluegill and Carp were the most frequently captured species. Although sample sizes were limited, the proportion of bluegill appeared to increase with turbidity. In our pilot avian survey, some bird species of Special Concern in MN (i.e., Purple Martin *Prognis subis*) were observed, suggesting lakes with poor water quality may still provide important avian habitat. Future work will expand water quality, fish, and avian sampling across 15 lakes during summer 2026 to extensively evaluate multi-taxa responses to water-quality gradients in shallow lakes.

## **Demographic Factors and Water Quality**

Author(s): Danielle Otto and Dr. Susan Colvin  
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The intent of the 1972 U.S. Clean Water Act (CWA) was to restore and maintain the chemical, physical, and biological integrity of the nation's waters and achieve fishable and swimmable lakes, rivers, and streams. These important goals are not always met when it comes to the water quality of our streams and rivers all over America. This insufficiency not only affects the people of America but also the environment. Poor water quality affects the health of all organisms that use that waterbody. Minnesota, known for its abundance of water, is not an exception to having poor water quality, and this is reflected in the 303-d list nationally along with other states, but many of our nation's waters lack assessment. For this study, we focused on possible demographic factors that could relate to reasons why waters go unassessed. We use census statistics and the EPA's "How's My Waterway" site to gather data reflecting water quality and demographics. We used a backwards step regression to identify the most statistically significant demographic variables related to unassessed river miles. The only significantly negatively related factor was population density ( $p=0.04$ ). As well as only about a quarter of streams and rivers nationally being assessed. The next step would be to increase assessment of the streams and rivers, and additionally find ways to avoid urban stream impacts and other water quality impairments as populations rise.

## **Recent spruce budworm defoliation and susceptible forests in Minnesota**

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Spruce budworm (*Choristoneura fumiferana*) is a native caterpillar that frequently erupts into outbreaks in Minnesota in areas heavy to older balsam fir and white spruce. We mapped defoliation and mortality from this insect on 1.37 million acres from 2021 through 2025, centered mostly in eastern Lake and western Cook counties. We show that outbreaks affected areas immediately to the west of the most current outbreak in stepwise fashion from 2022–2025 to 2014–2019 to 2005–2012 to 1998–2003. Dead and dying balsam fir and white spruce serve as fuel for wildfires. Stocks (1987)<sup>1</sup> found that wildfire potential due to spruce budworm impact was maximized 5–8 years after balsam fir died from spruce budworm defoliation, which would have been the case for the 2021 Greenwood Fire and 2025 Camp House Fire, and it would have been very close for the 2025 Jenkins Creek Fire. We show areas of defoliation marching west to east across Minnesota's Arrowhead from 1996 to 2025. In anticipation of a continued eastward trajectory of spruce budworm outbreaks, we used Lidar-derived inventory to display fir and spruce-dominated forests that are at high risk for mortality and wildfire starting in 2028.

## **Grazing Intensity and Its Effects on Soil Nutrients and Wildlife Habitat at Darakuta Ranch, Tanzania**

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Livestock grazing has a significant impact on soil nutrient composition, which in turn has cascading effects on vegetation, agricultural practices, and ecosystems. At Darakuta Ranch, Tanzania, traditional Maasai cattle practices are employed, with Sakuma cows grazing on dedicated pastures. This study examined the environmental impacts of these cattle on two different pastures. One pasture, a recently established site in January 2024, had been exposed to intensive grazing, and an older pasture had remained largely undisturbed for two years. The aim was to evaluate how grazing duration and intensity affect soil nutrient levels, particularly nitrogen, phosphorus, potassium, and pH levels. To evaluate the soil health, soil samples were collected using a 6-inch soil probe and analyzed using Rapitest soil test kits. The results indicated lower nutrient levels in the newer pasture, with nitrogen and phosphorus frequently showing depletion. In contrast, the older pasture presented higher nutrient concentrations. Prolonged exposure to livestock manure appeared to enhance soil nutrient content over time, potentially supporting stable ground cover and food resources for wildlife. However, unmanaged nutrient accumulation may pose environmental risks through nutrient runoff into surrounding ecosystems. Soil compaction in the newly grazed pasture likely restricted water infiltration, aeration, and nutrient cycling. This can contribute to increased erosion and diminished habitat quality for insects and grazing wildlife. These findings underscore the importance of regulating grazing intensity and duration to maintain soil health, agricultural productivity, and wildlife habitats. Further research should refine sampling and explore additional factors that may influence nutrient dynamics in grazing systems.

## **Anticoagulant rodenticide exposure in Minnesota carnivores: current results and future directions**

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Anticoagulant rodenticides (ARs) are commonly used to control rodents in agricultural, residential, and commercial settings. ARs are long lasting chemicals that disrupt an animal's ability to produce clotting factors causing sublethal and lethal effects based on the accumulation in and resistance of an individual. Importantly, these effects are not restricted to the target species and secondary or tertiary exposure to ARs has been shown in terrestrial carnivores. Where studied, AR exposure prevalence in carnivores is shockingly high. Given recent research elsewhere, data are needed to evaluate AR exposure in Minnesota's carnivores, establish a baseline to determine if rates increase or decrease over time, and evaluate individual- and population-level effects of exposure. We are conducting a study to evaluate AR exposure in bobcats (*Lynx rufus*), and fishers (*Pekania pennanti*) in Minnesota. Our specific objectives are to: 1) evaluate AR prevalence in these species, 2) evaluate biological and environmental factors influencing AR exposure, 3) map AR exposure risk to carnivores throughout the Minnesota landscape based on risk factors, and 4) evaluate the negative effects of AR exposure on carnivores by examining population trends, disease presence, and body condition correlations with AR exposure. We have collected 172 liver samples from fisher and bobcat carcasses and sent them to a laboratory for toxicological analysis to determine presence of 11 AR compounds. We are using GIS to evaluate risk factors for AR exposure. We will present preliminary results and future directions.

## **Comparison of Calcified Structures to Estimate Ages of Northern Pike *Esox lucius* in Various Lakes.**

Author(s): Kaed Rauk, Andy Hafs  
Presenter: Kaed Rauk  
Affiliation: Bemidji State University

Northern pike *Esox lucius* are a dominate predatory fish in many systems. They can have large impacts on the ecosystems they inhabit and are a popular game fish for many anglers. Northern pike are a difficult species to get accurate age estimates for. This study aims to compare calcified aging structures to determine trends and find which structure gives the most accurate age estimates. Northern pike were sampled and multiple structures from each fish were aged by multiple readers, a total of 119 fish were sampled. Coefficient variation (CV) was calculated for each structure. Sectioned sagittal otoliths are expected to exhibit the lowest CV, whereas cleithra are expected to have the highest CV. The results for this study are currently pending aging of structures, this will determine which structure is recommended for aging northern pike.

## **Movement and Habitat Use of Brook Trout During Changing Flow Regimes & Population Characteristics and Dynamics of Trout in the Knife River Watershed**

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The movements of North Shore trout were relatively unknown in the past with most accounts coming from anglers. There has always been speculation as to where trout along the North Shore go during the warm summer months since many rivers lack cold, groundwater inputs crucial for the growth of trout. The "Trout and Salmon Movement Study" along the North Shore aimed to assess this question. Data was collected on the local salmonid populations to better understand how changes in thermal refugia and flow regimes impact habitat utilization. For this study, three species of trout (brook, brown, and rainbow/steelhead) were selected to be sampled in the Knife and Stewart Rivers. The listed species received PIT tags for movement purposes and radio tags were implanted in a subset distributed throughout the two watersheds. Sampling took place from spring of 2024 to early fall of 2025. Main objectives during the project were to understand how trout use coldwater refugia during times of thermal stress, how their movements are impacted by flows, and assess seasonal movement patterns. Distribution of species when sampling via backpack-electrofishing was also impacted by temperature with more even dispersal of trout in early summer, in contrast to later summer, where deeper pools allowed for habitat of adult trout, seeking thermal refuge and cover. Sites that were dominated by gravel-cobble substrate with pools accessible to trout, generally had the highest populations sampled and were likewise habitats utilized by the radio-tagged trout. During the study, we found that temperature is a main driver of movement with largest watershed-scale movements occurring from trout that were sampled in the lower section of the Knife River, seeking thermal refuge in the headwaters. Trout that were sampled in the headwaters seemed to make less drastic movements due to more coldwater inputs and canopy cover. Overall, data has shown positive impacts from habitat restoration that utilizes boulder-made pools and gravel substrate, with the highest number of trout sampled at these sites. Headwaters, upstream sections, and tributaries of the main rivers were crucial to habitat for adult and juvenile brook trout in the late summer during times of thermal stress. Future management implications could be done to protect these areas that are now known to be "hotspots" for habitat selected by trout. Ensuring forest around areas of habitat stay intact, preventing streambank erosion, and creating suitable habitat for trout to spawn and live will be crucial in the future for the sustainability of North Shore salmonid populations.

## **Comparing Uncrewed Aerial Vehicle (UAV) and Autonomous Recording Unit (ARU) Surveys for Detecting Waterfowl and Marsh Birds in Cattail-Dominated Seasonal Wetlands**

Author(s): Nicholas C Rush, Jacob C Fischer, Sophie Wieland, Megan Fitzpatrick, Edmund Zlonis, Susan Ellis-Felege

Presenter: Nicholas Rush [nicholas.c.rush@und.edu](mailto:nicholas.c.rush@und.edu)

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In recent decades, non-native cattails (*Typha angustifolia* and especially the hybrid *T. x glauca*) have proliferated across the Prairie Pothole Region (PPR), forming dense monotypic stands that reduce open water and degrade habitat for waterfowl and secretive marsh birds. Non-native cattail creates a tall, visually obstructive “wall” of emergent vegetation that complicates traditional ground-based point counts and can lead to under-detection of birds that remain concealed or vocalize infrequently. Our goal was to assess the effectiveness and detection probabilities of autonomous recording units (ARUs) and uncrewed aerial vehicles (UAVs) for surveying birds in cattail-dominated wetlands. From May-June 2025, we conducted 39 surveys at 28 seasonal wetlands in western Minnesota across state lands. Each wetland received a Wildlife Acoustics Song Meter Micro 2 ARU at its center, programmed to record periods of diurnal choruses and nocturnal activity. Recordings were processed using the BirdNET classifier and validated in RStudio to generate standardized detection histories. Each wetland also received 1-2 UAV transect surveys (45m AGL; 2m/s) using a DJI Matrice 300 collecting paired infrared (IR) and electrical optical (EO) imagery. IR detections were confirmed with EO to identify species and when possible, sex and social groupings. We compared detection histories between methods to quantify relative performance and found ARUs appear better than drones at detecting species, but UAV offer count data not available from ARU surveys. An integrated ARU-UAV approach offers opportunities to improve inference and monitoring guidance on waterfowl and marsh bird use of structurally complex or cattail-dominated PPR wetlands.

## **Giant Liver Fluke (*F. magna*) and Brain Worm (*P. tenuis*) Prevalence in the White-tailed Deer Population of NE Minnesota**

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The moose population in Minnesota experienced a significant decrease in population size between 2006 and 2013 due to multiple factors including climate change, predation, parasites, and other health issues. Two parasites of concern, giant liver fluke (*F. magna*) and brain worm (*P. tenuis*), are known to have adverse and sometimes lethal effects on moose, a dead-end host for these parasites. It is estimated that about 25% of moose in Minnesota die due to a brain worm infection. Since 2016, the 1854 Treaty Authority has monitored the infection rate of these two parasites in the white-tailed deer population that resides within moose range and spreads the parasites to the moose population. Our study aims to track the parasite prevalence in the primary host, white-tailed deer, to document trends in prevalence and distribution of these parasites over time in moose range. Using deer pellets collected in winter, we can analyze the sample for giant liver fluke eggs using a Fluke Finder and find brain worm larvae using a modified version of the Baermann Technique. Since 2016 we have collected and analyzed 1,072 samples with an average infection rate of 26% for the giant liver fluke, and an average infection rate of 58% for brain worm in white-tailed deer.

## **Prevalence and Polymer Composition of Microplastics in the Prairie Pothole Region of North Dakota**

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Affiliation: Concordia College at Moorhead, MN

Concern about microplastic (plastic fragments and fibers <5mm) pollution has grown in recent years due to its large unknown impacts on the environment. This study investigates the prevalence and composition of microplastics in the Prairie Pothole Region of North Dakota. Three water samples were collected in three different potholes within each of four Wildlife Management Areas (WMAs), resulting in a total of 36 samples. Samples were filtered alongside a control to account for contamination. Suspected microplastics were identified using a dissecting microscope, and polymer composition was identified using infrared (IR) spectroscopy. A total of 173 suspected microplastics were observed, with 136 particles viable for IR spectroscopy. Overall, microplastics comprised 95.6% of the 136 analyzed particles. The majority of the identified microplastics (91.5%) are suspected to be aged polyethylene (PE) due to exposure to UV light and an oxidative environment. Additional polymers were detected, including polyethylene terephthalate (PETE), ethylene-vinyl acetate (EVA), polymethyl methacrylate (PMMA), and nylon. Black was the most common particle color (42.2%), followed by blue and red. Microplastics were detected in every pothole that was sampled, with Knox Slough WMA in Benson County, ND, having the highest microplastic abundance. The majority of the polymers identified are used in very common, single-use products that are prevalent pollutants in the environment. Identifying the sources of these microplastics can support management and mitigation efforts aimed at reducing the use of single-use plastics and limiting further contamination of prairie wetland ecosystems.

## **Diversity and Ecological Roles of Pupil Shapes in Freshwater Fishes**

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Pupil shape plays a pivotal role in visual ecology. Studies on mammalian herbivores, anurans, and snakes have documented wide diversity in pupil shapes and established linkages between pupil shape and ecological niche. However, systematic assessment of pupil shape diversity in fish is limited. This study investigates interspecific variation in pupil shape and its relationship with feeding groups across seven freshwater fish families, including: Acipenseridae, Catostomidae, Centrarchidae, Clupeidae, Cottidae, Leuciscidae, and Cyprinodontidae. Together, these surveyed families represent over 60 genera, 300 species, and approximately 1000 photographic records of individual fish specimens. This study surveyed image-based records from online platforms (e.g., iNaturalist, Joel Sartore's Photo Ark, state and federal agency sites), field guides, and primary literature. In addition, feeding group assignments were made using the open source FishTraits Database. For each species, a minimum of three and a maximum of five individual images were assessed. Species-level pupil shape was assigned using a majority rule, whereby a shape was recorded if at least two of three individuals shared the same form. A total of six pupil shapes were identified. Among families, Leuciscidae exhibited the greatest diversity of pupil shapes, while Centrarchidae and Clupeidae showed the lowest diversity. Chi-square tests revealed a significant association between pupil shapes and feeding groups. Additionally, specific shapes showed consistent tendencies toward particular feeding groups. Notably, pupils with vertices in the anterior position tended to be associated with stream predators. These results highlight the diversity in pupil shape and their functional association with foraging strategy and habitat use in fishes.

## **Turtles in Trouble: Adding Passive Use Values to the Toolkit**

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Turtles are among the most imperiled groups of vertebrates, and roads play a disproportionately large role in recent population declines. Effective solutions are well documented, and include wildlife fencing and underpasses, but adoption by transportation agencies at scale has been slow due, in part, to costs associated their installation and maintenance. New research on passive-use values of turtles helps inform cost-benefit analyses of countermeasures that reduce turtle road mortality and provides a renewed opportunity for road ecologists and regulatory agency staff to engage with transportation planners and engineers.

## **BODY SIZE AND GEOMETRY PREDICT ZOOPLANKTON SURVIVAL TO AIR EXPOSURE**

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Dormant life stages of freshwater zooplankton are typically resistant to environmental exposure, and this facilitates overland dispersal. However, environmental exposure and overland dispersal are less well understood for active life stages. To characterize empirically the longevity of active life stages out of water, survival time to air exposure was measured in the laboratory for seven cladoceran species using heartbeat cessation to signify survival time. Survival time increased with body dry weight with an allometric scaling exponent near  $2/3$  in both a single-species model with *Daphnia mendotae* and a multispecies model with five bivalved species that included *Bosmina longirostris*, *Acroporus harpae*, *Ceriodaphnia dubia*, *D. mendotae*, and *Daphnia magna*. The  $2/3$  scaling exponent is consistent with Euclidean geometry and points to water loss across the surface of a spherical body as the cause. Survival time of a 6th species, *Holopedium gibberum*, was 618% longer than predictions based on the multispecies model, likely due to its gelatinous mantle. Survival time of a 7th species, *Bythotrephes cederstroemi*, was 58–83% shorter than predictions based on the multispecies model, likely due to its lack of a bivalve carapace. The longest survival time of an individual was 225 min (*H. gibberum*). We share a conceptual model of how body size may predict overland dispersal capacity of zooplankton active life stages.

## ASSESSMENT OF YEAR-CLASS STRENGTH OF LAKE WHITEFISH IN TEN MILE LAKE, MINNESOTA

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Lake Whitefish (*Coregonus clupeaformis*) are a cold-water species that are important bioindicators for evaluating aquatic ecosystem health and quality. Lake Whitefish provide significant ecological, economic, and recreational importance across northern North America, but especially in the Laurentian Great Lakes. Ten Mile Lake, MN, provides an interesting opportunity to study a high-quality inland population that has been relatively unexploited. The objective of this study is to assess the year-class strength of lake whitefish in Ten Mile Lake utilizing age and growth data. Assessing year-class strength provides fisheries biologists with critical insight into fish population dynamics and recruitment variability. A total of 145 specimens were collected by the MNDNR in August 2020 using standard gill nets deployed between 85–115 ft. Age determination was conducted through otolith readings under a microscope. Age-frequency distributions and year-class strengths were modeled to identify recruitment, and variability was assessed using the coefficient of variation. Growth was depicted using the von Bertalanffy growth function to model cohort-specific growth patterns. Results indicated that there was a total of 53 year-classes present, representing cohorts from 1960 to 2016. Results revealed a diverse age structure, indicating multiple coexisting cohorts, with various years being stronger than others. By identifying strong and weak year classes, it provides biologists with insight into recruitment variability. Identifying patterns in recruitment leads to identifying the environmental and biological factors that come into play and affect the early growth and survival of lake whitefish. These findings provide valuable information to help guide conservation efforts and practices in protecting the environmental and biological inhabitants.

### **Relationship Between Richardson’s Ground Squirrel Burrow Condition to Population Size**

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Richardson’s ground squirrels (RGS, *Urocitellus richardsonii*) are the largest ground squirrels in northwestern Minnesota prairies and their burrow placement and grooming may have significance regarding population size. Previous research has indicated that ground squirrel burrows are generally placed near visual obstructions. Additionally, the condition of burrows varies over time and use. Our research sought to determine the significance of burrow attributes and their relationship to population size. We used global navigation satellite system (GNSS) devices to plot burrow location data on ArcGIS field maps. We collected data about vegetation height, thistle presence, hole diameter, opening direction, and hole condition in three sites around Minnesota with previously estimated population sizes of RGS (Site 1: 23 RGS, Site 2: 21 RGS, and Site 3: 14 RGS). Data for 761 holes was collected from the three sites and JMP was used to determine data significance in comparison to population size. Groomed burrow sites were significantly more abundant in site 1 compared to the other sites indicating a relationship between groomed burrow condition and larger population size. The recently abandoned condition was most common in sites 2 and 3 indicating a relationship between abandoned burrows and smaller population size. Among all three sites, old RGS burrows were least common. We found no significance in hole diameter and opening direction. In future work, data from thistle presence and vegetation height can be analyzed as we’ve noted interesting trends that may be biologically significant.

## Neonicotinoid Bioaccumulation in Bluegill & Bullhead within Lake Julia & Lake Zumwalde

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Brown Bullhead *Ameiurus nebulosus*, Yellow Bullhead *Ameiurus natalis*, and Bluegill *Lepomis macrochirus* are unique in their stark differences. The Bullhead are scaleless bottom feeders that can tolerate high pollution and low O<sub>2</sub> conditions. In contrast, Bluegill are scaled, aggressive nesters and are less tolerant of high pollutants or low-oxygen conditions. Among these pollutants include a class of chemicals called neonicotinoids (hereafter referred to as neonics). Neonics are a class of insecticides primarily used within agriculture and pest management. Due to the effectiveness, application has escalated on a global scale. They have been well documented by many toxicology assessments. Although these compounds are known endocrine disruptors in fish, little research has examined them in Minnesota lakes. The objective of this study was to determine neonic concentration in Bullhead and Bluegill livers. A secondary objective of this study was to test whether pollution levels influence neonic concentration in Bullhead and Bluegill livers. An ELIZA kit will be used on fish livers to evaluate whether pollution levels predict neonic concentration. Laboratory analyses are ongoing, and results will be reported upon completion.

### **River Characterization of the Driftless Area (MN, WI, IA, IL): A Process Based Approach to Understanding the Impact of Disturbances.**

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Functional Process Zones (FPZs) provide a framework for segmenting river networks into zones that share similar geomorphic controls, hydrologic connectivity, and ecological function. FPZs link physical structure to ecosystem processes such as sediment transport, floodplain inundation, and habitat formation, which collectively shape biological community composition and dynamics. However, consistent and reproducible implementation of FPZs across river networks has been limited by the lack of scalable, quantitative methods for measuring channel–valley interactions.

The River EScares and Network Organization Metrics (RESonate) toolbox operationalizes FPZ theory through a GIS-based workflow that integrates stream networks, valley-floor polygons, and terrain data. RESonate derives reach-scale geomorphic metrics at user-defined node spacing, including channel and channel-belt width, sinuosity, confinement, and lateral complexity. These metrics describe the physical template that governs ecological processes such as floodplain connectivity and disturbance frequency. By explicitly quantifying spatial variation in geomorphic form, RESonate supports interpretation of biological patterns, including longitudinal shifts in fish assemblages, macroinvertebrate diversity, and riparian vegetation structure associated with distinct FPZs. For example, laterally unconfined FPZs with complex channel belts tend to support higher habitat heterogeneity, greater organic matter retention, and increased availability of off-channel habitats critical for juvenile fish and invertebrates.

From a management perspective, RESonate provides a process-based foundation for river restoration by identifying FPZ-specific constraints and opportunities. This enhances the likelihood of sustained ecological benefits in river restoration.

## **Surveillance and sequencing of A/H5N1 in Minnesota wildlife species shows emerging HA subclade and viral reassortment**

Author(s): Esther Vogt , Clarissa Pellegrini , Kristin Bondo, Amanda Palowski, Michelle Schultze, Bradley Seufzer, Tiffany Wolf, Arno Wuenschmann, Declan Schroeder

Presenter: Esther Vogt [vogt0121@umn.edu](mailto:vogt0121@umn.edu)

Affiliation: University of Minnesota

H5N1 influenza A virus (IAV) has had several spillover events in recent years, turning this virus into a global zoonotic pathogen. While A/H5Nx variants have historically impacted mainly the poultry industry, H5N1 has now been detected in mink in Europe, marine mammals in South America, and dairy cattle in the United States. IAV is a fast-evolving virus with the potential to continue spillover into mammalian species, harming wildlife, agricultural and domestic animals, and humans. It is critical to understand how A/H5N1 is impacting wild mammalian and avian species and to characterize its transmission and evolution. We collected oral and cloacal swab samples from both mammals and wild birds that were submitted to rehabilitation centers in Minnesota. We used standard (S) and viability (V) RT-qPCR in conjunction with live virus culturing in MDCK cells to confirm that influenza virus positive cases were still shedding both viable and infectious particles. For samples that were both IAV V-RT-qPCR and CPE positive we used the Oxford Nanopore Technologies GridION sequencing platform to determine the sequence identity of our samples. We observed a potential local reassortment on the PB1 genomic segment collected from a peregrine falcon. We also observed two distinct subclades of HA D1.1 from samples collected between September - December 2025. These results highlight the importance of a comprehensive A/H5N1 surveillance program in wildlife to better understand the evolution and future zoonotic threats to multiple species.

### **Assessing the Prey Contents in Northern Saw-Whet Owl Pellets in Fargo, North Dakota.**

Author(s): Peter J. Weinzierl, Katie P. Waugh, Madelyn T. Barlage, Gavin M. Groshelle, Dan Mason, Joseph C. Whittaker

Presenter: Peter Weinzierl [pweinzie@cord.edu](mailto:pweinzie@cord.edu)

Affiliation: Concordia College Moorhead

Northern Saw-Whet Owls (NSWO) are the smallest owl species in North America. They occupy primarily forested areas year-round and hunt mainly small mammals. Owls are often known for their ability to form pellets composed of undigestible food contents; however, this ability is not exclusive to owls as Corvids, Ardeids, and Accipitrids are a few examples of other families that also produce pellets. Owl pellets are unique among predatory birds as they do not digest bones, leaving them in the pellet. This makes them a valuable tool for surveying prey species in an area through unbiased means. The owl pellets acquired were provided by a local owl expert and donated to Concordia college's Elsie Welter Natural History Museum. These pellets were then dissected by students in the Mammalogy and Ornithology classes and compiled these data. The number of prey per pellet, in addition to presence of a skull, order, family, subfamily, genus, species (when possible) and presence of post cranial bones in each pellet were recorded as well. One hundred and fifty-four pellets had been collected with 108 of them contained at least one skull. Of these skulls 79 were *Peromyscus* spp., 14 *Microtus pennsylvanicus*, 4 *Blarina brevicauda*, 2 *Clethrionomys gapperi*, 1 *Sorex* spp., 1 *Microtus* spp., 6 unidentified Cricetids and 1 unidentified rodent. By compiling the remains found in NSWO pellets we may better understand the small mammal species that inhabit the NSWO habitat through an accurate, unbiased means with minimal disturbance to the ecosystem or its wildlife.

## **Statewide Northern Pike Response to Minnesota's 2018 Regulation Change**

Author(s): Elijah Wozniak, Andrew Hafs  
Presenter: Elijah Wozniak [elijahwozniak5@gmail.com](mailto:elijahwozniak5@gmail.com)  
Affiliation: Bemidji State University

Northern Pike management is difficult as it attempts to balance ecologically sustainable practices with angler interests. Populations of Northern Pike often diminish the size of other fish, which can stunt their growth also. Due to the emphasis anglers placed on trophy sized fish, the DNR implemented a new statewide regulation change for northern pike in 2018. The objective of this study was to determine whether the regulation successfully increased the weight, length, and CPUE of Northern Pike in Minnesota. The DNR LakeFinder resource will be used to obtain information from lakes within each of the three pike regulation zones using specified criteria. The gathered data will include CPUE, weight, and length measurements for each year after the new regulation. A trendline analysis will determine the P-value and significance of the information. The collection and analyzation of the data is pending completion. The purpose of this study is to better understand the response of Pike to fishing regulations and to hopefully gather useful insight for informing adjustments to current fishing guidelines. Future research could look at the ecological factors influencing pike size and what resources need to be present to support prolonged pike growth. Hopefully, the findings are useful for understanding how effective fishing regulations are at changing size structure of fish populations.

### **Microplastic concentration in comparison to depth within Lake Bemidji**

Author(s): Parker Young, Dr. Andrew Haffs  
Presenter: Parker Young [parkeryoung355@gmail.com](mailto:parkeryoung355@gmail.com)  
Affiliation: Bemidji State University

Microplastics, plastic particles 5mm or less in size, are an emerging pollutant of growing concern in freshwater ecosystems, yet their vertical distribution and physical characteristics within stratified lakes remain insufficiently understood. This study examined microplastic abundance at six depths (0–10 m) in Lake Bemidji, Minnesota, to characterize how particle concentrations and visible traits vary throughout the water column. Microplastic counts ranged from 4 to 15 particles per 100 ml, with the highest concentrations observed at mid-depths (4–8 m), suggesting that particles become trapped or accumulate within the metalimnion. Microscopic observations revealed that deeper samples contained larger, more visually distinct particles compared to the smaller, more translucent microplastics found near the surface. These patterns indicate that vertical transport processes—such as biofouling, aggregation with organic matter, and stratification-driven density barriers—may influence both the abundance and morphology of microplastics as they move through the lake. The combined findings demonstrate that microplastics are not uniformly dispersed and emphasize the need for depth-stratified sampling in freshwater systems. This work provides foundational insight into microplastic behavior in Lake Bemidji and highlights the importance of further studies examining seasonal dynamics, particle composition, and potential ecological impacts within stratified lake environments.

## **Mapping Relative Abundance of Crows and Avian Prey as Proxies for Urban Merlin Habitat in Moorhead, Minnesota**

Author(s): Afton Gast, Suz Zeki, Chris Merkord  
Presenter: Suz Zeki [afton.gast@go.mnstate.edu](mailto:afton.gast@go.mnstate.edu)  
Affiliation: Minnesota State University Moorhead

Merlin (*Falco columbarius*) populations have increased in many urban areas of the Northern Great Plains, but the factors driving this increase remain unclear. Two leading hypotheses suggest that urban merlins may be responding to increased availability of nest substrates associated with American crows (*Corvus brachyrhynchos*) or to increased availability of avian prey. We propose to evaluate these hypotheses using standardized point-count surveys in Moorhead, Minnesota, prior to the main nesting season. From February through April, we will conduct walking point-count surveys at 40 fixed locations distributed across a 1–2 km<sup>2</sup> urban study area. Each point will be surveyed three times using 5-minute counts and three distance bands. During each survey, we will record detections of American crows, merlins, and small passerines that represent potential merlin prey. Point-count data will be used to generate smoothed relative abundance surfaces for crows and prey species across the study area. We will assess spatial overlap between merlin detections and areas of relatively high crow and prey abundance to evaluate which factor better explains early-season merlin activity. This project provides a repeatable framework for assessing urban predator–prey and nest-proxy relationships and establishes a baseline for future studies that incorporate confirmed nest locations later in the breeding season.

## **Engaging Students in Amphibian Conservation: The Minnesota Student Network for Amphibian Pathogen Surveillance**

Author(s): Momo Zumbahlen, Emily Banks, Galia Modabbernia, Jennifer Y. Lamb, Daniel A. Grear, Megan E. Winzeler, Amy C. Kinsley  
Presenter: Momo Zumbahlen [zumba015@umn.edu](mailto:zumba015@umn.edu)  
Affiliation: University of Minnesota

The Minnesota Student Network for Amphibian Pathogen Surveillance (MN SNAPS) is a program that engages educators and students in surveillance of threats to amphibian populations, with a focus on the emerging pathogen *Batrachochytrium salamandrivorans* (Bsal). Bsal is a fungal pathogen that has caused population declines in European amphibian populations. While it has not yet been detected in North America, it has the potential to decimate native populations of amphibians if introduced through pathways such as the exotic pet trade. The early detection of this pathogen in North America is crucial in mitigating its spread and subsequent population declines. The mission of MN SNAPS is to mobilize students, educators, and conservationists around the state as part of surveillance efforts and to engage people in hands-on learning through sampling wild amphibians and collecting data. MN SNAPS is part of the national Student Network for Amphibian Pathogen Surveillance (SNAPS), coordinated by the U.S. Geological Survey, which provides the necessary tools, such as swabs, vials, and labels, along with biosafety protocols and lesson plans for educators to complement sampling efforts. The involvement of more educators and students is essential to gaining further data, and this poster will serve to inform its audience of MN SNAPS with the intention of recruiting more participants.

# **Concurrent Session 1**

## **Applied Technologies**

### **Trends in watercraft traffic on Minnesota lakes: Utilizing motion-activated trail cameras to provide insights on freshwater recreation**

Author(s): Jared Langer, Nicholas Phelps, Amy Kinsley

Presenter: Jared Langer [lang1496@umn.edu](mailto:lang1496@umn.edu)

Affiliation: Minnesota Aquatic Invasive Species Research Center & Conservation Sciences Graduate Program, University of Minnesota

Healthy lakes, rivers, and reservoirs provide important socio-economic and recreational benefits, yet recreational watercraft traffic also poses ecological risks, including the spread of aquatic invasive species (AIS), degraded water quality, and shoreline erosion. Effective management of these risks requires accurate information on when and where waterbodies are used. Managers commonly rely on watercraft inspection programs and user surveys to estimate traffic patterns. However, available information on recreational use varies widely across jurisdictions. Some states maintain watercraft inspection programs or conduct user surveys, while others lack consistent or spatially extensive data on lake use.

Remote monitoring tools such as motion-activated trail cameras offer a cost-effective complement to traditional methods, providing continuous estimates of watercraft activity with minimal staffing.

However, these data are typically site-specific and lack contextual information about boater behavior or trip origins, making validation against existing data sources essential.

In Minnesota, the Department of Natural Resources (DNR) operates one of the largest AIS inspection networks in North America and supports analytical tools such as AIS Explorer, which uses estimates of boat traffic to assess invasion risk among waterbodies. To evaluate the performance of existing traffic estimates and assess AIS inspection data as a proxy for daily lake use, we deployed motion-activated trail cameras at 36 Minnesota lakes representing diverse sizes, regions, and access types. We will describe trends in day-to-day watercraft traffic based on preliminary data. Results inform the integration of remote monitoring technologies into AIS prevention and recreational water management programs.

## Salmonid Movement and Habitat Use in Minnesota Tributaries to Lake Superior

Author(s): Dylan Undlin, Dr. Justin VanDeHey, Nick Peterson, Dr. Joshua Raabe, Cory Goldsworthy

Presenter: Dylan Undlin [dundlin@uwsp.edu](mailto:dundlin@uwsp.edu)

Affiliation: University of Wisconsin - Stevens Point

Minnesota tributaries to Lake Superior are relatively groundwater limited and climate change is forecasted to reduce cold-water habitats in these tributaries. Native Brook Trout *Salvelinus fontinalis* and non-native Steelhead *Oncorhynchus mykiss* depend on cold, fluvial habitat for at least a portion of their life, but knowledge is limited regarding the habitat these Salmonids use especially during periods of stressful water temperatures and extreme flows. Therefore, our research aimed to 1) identify critical habitat (i.e. thermal refugia) for Salmonids, and 2) determine if movements of Salmonids were related to water temperature and flow. Salmonid movement was investigated in the Knife and Stewart River watersheds using 16 PIT arrays and radio telemetry. Between 2024 and 2025 we PIT tagged 1,010 Brook trout and 3,060 Steelhead and implanted radio transmitters in 42 adult Brook Trout and 18 Steelhead. Water temperature and flow data were collected by loggers stratified among sub watersheds. Summertime water temperatures in the lower Knife River periodically surpassed the lethal threshold for Brook Trout, indicating an ephemeral thermal barrier between headwaters and Lake Superior. Brook Trout movement was minimal for most of the study period, increasing only during the fall spawning period. However, some adult Brook Trout used more productive lower river habitat in the spring and early summer but used cooler headwater tributaries in late summer when water temperature peaked and flows decreased. Juvenile Steelhead generally used all habitats in the Knife River regardless of water temperature and flow. By identifying critical habitat and understanding habitat limitations for Salmonids in these watersheds we will help inform habitat conservation and restoration in the face of climate change.

## Acoustically conditioned bigheaded carp deter naïve fish from upstream passage

Author(s): Jack Vannurden, Michael Frett, Brooke J. Vetter, Ella Stenberg, Matteo Veglia, Allen F. Mensinger

Presenter: Jack Vannurden [velan018@d.umn.edu](mailto:velan018@d.umn.edu)

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Broadband sound and CO<sub>2</sub> are non-physical deterrents which show potential for restricting upstream migration of invasive silver (*Hypophthalmichthys molitrix*) and bighead carp (*H. nobilis*). A multimodal deterrent combining broadband sound (100 hp outboard boat motor recording; 2 kHz – 4 kHz; 150 dB re 1 μPa SPLrms peak) and dissolved CO<sub>2</sub> proved 100% effective at deterring upstream passage in a model lock and dam for conditioned bighead or silver carp schools, including food motivated trials. While lock chambers provide strategic bottlenecks to deploy this deterrent, not all fish in the area may experience conditioning and new fish may arrive between treatments. To assess the efficacy of this deterrent under field conditions this study determined if conditioned fish can influence naïve fish. Schools (N = 4 schools/species; N = 10 individuals/school) were situated in a 10,000 L model lock and dam and trained to move upstream to receive food. Three fish of the ten fish in each school underwent carbon dioxide and acoustical conditioning. The mixed schools underwent 28 sound-only trials over the course of a week, with 98.8% of these fish deterred (one naïve fish passed through the chamber). In comparison, the deterrence rate of naïve bighead or silver carp under similar conditions was only 20.0%. Thus, a minority of conditioned fish can influence the behavior of naïve fish which would greatly improve effectiveness of acoustic deterrents under standard lock operations. These results support the use of multimodal deterrents to prevent upstream migration of bigheaded carp.

## **A Comparison of Vessel and Autonomous Underwater Vehicle (AUV) Based Acoustic Estimates of Demersal Fish Density in the Great Lakes**

Author(s): Aidan Waterhouse, Thomas Hrabik, Daniel Yule, Jared Myers, Michael Seider, Jason Smith, Ian Harding, Chad Lafaver

Presenter: Aidan Waterhouse [water523@d.umn.edu](mailto:water523@d.umn.edu)

Affiliation: University of Minnesota-Duluth

Acoustic and mid-water trawl surveys have been a standard approach for estimating abundance and biomass of Great Lakes coregonines for decades. Acoustic sampling will likely have increased importance in the near future as coregonine restoration efforts across the Great Lakes basin are implemented. Of particular interest are more demersal species such as Bloater *Coregonus hoyi* and Lake Whitefish *C. clupeaformis*, whose abundance estimates are undoubtedly conservative due to the Acoustic Dead Zone (ADZ) phenomenon and decreased vulnerability to mid-water trawls. Tall(4m) bottom-set gillnets, bottom trawls, as well as an Autonomous Underwater Vehicle (AUV) retrofitted with an acoustic array, were deployed concurrently with standard vessel-based acoustic survey methods in order to better sample the ADZ. In theory, the AUV would provide more exacting demersal species estimates due to an inherently smaller ADZ. Acoustic data analysis followed the Great Lakes Standard Operating Procedure and combined a Classification and Regression Tree (CART) model built from the fishing data to ascribe species to acoustic detections. Measuring capture distance off-bottom in the bottom-set gillnets strengthens the CART model, helping to provide more precise species assignments, and improves exploration of the ADZ by quantifying the biomass potentially unavailable to acoustics. Vessel-based acoustics estimate Lake Whitefish at 16.83 kg/ha in the WFS-05 Lake Whitefish management unit outside of Munising, MI and Bloater at 1.54 kg/ha in the WFH 01-04 Lake Whitefish management units in Northern Lake Huron. This project compares these standard estimates against those obtained from more extensive ADZ focused approaches derived from an AUV.

## **Tribal Session**

### **Effects of Anthropogenic Structures on Gray Wolf (*Canis lupus*) Movements on the Fond du Lac Reservation**

Author(s): Grace Lavan and Mike Schrage

Presenter: Grace Lavan [grace.k.lavan@gmail.com](mailto:grace.k.lavan@gmail.com)

Affiliation: University of Minnesota Duluth

Ma'iingan (gray wolves) are a culturally significant animal to the Lake Superior Chippewa. The Fond du Lac Band of Lake Superior Chippewa's Resource Management Division has conducted research and monitored ma'iingan (gray wolf) populations on and around the Fond du Lac Reservation since 2016. Gaining a better understanding of wolf behavior and preferred habitat contributes to the development of management strategies to prevent conflicts and support wolf populations. The purpose of this study was to examine the proximity of wolves to anthropogenic structures in northeastern Minnesota. We used light detection and ranging (LiDAR) data to identify and map building footprints. We then compared distance from wolf locations and random points to building footprints to evaluate the response of wolves to human structures. Overall, wolves spent their time farther from buildings than expected by random chance ( $p < 0.001$ ). Time of day did not influence wolf proximity to buildings ( $p = 0.213$ ). Wolves did not show any evidence of using areas near buildings during the night when human activity was expected to be lower. Results from this study have implications for what can be considered suitable wolf habitat in the Great Lakes region.

## **Response of ma'iinganag (gray wolves) to oil pipeline construction on the Fond du Lac Reservation in northeast Minnesota**

Author(s): Mike Schrage, Grace Lavan and Cynthia Welsh  
Presenter: Mike Schrage [michaelschrage@fdlband.org](mailto:michaelschrage@fdlband.org)  
Affiliation: Fond du Lac Resource Management Division

Ma'iingan (the wolf) is an animal of significant cultural importance to the Fond du Lac Band of Lake Superior Chippewa. As such, the Band's Resource Management Division is charged with monitoring local wolf populations and assessing the impacts of major environmental changes on them. In 2018, the Band and Enbridge Energy reached an agreement to allow the replacement of two oil pipelines along a 21km corridor across the Band's Reservation west of Cloquet, Minnesota. Pipeline construction on the first line (Line 3) began in December 2020 with most work completed by November 2021. Using Global Positioning Satellite (GPS) collars and other techniques, we assessed the before, during and after effects of pipeline construction on the three Reservation wolf packs whose territories were directly impacted. Construction related impacts appear to have been absent or short-lived. Each collared wolf in each of the three packs regularly crossed the pipeline corridor during the construction period. None of the three packs abandoned their territories and no pup or adult wolf mortality was documented related to pipeline construction. Two of the three packs established natal dens <1km from the pipeline corridor during a seasonal pause in construction activities. One of the packs established a summer 2021 rendezvous site on or immediately adjacent to the pipeline corridor while some construction activities were still ongoing.

### **Ma'iingan (Wolf) Pup Survival Monitoring**

Author(s): Morgan Swingen, Sammi Shimota, Mike Schrage  
Presenter: Morgan Swingen [mswingen@1854treatyauthority.org](mailto:mswingen@1854treatyauthority.org)  
Affiliation: 1854 Treaty Authority

The 1854 Treaty Authority is an inter-tribal natural resource agency governed by the Bois Forte Band of Chippewa and Grand Portage Band of Lake Superior Chippewa. Our mission is to protect, preserve, and enhance the exercise of treaty rights in the 1854 Ceded Territory (present-day northeastern Minnesota). Our work includes research and monitoring of the culturally important resources in this area, including ma'iingan (wolf) populations. One main component of this work is monitoring survival of wolf pups. Much of this work has been in collaboration with the Fond du Lac Resource Management Division and uses locations from collared adult wolves to locate dens in the spring. We fit pups with expandable VHF collars and monitor them to estimate survival and determine causes of mortality. Since 2020, we have collared 74 wolf pups, and have recorded 17 mortalities. Causes of mortality for pups could not always be determined, but included disease (e.g. canine parvovirus, canine distemper virus) and predation for younger (<6 months old) pups, and human-related causes (e.g. poaching, vehicle strike, accidental take) for older (>6 months old) pups. We estimate wolf pup survival in our study area from 2020-2025 to be approximately 67% to 6 months old, recognizing some bias in our data due to methodological constraints.

## Working Dogs for Conservation

Author(s): Michele Lovara  
Presenter: Michele Lovara [michele@wd4c.org](mailto:michele@wd4c.org)  
Affiliation: Working Dogs for Conservation

Working Dogs for Conservation (WD4C) partners with Tribal biologists to provide conservation detection dog support for wildlife monitoring, biosecurity, and environmental health on Tribal lands. Detection dogs offer a highly sensitive, noninvasive tool that enhances survey efficiency while supporting Tribal-led conservation priorities and sovereignty.

WD4C assists Tribal programs by sourcing, training, and deploying invasive mussel detection dogs at watercraft inspection and decontamination stations. These dogs increase early detection capacity and reduce the risk of introductions of aquatic invasive species that threaten culturally and ecologically important waters. WD4C also supports projects for various species, including wolves and black-footed ferrets, by using detection dogs to locate scat or live animals for population surveys and by improving monitoring of these species by increasing detection probability across large or logistically challenging landscapes. In aquatic systems, WD4C works with Tribal biologists to conduct mink and river otter surveys for contaminant monitoring. Detection dogs locate scats for targeted, nonlethal sampling to assess exposure to per- and polyfluoroalkyl substances (PFAS) and heavy metals.

WD4C further supports Tribal capacity building through paid Tribal internships that provide hands-on training in field methods, conservation detection dog handling, and applied wildlife research. Together, these collaborations demonstrate how detection dogs can strengthen Tribal wildlife programs, expand monitoring capacity, and support long-term conservation outcomes.

## Ecological Resilience

### **Comparative Analysis of Attachment Strength in Invasive and Native Lamprey Species under Static and Flowing Conditions**

Author(s): Lauren E. Willman, Allen F. Mensinger  
Presenter: Lauren Willman [willm112@umn.edu](mailto:willm112@umn.edu)  
Affiliation: University of Minnesota - Duluth

Lampreys (*Petromyzontiformes*) utilize an oral disc for essential behaviors including feeding, nest building, and locomotion. While the adhesive capabilities and suction forces of the invasive Sea lamprey (*Petromyzon marinus*) have been studied, there is little information examining the same traits in native species. The primary objective of this study was to compare attachment strength in both static and flow through test aquaria and the force necessary to detach adult fish from the substrate was quantified in Sea, Silver (*Ichthyomyzon unicuspis*), American brook (*Lethenteron appendix*), and Northern brook (*I. fessor*) lampreys. Results demonstrated that attachment strength is significantly different between species but may be independent of attachment plane (horizontal or vertical), sex, or size (total length or mouth diameter). Parasitic species (Sea and Silver lamprey) exhibited significantly higher mean attachment forces (Newtons, N) (1.10 N and 0.76 N, respectively) compared to non-parasitic species (0.03–0.06 N). Furthermore, Sea lampreys withstood significantly higher flow velocities than native species before detaching. This research fills a vital knowledge gap in attachment performance, facilitating the development of evidence-based management practices that distinguish between invasive threats and ecologically significant native species.

## **MCH, a pheromone component produced by female eastern larch beetle, interrupts the aggregation behavior of flying eastern larch beetles.**

Author(s): Ian Grossenbacher-McGlamery, Brian Sullivan, Brian Aukema  
Presenter: Ian Grossenbacher-McGlamery [gros0437@umn.edu](mailto:gros0437@umn.edu)  
Affiliation: University of Minnesota-Twin Cities

Abstract A major outbreak of eastern larch beetle (*Dendroctonus simplex*), has been killing mature tamarack, *Larix laricina*, in Minnesota since the year 2000. While *D. simplex* is native, warming temperatures have altered the beetle's demography, increasing the number of generations from one to two each summer and increasing beetle populations. *D. simplex* kills trees by mass attacking them with many beetles simultaneously, overwhelming the defensive systems of the tree and destroying the phloem. Female pioneering beetles select trees and initiate the pheromone-mediated mass attack, attracting beetles of both sexes towards the chemical signal. Some bark beetle pheromone components repel conspecifics and are released by beetles in heavily colonized trees to reduce intraspecific competition. For some species of bark beetles, these anti-aggregation pheromones can be synthesized and applied to protect trees from attack, but such strategies have not been explored for eastern larch beetle. We evaluated the efficacy of the pheromone component MCH in disrupting eastern larch beetle's aggregation to its primary attractant pheromone component, seudenol, in both trap and log protection assays. Trap assays evaluated beetle catch against MCH concentrations from 0.03 mg/day to 15 mg/day over seven weeks in seudenol baited traps, while log assays evaluated the effect of adding 30 mg/day release rate MCH to seudenol baited logs that were left near active beetle infestations for three months. We saw significant reductions in beetle catch and colonization in traps and logs respectively when treated with MCH applications at more than 1 mg/day.

## **Modeling the risk of *Batrachochytrium salamandrivorans*, an emerging pathogenic fungus, in Minnesota amphibians**

Author(s): Emily Banks, Galia Modabbernia, Momo Zumbahlen, Jennifer Y. Lamb, Daniel A. Grear, Megan E. Winzeler, Amy C. Kinsley  
Presenter: Emily Banks [banks214@umn.edu](mailto:banks214@umn.edu)  
Affiliation: University of Minnesota: College of Veterinary Medicine

*Batrachochytrium salamandrivorans* (Bsal) is an emerging pathogenic fungus that has caused mass mortality events of a variety of salamander species in Europe and poses detrimental effects to the biodiversity of North American amphibians. Bsal has not yet been detected in North America to date; however, Minnesota faces unique challenges due to the risk of introduction through the extensive pet markets accelerated by global trade and a habitable environment suitable for the pathogen's residence. To provide updated information for management decisions in determining local preventative actions, a specific risk model was developed for Minnesota. This study incorporates data on pet trade pathways, environmental suitability, and species-level host susceptibility using a multi-criteria, unweighted linear combination model. High-risk areas were identified with both a high likelihood of introduction, pet store density, and severe consequences based on environmental temperature suitability and the richness of known susceptible species. The final risk scores provide a practical tool for disease surveillance and rapid institution of management actions in the event of a Bsal incursion.

## Chytrid presence in Minnesota True Frogs (Family Ranidae)

Author(s): Kerri Beers, Megan Winzeler, Dan Grear Ph.D., Amy Kinsley Ph.D., Jennifer Y. Lamb Ph.D.

Presenter: Kerri Beers [hi8665ap@go.minnstate.edu](mailto:hi8665ap@go.minnstate.edu)

Affiliation: St. Cloud State University

The pathogenic fungus *Batrachochytrium dendrobatidis* (Bd) infects many species in the family Ranidae, Minnesota's most species-rich amphibian group. This study asks whether Bd prevalence varies among ranids sampled along an aquatic-terrestrial gradient (Aquatic-Terrestrial Index), and whether Bd presence is influenced by date, precipitation, and air temperature. We predicted that more rainfall and being highly aquatic will increase Bd presence among frogs, and that temperature and date will be negatively correlated with Bd. We swabbed 253 ranids across six sites, and Bd presence was confirmed via qPCR. We created and compared generalized linear mixed models (GLMMs) with Akaike's Information Criterion for small sample sizes (AICc). Our results suggest that as calendar day ( $p = 0.050$ ; 85% CI not overlapping zero) and maximum air temperatures increased ( $p = 0.081$ ; 85% CI not overlapping zero), Bd prevalence decreased. Bd prevalence was lowest in the Northern Leopard Frog (*Lithobates pipiens*; 0.12), highest in the Wood Frog (*L. sylvaticus*; 0.62), and varied across sites (range = 0.09 - 0.69). These results help us better understand which Minnesota ranids are most likely to harbor, and potentially spread Bd, as well as what environmental factors play a role in the persistence of Bd in the state.

## General Session

### **How loggers identify and protect sensitive soils during their operations**

Author(s): Lane Moser, Marcella Windmuller-Campione, Charlie Blinn

Presenter: Lane Moser [moser196@umn.edu](mailto:moser196@umn.edu)

Affiliation: University of Minnesota

Many forest stands in Minnesota have sensitive soils that necessitate harvesting under frozen ground conditions to maintain soil structure and function and prevent degradation of the site. Meanwhile, winters in Minnesota are getting warmer and wetter. In light of these current and predicted changes in weather coupled with the operational nuance from one site to the next, we implemented a study aiming to 1) better understand the ways in which loggers identify and protect sites with sensitive soils during their harvesting operations and 2) determine if specific training materials might allow loggers to expand their operations during dry summer and fall conditions. At the spring 2025 logger conferences in Virginia and Bemidji, MN we held four focus groups comprised of loggers in either conventional or cut-to-length (CTL) systems, totaling eight focus groups and 67 loggers.

We found that loggers relied heavily on their local knowledge when identifying potential problem areas but were also aided by Avenza maps, including those with topography and digital elevation model (DEM) layers. Loggers also felt that protecting sites with sensitive soils was a two-way street, noting some ways foresters could help regarding how they prepare and administer sales. After identifying these marginal areas, participants noted both proactive and reactive strategies to protect the sites and continue their operations—although these strategies sometimes differed depending on whether respondents were operating conventional or CTL equipment. This presentation will cover the takeaways from our analysis as well as next steps and the implications for how the findings from this study can be applied to FMG training or other continuing education opportunities.

## **EAB and Forest Management in Black Ash Wetlands: Impacts on wildlife, carbon storage, hydrology, forest structure and biodiversity.**

Author(s): Erin Clark, Steve Kolbe, Alexis Grinde  
Presenter: Erin Clark and Steve Kolbe [clar2728@umn.edu](mailto:clar2728@umn.edu)  
Affiliation: University of Minnesota

Black ash–dominated wetlands are a distinctive forested wetland system in Minnesota, supporting unique ecological processes and wildlife communities. Black ash functions as a foundational species, maintaining forest structure, hydrology, carbon storage, and forest-associated wildlife habitat. Non-native emerald ash borer (EAB) will likely cause widespread ash mortality in these systems, with the potential to drive a long-term state shift from forested wetlands to emergent marshes, fundamentally altering ecosystem function. We evaluated ecosystem and wildlife responses to EAB with long-term data from an operational-scale experiment in the Chippewa National Forest and Leech Lake Reservation. Treatments included emulated EAB-induced ash mortality, preemptive management strategies (clearcutting and group selection), and undisturbed reference stands. After 14 years, we’ve found water tables remain elevated in both clearcut and emulated-EAB treatments, which may constrain tree regeneration, forest structure redevelopment, and wildlife habitat. Group selection harvests maintained hydrologic function and structural complexity relative to clearcutting. Across reference sites, hydrologic regime, ash canopy cover, and understory structure strongly influenced bird and amphibian communities. Black ash wetlands supported unique bird communities, with higher species richness and more indicator species than adjacent upland aspen forests, likely due to greater structural heterogeneity and surface water. EAB also poses a substantial carbon risk, threatening an ~ 0.117 Pg of carbon in Lake States black ash wetlands. Management strategies that maintain forest cover and structural complexity, including alternative tree establishment, will be critical for sustaining wildlife diversity, carbon storage, and ecosystem function under continued EAB pressure.

### **Long term oak regeneration after oak wilt management**

Author(s): Grace Haynes, Erica Houser, Anna Yang, Rebecca Montgomery  
Presenter: Grace Haynes and Erica Houser [ahaynes@umn.edu](mailto:ahaynes@umn.edu), [house327@umn.edu](mailto:house327@umn.edu)  
Affiliation: University of Minnesota

Oak wilt (*Bretziella fagacearum*) is recognized as the most destructive oak pathogen in the Upper Midwest and is responsible for large-scale oak mortality. The negative effects are compounded by historic fire suppression and high deer densities, which have led to an increase in mesic species such as red maple (*Acer rubrum*). In Minnesota, oak regeneration is an important management priority, but is currently inconsistent and below desirable levels. Oak wilt and its management create canopy gaps that increase light and could potentially foster oak regeneration, but prior research suggests that oaks are being replaced by shade tolerant species such as red maple and buckthorn (*Rhamnus cathartica*; *Frangula alnus*). In this presentation, we will share preliminary data on the impacts of factors such as oak wilt management strategy, light, soil moisture and texture, and competing understory species, on community composition in gaps created by oak wilt and its management. Results from this study will provide support to land manager decision making such as choice of oak wilt management method and conditions that foster natural oak regeneration after oak wilt infection. Our project will expand beyond limiting disease transmission to a more holistic examination of oak wilt and its management. Results will be of immediate relevance to federal, state, municipal, and private land managers who share the common goal of reducing oak wilt spread and regenerating oaks in Minnesota woodlands and forests.

## **Findings from the 2024 survey of silvicultural practices in Minnesota**

Author(s): Lane Moser, Marcella Windmuller-Campione, Eli Sagor  
Presenter: Lane Moser [moser196@umn.edu](mailto:moser196@umn.edu)  
Affiliation: University of Minnesota

Since 1991 the Minnesota Silviculture Survey has quantified the silvicultural and forest health practices of state, federal, county, forest industry, and Tribal forest lands in Minnesota. These practices reflect the intersection of ecological, economic, and social values and their associated impacts on Minnesota's forested landscape. While an individual survey may capture a snapshot of silvicultural practices, this survey builds on data collected in 1991, 1996, 2008, 2017, and now 2024 to define long-term trends as well as emerging issues such as forest health threats or the development of carbon markets. We asked forest management organizations about their silvicultural activities in calendar year 2024 or most recently completed fiscal year. Respondents provided a comprehensive look at their forest management; this presentation will describe the type and extent of silvicultural treatments ranging from regeneration through regeneration harvest as well as respondents' management of insect and disease threats.

## General Session

### **Participating in the Minnesota Animal Movement Archive**

Author(s): Smith Freeman, Dr. John Fieberg  
Presenter: Smith Freeman [freem850@umn.edu](mailto:freem850@umn.edu)  
Affiliation: University of Minnesota

Want to learn how to participate in and use the Minnesota Animal Movement Archive? The archive is a collection of studies in Movebank that contain animal movement and other animal-borne sensor data from the state of Minnesota. With this archive, we aim to bring together datasets from Environment and Natural Resources Trust Fund (ENRTF) projects and partnerships with State, Tribal, Federal, and University researchers to create a unified resource for understanding how Minnesota's wildlife navigate and use their habitats. This presentation will be a demonstration of how to submit your GPS data to the archive and how to use data from the archive to perform resource selection functions (RSFs) and step-selection functions (SSFs) using the no-code analytical platform, MoveApps.

## **Lifecycle modeling as a tool for conservation**

Author(s): Amanda Tveite, Matthew Etterson, Alexis Grinde

Presenter: Amanda Tveite [tveit025@d.umn.edu](mailto:tveit025@d.umn.edu)

Affiliation: University of Minnesota, Duluth

Understanding the needs and vulnerabilities of wildlife populations is critical for effective conservation, yet some of the most influential life stages remain poorly understood. For birds, the period immediately following fledging represents a particularly vulnerable stage that is difficult to study in the field, yet has a disproportionate effect on population recruitment. Avian Lifecycle Models that incorporate this post-fledging period provide a powerful way to quantify survival thresholds at different life stages, providing insight into the stages that most strongly influence population dynamics. Integrating life-cycle modeling with targeted field studies can reveal critical demographic bottlenecks and survival thresholds that help prioritize research and management actions. Examples from Golden-winged Warblers and Boreal Chickadees illustrate how post-fledging survival is linked to habitat structure and landscape context. At this intersection of modeling and field-based research, life-cycle models help focus empirical efforts, identify stages most responsive to management, and inform conservation actions. This framework provides managers with a practical tool to evaluate how alternative management strategies influence survival across the full annual cycle and to support decisions that promote long-term population persistence.

## **Evaluating prey limits on larval walleye growth using bioenergetics-based modeling**

Author(s): Jeannine Doyle, Heidi Rantala, Kevin McDonnell, Patrick Schmalz

Presenter: Jeannine Doyle [rdoyle@nmu.edu](mailto:rdoyle@nmu.edu)

Affiliation: Northern Michigan University

Declines of walleye across the upper Midwestern United States have plagued fisheries managers and stakeholders in recent decades. With changes to lake-wide productivity as a result of invasive species and changing climate regimes, fish species like walleye are facing increased recruitment failures. It was hypothesized that lack of available zooplankton prey in the larval stages is leading to reduced larval growth and survival to recruitment. To assess this, we developed a bioenergetics foraging model using long-term lake monitoring data from Lake Mille Lacs, MN. Despite significant declines in zooplankton biomass over the past two decades, our results indicate that larval walleye are not experiencing starvation during their zooplanktivorous stage. Instead, model outcomes suggest that water temperature regimes have a stronger influence on larval growth than zooplankton composition or biomass in Lake Mille Lacs. Long-term datasets are important for detecting ecosystem change and providing context for these conditions prior to potential tipping points. These findings highlight the importance of understanding the mechanisms driving larval growth and survival, as even small changes in early life history survival can lead to strong effects on recruitment and year class development.

## Through the Looking Glass: Reconstructing Historical Trophic Ecology of Walleye by Stable Isotope Analysis of Fish Eye Lenses

Author(s): Kaylee Bachman, Kyle Zimmer, Brian Herwig, Will French  
Presenter: Kaylee Bachman [kaylee.bachman@stthomas.edu](mailto:kaylee.bachman@stthomas.edu)  
Affiliation: University of St Thomas

Analysis of stable isotopes  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  in fish muscle is useful for understanding fish trophic ecology, with  $\delta^{13}\text{C}$  estimating pelagic versus littoral energy use and  $\delta^{15}\text{N}$  assessing trophic position of fish. However, muscle tissue does not show life-long feeding patterns. In contrast, fish eye lens layers record life-long diet patterns, but few studies have been done on freshwater species. We analyzed  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  in Walleye (*Sander vitreus*) eye lenses from Ten Mile Lake, MN to a) assess efficacy of use, b) test for ontogenetic trophic patterns in individual Walleye, and c) assess whether Walleye ontogenetic patterns have changed through time. Results showed Walleye eye lenses record trophic history of individual fish from age 0 through age at capture, with resolution averaging 17 trophic estimates during life span of a fish 560mm at capture. Eye lenses showed two groups of Walleye in the lake with one group increasing  $\delta^{15}\text{N}$  and the other decreasing  $\delta^{15}\text{N}$  as fish grew in size. Preliminary results indicate the switch from positive to negative  $\delta^{15}\text{N}$  slopes may be related to fish age, suggesting a recent trophic change in Ten Mile Lake Walleye. Our results indicate analysis of fish eye lenses is a promising tool for understanding trophic ecology of Walleye and other species, as it can identify differences in ontogenetic patterns among individual fish and whether ontogenetic patterns change through time.

### General Session

#### **Population dynamics of the carpsuckers (*Carpiodes* spp.)**

Author(s): Alec R. Lackmann, John Lyons, Kimberly A. Kuber, Timothy P. Parks, Daniel L. Walchak, Ewelina S. Bielak-Lackmann, Charles R. Vaughan, Sarah D. Kuehl, John D. Woodling, Mark E. Clark  
Presenter: Alec Lackmann [alackman@d.umn.edu](mailto:alackman@d.umn.edu)  
Affiliation: University of Minnesota Duluth

The carpsuckers (*Carpiodes* spp.) are a little-studied genus of three freshwater fishes within Catostomidae often outcast as “rough fish.” More information is needed on their life history and population dynamics. Here we aged the lapillus otoliths of 189 carpsuckers, including quillback (*C. Cyprinus*), highfin carpsucker (*C. velifer*), river carpsucker (*C. carpio*), and intergrades collected from the Lower Wisconsin River in 2023 and 2024 during Wisconsin Department of Natural Resources fish surveys. Age scores were precise among readers. All three species exhibited pronounced asymptotic growth, sexual dimorphism in either asymptotic length or instantaneous growth rate, and highly variable recruitment across time with most individuals from year classes produced decades ago. We observed maximum ages greater than 50 years for each species. We also found that lapillus otolith mass explained more than 95% of the variation in carpsucker age, and the likelihood of epidermal black spots on the carpsuckers increased with age similar to black-spot pigmentation accrual on the buffalofishes (*Ictiobus* spp.). The carpsuckers are long-lived periodic strategists living in increasingly human-altered ecosystems, as is the case for many catostomids.

## **Population Dynamics of Rock Bass in Select West-Central Minnesota Lakes**

Author(s): Ethan J. Rasset, Aaron P. Muehler

Presenter: Ethan Rasset [Ethan.Rasset@state.mn.us](mailto:Ethan.Rasset@state.mn.us)

Affiliation: Minnesota Department of Natural Resources

Rock Bass *Ambloplites rupestris* are an understudied native game fish in the state of Minnesota. Despite regulated harvest, little information is collected and known regarding the species' population demographics, specifically relating to age and growth. As such, nine west-central Minnesota lakes in Otter Tail County were selected for an initial study to obtain pertinent data. Lakes included in this preliminary study were Clitherall, Eagle, Long, North Lida, Otter Tail, Pelican, South Ten Mile, Star, and West Battle. A total of 1,199 Rock Bass were observed during Minnesota DNR sampling on these lakes with a subsample (i.e., 683) of Rock Bass collected for otolith acquisition via AFS experimental gill netting, fyke netting, and hook and line sampling. Additionally, 496 Rock Bass were assigned ages using an age-length key for a total sample size of 1,179 for age, growth, and mortality rate estimation. Results reveal surprising longevity with growth, mortality, and recruitment differing among lakes. Documenting population parameters of Rock Bass in future DNR fisheries work will enable for long-term monitoring, evaluation of regulations, and inform management decisions. Due to intriguing findings, additional waterbodies in Minnesota will be assessed for Rock Bass population dynamics.

## **Cold Fish, Hot Data: Using Genetics to Understand Burbot Populations**

Author(s): Kristen Patterson, Beth Holbrook, Loren Miller

Presenter: Kristen Patterson [kristen.patterson@state.mn.us](mailto:kristen.patterson@state.mn.us)

Affiliation: MN DNR

Underappreciated, understudied, and hiding under the ice, the burbot (*Lota lota*) have more genetic secrets than anyone expected—and we're going to share them with you! Can a few dozen fish help us monitor burbot long term? Can we identify suppressed populations? How diverse are burbot populations across the state? What's that cold water fish doing in a warm water stream? The more we learn, the more questions we have! Join us as we share the importance of collaborative efforts among fisheries enthusiasts, walk through preliminary results, and discuss the current and future direction of our research.

## **Wrestling with halfbeaks: A Phylogenomic Perspective on the Evolutionary Relationships of Atherinomorpha (Ovalentaria)**

Author(s): Matthew Davis, Leo Smith

Presenter: Matt Davis [mpdavis@stcloudstate.edu](mailto:mpdavis@stcloudstate.edu)

Affiliation: St. Cloud State University

The Atherinomorpha includes over 30 families of ovalentarian fishes distributed throughout the world in fresh, brackish, and marine waters. With an incredible breadth of morphological diversity, reproductive strategies, and habitats, atherinomorphs are a diverse and ecologically important lineage of teleost fishes. Three orders of fishes constitute the Atherinomorpha, including Atheriniformes (silversides and their allies), Beloniformes (needlefishes and their allies), and Cyprinodontiformes (killifishes and their allies). In this study we use a combination of ultraconserved elements (UCEs) and mitochondrial genomes to investigate the evolutionary relationships across the atherinomorph radiation and discuss their diversification across the globe.

## General Session

### **Walleye Harvest Management in the Red Lakes: 20 Years of Adaptive Management**

Author(s): Tony Kennedy, MNDNR; Pat Brown, Red Lake DNR

Presenter: Tony Kennedy [tony.kennedy@state.mn.us](mailto:tony.kennedy@state.mn.us)

Affiliation: MNDNR

The Red Lakes are comprised of two basins covering 285,000 acres with shared jurisdiction between the State of Minnesota and Red Lake Band of Chippewa. After decades of overexploitation, a moratorium was placed on walleye harvest from 1999 to 2005. Prior to re-opening both the sport and commercial fisheries in 2006, the Red Lake Fisheries Technical Committee (RLFTC) developed the Harvest Plan for Red Lakes Walleye Stocks. This plan relied on fall gill net assessments to inform managers on the status of the walleye population, particularly mature female biomass (spawning stock biomass; SSB). The harvest plan used four categories of SSB to prescribe annual target harvest levels. While this approach prevented overharvest, target harvests were overly conservative and did not allow enough harvest to actively manage SSB or prevent negative density-dependent effects. In 2015, the plan was revised increasing harvest to levels that better fulfilled walleye population and fishery objectives. However, the stair-step approach that tied target harvests to SSB categories sometimes caused substantial differences in target harvests in response to small changes in SSB. In response, the 2025 harvest plan decoupled target harvest levels from SSB categories and now uses a continuous, sliding target harvest based on SSB. This prevents unnecessary regulation changes to restrict (or increase) harvest based on small differences in SSB. Twenty years after reopening, the Red Lakes' walleye population is robust, provides high angler catch rates, and yields approximately one million pounds of annual harvest to anglers and the commercial fishery.

### **St. Louis River and Western Arm Lake Superior Walleye Regulation Change**

Author(s): Dray Carl, Paul Piszczek, Sam Peterson

Presenter: Sam Peterson [samuel.peterson@wisconsin.gov](mailto:samuel.peterson@wisconsin.gov)

Affiliation: Wisconsin Department of Natural Resources

Current regulations for walleye in the St. Louis River were implemented in 1992 mainly to control Eurasian ruffe *Gymnocephalus cernua*. Though no ruffe abundance reductions were observed after implementation, the regulation was retained to protect the walleye fishery from overharvest due to the fishery's popularity as the river's water quality continued to improve. Over the years, tagging and genetics studies had shown walleye to exhibit strong transient behaviors between the river and Lake Superior, which prompted MN DNR and WDNR to evaluate the walleye fishery and current regulations. Fisheries managers seek to 1.) manage the migratory walleye population of the St. Louis River and western Lake Superior as one system, 2.) implement public desire to provide additional protection to the spawning stock while maintaining opportunities for memorable fish, and 3.) provide a more stable fishery with less interannual variability in fishery recruitment. These goals and a thorough evaluation of available data resulted in a proposed regulation change consisting of a two-bag, 15-inch minimum length limit with one fish over 20-inches between the St. Louis River and both appropriate MN and WI Lake Superior management units beginning in 2027. This regulation aims to meet interjurisdictional management goals, enforcement consistency across management units, and provide a strong, sustainable walleye population in the western arm of Lake Superior for future generations.

## **Spawning habitat partitioning of sympatric salmonid populations in the upper Bois Brule River, Wisconsin**

Author(s): Thomas R. Hrabik, Benjamin T. Schleppenbach , Greg G. Sass, Karen Gran, Daniel D.McCann

Presenter: Thomas Hrabik [thrabik@d.umn.edu](mailto:thrabik@d.umn.edu)

Affiliation: University of Minnesota, Duluth

The Bois Brule River is a spring-fed, western Lake Superior tributary in Wisconsin, USA, that supports five naturally reproducing populations of salmonids including native brook trout *Salvelinus fontinalis* and introduced brown trout *Salmo trutta*, rainbow trout *Oncorhynchus mykiss*, coho salmon *Oncorhynchus kisutch*, and chinook salmon *Oncorhynchus tshawytscha*. With increases in recreational angler use, combined with predicted changes to trout stream habitat from a warming climate, a better understanding of species interactions during spawning will become increasingly important to guide future management of these sportfish populations. Our objective was to map species-specific spawning redd locations and evaluate physical, flow, and thermal conditions in these habitats of the Bois Brule River during 2021-2022. We conducted observational redd surveys by canoe over a 15.3 river km section that encompassed historically important spawning areas. Our results indicated that spring spawning rainbow trout and fall spawning pacific salmon species were using the same spawning locations on larger gravel reefs in the center of the channel, downstream of riffle sections. Native brook trout were found spawning on smaller substrates with slower streamflow on the edges of the stream channel, with large congregations of spawning activity occurring in shoreline areas of lentic habitats of the river. Our results provide valuable spawning habitat information, increase understanding of species interactions for stream habitat management of the Bois Brule River in the future and may provide insight into management of other Great Lakes tributaries with similar sympatric, naturally reproducing salmonid species.

### **A Hidden Stronghold: Lake-Spawning Coaster Brook Trout in Grand Marais Harbor**

Author(s): Nick Peterson, Loren Miller, Steve Shroyer, Ryan Grow, and Cory Goldsworthy

Presenter: Nick Peterson [nick.peterson@state.mn.us](mailto:nick.peterson@state.mn.us)

Affiliation: Minnesota DNR

Lake-spawning Coaster Brook Trout have recently been documented in Grand Marais Harbor, raising the question of whether this population represents a recolonization event or one that has long gone undetected. The Minnesota Department of Natural Resources has historically monitored Brook Trout in Lake Superior tributaries but only recently initiated targeted sampling in nearshore Lake Superior habitats. From 2019–2024, Minnesota DNR and Grand Portage Band captured Coasters during summer nearshore electrofishing surveys. Following angler reports of reproductively mature Coasters in fall, electrofishing surveys in 2024 confirmed lake-spawning activity in Grand Marais Harbor. In 2025, multiple nights of fall sampling were conducted to support a mark–recapture population estimate. Summer sampling captured 27–89 Coasters annually, whereas fall 2025 sampling yielded 223 unique individuals and 88 recaptures. In fall 2025, fin-clipped (stocked) Isle Royale strain Coasters comprised only 16% of the total catch, indicating that most individuals originated from natural reproduction. Model-averaged population estimates were similar between a gross estimate (N=334; range 285–382) and a net estimate (N=298; range 250–347). Genetic analyses indicated that approximately half of sampled fish exhibited ancestry associated with Coaster hatchery strains (Nipigon or Isle Royale) or migrants from the Nipigon region of Lake Superior, and approximately 40% were likely derived from above-barrier North Shore populations. Fish with Nipigon ancestry were predominant among the largest individuals sampled in 2025. These results document a relatively robust lake-spawning Coaster population in Grand Marais Harbor and provide the first quantitative baselines needed to inform conservation, monitoring, and future management considerations.

## **Concurrent Session 2**

### **Applied Technologies**

#### **Using temperature loggers to monitor den box use by American martens, fishers, and tree squirrels**

Author(s): Michael J. Joyce, Taylor B. Velander, Michael C. McMahon, and Ron A. Moen

Presenter: Taylor Velander [velan018@d.umn.edu](mailto:velan018@d.umn.edu)

Affiliation: University of Minnesota-Duluth

Tree cavities are keystone habitat resources used by many animal species. Artificial den boxes can provide habitat for cavity-dependent wildlife where natural cavities are rare and have been used to address a variety of conservation, research, and management objectives. Accurate, cost-effective methods are needed to monitor den boxes to meet research and management objectives. Here, we describe a novel approach for monitoring den boxes using internal temperature loggers that relies on temperature rate of change values. Our objectives were to describe the pattern of temperature rate of change corresponding to uses of den boxes by American martens, fishers, and tree squirrels; evaluate how effectively temperature rate of change could detect den box uses; and evaluate whether temperature rate of change could be used to identify the species using den boxes. We installed 86 fisher den boxes in northern Minnesota, USA and monitored each box year-round for 3 years using remote cameras and internal temperature loggers. We found that temperature rate of change showed a consistent pattern when animals entered, remained in, and then left the den box. We also successfully identified all instances in which remote cameras documented fishers and martens using den boxes, but we rarely detected use by tree squirrels. The rate of change pattern when fishers used den boxes was statistically different from the pattern when martens used den boxes, demonstrating that species identification from temperature data is possible. Temperature loggers are an accurate, cost-effective method for monitoring den boxes to aid wildlife conservation, research, and management.

#### **Testing assumptions in fisher (*Pekania pennanti*) habitat suitability indices to understand fisher distribution in Minnesota**

Author(s): Adam L. Mortensen, Michael C. McMahon, Anna O. Mangan, Grace K. Lavan, Michael J. Joyce

Presenter: Adam Mortensen [morte311@d.umn.edu](mailto:morte311@d.umn.edu)

Affiliation: Natural Resources Research Institute

Animals often encounter landscapes that are significantly different from their core population range when recolonizing areas of prior extirpation. This can result in species returning to habitat that wildlife biologists may consider to be unsuitable. Realizing human perspectives on habitat quality with parameters of landscape use can help managers better understand population distributions and species' needs. Fishers (*Pekania pennanti*) are mid-sized, forest dependent carnivores that historically occupied much of the forested regions of the western Great Lakes. They were extirpated from much of Minnesota in the early 1900s and began recolonizing southern Minnesota in the early 2000s. Fisher habitat suitability indices (HSIs) were developed over 40 years ago in the western United States where extant populations were restricted to habitat characterized by large tracts of old growth, conifer-dominated forests. This led to long held assumptions that fishers require coniferous forests, and that deciduous-dominated forests would not represent high-quality habitat. Recent work in Minnesota has shown that fishers are more tolerant of deciduous forests than previously thought. Our objectives were to better understand fisher habitat needs by comparing previously developed HSI models to a new HSI model we developed that considered the distribution of critical habitat resources across Minnesota. We used location data from 30 GPS-collared fishers collected across Minnesota to evaluate which models best captured fisher habitat selection. Our results contradict previous assumptions that deciduous-dominated forests do not provide high quality habitat to fishers. This new HSI will provide managers with a better tool to assess fisher habitat across Minnesota.

## **Using Traditional and eDNA Surveys to Detect Spotted Salamanders (*Ambystoma maculatum*) in Minnesota**

Author(s): Sam Skinner, Spencer Rettler, Jennifer Y. Lamb, Ph.D

Presenter: Sam Skinner

Affiliation: St. Cloud State University

Environmental DNA (eDNA) sampling is a technology that allows for quick, non-invasive, and potentially cost-effective sampling for elusive species. Spotted Salamanders (*Ambystoma maculatum*) are a Species of Concern in Minnesota and are monitored by the Minnesota Dept. of Natural Resources. By completing eDNA surveys and traditional surveys alongside each other, and during different life-history periods (when eggs are present vs. larvae), we can compare detection rates among different survey methods and survey seasons. We expect to see equivalent or higher detection rates using eDNA compared to traditional surveys, as well as higher eDNA detection rates in the larval season compared to the egg laying season. eDNA and traditional surveys (egg mass surveys and larval dipnet/dip-pan surveys) were conducted in the spring and summer of 2025 at Nemadji and St. Croix State Forests. Twenty-seven wetlands were surveyed during the egg laying season and 11 in the larval season. We detected a total of 212 egg masses at twenty-three sites, and fifty-five larval Spotted Salamanders at eight sites with traditional methods. Challenges with traditional sampling included accurate larval identification, tannic water conditions, and habitat disturbance. Laboratory analyses of eDNA samples are ongoing and preliminary results will be shared. eDNA technology has the potential to extend the sampling season for biologists and save time, labor costs, and reduce habitat impact, but this method must be compared against established survey methodology.

## **Evaluating eDNA metabarcoding for fish community sampling on a remote freshwater archipelago**

Author(s): David Gallagher, Tom Hrabik, Mike Seider, Jared Myers, Jason Coombs, Aaron Maloy

Presenter: David Gallagher [galla621@d.umn.edu](mailto:galla621@d.umn.edu)

Affiliation: University of Minnesota-Duluth

Environmental DNA (eDNA) metabarcoding is a promising tool for surveying remote fish communities, often detecting rare species with less sampling effort than conventional methods. However, biases and contamination throughout the metabarcoding pipeline can complicate filtering threshold selection and interpretation of results. We evaluated the performance of eDNA metabarcoding for six lakes on Isle Royale, Michigan, USA. Our objectives were to 1) evaluate the effects of different thresholds on species richness, 2) optimize lake-specific thresholds using species' geographic distributions to minimize false positives while retaining true detections, and 3) compare eDNA metabarcoding with conventional sampling methods in characterizing fish biodiversity. Species richness immediately declined with increasing threshold stringency and then stabilized, although lake-specific responses varied. Optimal thresholds differed among lakes, with minimum read frequency ranging from 0.03–1.66% per species per sample and detections required in two to eight samples. This variability indicates that global thresholds may increase false positive and false negative error rates. Despite lake-specific thresholds, several detections inconsistent with known geographic ranges remained and were interpreted as putative false positives. Metabarcoding detected 80.8% (42/52) of species incidences recorded in the most recent conventional surveys, plus six incidences of historically documented species and four incidences of species from nearby waters. Ten incidences across eight species were detected only by conventional methods, likely reflecting habitat use, low abundance, and conservative threshold selection. Overall, our results highlight the complementarity of eDNA metabarcoding and conventional sampling while underscoring the importance of context-dependent threshold selection in remote freshwater systems.

## Tribal Session

### **Miinin (blueberries), Prescribed Fire and Cultural Burning in Red Pine Ecosystems: The Sunken Lake Blueberry Project**

Author(s): Bugwajiniinii (Daniel DeVault)  
Presenter: Bugwajiniinii (Daniel DeVault) [daniel.devault@lltc.edu](mailto:daniel.devault@lltc.edu)  
Affiliation: Bemidji State University, Leech Lake Tribal College

The Sunken Lake Blueberry Project is a long-term ecological research initiative conducted within the Sunken Lake Research Natural Area of the Cutfoot-Sioux Experimental Forest in north-central Minnesota. The project examines the response of Miinin wild blueberry (*Vaccinium* spp.) and associated understory vegetation to fire in red pine-dominated forest systems. Conducted as a partnership between Leech Lake Tribal College, the US Forest Service, and Bemidji State University, the project employs student interns who receive hands-on training in field forestry, vegetation monitoring, and fire ecology. Daniel DeVault (Bugwajiniinii) serves as the primary mentor and liaison with forestry partners, directly mentoring Tribal College students and coordinating research activities between the college and forest managers. Central to this work is the concept of cultural burning, which frames prescribed fire within a broader Indigenous land stewardship philosophy that emphasizes intentional, place-based fire use to sustain culturally important plant species, enhance ecosystem health, and maintain reciprocal relationships with the land. Through repeated vegetation surveys and plot-based monitoring, the project evaluates fire as a management tool to promote understory diversity, support non-timber forest products, and increase forest resilience. By integrating Indigenous ecological knowledge with Western forestry science, this research contributes to adaptive forest management and workforce development in northern Minnesota's red pine ecosystems.

### **Blueberry Burning**

Author(s): Tirmenstein, D. A.  
Presenter: Erik Carlson [erikc@grandportage.com](mailto:erikc@grandportage.com)  
Affiliation: Grand Portage Wildfire

We will gain understanding of how prescribed burning every 5 to 6 years has helped the land return to a more healthy and natural condition.

## **Fond du Lac Lake Superior Subsistence Fishery**

Author(s): Eric Torvinen

Presenter: Eric Torvinen [erictorvinen@fdlband.org](mailto:erictorvinen@fdlband.org)

Affiliation: Fond du Lac Lake Superior Subsistence Fishery

The Fond du Lac Band of Lake Superior Chippewa had not conducted fisheries harvest in Lake Superior for over 100 years. In 2023, Fond du Lac initiated its Lake Superior subsistence fishing program. The original objective of this program was to provide access to a traditional, culturally relevant food source. To make this happen took considerable effort. Quotas were declared, gear was purchased or built, and ceremony was done. On August 19th, 2023 the first net in over 100 years was set. Catch rates were significantly better than expected. All harvested Lake Trout were smoked and distributed to the entire Fond du Lac community at the annual Ganawenjigewin Maawanji'idiwin “Taking Care of Things” Gathering. While the original objective remains true, this program has evolved more into community driven communal harvests. Using that momentum, this past fall, the Fond du Lac community brought a group of youth Band members on Lake Superior to exercise their Treaty Rights, most for the first time. Lake Trout harvested during this event were then brought back to the Ojibwe School and served for school lunches in the cafeteria. This was an important goal for this program, telling the story of the full harvest circle.

This presentation is less about fisheries science and more about story telling. The story of this program is worth sharing in terms of cultural significance, healthy-local-traditional food sovereignty, Lake Trout rehabilitation, interagency cooperation, and novel operations by a Tribal Natural Resource Agency.

## **Listening to the Lake: Tracking Subsistence Giigoonh (Fish) Movements in Grand Portage Waters**

Author(s): Ryan Grow, Seth Moore, Nicole Watson, Daniel Yule

Presenter: Ryan Grow [rgrow@lakeheadu.ca](mailto:rgrow@lakeheadu.ca)

Affiliation: Grand Portage Band of Lake Superior Chippewa

Native fish species in the Grand Portage region of Lake Superior are vital to the Grand Portage Band of Chippewa for cultural, subsistence, and economic purposes. Key species include Namegos (lake trout), Maazhmegosens (coaster brook trout), Ogaa (walleye), Name (lake sturgeon), Okewis (cisco), Menominee (round whitefish), and Adikameg (lake whitefish). Although these species occupy a wide range of nearshore and offshore habitats throughout the year, the timing, locations, and extent of their movements remain poorly understood.

Addressing this knowledge gap is essential for identifying critical habitats, informing management decisions, and minimizing the risk of overharvest. In 2024, the Grand Portage Band partnered with the U.S. Geological Survey–Great Lakes Science Center (USGS-GLSC) to initiate a multi-year acoustic telemetry project. As part of this effort, 48 acoustic receivers were deployed throughout the Grand Portage Zone to track movements of native fish species.

During the fall of 2024 and 2025, we tagged 31 Okewis, 25 Menominee, 25 Adikameg, and 15 Namegos with depth- and temperature-sensitive acoustic transmitters to assess habitat use, seasonal movements, and spawning behavior. Data from the first year of fish tracking indicate that there are diel, spatial, and seasonal differences in the behavior of our tagged fish. Through this collaboration, the Grand Portage Band and USGS-GLSC aim to improve understanding of native fish ecology while supporting long-term conservation, sustainable harvest, food sovereignty, and subsistence practices for future generations.

# Ecological Resilience

## **Assessment of Walleye and Lake Whitefish Spawning Habitat Usage for Use in Predictive Model Validation**

Author(s): Benjamin Erb, Marianne Bachand, Ryan Maki, Andrew Hafis

Presenter: Benjamin Erb [benjamin.erb@live.bemidjistate.edu](mailto:benjamin.erb@live.bemidjistate.edu)

Affiliation: Bemidji State University

This project exists to validate and enhance upon models provided by Environment and Climate Change Canada (ECCC) which predict spawning sites for Walleye and Lake Whitefish in the Rainy-Namakan System. Model validation was accomplished by sampling for fish eggs and comparing sample data to the predictive model. Walleye eggs were sampled on Rainy Lake only, and Whitefish data was collected from both Rainy Lake and Namakan Reservoir. Walleye eggs were sampled in <1 m of water using a scap net, and Lake Whitefish eggs were sampled in 2 – 4.5 m of water using egg-mats. Model performance differed largely between predictions of egg presence and absence. For both species, the models performed substantially better at predicting egg absence (71% for Walleye and 70% for Lake Whitefish) than egg presence (24% and 30%, respectively), indicating a greater ability to identify unsuitable spawning habitat. Field observations show that Walleye spawned on relatively shallow lake bottom slopes (3-15 °) and that depth was a key predictor for both Walleye and Lake Whitefish (Walleye egg samples were most productive in 25 cm samples, and Lake Whitefish egg samples were most productive between 2.8-3.9 m depths). Contrary to model expectations, wave energy was not a reliable predictor of egg presence in this study, although it may still be useful as a proxy for substrate. The low success rates for egg presence suggest that important habitat characteristics, particularly substrate, are not adequately represented in the current models, so further refinement is needed as additional results become available.

### **Bright spots and factors related to unexpected walleye success**

Author(s): Christopher I. Rounds, Holly Embke, Zachary S. Feiner, Olaf Jensen, Quinnlan Smith, Jake Vander-Zanden, Dan Isermann, Ben Vasquez, Denver Link, Gretchen JA Hansen

Presenter: Christopher Rounds [round060@umn.edu](mailto:round060@umn.edu)

Affiliation: University of Minnesota Twin Cities

Inland fisheries are affected by land use change, climate change, species introductions, and other anthropogenic stressors. In the Midwestern United States, walleye are an important cool-water species sensitive to changing environmental conditions. Walleye stocks have declined in some locations in which they once thrived, while at the same time, other populations have thrived while experiencing similar stressors. Using a “bright spots” approach, we highlight where walleye are doing better than expected, and quantitatively and qualitatively highlight potential mechanisms behind the unexpected success. Using data from 11,544 agency fishery surveys across 1,764 lakes in Minnesota and Wisconsin, we identify bright spots and dark spots (i.e., lakes performing better than or worse than expected given biophysical conditions) for adult walleye relative abundance using a Bayesian GAMM. Quantitatively, we used these bright spots to understand how factors local environmental managers can control contribute to a lake performing better than expected (and being a bright spot). Qualitatively, we used lake expert surveys and interviews to investigate the social and management characteristics of walleye stocks that are healthier than expected. Focusing on bright spots and examples of success tends to can highlight effective management practices and useful tools for effective management in the face of large environmental change.

## **Thermal Sensitivity of Walleye Strains: Implications for Fisheries Management in a Warming Climate**

Author(s): Laurel H. Sacco, Tyler J. Firkus, Gretchen J. A. Hansen, Loren M. Miller, and Nicholas B. D. Phelps

Presenter: Laurel Sacco [sacco050@umn.edu](mailto:sacco050@umn.edu)

Affiliation: University of Minnesota

Walleye, a cool-water species, are particularly vulnerable to climate change, and strain-level thermal tolerance may be critical for future adaptation. In Minnesota, seven genetically distinct walleye strains are associated with major watersheds and show evidence of regional environmental adaptation. This study examines strain-specific responses to warming by evaluating differences in growth, physiological stress responses, disease susceptibility, and critical thermal maximum (CT<sub>max</sub>). In a controlled laboratory environment, 4.5-month-old walleye from two northern Minnesota strains (Pike, Pine), one southern Minnesota strain (LMS), and a commercially reared strain sourced from Wisconsin (NADF) were exposed for three weeks to temperatures representing current and predicted future (2070-2100) peak summer conditions. We measured growth and collected tissues for gene expression analyses to assess physiological stress and immune competence. Growth differences were detected only among temperature treatments associated with the Wisconsin strain: fish reared at current summer temperatures (27°C) grew significantly faster than fish held at either 20°C or 30°C (future peak summer temperature). Low sample sizes for Minnesota strains impacted our statistical inference. Following the thermal trial, CT<sub>max</sub> was assessed for the Wisconsin walleye acclimated to 8, 20, 27, and 30°C. CT<sub>max</sub> increased with acclimation temperature, ranging from 28.5°C to 37.3°C, higher than previously published. Ongoing work includes gene expression analysis of tissues from the 2025 experiment and a 2026 trial evaluating thermal tolerances in northern and southern Minnesota strains reared under spring-to-summer warming reflecting current and future conditions.

### **An evaluation of Cisco condition in Wisconsin waters of Lake Superior**

Author(s): Jeremiah Shrovnal, Brad Ray, Dray Carl, Ian Harding, Scott Sapper, Chris Zunker, Lynn Waterhouse

Presenter: Jeremiah Shrovnal [shrov001@umn.edu](mailto:shrov001@umn.edu)

Affiliation: University of Minnesota-Twin Cities

Commercial harvest of Cisco (*Coregonus artedii*) in Wisconsin waters of Lake Superior has increased due to the emergence of a commercial roe fishery resulting in a need for a more comprehensive understanding of body condition of the stock. Various fishery independent surveys are conducted during summer months and winter spawning aggregations that can provide insight into Cisco somatic and gonadal development throughout the course of a year. While the average weight of an individual is currently incorporated into the quota setting procedure, additional exploration of potential differences in Cisco condition in relation to sex and maturity may provide fishery managers with a more thorough understanding of sources in annual variability in this metric and how it may influence the quota setting process. The purpose of this work is to 1) explore the weight-at-length of Cisco captured in monitoring surveys to identify differences in condition based on sex and maturity and utilize these relationships to 2) build bioenergetic models to explore the potential for condition to vary in response to changes in consumption or the environment. Preliminary results indicate variation in condition between males and females as well as among maturity states. These findings can be incorporated into the quota setting procedure to help ensure consistent application of weight-at-length relationships for determining standing stock biomass.

## General Session

### **Behavioral Plasticity, Landscape Features Drive Variability in Fawn Space Use**

Author(s): Samuel J. Overfors, Tyler R. Obermoller, Joseph K. Bump, Eric S. Michel

Presenter: Samuel Overfors [overf005@umn.edu](mailto:overf005@umn.edu)

Affiliation: University of Minnesota

Movement is risky for White-tailed deer (*Odocoileus virginianus*) fawns, with increasing energy needs, changing habitat use, and predator avoidance impacting their decisions. However, these impacts on fawn space use are not well studied in Minnesota or characterized individually. Our objective was to assess fawn summer space use and associated responses related to anti-predator behaviors within an agriculturally dominated landscape. We hypothesized that most fawns would exhibit spatial shifts associated with anti-predator strategies and that forest cover would be highly sought after, but scarcely available, driving large home range sizes. We captured and GPS-collared 364 fawns in south-central Minnesota, USA from 2021 to 2024. We conducted individualized changepoint analysis using daily space use metrics to assess spatial responses related to anti-predator behavior of fawns. We calculated fawn summer home ranges, an indicator of range quality, using 95% auto-correlated kernel density estimates and extracted size and habitats at the individual scale. We found individuality in fawn spatial responses, driven by behavioral plasticity, that allowed them to adapt to varying influences. Mean summer home ranges were  $87.1 \pm 115.2$  (SD) ha across years and we found that for every 1% increase in forested, wetland, and grassland cover, fawn summer home ranges decreased by 8%, 4%, and 3%, respectively. This indicates that there are likely benefits to managing for diverse habitat that better meets requirements of fawns and their mothers. Further, our results indicate that anti-predator behaviors do impact space use of fawns, but available permanent habitat and maternal care may overshadow their effect.

### **Zombie Deer are Coming: Portrayal of Chronic Wasting Disease in U.S. Newspapers**

Author(s): Miranda HJ Huang, Rebecca Swenson, Marc Schwabenlander, Noelle Thompson, Melia Lachinski, Amelia Goldwasser, Tiffany M Wolf

Presenter: Miranda Huang [huan2928@umn.edu](mailto:huan2928@umn.edu)

Affiliation: University of Minnesota

Chronic wasting disease (CWD) is an invariably fatal, cervid disease which has been spreading since the 1960s. As a prion disease, there is no known treatment or cure. Management and surveillance often relies on the cooperation of hunters to submit tissue samples for testing, report sick-looking deer, and increase hunting efforts to reduce deer density. This reliance on the hunting public underscores the importance of effective communication between wildlife managers and stakeholders. While several studies have considered public perception and other communication sources, literature on how newspapers, a common information source for the public, have covered CWD is lacking. In this study, we performed a content analysis of state and local newspaper articles published across the United States from 1996 to 2024 to evaluate themes and shifts in story foci, keywords, quotes, and proposed solutions relating to the disease.

Initial findings indicate that the most common story focus was disease management (46% of articles), followed by surveillance and test results (28%). Over time, the percent of articles that included people as sources decreased ( $p < 0.001$ ) whereas those that included an action or solution increased ( $p < 0.001$ ). This dataset also allows us to examine how messaging varies geographically and by news source. These preliminary results highlight how media narratives have transitioned from describing the threat of CWD to covering the latest surveillance results and management actions. Understanding these trends allows wildlife managers to better tailor communication strategies, ensuring public trust and cooperation in long-term disease mitigation efforts.

## **Grazing...it's for the birds!**

Author(s): Krysten Zummo  
Presenter: Krysten Zummo [krysten.zummo@audubon.org](mailto:krysten.zummo@audubon.org)  
Affiliation: National Audubon Society

Grasslands historically made up one-third of North America thanks to the impacts of roaming bison herds and occasional fire. Due to their fertile soils, lack of trees, and flat or rolling landscape, they have been the easiest habitat to convert for human uses. Since 1970, we have lost 60% of our grasslands to conversion and woody encroachment, making them our most threatened and least protected ecosystem in the United States. Paralleling this habitat decline, grassland birds have lost nearly 43% of their populations over the same time period (North American Bird Conservation Institute, 2025). With bison no longer on the landscape and the restriction of fire, the path forward for grasslands lies in the hands of private landowners who dominate the ownership or management of these habitats. In 2017, the National Audubon Society developed a grassland focused program, Audubon Conservation Ranching (ACR), to work alongside graziers to bend the bird curve through adaptive grazing. In 2023, Audubon established the ACR program in Minnesota and Wisconsin. In our first two years we have certified over 10,000 acres, 7,000 in MN, including a MN based national brand. This presentation will discuss why working with graziers is key to grassland bird conservation, summary findings from the first few years of bird surveys, and where ACR in Minnesota goes from here.

### **A multi-model approach to flying squirrel survey planning and conservation in Minnesota**

Author(s): Anna R. Peterson, Anna O. Mangan, W. Mark Ford, Katie G. Pfaff, Ron Moen, Michael Joyce  
Speaker: Anna Peterson [hallx778@d.umn.edu](mailto:hallx778@d.umn.edu)  
Affiliation: UM-Duluth

In Minnesota, northern and southern flying squirrels (*Glaucomys sabrinus* and *G. volans*) act as indicators of forest health for coniferous and deciduous landscapes, respectively. However, their nocturnal and arboreal nature make them difficult to monitor. While methods such as passive acoustic monitoring make this effort more efficient, habitat suitability models and predicted distribution models are necessary for survey planning and conservation efforts. We developed a habitat suitability model utilizing vegetation variables that was used to identify habitat suitability in a known sympatric area. We then deployed acoustic detectors at 102 sites stratified by predicted habitat suitability and determined if flying squirrels were present. Southern flying squirrels were detected at 70%, 78%, and 88% of sites predicted as low, medium, and high suitability for that species. Few northern flying squirrel calls were detected regardless of predicted habitat suitability. We also present a MaxEnt distribution model to discuss climate and vegetation variables that correlate with the distribution of both species throughout the state. This model can then be used to predict future refugia in Minnesota with modeled climate and vegetation shifts. These approaches assist managers and researchers in their efforts to determine survey regions as well as areas to highlight as potential refugia.

## General Session

### **Factors Influencing the Body Condition of Yellow Perch in Minnesota Lakes**

Author(s): Georgina F. Leramo, Bethany J. Bethke, Beth V. Holbrook, and Andrew W. Hafs

Speaker: Georgina Leramo [georginaleramo1@gmail.com](mailto:georginaleramo1@gmail.com)

Affiliation: Bemidji State University

Yellow Perch *Perca flavescens* is a key species in Minnesota lakes, fulfilling ecological roles as both an important forage fish and a harvested sport species. Understanding factors influencing body condition can provide insight into population health and ecosystem dynamics. We assessed relative condition (Kn) of Yellow Perch from 27 Minnesota lakes sampled between 2017 and 2021 and evaluated environmental and biological predictors of variation in Kn. Relative condition was calculated using sex-specific length-weight relationships, and mixed-effects models were used to assess predictors of Kn with lake included as a random effect. Model selection was based on Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC).

Males exhibited higher Kn than females across lakes. Body condition declined with increasing age and surface temperature in both sexes, with a strong temperature effect observed in females. Kn varied by gear types, likely reflecting seasonal differences in sampling rather than gear-specific effects. Females showed a gradual decline in year following 2017 (no data in 2018), with no effect in males. Secchi depth, length at 50% maturity, and Walleye Kn showed no influence on Yellow Perch condition. These results indicate that Yellow Perch body condition varies among lakes and is primarily influenced by biological factors and thermal conditions, highlighting the importance of sex-specific effects and variation among lakes when assessing Yellow Perch populations in Minnesota.

### **Emerald Bowfin Ecology in Three Minnesota Lakes: Abundance, Age Analysis, Diet Composition, and Stable Isotope Food Web.**

Author(s): Griffin R. Blegen, Shannon J. Fisher, Alec R. Lackmann, Solomon R. David, Andrew W. Hafs

Speaker: Griffin Blegen [griffin.blegen@live.bemidjistate.edu](mailto:griffin.blegen@live.bemidjistate.edu)

Affiliation: Bemidji State University

The Emerald Bowfin *Amia ocellicauda* is a native Minnesota predator long dismissed as a “trash” fish, leaving its ecology and interactions with other species poorly understood. This study aims to expand knowledge of Bowfin ecology and provide population estimates to inform future management. Bowfin were sampled in spring 2024 and 2025. A multi census mark-recapture model was used to estimate abundance in three lakes. Estimated populations were 196 individuals in Little Toad Lake (95% CI: 116–242), 657 in Lake Sarah (95% CI: 436–1014), and 612 in Gun Lake (95% CI: 368–861). A subsample of 146 Bowfin was collected for age, growth, diet, and stable isotope analyses. Otoliths indicated ages from 2 to 33 years. All von Bertalanffy growth parameters were sex-specific, with asymptotic lengths of 702 mm for females and 561 mm for males, and growth coefficients of 0.218 and 0.633, respectively. Diet analysis showed Bluegill *Lepomis macrochirus* as the dominant prey item in all lakes, with odonates and crayfish also being important prey items. Bowfin and Northern Pike *Esox lucius* occupied lower trophic positions than Walleye *Sander vitreus* and Largemouth Bass *Micropterus nigricans*. Additionally, Bowfin displayed the broadest isotopic niche, with niche overlap highest between Bowfin and Northern Pike. These results indicate that Bowfin occur at low densities, reach old ages, experience low recruitment and mortality, and maintain a generalist diet while occupying a distinct role within the predator community. Overall, these findings highlight Bowfin as important native predators that contribute to ecosystem balance.

## **Comparing life history and trophic ecology of Longnose and Shortnose Gars between Northern and Southern metapopulations**

Author(s): Gabrielle Gonzales, Alec Lackmann, Charles Vaughan, Solomon R. David

Speaker: Gabrielle Gonzales [gonz1056@umn.edu](mailto:gonz1056@umn.edu)

Affiliation: University of Minnesota - Twin Cities

Gars (family Lepisosteidae) have been historically perceived as “trash fish” and understudied relative to game species. Shortnose Gars (*Lepisosteus platostomus*) and Longnose Gars (*L. osseus*) have a wide latitudinal range, and face threats of increasing exploitation and habitat modification. To address this fisheries data deficiency, we investigated the life history and trophic ecology of Longnose and Shortnose Gars, including comparisons between two metapopulations in the northern (Midwest) and southern United States. We analyzed total length, sex, age using otoliths, and trophic position based on stable isotope analysis ( $\delta^{15}\text{N}$ ) of fin tissue. Preliminary results indicate that at a given age, Longnose and Shortnose Gars grow larger in the South than in the North. However, both otolith age estimates and otolith mass indicate that Northern gars live longer than Southern gars. Further, the trophic position of Longnose Gars was higher than that of Shortnose Gars in Southern populations. Thus far, results indicate notable differences between the life history and trophic ecology of these species. Based on latitudinal variation between these metapopulations, our results could inform future studies on how fishes may adapt to increasing impacts of climate change.

## **Understanding Longnose Gar otolith age derivation, growth, and population dynamics in two large Upper Midwestern rivers**

Author(s): Charles R. Vaughan, Alec R. Lackmann, Solomon R. David, Allen H. Andrews, Mark E. Clark

Speaker: Charles Vaughan [vaugh377@umn.edu](mailto:vaugh377@umn.edu)

Affiliation: University of Minnesota - Duluth

Recent reevaluations of “native rough fish” management in Minnesota have identified Longnose Gar (*Lepisosteus osseus*) as a priority species with notable gaps in life history information. The objectives of this study are to: 1) develop baseline size at age models and vital rates for Minnesota populations, 2) compare utility of Longnose Gar lapillus otoliths to traditionally-used sagittal otoliths, and 3) quantify the approximate age and size at recruitment into the Upper Mississippi River (UMR) bowfishery. Preliminary results are from 2024–2025, where 303 fishery dependent and independent specimens were sampled via gill nets, electrofishing, trap nets, bowfishing, hook and line angling, and commercial seine (Mississippi River (n = 199) and St. Croix River (n = 104)). These results indicate age ranged from 0.2 yr to > 40 years for fish 152 to 1352 mm TL. Age ranged widely within 50 cm length bins. Von Bertalanffy growth models and weighted catch curves show significant differences between male and female growth parameters, and an annual mortality of ~6-8% in sampled reaches. A UMR bowfishing tournament (Pools 2-6) sample of 51 fish showed entry into the fishery at a 10th percentile total length of 659 mm, modal length bin of 700–750 mm, and median age of 7 and 10 for males and females, respectively. This research aims to provide essential demographics and fisheries- relevant data for these valued native resources.

## General Session

### **Lowland conifer forests: Structure, composition, and alternative management**

Author(s): Laura Reuling, Marcella Windmuller-Campione, Alexis Grinde, Rob Slesak

Speaker: Laura Reuling [lruling@umn.edu](mailto:lruling@umn.edu)

Affiliation: University of Minnesota

Lowland conifer forests make up approximately 3 million acres (17%) of Minnesota's 17 million acres of forest land. These forests are an important timber resource, but they also play an integral role in carbon storage, hydrology, water filtration, and plant and animal habitat. Our research uses a chronosequence approach to explore how stand structure, understory shrubs, and the herbaceous community develop across time in lowland conifer peatland forests in Minnesota. We found that forest characteristics important for peatland specialist birds (including several species of greatest conservation need) may take 150 or more years to develop after a major disturbance. There is interest in Minnesota and elsewhere to look beyond traditional clear-cut management of these forests to alternative silvicultural systems that integrate increased complexity, improve habitat for particular species, and broaden the "value" of these forests beyond just an economic one. The type of baseline data collected in this project is not currently readily available for these systems; increased understanding of these systems and availability of these data will allow for more informed decision making and allow managers to better design alternative management systems.

### **Rehabilitating Old Growth: a Synthesis Framework for Eastern Forests**

Author(s): Anna Yang, Roi Ankori-Karlinsky, Frank Halprin, Jacob Fraser, Christel Kern,

Speaker: Anna Yang [anna.yang@usda.gov](mailto:anna.yang@usda.gov)

Affiliation: ORISE; USDA Forest Service Northern Research Station

Old-growth forests in eastern North America are deeply valued, yet surprisingly difficult to define. Shaped by centuries of intensive land use and altered disturbance regimes, eastern forests deviate substantially from old-growth concepts of western states. As a result, managers and policymakers often lack a shared framework for identifying and managing old-growth across regions and forest types. We synthesize peer-reviewed literature and practitioner knowledge to examine how old-growth has been conceptualized and characterized in eastern forest ecosystems. Our synthesis explores common indicators used to define old growth, including stand structure and age, species composition, disturbance history, while also characterizing qualitative attributes such as values and threats across forest types. Rather than proposing a single definition, this work builds towards a flexible approach to characterizing eastern old-growth forests that moves beyond fixed thresholds. Our work is intended to inform ongoing discussions around inventory, planning, conservation, and monitoring among managers.

### **Applications of Remote Sensing**

Author(s): Jennifer Corcoran

Speaker: Jennifer Corcoran [jennifer.corcoran@state.mn.us](mailto:jennifer.corcoran@state.mn.us)

Affiliation: Minnesota Department of Natural Resources

This presentation describes the evolution, capabilities, and future direction of the Minnesota DNR Forestry Resource Assessment Program's Remote Sensing Program. It highlights how aerial imagery and related technologies support forest inventory, monitoring, emergency response, and decision-making across Minnesota. Emerging technologies such as lidar, thermal sensors, uncrewed aerial systems, and the integration of stereo aerial photography are showcased as tools that expand RAP's ability to map and monitor forest conditions in three dimensions and over time.

## Policy and Program Reviews

### **Managing People in Fisheries Management: An Overview of Fishing Regulations**

Author(s): Shannon J. Fisher; John R. Dunn

Speaker: Shannon Fisher [shannon.fisher@state.mn.us](mailto:shannon.fisher@state.mn.us)

Affiliation: MN Department of Natural Resources

The American Fisheries Society defines fisheries management as the manipulation of aquatic organisms, aquatic environments, and their human users to produce sustained and ever-increasing benefits for people. Human users are influenced by societal norms, economics, and outreach programs. However, the most utilized approach to manage human users is regulation. Regulations are in place that help resource agencies manage everything from when and where people can fish to harvest methods and bag limits. The goal of most successful regulations is to create a sustainable fishery that maximizes recreational opportunities. Regulations are intended to help maintain healthy fisheries – fisheries that support local economies and contribute to societal health. But how are these regulations developed? What is the process? Minnesota utilizes regulations based in statute and administrative rules. The processes used to establish these rules differ based on the type of rule being promulgated. Fisheries rulemaking has been active in recent months, with several changes going into effect, currently under consideration, or being planned. This presentation will provide an overview of the types of regulations used in Minnesota, outline the regulation development process, and highlight recent and upcoming regulation proposals.

### **Volunteers Can Help You to Meet Your Mission & Conservation Goals**

Author(s): Amy Rager, Andrea Lorek Strauss, Kacey Tait

Speaker: Amy Rager [rager001@umn.edu](mailto:rager001@umn.edu)

Affiliation: University of MN

Volunteers can greatly expand the amount of work that can get done on complex projects. Presenters will provide three examples of how this can successfully be implemented with multiple agencies/organizations at local, state and national levels. University of Minnesota Extension research over the past 20 years of service, documents the ecological impacts that Minnesota Master Naturalist volunteers have had on the conservation goals for individual organizations. Sponsors report that volunteers have contributed to creating healthier ecosystems through their work on habitat restoration projects and public-facing activities by providing extra hands to a project and freeing up valuable time of natural resource managers. Volunteers bring enthusiasm and energy to projects. They can help accomplish those back-burner projects that we all have and wish we had more time to devote to. Tips and tools for recruiting and working successfully with volunteers, who require training, care and feeding, will be shared to help you maximize your time and energy working with them to accomplish the conservation goals of your organization.

For reference:

[Journal Article: Master volunteer life cycle: A wide angle lens on the volunteer experience](#)

## Minnesota's Wildlife Action Plan Updated for 2025-2035

Author(s): Alison Cariveau, MN DNR Nongame Wildlife Program, and many others

Speaker: Alison Cariveau [alison.cariveau@state.mn.us](mailto:alison.cariveau@state.mn.us)

Affiliation: Minnesota Department of Natural Resources

This talk highlights what is new and updated in "Minnesota's Wildlife Action Plan 2025-2035: Conserving Habitats and Biodiversity." This is the third iteration of 10-year plans guiding conservation for at-risk wildlife species and their habitats. The Plan brings together information and resources to help practitioners sustain the long-term health and viability of our biodiversity, focusing on rare, declining, and vulnerable species and habitats. This year plants and lichen were added to the list of Species in Greatest Conservation Need (SGCN), and the list also grew with many additional invertebrate species. The Plan includes detailed stressor analyses and action tables for species groups and habitats, and sections on monitoring and public engagement. The Plan includes the The Conservation Action Network, a spatial tool representing biodiversity, high quality habitats, and connectivity. Conservation Opportunity Areas are areas designated for collaborations for on-the-ground habitat work for SGCN. The Plan will be shared in an online data portal coming in 2026.

### Public Preferences for Deer, Moose, and Wolf Wildlife Management in Northeast Minnesota

Author(s): Shanell Lovelace, Adam C. Landon, Afton Clarke-Sather, Roger Faust, Kathryn Haglin, Kyle Smith

Speaker: Adam Landon [adam.landon@state.mn.us](mailto:adam.landon@state.mn.us)

Affiliation: Minnesota Department of Natural Resources

The management of wolves, moose, and white-tailed deer in northeast Minnesota presents an interlinked challenge that is social, ecological, and economic in nature. Each species is central to the values of diverse stakeholder groups, drawing broad public interest. To understand statewide views, we surveyed a random sample of Minnesota households stratified as a) the seven-county Twin Cities metro, b) counties within wolf range, and c) counties outside wolf range (n = 12,000; 4,000 per stratum). We used a best-worst scaling choice experiment to elicit respondents' priorities for management objectives for wolves, moose, and deer. We also applied the RAD (resist–accept–direct) framework to assess preferences for moose population management. Across the state, Minnesotans consistently placed the highest importance on “ensuring moose remain in Minnesota in the future,” regardless of ecological dominance orientation or identity. Respondents across all three strata expressed similar priorities, with moose conservation dominating the share of preference. Within the RAD framework, Minnesotans favored efforts to recover moose to their estimated population around 2010, rather than resisting change or accepting current declines. While conserving moose was the priority for most, preferences for other objectives and moose management activities varied with ecological dominance orientation, identity, and residential location. Overall, the survey showed broad agreement that moose should remain in Minnesota and that conserving them is a higher priority than managing deer or wolves. Although there was not uniform agreement on which specific management actions to pursue, it is clear that public preference prioritizes moose over deer and wolves.

## **Concurrent Session 3**

### **Applied Technologies**

#### **Protecting Upper Mississippi River from Invasive Carp - Lock and Dam 5 Deterrent Project**

Author(s): Carli Wagner, Dr. Grace Loppnow, Kayla Zankle, Mike Noreen, Dr. Kelly Pennington

Speaker: Carli Wagner [carli.wagner@state.mn.us](mailto:carli.wagner@state.mn.us)

Affiliation: Minnesota Department of Natural Resources

Following the recommendation of the Lessard-Sams Outdoor Heritage Council, the Minnesota Legislature appropriated \$12 million to the Minnesota DNR (DNR) to fund design and installation of a deterrent for invasive carp at Lock and Dam 5 on the Mississippi River. Lock and Dam 5 presents challenges and opportunities for deterring invasive carp because they can pass upstream through the dam gates when open during flooding, but the gates there open less than at most other dams in Minnesota. The DNR is pursuing a comprehensive approach to address upstream passage of invasive carp across the entirety of Lock and Dam 5. Engineering design for a deterrent at the lock is underway via a contract with the U.S. Army Corps St. Paul District. To support effectiveness of the deterrent, the DNR is scoping a trap and sort system that would remove invasive carp below the dam and potentially pass native fish upstream. Addressing passage through the dam gates when they are open is a longer-term goal, because deterrents for dam gates still need to be developed. Monitoring to evaluate and adaptively manage the planned deterrent system is a priority and the DNR and partners began tagging invasive carp and native fish below Lock and Dam 5 in 2025. The DNR will cover progress to date and future plans during this presentation.

#### **Easier egg hunt: Using FluEgg modeling of silver carp ichthyoplankton drift to tailor monitoring methods and locations in Minnesota**

Author(s): Grace Loppnow, Jessica Z. LeRoy, P. Ryan Jackson, G. Everett Lasher

Speaker: Grace Loppnow [grace.loppnow@state.mn.us](mailto:grace.loppnow@state.mn.us)

Affiliation: Minnesota Department of Natural Resources

Captures and sightings of mature silver carp (*Hypophthalmichthys molitrix*) in Minnesota have increased in recent years, prompting concerns about the potential for reproduction to occur. Pools 1-10 of the Mississippi River are complex and varied in flow and habitat, raising questions about where recruitment could succeed, where eggs would hatch if a spawn occurred, and how best to monitor for reproduction. Simulations of hypothetical spawning scenarios using U.S. Geological Survey's Fluvial Egg Drift Simulator (FluEgg) have provided some new insight into these questions. The Minnesota Department of Natural Resources is using the results from USGS's FluEgg simulations in Pools 1-10 to focus ichthyoplankton sampling to areas that are more likely to produce viable young, and to tailor sampling methods to the life stage most likely to be found in those pools. Modeling results and application are covered in this presentation.

## **eDNA to Identify Presence of Terrestrial Invasive Species in Minnesota**

Author(s): Dr. Alexis Grinde, Dr. Ron Moen, Kara G. Snow

Speaker: Kara Snow [snowx043@d.umn.edu](mailto:snowx043@d.umn.edu)

Affiliation: Natural Resources Research Institute, University of Minnesota

Terrestrial invasive species pose significant ecological and economic risks to Minnesota's natural resources, making early detection critical for maximizing effective management strategies. While conventional monitoring techniques, such as ground-based and aerial surveys, have been useful for detection of invasive species populations that have already been established, they can miss species at immature life stages or in areas of new outbreaks. New monitoring tools which can detect invasions earlier and across broader landscapes are needed. Environmental DNA (eDNA) metabarcoding is a taxonomic method that uses genetic markers to identify species from biological material. This project explores the feasibility of using eDNA extracted from the fecal and gut contents of birds and mammals to detect terrestrial invasive species. To date, we have extracted DNA from over 500 samples. Using metabarcoding, we have detected two Priority Species listed by The Minnesota Invasive Terrestrial Plants and Pests Center (MITPPC): the spotted wing drosophila (*Drosophila suzukii*) and the brown marmorated stink bug (*Halyomorpha halys*), as well as three genera matching Priority Species (*Drosophila*, *Tipula* and *Coleophora*). These preliminary results suggest that the use of eDNA may be an effective tool for invasive species detection and monitoring their distribution. We will discuss the strengths, limitations and management applications of this method and outline the future directions of this project.

## **A New Tool for Early Detection of Endangered Turtles**

Author(s): Christopher E. Smith, Mark A. Davis

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Affiliation: Minnesota Dept. of Transportation

As turtle populations decline worldwide, there is an increased need for rapid and reliable monitoring of species to meet the need of increased regulatory burdens. The use of environmental DNA (eDNA) as a monitoring tool for rare species is becoming increasingly common, but there is still a need to optimize methods in the laboratory and the field at a per assay level. Here, we evaluated the effectiveness of environmental DNA (eDNA) for detecting Blanding's turtles and wood turtles across Minnesota. We developed two highly sensitive eDNA assays, sampled aquatic habitats across multiple seasons aligned with key life history stages of the turtles, analyzed occupancy and detection probabilities based on these sampling efforts, and assessed the costs associated with implementing these surveys. Both of our assays are developed up to the "Operational" level on the Thalinge eDNA validation scale and can be used with confidence for detecting turtles. We found that Blanding's turtles are easier to detect in the late summer and early fall months and are more likely to occupy smaller bodies of water. Individual predictors for wood turtles were weakly supported and would benefit from increased replication targeting this species in future studies. We found that our per sample cost of this study was \$79.38, however cost per detection varied with time of year and species. These eDNA assays are rapid, reliable tools for detection of Blanding's and wood turtles at a reasonable cost and provide potential for greatly improved methods of monitoring these rare species throughout Minnesota.

## Tribal Session

### **Thermal niches of predator and prey fish species in Mille Lacs Lake**

Author(s): Carl Klimah, Adam Ray, Aaron Shultz  
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Affiliation: Mille Lacs Band of Ojibwe

Mille Lacs Lake is a well-known Walleye fishery that supports indigenous and non-indigenous harvest. Unfortunately, this important fishery has experienced elevated juvenile Walleye mortality in the past, leading to a decline in harvestable Walleye. While the mechanisms underlying the elevated juvenile Walleye mortality are unclear, a diet study indicated that adult Walleye and Northern Pike are their primary consumers. In addition, increased water temperatures and clarity in the lake may be changing predator (adult Walleye, Northern Pike) and prey (juvenile Walleye, Yellow Perch, Tullibee) interactions. The objectives of this study were to: (1) characterize seasonal thermal niches of predator and prey fish species and life stages; (2) identify key aquatic habitats used by these groups; and (3) quantify their temporal, spatial, and thermal overlap. From 2018-2020, we used our gridded telemetry array (n=61) in Mille Lacs Lake and acoustically tagged 70 adult and juvenile Walleye and 20 each of Northern Pike, Yellow Perch, and Tullibee. The only difference in fish thermal habitats/niches occurred during winter, but there were distinct seasonal differences in fish depth and geographic location. Predators occupied shallower waters, in 4 distinct bays/regions, while prey fish occupied deeper offshore waters. Our results indicate distinct predator and prey zones in the lake with ontogenetic niche partitioning occurring. These findings can be used by managers/stewards to conserve habitats that predator and prey fish use, which may improve the survival of young Walleye. Actions may include designating in-lake protected areas and promoting best management practices along shorelines and throughout the watershed.

### **Odibaabandamawaan odinawemaagana, Gaa-zagaskwaajimekaag adikamegwag “Looking in on our relatives, the Leech Lake Whitefish”**

Author(s): Michael O'Brien  
Speaker: Michael O'Brien [michael.obrien@llobjibwe.net](mailto:michael.obrien@llobjibwe.net)  
Affiliation: Leech Lake Band of Ojibwe DRM Fish, Wildlife and Plants

Adikameg, or lake whitefish (*Coregonus clupeaformis*), hold significant cultural, subsistence, and ecological importance for the Anishinaabe people, including the Leech Lake Band of Ojibwe (LLBO). Since the late 1980s, the Band's hatchery program has stocked roughly 3.5 million fry and 2.5 million fingerlings into Leech Lake, representing a substantial long-term investment. Yet lake whitefish remain difficult to assess using standard monitoring approaches, leaving important questions about population status and long-term sustainability. This study uses molecular tools to evaluate the genetic “health” of the Leech Lake whitefish population. Fin clips collected through ongoing sampling efforts will be analyzed to quantify genetic diversity and estimate effective population size using linkage-disequilibrium methods in LDNE (Waples & Do, 2008). These metrics provide insight into whether the population exhibits signs of reduced diversity, past bottlenecks, or demographic instability—patterns that may not be detectable through conventional sampling methods. Findings from this work will directly inform management decisions regarding LLBO's hatchery program and its future role in supporting whitefish within the lake. By integrating contemporary genetic approaches with the Band's stewardship priorities, this project aims to strengthen our understanding of whitefish population dynamics and support informed, culturally grounded management of a species, or in the eyes of the Anishinaabe, “protection for our relatives.”

## **Sturgeon Monitoring on the Lower St. Louis River**

Author(s): Nick Bogyo

Speaker: Nick Bogyo [nbogyo@1854treatyauthority.org](mailto:nbogyo@1854treatyauthority.org)

Affiliation: 1854 Treaty Authority

In 2011, the 1854 Treaty Authority and the Fond du Lac Band began a larval drift net survey to document the success of natural reproduction of sturgeon on the lower St. Louis River. Following the Minnesota and Wisconsin Departments of Natural Resources stocking efforts and habitat restoration projects, a spawning population is once again present in the estuary. This survey was implemented as a means of observing the success of these spawning individuals. The future goal of this survey is to eventually observe a correlation with the number of larval sturgeon captured in drift nets and the number of juvenile sturgeon captured in our trawl surveys. The 1854 Treaty Authority also conducts three seasonal trawl surveys each year. The goals of these surveys are to monitor native and non-native fish communities, monitor for new invasive species, and to document the survival of naturally reproduced sturgeon. In 2019, the 1854 Treaty Authority implemented a sturgeon setline survey on Lake Superior to monitor recruitment, year class strength, and population trends over time. This survey was also implemented as a means of drastically reducing by-catch numbers compared to standard gill-net surveys.

## Ecological Resilience

### **Straight River Brown Trout and Bait Harvest, Can They Coexist?**

Author(s): Carl Pedersen, Kyle Little, Heidi Rantala

Speaker: Carl Pedersen [carl.pedersen@state.mn.us](mailto:carl.pedersen@state.mn.us)

Affiliation: MN DNR

The Straight River is a premier Brown Trout fishery in NW Minnesota sustained entirely by natural reproduction. Historically bait harvest has not been permitted in most Minnesota designated trout waters. As surrounding waters are lost to bait harvest due to AIS infestations increased pressure to allow some bait harvest has occurred. This presentation introduces the Straight River, some work to evaluate how effective bait harvest would be in the river and outlines potential future bioenergetics work to determine how impactful bait harvest might be to the Brown Trout fishery.

## **Decay and longevity dynamics of retained snags following regeneration of red pine stands in north central Minnesota**

Author(s): Gregory Harris, Chris Edgar, Lee Frelich, Marcella Windmuller-Campione

Speaker: Greg Harris [harr3533@umn.edu](mailto:harr3533@umn.edu)

Affiliation: University of Minnesota

Snag retention is commonly used in regeneration harvests to provide structural continuity in managed forests, yet their short-term persistence and decay trajectories remain poorly understood in even-aged managed red pine stands. Because natural snag recruitment remains low for several decades following stand initiation, the longevity and structural evolution of retained legacies play an important role in determining whether an ecologically meaningful snag component can be sustained during early stand development.

To quantify post-harvest snag dynamics, I conducted a complete census of 354 retained snags across a chronosequence of 12 regenerated red pine stands (0–11 years post-harvest). Snag attributes such as species, diameter, height loss, branch and bark retention, cavity formation, and decay class were measured and evaluated using mixed-effects modeling to assess how structural and decay characteristics shift following clearcut regeneration.

Although snag densities remained similar across the chronosequence, decay pathways and structural stability diverged sharply by species group. Aspen–birch snags exhibited rapid advancement through decay classes, accelerated branch and bark loss, and substantial height reduction, indicating relatively fast structural transformation. Pines, in contrast, maintained taller, more intact forms with slower morphological change, reflecting greater near-term structural stability but different long-term breakdown trajectories.

These findings demonstrate that species-driven differences in decay and structural stability, not simply the number of retained snags, shape the longevity and functional contributions of these legacy structures. Such insights can inform silvicultural prescriptions aimed at maintaining structural complexity that supports wildlife and broader biodiversity objectives.

## **Monitoring the Response of Four-toed Salamander (*Hemidactylium scutatum*) Populations to Forest Management**

Author(s): Spencer Rettler, Andrew Herberg, Christopher Jennelle

Speaker: Spencer Rettler [spencer.rettler@state.mn.us](mailto:spencer.rettler@state.mn.us)

Affiliation: Department of Natural Resources

Forest management has profound impacts on wildlife, yet quantifying effects often entails intensive long-term monitoring. This is particularly vital for rare and vulnerable species. Here we share preliminary results on impacts of forest management on a rare forest-dependent amphibian: the four-toed salamander (*Hemidactylium scutatum*). This species relies upon vernal pools, as well as intact mature upland forest, for successful recruitment. We hypothesized that salamander relative abundance would decrease after forest management occurred in proximity to a vernal pool. Using BACI study design, we monitored 21 control and 24 treatment vernal pools (n=45) where salamander nesting activity was observed. Treatments entailed vernal pools with planned forest management between 2023 – 2029. We used detection trials to estimate individual observer detection probabilities. We recorded salamander detections, as well as characteristics about their nesting and wetland habitat, while conducting time constrained nest surveys each spring. Trail cameras were deployed at vernal pools to record changes in hydroperiod. Detection trials identified individual variability in detection probability, yet the group average was approximately 0.8 after 5 minutes of searching. Overall, we observed a 40% decline in nest detections between 2023 and 2025; however, there was notable year-to-year variation within a given wetland. On average, the hydroperiod was over three weeks shorter in 2025 (82.9 days [SD=48.5]) than in 2024 (106.4 days [SD=26.2]). To date, only 25% of treatment wetlands have experienced management; therefore, there is insufficient data to determine whether these apparent trends are driven by forest management or natural annual variation.

## **Urban Tree Assessment - Trends in Urban Tree Populations Using Repeat Surveys and Remote Sensing**

Author(s): Lucas Spaete, Rachel Morice, Valerie McClannahan, Luka Pearson

Speaker: Lucas Spaete [lucas.spaete@state.mn.us](mailto:lucas.spaete@state.mn.us)

Affiliation: MNDNR - Forestry

What is your community forest like, and how has it changed in the past decade? This presentation will guide you through the methodology and results of the MN DNR's Urban Community Forestry Rapid Assessment project. This rapid assessment of community forests across Minnesota consists of two main parts: detailed, on-the-ground community tree survey reports and an expansive, lidar-derived tree canopy change detection raster. The survey provides detailed information about tree species, health, and size class distribution along public roads in commercial and residential areas, while the canopy change detection conveys a broad overview of forest loss or gain everywhere within the municipal boundary. The results are shared via an ESRI Experience Builder web app that maps community tree canopy change across over 900 Minnesota towns and street tree inventory reports for 304 of the most populated communities. The community tree survey was designed to follow up on a similar 2010 survey assessing the spread of Emerald Ash Borer, and the results show a clear decline in Ash population and fewer large trees across many towns in MN.

## Forestry for Birds

### **Forest structural complexity and its influence on black spruce peatland bird communities.**

Author(s): Joshua M. Kolasch, Alexis R. Grinde, Robert A. Slesak, Marcella A. Windmuller-Campione

Speaker: Josh Kolasch [kolas041@d.umn.edu](mailto:kolas041@d.umn.edu)

Affiliation: University of Minnesota - Natural Resources Research Institute

Forest structural complexity is a primary driver of species distribution, abundance, and diversity, especially in bird communities. Forest structure shapes nearly every aspect of avian ecology, including where birds perch, forage, nest, and avoid predators as well as how resources are distributed across the landscape. Forest bird communities have high degrees of habitat specialization associated with different successional stages of forest development and are highly susceptible to habitat alterations. Minnesota's boreal forests, which represent the southern range limit for many boreal bird species, are particularly vulnerable. Peripheral populations at range edges are often more susceptible to disturbance, a vulnerability that is amplified in specialized systems like productive black spruce peatland forests. These peatlands are shaped by long, infrequent disturbance intervals that generate high structural heterogeneity characteristic of older successional forests, conditions that support many specialist bird species. In Minnesota, contemporary forest management has dramatically shifted the age class distribution of black spruce peatlands and simplified forest structure through timber extraction via clear-cutting. This simplification of habitat structure has negatively impacted several specialist species identified as Species of Greatest Conservation Need. To better understand how simplification of forest structure impacts the black spruce peatland bird community, we used field collected measurements, high density LiDAR and bird point counts collected across 19 black spruce peatland forest of various age class to identify key structural features influencing both specialist habitat selection and community grouping patterns. By identifying structural relationships for this bird community, we hope to further iterate the importance of older successional forests and the need to maintain structural complexity in forest management.

## Performance of Automated Acoustic Classifiers for Two Declining Bird Species

Author(s): April Strzelczyk Haverstock, Elena West  
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Affiliation: University of Minnesota

Monitoring declining wildlife species can be challenging, particularly for species that are rare, cryptic, or nocturnal. Passive acoustic monitoring (PAM) using autonomous recording units (ARUs) can be an effective approach for monitoring vocal species, but the substantial amounts of audio data generated can be difficult to process efficiently. Automated and semi-automated classifiers that do not require custom programming offer users a way to analyze large acoustic datasets, although classifier performance varies across species and can depend on the quantity of training data used. We evaluated three semi-automated classifiers, BirdNET, Kaleidoscope, and MonitoR, on their ability to detect two Species of Greatest Conservation Need in Minnesota: the Eastern Whip-Poor-Will (*Antrostomus vociferus*) and the Red-Headed Woodpecker (*Melanerpes erythrocephalus*). Classifier performance differed by species and number of training data clips. BirdNET consistently showed the strongest discriminatory performance for both species (AUC = 0.93–0.96 for Red-Headed Woodpeckers and 0.94–0.97 for Eastern Whip-Poor-Wills). Red-Headed Woodpecker detections were highest when classifiers were trained with presence and absence clips from the field, whereas Eastern Whip-Poor-Will detections were strongest using BirdNET's default settings. In comparison, Kaleidoscope showed lower and more variable performance (AUC = 0.47–0.63 for Red-Headed Woodpeckers; 0.53–0.93 for Eastern Whip-Poor-Wills), while MonitoR exhibited moderate performance across both species (AUC = 0.69–0.81 for Red-Headed Woodpeckers; 0.67–0.73 for Eastern Whip-Poor-Wills). Additional metrics including precision, recall, and F-score were used to assess classifier performance. Our results provide practical guidance for wildlife managers and researchers in Minnesota using PAM, highlighting how classifier choice and size of training data can influence detection accuracy and be used to improve conservation monitoring efforts.

### Wildlife responses to alternative harvesting in black spruce forests of northern Minnesota.

Author(s): Alexis Grinde, Steve Kolbe, Marcella Windmuller-Campione, Mike North, Charlie Tucker  
Speaker: Josh Bednar [bedn0050@d.umn.edu](mailto:bedn0050@d.umn.edu)  
Affiliation: Natural Resources Research Institute - University of Minnesota

Widespread declines in breeding bird populations have been documented across North America since the 1970s and concerns for loss of avian biodiversity are growing. Specifically, species using lowland conifer cover types in Minnesota have shown some of the steepest declines here at the southern edge of their breeding range – many of which require mature forest. Notably, the Connecticut Warbler (*Oporornis agilis*) which is a species of conservation concern, has seen a population decline of >90% in the National Forests of Minnesota over the past 30 years. Connecticut Warblers breed in forests in Central Canada and around the Western Great Lakes; throughout a portion of its breeding range, this species is associated with lowland black spruce (*Picea mariana*) and tamarack (*Larix laricina*) forests. To mitigate this decline and to address additional management concerns in lowland conifer forests, we developed three experimental treatments in two predominantly black spruce stands in northern Minnesota with the goal of retaining mature forest habitat while creating habitat for Connecticut Warblers. Our treatments consisted of thin and thick strip cuts and group selection cuts that retained ~40% of the stand. Preliminary results of these experimental harvests show a positive response of Connecticut Warblers to the treatments post-harvest. The overall breeding bird community response was also positive. Here, we present the pre- and post-harvest breeding bird and small mammal responses. Results from this study can be used by natural resource managers to develop conservation strategies that will provide critical habitat to support this species along with many others.

## **State of Minnesota's black spruce: a bird's eye view**

Author(s): Steve Kolbe, Josh Bednar, Alexis Grinde

Speaker: Steve Kolbe [kolbe023@d.umn.edu](mailto:kolbe023@d.umn.edu)

Affiliation: University of Minnesota - Natural Resources Research Institute

Black spruce forests in Minnesota provide year-round habitat for many of the state's most charismatic bird (and other wildlife) species, many of which are Species in Greatest Conservation Need. These same forests are also threatened by climate change, land use changes including fragmentation and habitat loss, and forest pests. Unlike many other cover types in the state, the vast majority (>80%) of Minnesota's black spruce is managed by public entities (the state, the federal government, a few counties), and this creates both an exciting opportunity and significant challenges to effect change in these forests on a large scale. Our research demonstrates the importance of black spruce forests for local and regional hydrology, vegetation, and wildlife diversity while framing these results both in a Minnesota and North American context. We present an overview of the changes and challenges black spruce forests in Minnesota have experienced in the past, discuss the ecological implications of these issues, and provide evidence and justification for maintaining these high-value and charismatic habitats on the landscape into the future while simultaneously enhancing the resiliency of the forest. We also acknowledge the many challenges and competing interests inherent in this topic. Results from this study can be used by managers to understand the broader context and importance of black spruce in the region and beyond.

## General Session

### **A Comparison of Gear Efficacy for Fishes Occupying Near-Shore, Off-Channel Riverine Habitats**

Author(s): Devon C. Oliver, Charmayne L. Anderson, and Daniel Spence

Speaker: Charmayne Anderson [charmayne.anderson@state.mn.us](mailto:charmayne.anderson@state.mn.us)

Affiliation: Minnesota Department of Natural Resources

Riverine fish monitoring often emphasizes main-channel habitats, despite many species relying on near-shore, off-channel habitats (e.g., backwaters, side channels, partially submerged islands) for much or all their life history. Limited evaluation of sampling gears in these habitats may result in biased estimates of species presence and community composition. We compared the efficacy of four standardized sampling gears – mini-trap nets, cylinder minnow traps, shoreline seining, and near-shore backpack electroshocking – for sampling near-shore, off-channel fish assemblages in Pools 3, 5, and 6 of the Upper Mississippi River. Sampling was conducted over three weeks in late summer 2024 at three randomly selected sites per pool. Each gear was replicated three times per site, resulting in 108 total samples. Fish were identified, counted, and measured, and habitat characteristics were qualitatively assessed. Gear performance was evaluated using metric of species richness, observed mean presence, precision (coefficient of variation), and detection probability. Random forest classification was used to assess the relative importance of species, gear type, Pool, and environmental variables in predicting species presence. Mini-trap nets captured the greatest species diversity and had the highest observed mean presence, whereas minnow traps exhibited the lowest detection rates and diversity. No consistent trends in precision were observed among gears, although variability differed by species. Random forest results indicated species and gear type were the most important variables in determining presences vs. absence. These results highlight the importance of multi-gear approaches and provide a framework for incorporating detection bias into future occupancy-based monitoring of large river fish assemblages.

## **Fish index of biological integrity monitoring and assessment: Baseline conditions in Minnesota lakes**

Author(s): Derek Bahr, Jacquelyn Bacigalupi, Lucas Borgstrom, Josh Knopik, Jessica Massure, Stephanie Simon, Aaron Sundmark, Zachary Witzel

Speaker: Derek Bahr [Derek.Bahr@state.mn.us](mailto:Derek.Bahr@state.mn.us)

Affiliation: Minnesota Department of Natural Resources

The Minnesota Department of Natural Resources (MNDNR), in coordination with the Minnesota Pollution Control Agency (MPCA), completed the first cycle of fish index of biological integrity (IBI) monitoring and assessment across lakes statewide. This effort was funded by the Clean Water, Land, and Legacy Amendment and implemented in alignment with MPCA's watershed monitoring schedule. These results represent the most comprehensive assessment to date of fish community integrity in Minnesota lakes, spanning all major basins and a wide range of environmental conditions. Statewide, 77% of lakes were assessed as fully supporting aquatic life, based on fish IBI scores that were above the impairment threshold. Conversely, 23% were assessed as impaired, based on fish IBI scores that were below the impairment threshold. Nutrient enrichment and shoreline development were consistently associated with lower biological integrity, indicating common stressors affecting lake fish communities statewide. These findings establish a statewide baseline for fish community integrity, identify impaired and potentially vulnerable lakes, and will inform future monitoring and targeted management and conservation efforts to restore or protect Minnesota's lake ecosystems and fisheries.

## **Applying machine learning to predict and understand native and invasive aquatic species distributions**

Author(s): Grant Vagle, Jeremiah Shrovnal, Wesley Daniel, Nick Phelps, Richard Erickson, Lynn Waterhouse

Speaker: Grant Vagle [vagle019@umn.edu](mailto:vagle019@umn.edu)

Affiliation: University of Minnesota, Twin Cities

Aquatic invasive species threaten water quality, ecosystem functioning and services, and the economic and cultural value of waterbodies in the Upper Mississippi River Basin (UMRB). However, identifying at-risk waterbodies is a difficult task given the multitude of potential invasive species and the wide variety of characteristics exhibited by waterbodies in the six-state region. Here, we used a machine learning model (boosted regression trees) to predict the potential distributions of 35 aquatic invasive species across all sub-watersheds of the UMRB. We retrieved global species records from the Global Biodiversity Information Facility and included globally available covariate data including hydrology, physiography, climate, land use/land cover, soil/geology, and anthropogenic variables. For 35 aquatic invasive species including fish, invertebrates, and aquatic plants, we generated predicted infestation risk maps and used model interpretation methods to understand which variables influenced the predicted risk in the UMRB. We produced model reports for each species, as well as tools that use the model outputs to produce interactive maps. This presentation will walk through the modeling process and show example model results and outputs. Additionally, we will introduce an ongoing extension of these methods applied to native aquatic species in Minnesota and projecting potential changes in habitat suitability under future environmental change scenarios.

## **Goldfish management in a shallow urban lake: familiar tactics for a new foe**

Author(s): Jordan Wein

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Affiliation: Nine Mile Creek Watershed District

Common carp research has been pivotal in managing the invasive species and water improvements have been made in many of those lakes. Goldfish, a similar invasive species, have been detected in a number of water bodies especially in urban areas and that number continues to grow. They, like carp, can have significant negative impacts on water quality and ecological health of a water body. But unlike carp, there are relatively few instances of successful management other than aggressive “reset button” options like rotenone or water level augmentation. One commonly used method for removal of adult carp is known as baited box net trapping and can be very effective. Our work explored this method with goldfish in Lake Cornelia in Edina. We present the results of this effort and also discuss what a program to manage goldfish can look like.

## **General Session**

### **NOBODY SAID IT WAS EASY, NO ONE EVER SAID IT WOULD BE THIS HARD: QUANTIFYING FISH RESPONSES TO CLIMATE CHANGE IN LAKES OF THE MIDWESTERN UNITED STATES**

Author(s): Gretchen JA Hansen, Denver Link, Christopher Custer, Holly K Masui, Jenna KR Nelson, Josh North, Jordan S Read, Erin Schliep, Michael R Verhoeven, Tyler Wagner

Speaker: Gretchen Hansen [ghansen@umn.edu](mailto:ghansen@umn.edu)

Affiliation: University of Minnesota

Predicting the effects of climate change on multiple fish species across diverse lakes requires interdisciplinary approaches. We developed process-based models for simulating past and future temperatures of tens of thousands of lakes under climate change. We collated fish relative abundance data collected by agencies and developed workflows to clean, restructure, and combine datasets resulting in a database of millions of fish records from tens of thousands of lakes. Finally, we developed a spatially explicit, joint-species physiologically guided abundance (jsPGA) model that combines laboratory information on thermal preferences and tolerances with empirical data on fish relative abundance and environmental conditions for predicting the effects of warming on multiple species concurrently. We apply these tools to predict the responses of eight freshwater fish species with differing distributions and thermal tolerances to future climate change in lakes throughout the Midwestern United States. Lake-specific predictions varied among lakes and species, although across all locations temperatures were predicted to increase and average projected changes in fish abundance were linked to species thermal tolerances. July surface water temperatures were projected to increase by an average of 2.3°C by mid century and 4.3°C by the end of the century. Coldwater cisco responses were most severe, with abundance predicted to decline by 85% and an average extirpation probability of 46% by end of century. Coolwater walleye and northern pike were predicted to decrease by an average of 33% and 24%, respectively, while warmwater bluegill and largemouth bass were projected to increase in abundance by 7 and 4%, respectively. Smallmouth bass and black crappie predicted responses varied by lake, but average changes in abundance across the region were close to zero. Collectively, this work demonstrates the power of interdisciplinary approaches for analyzing large datasets to understand and predict community responses to environmental change across diverse ecosystems.

## **Restoring nearshore lake ecosystems through mechanical harvest of invasive cattails**

Author(s): Claire L. Rude, Amy J. Schrank

Speaker: Claire Rude [rudex109@umn.edu](mailto:rudex109@umn.edu)

Affiliation: University of Minnesota Sea Grant Program

Invasive hybrid cattails (*Typha X glauca*) are widespread in Minnesota and form dense monoculture stands along lakeshores, posing threats to organisms that rely on lake littoral zones. Since 2021, we have been researching whether small-scale mechanical removal of these cattails helps mitigate negative ecological impacts by allowing native vegetation to reestablish and improving habitat for fish. We removed cattails in 30-ft wide sections in lakes from shore to open water, trimming cattails above the substrate and below the water line and harvesting biomass. Our results showed that this management strategy increased dissolved oxygen in cattail removal sites, allowed passive revegetation of native aquatic plants, and increased submergent plant cover. In some lakes we observed altered fish communities and greater minnow abundance post-removal. Small-scale mechanical harvest is a promising option for invasive cattail management and nearshore habitat restoration, especially for native plants, and can be applied by the public more readily than other management strategies based on Minnesota's aquatic plant management regulations. In the next phase of the project, we are helping communities put this management strategy into action statewide with the Minnesota Cattail Collaborative. In collaboration with lake managers and local communities, small-scale mechanical cattail harvest will be implemented across Minnesota, and participants will collect pre- and post-removal data. Translating our research into management actions that lakeshore communities can implement will allow us to evaluate the benefits of this management strategy in a greater number and variety of lakes, and empower managers and communities to restore cattail-impacted nearshore habitats.

## **Lake restorations followed by northern pike and yellow perch stocking to improve habitat quality in shallow southern Minnesota lakes**

Author(s): Brian R. Herwig, Kyle D. Zimmer, Sarah Howe, Natalie Ganzel, Rachel Klaras Barkett, Catherine Hegedus, Claire Herzog, Danelle M. Larson, Nicole Hansel-Welch

Speaker: Brian Herwig [brian.herwig@state.mn.us](mailto:brian.herwig@state.mn.us)

Affiliation: MN Department of Natural Resources - Fisheries Research

Shallow lakes in agriculturally dominated landscapes often exhibit phytoplankton-dominated, turbid water conditions reinforced by persistent populations of invasive Common Carp and native undesirable fishes such as Black Bullhead. These systems frequently experience high, stagnant water levels and infrequent winterkills. Lake restoration practices in Minnesota include drawdowns, chemical treatments (infrequent), fish barriers, and/or stocking predatory fish such as Northern Pike (pike) to reduce undesirable fish populations and shift lakes from turbid to clear-water states. Our study was conducted in southern Minnesota on four rehabilitated lakes 1–5 years after water-level or other manipulations to determine whether pike and Yellow Perch (perch) stocking in three of the four lakes provided top-down predatory control of prey fishes and prolonged clear-water conditions. We collected data on water chemistry, invertebrates, aquatic vegetation, and fish relative abundance, diets, and stable isotope signatures to understand the relative influences of stocked and native/invasive fishes in these shallow lake food webs. Pike were highly piscivorous and likely exerted some control on small-bodied minnows. Perch populations increased rapidly and fed primarily on macroinvertebrates. Although perch were an important prey item for pike, pike did not control perch abundance. A new food-web pathway developed from littoral energy to perch to pike, black bullheads remained abundant, common carp reinvaded most lakes, and lakes reverted to turbid states during the study. Detailed results and management implications will be discussed.

## Walleye Biomanipulation: Collaborative Conservation in Prairie Wetlands

Author(s): Sara Vacek, Storm Kettelhut, Kyle Anderson

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Affiliation: U.S. Fish and Wildlife Service

Walleye biomanipulation – introducing walleye fry to control overabundant fathead minnows (FHM) – can improve water quality and habitat conditions in prairie wetlands. Since 2005, U.S. Fish and Wildlife Service (USFWS) and Minnesota Department of Natural Resources (DNR) have used this tool to improve wetland conditions on public lands, while simultaneously providing DNR with needed walleye rearing sites.

Water quality in many prairie wetlands has deteriorated significantly over the last 50 years. One factor in this decline is the trophic shift caused by an overabundance of planktivorous fish, particularly FHM. Fathead minnows feed on aquatic invertebrates and zooplankton, which in turn causes phytoplankton to increase. High abundance of phytoplankton leads to low water clarity, blocking sunlight from reaching wetland bottoms and reducing submerged aquatic vegetation (SAV). Loss of SAV allows winds to stir up bottom sediment, which further reduces water clarity.

Field staff from USFWS and DNR collaborate to identify potential treatment sites, then DNR staff collect pre-treatment data on existing fish populations, water depth and clarity, and SAV cover and species richness. On wetlands that fit our selection criteria, DNR staff stock walleye fry in spring, conduct wetland monitoring at least once during the summer, and remove walleye fingerlings in early fall. In this presentation we will review examples of walleye biomanipulation. We will share criteria used to identify appropriate treatment sites and monitoring results from treated wetlands. We will also discuss locations where we determined biomanipulation was not appropriate and potential considerations for land managers contemplating this tool.

## Policy and Program Reviews

### **Multi-disciplinary, All-Lands, Forest Resource Planning through the Regional Landscape Program**

Author(s): Jaimé Thibodeaux

Speaker: Jaimé Thibodeaux [jaimethibodeaux@state.mn.us](mailto:jaimethibodeaux@state.mn.us)

Affiliation: Minnesota Forest Resources Council

The Minnesota Forest Resources Council (MFRC)'s locally led regional forest resource committees bring people together across perspectives—Tribal representatives, landowners, multi-disciplinary natural resource professionals, industry, recreation enthusiasts, and more—to discuss issues, collaborate on the management for our forests, and plan for the future across all ownerships (state, federal, Tribal, private, and family forests). Jaimé Thibodeaux will provide an overview of Minnesota's regional landscape program, the landscape planning process, how plans are used, ongoing activities of regional committees as well as implications and opportunities for integrated forest, wildlife, and fish management. Join us and learn why this program matters for forest resource management in Minnesota and how you can get involved.

## **Operationalizing Lidar Derived Forest Inventory**

Author(s): Keb Guralski

Speaker: Keb Guralski [keb.guralski@state.mn.us](mailto:keb.guralski@state.mn.us)

Affiliation: Minnesota DNR - Division of Forestry

The Minnesota DNR is producing an update to forest inventory across the State of Minnesota using lidar derived forest inventory models, small area estimation, and a new plot-based inventory (PBI) field network. In collaboration with the USGS 3D Elevation Program, DNR Division of Forestry, and dozens of other State and local partners, the use of these cutting-edge remotely sensed datasets have effectively enhanced our forest inventory system and serve to provide updated, accessible data to a variety of stakeholders.

As modeled inventory data becomes available, a multitude of operational needs are being considered. During this presentation, we will explain how various models were produced (e.g., standing volume, above ground biomass, basal area, quadratic mean diameter, trees per acre, site index and stand age) and share results from our new lidar derived forest inventory data. The updated forest inventory data products will be made accessible to professional foresters, landscape planners, and the average landowner. The presentation will focus on “operationalizing” the data to better assist MNDNR staff, partners and landowners as they navigate the use of this exciting new data. We will review how the inventory data that is being produced will create efficiency for staff, update existing inventory data sets and assist in a variety of critical analysis needs with the goal of improved forest management.

### **Achieving interdisciplinary resource management through integrated forest management**

Author(s): David C. Wilson, PhD

Speaker: David Wilson [david.c.wilson@state.mn.us](mailto:david.c.wilson@state.mn.us)

Affiliation: Minnesota Forest Resources Council

Interdisciplinary forest resource management requires coordination of management practices at site and landscape levels. The Minnesota Forest Resources Council has just published a major update to the voluntary site-level forest management guidelines (FMGs) developed to mitigate potential negative outcomes of timber harvest operations in Minnesota. These guidelines are designed to protect water quality, forest soils, wetlands, riparian zones, and other sensitive areas while providing adequate leave trees for forest regeneration, wildlife habitat, visual quality, and other needs. The FMGs cover topics from timber harvest planning to cultural resources, filter strip implementation, and erosion control practices for roads and approaches to wetlands or waterways. An important role of the MFRC (and the FMGs) is to foster integration of best management practices for multiple resources at site and landscape scales through interdisciplinary planning of forest resource management. While MFRC's Site-Level Program cannot address these landscape concerns, the integrated planning work is done at the MFRC Landscape Regional Committee level. David Wilson will discuss the history and development of the site-level guidelines while focusing on oak management, forest type transition, and mast resources on Minnesota's East Central landscape region (Mille Lacs Uplands Section). Additional planning resources will also be discussed.

## **Mainstreaming Prescribed Fire with the Minnesota Prescribed Fire Council**

Author(s): Lane B. Johnson

Speaker: Lane Johnson [lbj@umn.edu](mailto:lbj@umn.edu)

Affiliation: University of Minnesota Cloquet Forestry Center

The Minnesota Fire Needs assessment estimates that one million acres of remaining Minnesota grasslands and forestlands need fire annually to prevent further degradation of our natural and cultural heritage. On average, less than 100k acres are burned annually across the state. Meanwhile, more than 70% of Minnesota's grasslands and 40% of Minnesota's forests are privately owned or managed and many of these native plant communities require periodic fire to restore and maintain their integrity. In response to this need, the Minnesota Prescribed Fire Council (MNPFC) was established in 2017 as a volunteer coalition of fire practitioners to expand access to the safe and beneficial use of prescribed fire. Minnesota landowners and non-agency land managers have great difficulty finding prescribed fire training, technical support, and vendors that offer affordable prescribed fire services while simultaneously navigating a sociopolitical climate shaped by strict liability law. The MNPFC is actively working to amplify the voices of non-agency prescribed fire practitioners through community building, advocacy, and outreach. Presently, an effort is underway through the MNPFC to develop a Minnesota Certified Prescribed Burn Manager program and clarify liability standards for prescribed fire practitioners, moving prescribed fire from counterculture to common practice.

## **Concurrent Session 4**

### **Applied Technologies**

#### **Innovative technology applications in fisheries management: remote monitoring buoys, an underwater game camera, and modified trap nets in Eagan, Minnesota**

Author(s): Jessie Koehle

Speaker: Jessie Koehle [Jessie.Koehle@EaganMN.gov](mailto:Jessie.Koehle@EaganMN.gov)

Affiliation: City of Eagan

Advances in technology offer many opportunities to test new workflows. We have recently started using buoys from Winter Recreation Technologies in Richmond, Minnesota, to monitor dissolved oxygen, temperature, ice thickness in 13 neighborhood fishing lakes that are managed for winter aeration, along with conductivity on three of those lakes monitored regularly for chloride levels. Another technological trial is the use of an underwater game camera from Seeweed, out of Saint Paul, Minnesota. We use the camera to view fish and turtle behavior near our trap nets which has revealed helpful information. Finally, we started testing fyke nets modified with turtle exclusion devices as well as one net with a mammal escape hatch toward the cod end of the net. We want to keep using these devices, with additional modifications from our lessons learned, in the coming years.

Special thanks to: Jenna Olson, City of Eagan; Winter Recreation Technologies; Seeweed Underwater Game Cameras; and Duluth Nets.

## **Angler use of stocked trout lakes in northwest Wisconsin**

Author(s): Logan Cutler, Samir Shaikh, Nate Thomas

Speaker: Logan Cutler [logan.cutler@wisconsin.gov](mailto:logan.cutler@wisconsin.gov)

Affiliation: Wisconsin DNR

Evaluating angler use is critical for deciding how to use limited hatchery resources efficiently. However, hiring full-time creel clerks is costly and usually infeasible, especially for small waterbodies with intermittent use by anglers. We used voluntary surveys at kiosks, paired with camera traps to estimate angler effort, catch, and harvest at 9 stocked trout lakes in Douglas and Bayfield counties of northwest Wisconsin. Anglers completed 279 surveys from May 2024 to January 2026. Voluntary reporting rate was 20%, and was generally similar among lakes, but higher during winter than summer. Angler effort, catch, and harvest were highly variable among lakes but similar between years. Angler reports also provided insight into over summer and over winter survival of stocked trout. Voluntary surveys paired with camera traps were a cost-effective approach to assess angler use and inform decisions on efficient use of hatchery resources.

## **Can Angler PIT Tag Reporting Assist with Lake Vermilion Muskellunge Management?**

Author(s): Kamden Glade, Matthew Hennen

Speaker: Kamden Glade [kamden.glade@state.mn.us](mailto:kamden.glade@state.mn.us)

Affiliation: MNDNR

Population characteristics such as recruitment, survival, growth, and mortality are essential for effective fisheries management. However, these dynamics are difficult to ascertain for low-density, long-lived species for which ages are unavailable or challenging to accurately obtain from structures, such as Muskellunge *Esox masquinongy*. The increased use of passive integrated transponder (PIT) tags in recent years has improved the quality of data available for Minnesota Muskellunge populations, but there is still significant effort required to recapture tagged fish. In 2025, we secured funding for PIT tag scanners from the Hugh C. Becker Trust Foundation with the objective of determining the effectiveness of relying on dedicated Muskellunge anglers to improve sampling efficiency and increase recapture frequency on Lake Vermilion. During the 2025 open water angling season, 42 anglers provided data on 250 captures. Captures included 67 Muskellunge PIT tagged and stocked as fingerlings between 2017-2024, 44 Muskellunge tagged as adults during a population assessment in 2019, and another 130 untagged fish. Tagged Muskellunge provided insights on fish survival relative to length at stocking, stocking location, and juvenile and adult growth patterns. Information gleaned from untagged fish was limited, but comparison of length at capture for tagged and untagged individuals provided additional evidence that both stocking and natural reproduction are contributing to the population. Year 1 results suggest angler augmentation to sampling is an effective way to improve sampling efficiency. Thus, the project will continue over the coming years, with the goal of incorporating angler-provided data into upcoming mark-recapture population estimates.

## **Now the rest of the Muskellunge DNA story.....**

Author(s): Calub Shavlik

Speaker: Calub Shavlik [calub.shavlik@state.mn.us](mailto:calub.shavlik@state.mn.us)

Affiliation: MN DNR - Fisheries

The use of newer technology has expanded the opportunity to learn more about the Muskellunge population in Mantrap Lake. This presentation will dive into the use of PIT tags and exploring the world of genetic Muskellunge ancestry of Mantrap Lake.

## **Tribal Session**

### **Reconstructing Forests to Foster Cultural Revitalization**

Author(s): Ferin Davis Anderson

Speaker: Ferin Davis Anderson

Affiliation: Shakopee Mdewakanton Sioux Community

Learn about the Shakopee Mdewakanton Sioux Community's (SMSC) approach to forest restoration that bridges traditional knowledge and ecological science. Since 2021, the SMSC has restored native trees, shrubs and plants to a 65-acre area that had been in row crop production for over 85 years. Over 23,000 trees and shrubs have been planted, and 30 species have been seeded in the understory. This session will provide strategies for integrating Indigenous knowledge and community engagement into restoration efforts, helping people to reconnect with a place and foster traditional practices on the landscape.

### **Leech Lake Band of Ojibwe, Co-Management with the Chippewa National Forest**

Author(s): Keith Karnes

Speaker: Keith Karnes [keith.karnes@llojibwe.net](mailto:keith.karnes@llojibwe.net)

Affiliation: Leech Lake Band of Ojibwe

The idea of Co-Management is a popular issue in forested lands in Indian Country. Historically, Tribes have been the original stewards of their lands, relying upon these lands to provide necessities. With the unique overlap experienced by the Leech Lake Band of Ojibwe, where 90% of LLBO lands occur within the boundaries of the Chippewa National Forest, a solid working relationship needs to exist.

In 2019, Leech Lake entered into a Memorandum of Understanding with the Chippewa National Forest. This MOU was a step in a series of steps to ensure LLBO and CPF are working towards common goals in natural resource management. Additionally, LLBO has drafted Desired Vegetative Conditions that are incorporated into CPF planning, invoked the 2004 Tribal Forest Protection Act numerous times for a multitude of projects, worked in lock-step with CPF staff to pursue funding to achieve projects, and many other successes.

The presentation will talk briefly about how we started and go through time, ending with where we are at today; is it Co-Management or is it Co-Stewardship?

## **A Method to Estimate Moose Forage from Forest Regeneration Surveys and Implications for Forest Management**

Author(s): Matt T. Petz Giguere, William J. Severud, Kim Teager, Tiffany M. Wolf, Seth A. Moore  
Speaker: Matt Petz Giguere [mt Tyler@grandportage.com](mailto:mt Tyler@grandportage.com)  
Affiliation: Forestry Dept, Grand Portage Band of Lake Superior Chippewa

A declining moose (*Alces alces*) population in northeastern Minnesota is a concern of the Gichi Onigaming Anishinaabeg (Grand Portage Band of Lake Superior Chippewa). Managers need practical methods to monitor moose forage density, while a better understanding of variation in moose forage production among tree and shrub species and over time may improve forestry treatments for moose recovery. Using data from an extensive 2019 moose browse survey at Gichi Onigaming (Grand Portage Indian Reservation, MN) and Minong (Isle Royale, MI), we fit models of twig production (number of twigs per plant) within moose reach as a function of species, canopy cover, and stem height. We validated models against an independent data set and developed a procedure using the regression equations to estimate moose forage density from common forest regeneration survey data. Twig production varied non-linearly with stem height. A unimodal curve with height fit better than allometric models or species means. Peak twig production, height at peak production, and rate of production decline with height varied among species. Model validation indicated that predictions were well correlated with observations and outperformed alternative models but had consistent over-prediction bias. Preliminary testing indicated the proposed method is 2-4 times faster than conventional forage transect methods, albeit with lower accuracy. This study's species-specific twig production models offer a powerful tool to evaluate how different forest treatments influence moose forage dynamics over time. Various forest management implications are discussed.

## **Collaborative Forestry Grounded in Indigenous Values**

Author(s): Phillip Hass  
Speaker: Phillip Hass [PhillipHass@FDLBand.org](mailto:PhillipHass@FDLBand.org)  
Affiliation: Fond du Lac Band of Lake Superior Chippewa

Forestry management on Tribal lands is guided by Indigenous values that emphasize respect, reciprocity, and responsibility to the land and future generations. This presentation highlights forestry goals and projects that integrate silviculture, wildlife habitat management, watershed protection, and fire management while sustaining culturally important forest resources, including berry-producing plants and other medicinal species. Management objectives focus on maintaining forest structural diversity, enhancing berry productivity, supporting wildlife habitat, and increasing forest resilience to climate change.

Prescribed fire is used as a management tool to restore natural disturbance processes, reduce hazardous fuels, promote fire-resilient plant communities, and support cultural activities. Our efforts also incorporate Firewise principles to reduce wildfire risk near Tribal infrastructure and community areas while maintaining ecological function and cultural values.

Current projects demonstrate the importance of collaboration among Tribal forestry, fire, and wildlife programs, as well as partnerships with state and federal agencies. Management approaches are informed by long-term monitoring, adaptive management, and the integration of Traditional Ecological Knowledge

with western science. This work illustrates how culturally grounded forestry and fire management can support integrated natural resource stewardship that benefits ecosystems, community safety, and cultural practices.

## Ecological Resilience

### **The plants have it! Aquatic plant communities explain sport fish community structure in Upper Midwest Lakes**

Author(s): Heidi M. Rantala, Robert P. Davis, Zachary S. Feiner

Speaker: Heidi Rantala

Affiliation: [heidi.rantala@state.mn.us](mailto:heidi.rantala@state.mn.us)

Lake management goals vary based on stakeholders and uses, and goals within an individual lake may conflict. Here we are interested in understanding the relationships between aquatic plant and sport fish communities, as siloed management of these organisms may have unintended impacts on fisheries. Aquatic plants are an important structural component in lake systems and influence multiple components of fish life histories, such as reproduction, growth, foraging. A better understanding of these relationships could guide co-management, potentially producing better outcomes. We used existing datasets from 388 lakes in Michigan, Minnesota, and Wisconsin from 2004-2022 to understand the co-variance between plant and fish communities. The plant community composition explained ~66% of the covariance in the fish community, while 28% of the variability was explained in the reciprocal relationship. Fish communities were organized along predictable gradients (for example, centrarchid- to percid-dominated, while the plant communities were less clearly structured. Additionally, the plant community composition and environmental variables almost equal amount of the variability in the fish community, while the physical structure of the plant community explained less variability. These results suggest that fisheries outcomes could potentially be improved by co-management aquatic plants and fisheries.

### **Evaluating the Influence of Lake Characteristics, Climate Factors, and Thermal Tolerance on Niche Breadth and Overlap of Minnesota Fish Populations**

Author(s): Cam Mosley, Denver Link, Naomi Blinick , Heidi Rantala, Gretchen Hansen

Speaker: Cam Mosley [cmosley@umn.edu](mailto:cmosley@umn.edu)

Affiliation: University of Minnesota

Climate change and dynamic global changes, such as warming water temperatures, threaten to exacerbate environmental extremes and redistribute resources within lake ecosystems. These changes may increase competition among coexisting fish species due to possible reductions in thermal habitat and prey availability. To quantify how species across thermal guilds use resources within lake ecosystems and determine if niche partitioning can be predicted by biological, ecosystem, and landscape factors, we examined stable isotope ratios across 36 Minnesota lakes. We calculated trophic position, littoral reliance, and niche breadth (standard ellipse area) for 8 piscivorous fish species across 3 different thermal guilds (cold, cool, and warmwater) using stable isotope mixing models. Niche breadth was significantly different across lakes and species, but was more influenced by lake identity than by species. On average, larger lakes had fish species with larger niche breadths. Random forest regression showed that the proportion of niche overlap between two species was best predicted by species pair, lake identity, and fish physiological metrics. Cool-warmwater species combinations were the most frequent pairs exhibiting niche overlap across lakes. The greatest average proportion of niche overlap between two species was between Walleye and Northern Pike. Results display frequent competition between co-occurring piscivores with different thermal preferences, regardless of local lake conditions and watershed factors. This study highlights that

coolwater species frequently overlap in ecological niche space with other coolwater species and warmwater species, which may result in increased interspecific competition stress to coolwater species as climate change intensifies in lake ecosystems.

### **Characterizing Fish Communities in Northeastern Minnesota Lakes: Creating a Framework for Classification, Monitoring, and Condition Assessment**

Author(s): Jessica Massure, Derek Bahr, and Jacquelyn Bacigalupi;

Speaker: Jessica Massure [jessica.massure@state.mn.us](mailto:jessica.massure@state.mn.us)

Affiliation: MN DNR

Fish communities in Minnesota lakes have been affected by anthropogenic stressors to varying degrees. The Minnesota Department of Natural Resources (MNDNR) developed lake Fish Indices of Biological Integrity (FIBI) to assess biological condition statewide; however, these indices are not suitable for Boreal Shield lakes in northeastern Minnesota. Lakes in this region are characterized by a limited stressor gradient, soft-water chemistry, low fish species richness, and a unique glacial and geologic history. Additionally, many lakes have sparse fish survey data due to difficult access and challenging sampling conditions. Despite these limitations, there is a need to characterize fish communities in the Boreal Shield, assess their current condition, and establish a baseline for detecting changes associated with climate change, mining, shoreline development, introductions of non-native fishes (e.g., Smallmouth Bass), aquatic invasive species (e.g., Spiny Waterflea, Zebra Mussels), and other stressors. This work is conducted as part of the Minnesota Pollution Control Agency's (MPCA) Intensive Watershed Monitoring (IWM) approach and is supported by the Clean Water Fund, contributing to Minnesota's watershed-scale monitoring and assessment program under the Clean Water Act (CWA). The objectives of this study are to (1) summarize existing fish species and community information; (2) classify lakes into comparable groups based on physical, chemical, and landscape characteristics; (3) characterize potential stressor gradients and (4) develop fish biogeographical models for Boreal Shield lakes. The resulting data and models will support lake assessments under the CWA, help protect high-quality aquatic resources and inform restoration and management priorities.

### **Isotope tracers inform area of concern actions in St. Louis River fish**

Author(s): Sarah Janssen, Joel Hoffman, David Krabbenhoft

Speaker: Joel Hoffman [jhoffma@d.umn.edu](mailto:jhoffma@d.umn.edu)

Affiliation: University of Minnesota

Numerous mercury (Hg) sources can contribute to fish burdens within aquatic ecosystems, including atmospheric deposition (e.g., precipitation), non-point source land runoff (e.g., watershed), and legacy contamination. Due to these different environmental entry points, it is often difficult to ascertain if legacy Hg contamination contributes to contemporary fish consumption advisories, especially in aquatic ecosystems with legacy point-sources. In this study, we aimed to assess the contributions of legacy Hg to sediments in nearshore wetland habitats and co-located fish (yellow perch) and prey items (dragonfly larvae) within the St. Louis River using Hg stable isotopes. We observed that nearshore sediments had the same Hg source portfolio as previously examined main channel sites. Furthermore, this data confirmed that two major Hg sources were contributing to sediments within nearshore regions of the St. Louis River: legacy and watershed Hg. The contribution of legacy Hg was estimated in fish and demonstrated that up to 64% of the Hg in fish tissue in the lower estuary (St. Louis Bay) was from legacy sources, but that this percentage declined substantially when examining regions upstream of St. Louis Bay. These data indicate the influence of legacy Hg to the food web varies spatially within the St. Louis River. We further found that watershed Hg sources are an important Hg contributor to the St. Louis River, which likely applies to other impacted and unimpacted tributaries across the region.

## Forestry for Birds

### **Conservation of Eastern Forest Birds Through Audubon's Bird-Friendly Maple Program**

Author(s): Dale Gentry, Jacob Crawford

Speaker: Jacob Crawford [jacob.crawford@audubon.org](mailto:jacob.crawford@audubon.org)

Affiliation: Audubon Upper Mississippi River

Eastern Forest Birds have declined by greater than 25% over the past half-century. These declines are tied to many causes, but the loss and degradation of high-quality forest habitat stand out as driving forces. Because over 80% of eastern U.S. forests are privately owned, strategies to improve habitat quality on private lands are paramount to address forest bird declines. While some private forests are managed for recreation or preserving the aesthetic value, many are managed for the economic value of its products. The harvest of forest commodities influences habitat quality for birds and wildlife but can be benign or even beneficial when managed intentionally. Audubon developed the Bird-Friendly Maple Program in Vermont to work with forest land owners and managers who harvest maple sap, to improve habitat quality for forest birds. The program is based on three pillars; 1) educate maple producers and consumers on the importance of healthy forests to birds and how they can be partners in conservation efforts, 2) provide technical assistance to maple producers on managing sugarbushes with birds in mind, and 3) recognize maple producers for their efforts to incorporate bird habitat into their forest management. This market-based conservation approach incentivizes good sugarbush stewardship through a recognition label on maple products. The program started in Vermont but is now expanding into eight states including the Midwestern states of Minnesota, Wisconsin, and Pennsylvania. We have enrolled over 140 producers who are managing over 19,800 acres for maple syrup and deciduous forest bird habitat.

### **Forestry for Minnesota Birds Conservation Guide: Practical Management Considerations and Strategies to Support Forest Birds**

Author(s): Peter Dieser

Speaker: Peter Dieser [dies0017@umn.edu](mailto:dies0017@umn.edu)

Affiliation: University of Minnesota – Extension

This presentation introduces the Forestry for Minnesota Birds (FMNB) Conservation Guide as a practical, science-based resource for incorporating bird habitat considerations into forest management strategies and prescriptions. Birds are among the most effective indicators of forest ecosystem health, and many forest-dependent species continue to experience long-term population declines linked to habitat loss, fragmentation, and degradation due to numerous threats and stressors.

This presentation will briefly summarize the widespread decline of bird populations throughout North America before showcasing the FMNB Conservation Guide while concentrating on the importance of preserving and protecting critical habitat features in multiple forest types such as large live trees, snags, downed woody debris, diverse age classes, and heterogeneous vertical and horizontal structure. These critical elements will be highlighted for their essential role in supporting breeding, foraging, and migration needs of forest birds.

A central theme will be the importance of habitat complexity and diversity, including how birds utilize different forest types and strata, from ground and shrub layers to midstory and canopy. Examples will include habitat specialists, mature forest interior species, and birds that depend on structural legacies.

The presentation will conclude with actionable silvicultural “tweaks” that can be integrated into existing forestry objectives. These include retaining important structural elements, diversifying stand composition and age, and maintaining diversity and complexity at multiple scales. The goal is to demonstrate how modest, intentional adjustments can yield meaningful benefits for forest birds.

### **Where Migrants Pause: Mapping Stopover Sites to Inform Avian Conservation in Minnesota**

Author(s): Dale Gentry, Sarah Hewitt, Tara Hohman, August Wise, Kathryn Bernard

Speaker: Dale Gentry [dale.gentry@audubon.org](mailto:dale.gentry@audubon.org)

Affiliation: Audubon Upper Mississippi River

A landmark 2019 study showed North American bird populations have declined by nearly one-third; a loss of three billion birds since 1970. A review of the declining species shows over 90% are migrants. Migratory birds face unique challenges each spring and fall as they complete a series of long flights separated by periods of resting and refueling at migratory stopover sites. Reversing the declines of migratory birds requires conserving these migratory stopover sites in addition to suitable habitat for breeding and overwintering. However, most avian conservation work in Minnesota focuses on breeding habitats, in part because an analysis of the use of different habitat patches by migrant birds has never been done. To address that gap, we used eBird Status and Trends data for migratory species of conservation concern to map migratory stopover sites and identify high priority areas for future conservation action. Our maps identified eight regions that are important stopover sites in the spring or fall or both. There is a clear need to both understand migration patterns and to communicate those understandings to our partners and the public. We are addressing both needs by developing a web-based interactive decision support tool and a conservation plan to share with partners and the public to guide the conservation of stopover sites and migratory birds in Minnesota.

### **Small Cuts, Big Impact: Exploring the effects of small-scale, frequent harvests on game and non-game forest birds**

Author(s): Alexis Grinde, Reid Siebers, Steve Kolbe, Josh Bednar

Speaker: Reid Siebers [siebe098@d.umn.edu](mailto:siebe098@d.umn.edu)

Affiliation: Natural Resources Research Institute

Minnesota’s managed forests provide critical habitat for hundreds of resident and migrant bird species. Forest management provides an important opportunity to conserve and cultivate critical habitat for species of management and conservation concern. Recent declines in upland game bird populations in the state have generated a renewed interest in using forest management to create habitats that support breeding adults and maximize juvenile survival. In response, the Chippewa National Forest initiated a long-term habitat improvement project implementing small-scale, frequent harvests (<5 acres, 5-year intervals) adjacent to hunter walking trails. The primary objective of the Chippewa National Forest Hunter Walking Trail Project is to assess the effects of experimental harvesting on Ruffed Grouse, American Woodcock, and breeding bird communities. Over the past six years, we have conducted intensive bird monitoring using both in-person line transect surveys and Autonomous Recording Units (ARUs) along approximately 34,000 meters of hunter walking trails. Surveys were conducted before and after harvest treatments were implemented and at control sites. Pre-harvest data established a robust baseline for long-term monitoring, while early post-harvest results provide initial insight into how small-scale harvests influence bird communities. In 2025, we detected 2,675 individuals of 81 bird species within 100 meters of trails during summer transect surveys and recorded 12,728 Ruffed Grouse drums on 24 ARUs. The long-term nature of this monitoring program is essential for understanding the cumulative

effects of small-scale, frequent harvests on breeding birds and for informing adaptive forest management strategies that balance wildlife conservation with recreational use.

## General Session

### **Evaluating the current status of lean lake trout populations in the Minnesota waters of Lake Superior**

Author(s): Kevin N. McDonnell

Speaker: Kevin McDonnell [kevin.mcdonnell@state.mn.us](mailto:kevin.mcdonnell@state.mn.us)

Affiliation: Minnesota Department of Natural Resources

The restoration of wild lake trout populations in Western Lake Superior has drawn special interest from users and stakeholders in recent years. The rehabilitation of wild stocks was largely due to large-scale harvest regulation, stocking and lamprey control efforts dating back to the 1960s. In 2016, stocking ceased in Minnesota waters of Lake Superior in response to the successful propagation of wild fish into the fisheries. The exact status (abundance, recruitment and mortality rates) of these wild fish has not been formally evaluated since stocking ceased. We developed statistical catch-at-age models to assess the current status of wild lean lake trout populations in the three Minnesota management units of Lake Superior. Assessment models relied on a combination of fishery dependent and independent data collected between 1990-2024. Estimated abundance and spawning biomass showed stable or increasing trends in all three management units. Lamprey and fishing mortality rates remained significant contributors of total mortality, but total mortality rates have remained below target thresholds throughout most of the time series. The southern most management unit was estimated to have the largest, most productive population. We evaluated several model diagnostics and identified key model components that warrant future research. These findings demonstrate that lean lake trout generally remain in good status and highlight usefulness of regular assessments in developing future management goals.

### **Determination and Comparison of Morphometrics and Meristics Used to Identify River and Shorthead Redhorse**

Author(s): Devon Oliver, Loren Miller, Cristian Hernandez, Anthony Sindt, Charmayne Anderson

Speaker: Devon Oliver [devon.oliver@state.mn.us](mailto:devon.oliver@state.mn.us)

Affiliation: MNDNR

Redhorse species face a diverse array of impacts and conservation issues but often remain overlooked relative to their sportfish counterparts. Furthermore, they often lack constituency groups that advocate for their conservation. River Redhorse is a member of the Catostomidae family that has experienced reductions in abundance and range over the last century. Furthermore, like many potentially imperiled or vulnerable catostomid species, River Redhorse suffers from a paucity of demographic and life history information. Additionally, for River Redhorse, there is some ambiguity as to which non-lethal morphological characteristics should be used to positively identify them relative to Shorthead and Greater Redhorse, which must be addressed first. Morphometrics and meristics used to determine species id can be highly variable, require harvest of the specimens, subjective, or are inconsistent in their determination across metrics both within and across different source material. To address this knowledge gap and to provide clarity in species identification for biologists and conservation hobbyists this study, 1) evaluated and compared morphometrics and meristics used to positively identify River Redhorse relative to Shorthead and Greater Redhorse, 2) determined useful morphometrics and meristics for identification of

the three redhorse species within Minnesota based on genetically confirmed specimens. Head to body ratio is the most promising single non-lethal metric for distinguishing River from Shorthead Redhorse, but the probability of accurate identification increases when used in combination with fin shape and lip characteristics (papillae/sub-plicate and plicate characteristics).

### **Survival of the Fishes: Expanding the Poor-Recruitment Paradigm**

Author(s): Lynn Waterhouse, Olivia Nyffeler, Jeremiah Shrovnal, and Grant Vagle

Speaker: Lynn Waterhouse [lwater@umn.edu](mailto:lwater@umn.edu)

Affiliation: University of Minnesota / USGS Minnesota Cooperative Fish and Wildlife Research Unit

The poor-recruitment paradigm suggests that it is easier to predict poor-recruitment rather than good-recruitment events. This is because many things must go right for a fish to survive from spawning to age at recruitment. The poor-recruitment paradigm suggests that there are abiotic or biotic drivers that result in poor-recruitment when ideal conditions do not occur. For example, a fish may need warm spring temperatures to hatch, and if temperatures remain too cold the hatching is delayed which could lead to a potential mismatch in feeding opportunities post-hatching. Much work has been done to try and identify the key bottlenecks that occur in recruitment (e.g, Cushing 1975). This work is incredibly difficult to achieve and costly to execute. Here we will briefly review the history of work attempting to explain recruitment, including Cushing's match-mismatch hypothesis. Building off the many theories of why, when, and how recruitment goes wrong we share a mathematical model based on the poor-recruitment paradigm. Our work extends the poor-recruitment paradigm developed by Gross et al. (2022). Our model assumes that there exists certain thresholds, that once crossed yield poor recruitment. When a time-series of recruitment can be converted into the binary good-poor recruitment (rather than a quantitative index of abundance), one can then use a classification tree approach to explore the covariate thresholds leading to poor-recruitment. We will share theoretical results, along with simulation studies, and an applied example using Cisco (*Coregonus artedii*) in Lake Superior.

### **An historic reconstruction of Minnesota's gamefish fishery describes a 50% decline in the annual number of game fish caught (and kept) since 1990**

Author(s): Sorensen, Peter W., Lee, Vicky, Pauly, Daniel, Palomares, Maria L.D.

Speaker: Peter Sorensen [soren003@umn.edu](mailto:soren003@umn.edu)

Affiliation: University of Minnesota

Minnesota classifies 37 fishes as game fish, which the DNR actively manages, generating ~4 billion dollars a year. In spite of its value, little is known about the overall size of this fishery and how it has changed over time. To address this, we examined data from the ~200 creel censuses performed annually. To estimate state-wide catch, we determined the number of fish reported caught and then either kept or released, categorized them by lake size, and then multiplied these values by the relative proportion of lakes of their size. We found that ~10 million game fish were caught most years between 1950-1990, but that this value started to decrease, reaching ~4 million in 2022. During this span, the ratio of species shifted from one dominated by northern pike and crappies, to one dominated by walleye. A concurrent evaluation of DNR lake survey data found that, while decreases in sunfish, perch, and crappie catch could be partially explained by decreased abundance, walleye could not. Their numbers have been relatively constant, likely because of localized stocking. An analysis of catch-and-release rates revealed these rates have been increasing and correlate well but imperfectly, with changes in catch suggesting they partially explain the trends in walleye and a few other species. However, the fact that overall catch continues to decline that a strategy based on catch-and-release cannot sustain fisheries indefinitely and that decreases in fish habitat may also be an important driver, as well as possible recruitment overfishing.

## General Session

### **Flying squirrel activity at overlapping range boundaries**

Author(s): Katie G. Pfaff, Anna O. Mangan, Anna R. Peterson, Ron A. Moen, Michael J. Joyce

Speaker: Katie Pfaff

Affiliation: Natural Resources Research Institute

Animal activity patterns represent tradeoffs between competing factors such as energetic costs, competition, predation risk, and resource availability. Climate change is shifting these tradeoffs by altering temperature regimes and seasonal energy demands for many species. Consequently, northern flying squirrels (*Glaucomys sabrinus*) and southern flying squirrels (*G. volans*) now exhibit greater range overlap as warmer winters allow southern flying squirrels to expand northward into historically allopatric northern flying squirrel range. At the northern edge of their range, southern flying squirrels may face novel diel constraints driven by colder temperatures and increased temporal overlap with northern flying squirrels. Our objective was to compare optimal versus actual activity patterns and identify drivers of activity intensity for northern and southern flying squirrels in allopatric and sympatric zones in Minnesota. We found that diel niche was largely dependent on thermal energy requirements and body size. Given small size and nocturnal habits, thermal cost minimization was a major driver of activity intensity. By contrast, timing of activity was not driven by thermal costs. Shared nocturnality between the species and high energetic costs of extreme winters in sympatric zones left limited opportunity for energy savings through temporal shifts.

### **Hybridization of Sharp-tailed Grouse and Greater Prairie-chickens in Minnesota and North Dakota**

Author(s): Charlotte Roy, Susan Ellis-Felege, Jesse Kolar, Stevie Vanderzwan, Benjamin Sacks

Speaker: Charlotte Roy

Affiliation: Minnesota Department of Natural Resources

Sharp-tailed grouse (*Tympanuchus phasianellus*) and greater prairie-chickens (*Tympanuchus cupido*) are hybridizing in areas where they are spatially overlapping after a long period of separation. In Minnesota, sharp-tailed grouse range is expanding south into prairie-chicken range, and in North Dakota, sharp-tailed grouse have nearly replaced prairie-chickens in the eastern part of the state. This hybridization creates F1 offspring that are able to backcross with both prairie-chickens and sharp-tailed grouse. We collected hybrids from leks in the spring and also samples submitted by sharp-tailed grouse and prairie-chicken hunters for analysis using genotyping by sequencing. Our objectives were to determine the proportion of hybrids in the Minnesota population, whether backcrossing had any directionality (F1 hybrids backcrossing with sharp-tailed grouse or prairie-chickens), and whether barriers to genetic swamping exist. Based on output from NewHybrids, Program Admixture, and PCA analysis, sharp-tailed grouse were clearly differentiated from greater prairie-chickens and hybrids were intermediate at >38,000 SNPs. We also found evidence of genetic structure between the sharp-tailed grouse subspecies in North Dakota and Minnesota. Our results indicate that 7.4% of the population is composed of hybrids. Hybrid backcrossing occurred into both the sharp-tailed grouse and prairie-chicken populations. Using a panel of 410 unlinked species-diagnostic single nucleotide polymorphisms (SNPs), we found no evidence of F2 hybrids (hybrids mating with hybrids). However, we found evidence that hybrid females most commonly

mated with males matching their sire. This directional backcrossing makes it difficult to detect hybrids after several generations, indicating that hybridization may be more common than previously appreciated.

### **Bird counts are more than data**

Author(s): Douglas H. Johnson

Speaker: Douglas Johnson [douglashjohnson@hotmail.com](mailto:douglashjohnson@hotmail.com)

Affiliation: University of Minnesota

Surveys of many species of animals are conducted to track their population sizes and, if appropriate, to make management changes depending on survey results. For birds, most nongame species are monitored by amateurs, with widely variable skill levels. It is not commonly recognized that reports by these surveyors are affected, not only by what they see and hear during their surveys, but also by prior knowledge that individual surveyors possess. This issue is brought into focus by acknowledging that surveyors, possibly without recognizing it, are functioning in a Bayesian decision analysis mode. I exemplify the issue with several scenarios, discuss the consequences of this phenomenon, and invite further thought about how surveys might be improved by incorporating the Bayesian paradigm.

### **Predator Use of Fences in Conservation Grazing Applications**

Author(s): Charlotte Roy, Jamie Horton

Speaker: Charlotte Roy [charlotte.roy@state.mn.us](mailto:charlotte.roy@state.mn.us)

Affiliation: Minnesota Department of Natural Resources

Conservation Grazing has potential utility as an additional prairie management tool to augment prescribed fire and mowing on wildlife management areas. However, grazing as a management tool is relatively unstudied in highly fragmented landscapes composed predominantly of row crop agriculture east of the Great Plains, where fencing perimeter:area can be very high. Installation of fencing to keep cattle contained on conservation areas managed with grazing may alter the behavior of wildlife. We examined the use of fences by predators of ground-nesting birds as potential travel corridors and perching sites for hunting. We used 2 approaches to quantify the influence of permanent fences, temporary fences, and unfenced areas as controls. We walked transects along fences and quantified predator scat and tracks within 1 m of fencelines or control transects, and also examined raptors perching on fenceposts and whitewash on fence posts. We also used trail cameras deployed at the intersection of permanent, temporary, and unfenced areas to examine use of fences by predators. Comparison of scats and tracks indicated that mammalian predators utilized permanent fences more than temporary fences and unfenced transects, consistent with their use as travel corridors. Comparisons of perching raptors and white wash indicated use of both permanent and temporary fence posts as perch sites for hunting. Trail camera findings supported the use of fence posts as perch sites by raptors and also corvids, but mammalian predator detections may have been impeded by the growth of vegetation and the distance at which cameras were triggered.

## Policy and Program Reviews

### **Minnesota Sea Grant's role in building a sustainable aquaculture future in Minnesota**

Author(s): Julianne M. Grenn, Donald R. Schreiner, Giovanni S. Molinari, and Amy J. Schrank

Speaker: Julianne Grenn [jgrenn@d.umn.edu](mailto:jgrenn@d.umn.edu)

Affiliation: University of Minnesota Sea Grant

Interest and support for the aquaculture industry in Minnesota is growing. In 2025 the state published a Minnesota State Aquaculture Plan and initiated an aquaculture working group to implement the plan. Continuing support for aquaculture research, extension, and workforce development is critical to support state goals. At the University of Minnesota, this work is led by Minnesota Sea Grant (MNSG) and facilitated by the MNSG Aquaculture Lab (MNSGAL).

MNSG work occurs in partnership with the aquaculture industry, the Minnesota Department of Natural Resources, and others. For example, we are completing a demonstration project focused on increasing bait production of Golden Shiner. This project will help alleviate the bait shortage and avoid bait importation to Minnesota, reducing the risk of introducing aquatic invasive species. An outcome of this work was a need to refine indoor aquaculture production methods for Golden Shiner and this work is beginning at MNSGAL in 2026. In addition, we are working with producers to revise methods to raise Yellow Perch as food fish indoors in recirculating aquaculture systems.

All projects at MNSGAL integrate workforce development and outreach. We train interns, lab staff, and extension agents, and provide MNSGAL tours and demonstrations to many audiences including aquaculture producers. Ongoing work includes developing an outreach program to assist K-12 teachers in constructing classroom baitfish aquaculture systems, and providing local Yellow Perch producers with biosecure fingerlings to stock in their grow out systems. MNSG aims to support sustainable food, stocking, and bait sectors in Minnesota and the region.

## **When Conservation Becomes Overreach: Federal Natural Resources Acts as an affront to Indigenous Sovereignty**

Author(s): Seth Moore, PhD<sup>1</sup>; Joseph Bauerkemper, PhD<sup>2</sup>; Douglas Thompson, JD<sup>2</sup>; Vallen Cook<sup>1</sup>,  
Stephen L. Pevar, JD<sup>3</sup>

Speaker: Seth Moore [samoore@boreal.org](mailto:samoore@boreal.org)

Affiliation: <sup>1</sup> Grand Portage Band of Lake Superior Chippewa

<sup>2</sup> University of Minnesota, American Indian Studies

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Federal conservation laws are often presented as the pinnacle of science-based environmental governance. When applied to sovereign Indigenous Nations, these same laws operate as instruments best described as colonial conservation: centralized regulatory regimes that presume federal authority over Indigenous governance systems, lands, and species relationships without consent.

This presentation argues that cornerstone federal natural resources statutes, including the Endangered Species Act, Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, and Marine Mammal Protection Act are routinely implemented in ways that conflict with inherent Tribal sovereignty and Treaty supremacy. Indigenous Nations possess sovereignty that predates the United States and is recognized through Treaties, which are affirmed as supreme law under Article VI of the Constitution. Under established doctrines of federal Indian law, Treaty rights may be diminished only through clear and explicit congressional intent. None of these conservation statutes expressly abrogate Treaty-protected rights to govern, harvest, or steward culturally significant species.

We draw on applied case studies involving wolves, salmon, marine mammals, migratory birds, and eagles, to examine how federal permitting systems, harvest prohibitions, and management mandates have constrained Indigenous subsistence lifeways, Tribal ecological governance, and cultural practices. Indigenous management systems are rooted in long-standing relational accountability and adaptive stewardship have been displaced by regulatory frameworks that prioritize federal supremacy over reciprocal ecological relationships.

The presentation further explores why Indigenous Nations have historically acquiesced to these regimes, including legal asymmetries, funding dependencies, and capacity constraints, while highlighting the substantial growth in Tribal scientific, legal, and regulatory capacity over the past three decades. Today, many Indigenous Nations operate sophisticated natural resources departments that integrate Traditional Ecological Knowledge with contemporary science, often exceeding federal conservation standards. The central argument is this: conservation science cannot remain insulated from the legal and political structures through which it is implemented. When conservation law overrides Treaty rights and inherent sovereignty, it perpetuates colonial governance rather than the government-to-government relationships of sovereign peers. Meaningful conservation in the 21st century requires not simply consultation or co-management, but structural recognition of Indigenous jurisdiction and authority. Absent that shift, conservation risks reproducing the very power imbalances it claims to transcend.

## **Restoration of common loons in Minnesota**

Author(s): Timothy S. Mitchell, William S. Beatty, Luke J. Fara, Brian R. Gray, Kristin Hall, Steven C. Houdek, Jayden Jech, Kevin P. Kenow, and Michael Wellik

Speaker: Tim Mitchell [tim.s.mitchell@state.mn.us](mailto:tim.s.mitchell@state.mn.us)

Affiliation: MN DNR

The Deepwater Horizon oil spill in 2010 impacted many wildlife species including common loons that breed in Minnesota but winter on the Gulf. The Minnesota Loon Restoration Project is a partnership created to help the conservation of loons in Minnesota. In this talk, we will describe our project goals and our progress to date. Our first goal is to acquire and protect loon nesting and foraging habitat, and we have acquired 5 parcels that collectively protect over 6.5 miles of lakeshore loon breeding habitat. Our second goal is to enhance loon habitat through lake stewardship and the deployment of artificial nesting platforms. To enhance lake stewardship, we have provided support to 50 lake associations by encouraging loon-friendly lake management plans, volunteer loon monitoring, and conscientious recreation. We have also completed a 5-year field study aimed at quantifying the impact of artificial nesting platforms on loon reproduction. During this study, we have recruited a network of volunteers who have built >40 artificial nesting platforms and deployed them annually in lakes that had relatively low loon reproductive output. Our study design will allow us to estimate how artificial nesting platform deployment has affected loon nesting success. Our third goal is to reduce lead exposure in loons by advocating for non-toxic tackle. To this end, we have distributed >10,000 sample packs of non-toxic fishing tackle annually and provided education and outreach to Minnesotans of all ages. Collectively these efforts have helped loon conservation in Minnesota.

## **Saving Wetlands, Shaping a Legacy: 75 Years of Minnesota's WMA System**

Author(s): David Trauba

Speaker: David Trauba [david.trauba@state.mn.us](mailto:david.trauba@state.mn.us)

Affiliation: Minnesota Department of Natural Resources

2026 marks the 75th anniversary of Minnesota's Wildlife Management Area (WMA) system. This session explores how the Save Minnesota Wetlands movement laid the foundation for one of the most successful public lands programs in the United States and helped reshape public attitudes toward environmental protection.

The presentation will examine the key individuals who were instrumental in establishing Minnesota's WMA system, the social and political challenges they faced, and the lessons learned that remain relevant to wildlife conservation today. The enduring importance of public lands will be highlighted, along with an overview of emerging challenges and future opportunities for the WMA program.

This session will be particularly valuable for students and early-career professionals seeking a deeper understanding of the origins of wildlife management and the conservation legacy that continues to influence Minnesota's landscape.

## **Concurrent Session 5**

### **Applied Technologies**

#### **Using Technology and Field Work to Identify and Describe Moose Use at Mineral Licks, Potential Ecological Traps**

Author(s): Anna Weesies, Todd Kautz, Seth Moore, William Severud

Speaker: Anna Weesies [aweesies@boreal.org](mailto:aweesies@boreal.org)

Affiliation: Grand Portage Band of Lake Superior Chippewa

Moose (*Alces alces*; mooz [singular] in Anishinaabemowin, Ojibwe language) are a species of particular importance to the Anishinaabeg (people) residing in northeastern Minnesota, USA who rely on subsistence harvest as a cultural resource. Mineral licks are focal points on the landscape that attract ungulate species through the mineral rich properties in the soil and water and are potential hotspots for disease and parasite transmission. We looked at recuse movements to 11 known mineral licks from 106 moose (79 cows, 27 bulls) from 10 February 2013 and 28 January 2025. These licks were identified using visual observation of GPS movements to focal locations and subsequent field visits and camera trap pictures capturing geophagia. We were interested in the time spent visiting licks, time between visits, and variations between sex, season, individual lick visits and diel times. The persistence of the northeastern Minnesota moose population is of great importance to the Grand Portage Band of Lake Superior Chippewa. Subsistence hunts are an exercise of retained 1854 Treaty rights and provide a traditional food source. The continuing threat from parasites spread from white-tailed deer to moose is an ongoing concern and focus for Tribal biologists. Identifying hotspots of ungulate concentration and understanding how animals are using these resources can help identify potential mitigation strategies to help preserve and protect a vital subsistence species for the Band today and future generations.

#### **Movement, Habitat Use, and SARS-CoV-2 Dynamics in Suburban White-tailed Deer**

Author(s): James D. Forester, Meggan Craft, Tyler Garwood, Elias Rosenblatt, Tiffany Wolf

Speaker: James Forester [jdforest@umn.edu](mailto:jdforest@umn.edu)

Affiliation: University of Minnesota

White-tailed deer are a vital natural resource in Minnesota, yet significant knowledge gaps remain regarding their movement and habitat selection within suburban landscapes. This study investigates deer movement and disease dynamics in human-dominated environments using data from over 100 GPS-collared deer in the western Twin Cities suburbs alongside spatial simulation modeling.

Our preliminary findings reveal that SARS-CoV-2 exposure is closely linked to increased time spent in areas with a high human footprint, a trend consistent across both Minnesota and national study sites. Serological testing of live and hunter-harvested samples showed a higher seroprevalence in males (34%; 37/108) compared to females (24%; 42/173), with site-specific prevalence reaching up to 42%. Behaviorally, seropositive deer maintained larger home ranges (42 km<sup>2</sup>) than seronegative deer (33 km<sup>2</sup>) and demonstrated a clear preference for using lawns, which likely facilitates human-to-deer spillover.

Furthermore, simulation models indicate that landscape fragmentation, local population densities, and variability in daily movement significantly influence the probability of viral persistence and the rate of

spatial spread. These results suggest that landscape conditions at the point of introduction dictate the scale of subsequent outbreaks. I will conclude by discussing how these insights into suburban landscape ecology will inform future research on other infectious agents.

### **Habitat Selection of Sympatric Bobcats and Fishers Contributing to Fisher Predation Risk**

Author(s): Michael McMahon, Ron Moen, Michael Joyce

Speaker: Michael McMahon [mcmah231@d.umn.edu](mailto:mcmah231@d.umn.edu)

Affiliation: MN Department of Natural Resources

Bobcats and fishers are ecologically, culturally, and economically important species in Minnesota, USA, but over the past two decades, Minnesota fisher populations have declined by 50%, while bobcat populations have nearly doubled. Past studies have suggested that bobcats are important predators of fishers and may be limiting fisher populations. We hypothesized that spatial overlap of bobcats and fishers within specific habitat types may be facilitating intraguild predation of fishers by bobcats and contributing to population shifts of these species in Minnesota. Our objectives were to 1) quantify habitat selection of bobcats and fishers, 2) identify areas of spatial overlap, and 3) compare fisher mortality site data to areas of overlap to determine forest characteristics associated with fisher predation risk. We deployed GPS collars on bobcats and fishers in northern Minnesota to collect spatial data for estimating home ranges and core-use areas. We used resource selection functions to quantify habitat selection of both species and identify habitat overlap where fishers would be most at risk for predation from bobcats. We further evaluated risk factor by comparing areas of overlap to site data where bobcats had killed fishers. Our findings show that bobcats and fishers both select for early seral stage forest, 5–20 years post timber harvest. Although fishers are associated with mature forest, these disturbed areas provide prey access. Foraging in highly disturbed landscapes may be elevating fisher predation risk from bobcats. Our results demonstrate how forest management activities are influencing intraguild interactions among forest carnivores in southern boreal forests.

### **Can forward-facing sonar be used to more effectively sample fish?**

Author(s): Tyler Ahrenstorff

Speaker: Tyler Ahrenstorff [tyler.ahrenstorff@state.mn.us](mailto:tyler.ahrenstorff@state.mn.us)

Affiliation: Minnesota Department of Natural Resources

Forward-facing sonar is a relatively new technology that allows users to find fish at unprecedented distances, and in the open water column, in three dimensions and in real time. While this technology has recently changed the fishing world, there has been little research about whether the technology may be used by fisheries professionals to more effectively sample fish. Specifically, we evaluated using forward-facing sonar while electrofishing for muskellunge, short-term gillnetting, and for pelagic muskellunge relative abundance surveys. The technology provided several benefits including seeing fish and habitat from farther distances away. However, there were also apparent limitations that prevented us from finding as many fish as we expected. Future work will continue to evaluate this novel technology.

## Tribal Session

### **One Tribe's response to combat the threats of emerald ash borer and climate change to forested swamps around wild rice lakes**

Author(s): Alex Mehne

Speaker: Alex Mehne [alexandermehne@fdlband.org](mailto:alexandermehne@fdlband.org)

Affiliation: Fond du Lac Band of Lake Superior Chippewa

Fond du Lac's conifer swamps have declined from past management and now face the additional challenge of climate change. Additionally, the dominant species in hardwood swamps, black ash, is imminently threatened from an exotic disease, emerald ash borer. With the importance of forested wetlands to Ojibwe culture and adjacent wild rice lakes, Fond du Lac is using an experimental methodology to aid in the establishment of culturally important tree species in efforts to restore and enhance sites that were formerly forested swamps. My presentation is on the results of this methodology on a site of particularly extreme hydrological disturbance.

### **A Tribe's Climate-Adaptive Strategy for Emerald Ash Borer Mitigation of a Floodplain Forest within the Upper Mississippi River Basin**

Author(s): Gabriel Miller

Speaker: Gabriel Miller [GABRIEL.MILLER@PIIC.ORG](mailto:GABRIEL.MILLER@PIIC.ORG)

Affiliation: Prairie Island Indian Community

The Prairie Island Indian Community (the Community) was recently impacted by Emerald Ash Borer (EAB) with the greatest effects felt in its floodplain forests. While most EAB mitigation strategies had focused on urban forestry, limited guidance existed for mitigating effects on forested landscapes, including those within floodplains. To address this challenge the Community utilized strategic timber harvest with a local partnership-inspired, climate focused, assisted tree migration methodology developed specifically for the Upper Mississippi River basin. This approach reduced excessive large woody debris while preparing sites for assisted-migration tree planting, using the "adaptive" migration option. This work is expected to enhance the long-term resiliency of the Community's floodplain forests.

### **Untitled**

Author(s): Gene Mensch

Speaker: Gene Mensch

Affiliation: Keeweenaw Bay Indian Community

## Ecological Resilience

### **Adapting old tools for new challenges: silvicultural practices on Minnesota's state lands**

Author(s): Mike Reinikainen

Speaker: Mike Reinikainen [mike.reinikainen@state.mn.us](mailto:mike.reinikainen@state.mn.us)

Affiliation: MN DNR Forestry

This presentation provides a broad overview of both established and emerging silvicultural tools being used to support reforestation efforts on state land in Minnesota. We examine current reforestation practices, identify limitations and opportunities, and describe innovative approaches under development. The session also highlights forward-looking projects designed to generate the knowledge and management options needed to support adaptive silviculture for future generations.

### **Fire, Regeneration, and Stewardship of Minnesota's Northern Forests**

Author(s): Marcella Windmuller-Campione & Laura Reuling

Speaker: Marcella Windmuller-Campione [mwind@umn.edu](mailto:mwind@umn.edu)

Affiliation: UMN

The Greenwood fire burned over 26,000 acres of public and private forestland in northern Minnesota in late summer and fall of 2021. The fire prompted the temporary closure of the Boundary Waters Canoe Area Wilderness for the second time in history as well as the evacuation of many residents and visitors in the area. This fire is of particular interest to researchers and land managers because of the diversity of forest types that burned in the fire (upland pine, aspen, birch, and spruce-fir as well as lowland black spruce). We will discuss a collaborative approach to sampling, initial results, and plans for re-sampling. We will also discuss how our research fits within large efforts to evaluate vegetation response and recovery across burn severities in lowland conifers, post-burn salvage harvesting operations, and incorporating assisted migration into reforestation efforts.

### **Minnesota Fire Needs Assessment**

Author(s): Michael Lynch

Speaker: Michael Lynch [mike@forestguild.org](mailto:mike@forestguild.org)

Affiliation: Forest Stewards Guild

Fire created and maintained many of Minnesota's ecosystems. The Minnesota Fire Needs Assessment provides insight into the historical and current conditions of Minnesota's fire-adapted ecosystems. This assessment estimates that one million acres of remaining Minnesota grasslands and forestlands need fire annually, while we are currently burning less than 100k acres. The pace and scale of prescribed fire must increase significantly to maintain these systems, but how and where?

Expansion in the public and private spheres will be important but private landowners and non-agency land managers are in the most need of increased access and capacity. More than 70% of Minnesota's grasslands and 40% of Minnesota's forests are privately owned or managed and landowners currently have difficulty finding prescribed fire training, technical support, and vendors that offer affordable prescribed fire services while simultaneously navigating a sociopolitical climate shaped by strict liability law.

We will discuss this need, some of the barriers, and look at a few solutions to increasing the pace and scale of prescribed fire as a restoration and maintenance process in Minnesota.

## Forestry for Birds

### **Connecticut Warbler at the Southern Edge: Population Declines, Range Retraction, and Conservation Priorities**

Author(s): Alexis R. Grinde, Josh Bednar, Steve Kolbe

Speaker: Alexis Grinde [agrinde@d.umn.edu](mailto:agrinde@d.umn.edu)

Affiliation: Natural Resources Research Institute, University of Minnesota

The Connecticut Warbler (*Oporornis agilis*) is experiencing substantial population declines, particularly near the southern limit of its breeding range. Addressing these declines requires improved population trend estimates and a more complete understanding of this understudied species across its full annual cycle. In 2022, the Connecticut Warbler Working Group, an international collaboration of scientists and land managers, was formed to synthesize existing knowledge and guide coordinated conservation action. Long-term analyses indicate a population decline of approximately 50% since 1970, with continued declines evident despite regional variation. Targeted surveys conducted from 2021 to 2024 across Minnesota, Wisconsin, and Michigan revealed pronounced range contraction, with no detections at previously occupied sites in Wisconsin and Michigan and a loss of 77% of historically occupied sites in Minnesota. Minnesota now represents the core of the remaining southern breeding population, underscoring the state's disproportionate importance for conservation of the species in the United States. Overall, 75% of historically occupied U.S. breeding sites no longer support Connecticut Warblers, highlighting a rapid retraction at the species' southern range edge.

Key conservation priorities include strengthening international partnerships, implementing high-impact habitat management on breeding grounds, and establishing standardized monitoring programs. Additional research is needed to map nonbreeding distributions, identify critical migratory stopover sites, and quantify demographic constraints on population growth. Together, these actions provide a coordinated framework to support Connecticut Warbler conservation across its full annual cycle.

### **Golden-winged Warbler productivity and fledgling movement in young forest and shrub wetland habitats of northern Minnesota**

Author(s): Alexis Grinde, Stephen Nelson, Steve Kolbe, Brett Howland and Kara Snow

Speaker: Stephen Nelson [nels6797@d.umn.edu](mailto:nels6797@d.umn.edu)

Affiliation: University of Minnesota - NRRI

Golden-winged Warbler is a species of greatest conservation need experiencing significant declines across most of its breeding range. Minnesota is a key region for conservation, supporting over half of the breeding Golden-winged Warbler population. In this region, Golden-winged Warblers primarily use two early-successional habitats: shrub wetlands and young forests; however, it is unknown whether these habitats differ in quality with respect to key factors affecting nest success and fledgling survival. To compare habitat quality, from 2019 - 2024 we monitored a total of 125 nests across 13 study plots (6 shrub wetland, 7 young forest) and tagged 126 nestlings, tracking them daily to document habitat use and survival. Our results indicated that nest success did not differ between habitat types and was primarily influenced by two temporal variables (date and nest age) and two vegetation metrics (open ground cover and subcanopy cover). Fledgling survival during the first week post-fledge (0–7 days) also did not differ between habitat types but was similarly affected by temporal variables (date and fledgling age) and vegetation characteristics (herbaceous ground cover, subcanopy cover, and canopy cover). Compositional analysis of the full post-fledge period (0–21 days; n = 938 locations) revealed that fledglings strongly preferred to remain within their natal habitat—either young forests or shrub wetlands—and showed no

evidence of “habitat switching”. These results highlight that vegetation structure at both micro- and macrohabitat scales is important for fledgling survival and suggest that shrub wetlands are high-quality, long-term habitat.

### **Woodpeckers and Their Aspen Habitat in Northern Minnesota**

Author(s): Michael R. North, Kaysie Maleski, Dr. Samantha Jones, Dr. Brian Hiller

Speaker: Michael North [michael.north@state.mn.us](mailto:michael.north@state.mn.us)

Affiliation: Minnesota DNR, Division of Fish and Wildlife

Cavity-dependent wildlife merit special consideration in forest management in Minnesota. Woodpeckers are the primary source for cavities, and quaking aspen is the primary tree used for nesting and roosting in northern Minnesota. We collected solid cores from 211 aspen between 18-65 cm dbh and aged them by counting rings under a stereoscope in a laboratory setting in 2022. We created scatterplots of the relationship between age and dbh and calculated slope, intercept, and Pearson coefficient to characterize the "available" nesting resource. From 2021-2024 we collected solid cores from 110 aspen trees used by woodpeckers for nesting. Average nest tree age was 76 years for northern flickers (n=19), 75 years for yellow-bellied sapsuckers (n=60) and downy woodpeckers (n=3) 70 years for pileated woodpeckers (n=7), and 63 years for hairy woodpeckers (n=21). Average nest tree ages exceeded rotation ages for aspen harvest (e.g., 40-60 years). Sapsuckers, flickers and hairy woodpeckers selected a set of nest trees whose growth rates were significantly different than the suite of "available" trees ( $p < 0.7E-13$ , 0.006, and 0.0001, respectively, based on two-sample t-tests), whereas pileated woodpeckers selected nest trees from the "available" pool ( $p = 0.57$ ). Based on nest tree size, age, and condition, yellow-bellied sapsuckers make an excellent umbrella species by which to manage the suite of woodpecker species that rely on the aspen resource for nesting in the Agassiz Lowlands ecological subsection in northern Minnesota.

### **Status of Wood Duck Nesting Habitat in North-central Minnesota**

Author(s): Edmund Zlonis, James Berdeen

Speaker: Edmund Zlonis [edmund.zlonis@state.mn.us](mailto:edmund.zlonis@state.mn.us)

Affiliation: MN DNR FAW

Wood ducks (*Aix sponsa*) are an important wildlife and game species in North America. The Upper Midwest, including large portions of Minnesota, encompass substantial tracts of breeding habitat for wood ducks. However, few studies in this region have focused on the selection of nest sites in natural tree cavities. We conducted 2 sequential studies in north-central Minnesota during 2016-2025, the first estimating suitable nesting habitat availability, and the second assessing nesting habitat use by hen wood ducks. In the first study, we developed models predicting the spatial and temporal dynamics of availability of suitable tree cavities across the forested region of Minnesota. We found that forest-inventory attributes including tree species, diameter, and health status, could reliably predict whether trees would develop suitable nesting cavities. We used this model in conjunction with Forest Inventory and Analysis data to estimate the number of trees with suitable cavities in the forested region of Minnesota during 1977-2019. In general, the number of trees with suitable cavities increased throughout this time period, with late-successional species contributing most to the increases. In the second study, we radiomarked hen wood ducks and assessed their nesting habitat use and selection across the same study area. Preliminary results from the second study suggest that hens selected for cavities excavated by woodpeckers in large aspen trees (*Populus tremuloides*, *P. grandidentata*). We will provide further results from our studies and discuss potential forest management implications.

## General Session

### **Balancing Water Storage and Chinook Salmon Objectives Under Uncertainty: How Decision Analysis can Inform Resource Management Tradeoffs**

Author(s): Chase A. Ehlo, Lisa H. Elliott, Brian D. Healy, Corey C. Phillis, Michael C. Runge

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Management of water resources in the Central Valley of California, USA, involves balancing conflicting values and associated trade-offs. Decision analysis tools can aid navigating such tradeoffs. Spawning of endangered winter-run Chinook Salmon (*Oncorhynchus tshawytscha*) and commercially important fall-run Chinook Salmon overlaps spatially on the Sacramento River but differs temporally. Fall flow management actions designed to meet Shasta reservoir storage objectives and downstream water demands put both runs at risk of redd dewatering, leading to a potential tradeoff between which run is dewatered. Decisions related to the timing and magnitude of flow releases are further complicated by uncertainty around spawning cohort sizes and density-dependent mortality of early life stages, which may affect fry production. We evaluated four hypotheses representing structural uncertainties in the strength of density-dependence and spawning run size to examine the effects of alternative flow management actions on fry production and used decision analysis tools to assess improvements in management performance that could be achieved after reducing uncertainty (Value of Information; VOI). Additionally, we assessed the effects of variation in a decision maker's values (objective weights) on the ranking of flow management alternatives and VOI. We found that uncertainty only hinders these decisions at a narrow range of objective weights, with VOI greatest when  $\geq 0.6$  weight was placed on the endangered winter-run objective. Our case study illustrates the practical application of VOI in a real-world decision context and highlights the importance of clarifying decision-makers' objectives when confronted by uncertainty in management outcomes.

### **Reconnecting Rivers: Fish Barrier Removal and Culvert Assessment on the Pomme de Terre River**

Author(s): Brian Mason, Neil Haugerud

Speaker: Brian Mason [Brian.Mason@state.mn.us](mailto:Brian.Mason@state.mn.us)

Affiliation: MN DNR

Dams and improperly sized culverts around the state pose barriers to fish passage. Barriers can be a detriment to fish biodiversity and block access to critical habitat. The Pomme de Terre River is fragmented by both dams and barrier culverts. Past projects addressed both the Marsh Lake Dam and Appleton Dam which reconnected the river up to Morris, MN. Two additional lake outlet modification projects were completed this winter on the upper and lower Pomme de Terre Lake Outlet Dams. The design and construction of those project will be highlighted as well as the Crissy Dam modification design proposed in Morris, MN. This presentation will also discuss the efforts to reconnect the rest of the Pomme de Terre River watershed and the culvert assessments that have been completed.

## **A cost-effective approach using eDNA and habitat assessment to inform fish passage restoration in Sand Creek, Minnesota**

Author(s): Sean Gibbs, Peter Hundt

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Affiliation: Mount Hood Environmental

Sand Creek, a tributary to the lower Minnesota River, is fragmented by Lagoon Park Dam, a 160-year-old structure that has blocked upstream fish passage for more than six decades. This ongoing five-year study (2023–2027) aims to quantify how the dam has affected fish and mussel assemblages throughout the watershed. Environmental DNA (eDNA) metabarcoding is being used, in conjunction with habitat and spatial covariates, to evaluate environmental drivers of species presence–absence at 25 sites across the watershed. Field measurements of water temperature, dissolved oxygen, channel depth, wetted width, and habitat cover are used to evaluate site-level habitat effects, while hydrologic and land-use datasets are used to test how reach-scale variables may influence assemblage distributions. Preliminary results indicate a substantial reduction in fish diversity upstream of the dam, with approximately 50% fewer taxa compared to downstream reaches, and point to species-specific patterns in how environmental covariates shape presence–absence across the watershed. Once data collection is complete in 2026, a spatial stream network model will be used to estimate species-specific reach-level occupancy probabilities under both passage and no-passage scenarios. Overall, this project demonstrates a cost-effective and scalable framework for assessing dam impacts and guiding fish passage restoration in fragmented stream systems.

## **Establishing the baseline: Characterizing the water quality and macroinvertebrate community in the Pomme de Terre River before channel modification**

Author(s): Tracey M. Anderson, Logan B. Blanke, Max E. Lundgren, Payton Prieve

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Environmental conditions in the Pomme de Terre River are influenced by dams, including the Crissy Lake Dam in Morris, MN. This dam will be removed and replaced by stone arch rapids to enhance upstream passage of fish and other organisms. We characterized water quality and the macroinvertebrate community prior to channel modification. We measured turbidity, total dissolved solids (TDS), conductivity and dissolved oxygen (DO) at 3 sites upstream and downstream from the dam (N=12 dates). Turbidity, TDS, and DO differed significantly among dates, but not among sites. Conductivity differed significantly among both dates and sites. Values do not suggest water quality impairment. In October 2024 we collected macroinvertebrate kick samples from the river channel and cutbank habitats upstream (1 site) and downstream (2 sites) from the dam. In September 2025 we collected macroinvertebrates in Ekman grab samples from 2 sites in the impoundment above the dam. The river samples contained 38 macroinvertebrate taxa (average richness = 16). Only 12 unique taxa were collected from the impoundment above Crissy Lake Dam (average richness = 5.8). The collectors, Chironomidae and oligochaete worms and the shredder, *Hyalella sp.*, comprised 96% of the abundance in Chrissy Lake. Though sampling methods are not directly comparable, data suggest that the impoundment supports an impoverished macroinvertebrate community, more similar to prairie pothole lakes in the region than that of the river channel. Establishment of a channel upstream from the current dam is predicted to increase habitat quality and lead to a more diverse macroinvertebrate community.

## General Session

### **30 Years of Blanding's Turtle (*Emydiodea blandingii*) Conservation Work at Camp Ripley Training Center**

Author(s): Andrew Herberg

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Affiliation: MN DNR & Camp Ripley Training Center

A large metapopulation of the Blanding's turtle, *Emydiodea blandingii*, occurs in Central Minnesota centered around the Camp Ripley Training Center (CRTC). Low intensity land use and lack of development coupled with disturbed habitat used for nesting is believed to be responsible for the substantial extant population of Blanding's turtles at CRTC. Wildlife management practices have been developed to maintain aquatic and nesting habitat in a manner compatible with military training requirements and the needs of Blanding's turtles. Ongoing research at CRTC continues to document new adults and newly matured turtles. To date, 193 turtles have been marked, helping to better understand the population within CRTC. Since 2002, CRTC efforts have focused on increasing nesting success through breeding season surveys and nest protection efforts. To date, 191 nests have been protected, successfully producing more than 2,000 hatchlings. Much has been learned about the reproductive ecology of Blanding's turtles at CRTC including nest site fidelity, ages at first reproduction, hatch rates, clutch sizes, incubation durations, amongst others. However, hatchling survival and overall recruitment rates remain unknown. Future work will focus on better understanding recruitment and male/juvenile demographics at CRTC.

### **Wood Turtle Conservation in Northeastern Minnesota**

Author(s): Gaea Crozier, Ron Moen

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Affiliation: MN DNR

The wood turtle is a threatened species in Minnesota and is currently being considered for federal listing. We undertook conservation actions in northeastern Minnesota to address threats to wood turtles, including enhancing nesting habitat, protecting nests from predators, and reducing road mortality. We assessed short-term effectiveness of the conservation actions using field surveys, game cameras, and GPS telemetry. We established a long-term monitoring program using mark-recapture methods to lay the foundation for assessing population change and the effectiveness of conservation actions. A population model was developed based on 30 years of mark-recapture data to evaluate population parameters and assess the potential impact of conservation actions on the population. In addition, we refined our understanding of wood turtle movement and habitat use using telemetry data and conducted surveys in under-surveyed rivers to identify new areas for future conservation work. This project implemented high priority conservation actions identified in the Minnesota Wood Turtle Conservation Plan and was part of a collaborative effort with the states of Iowa, Michigan, and Wisconsin to address wood turtle conservation in the region.

## **Wood Turtle (*Glyptemys insculpta*) Conservation Efforts in Southeastern Minnesota**

Author(s): Neil Slifka

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Wood turtles are a state-threatened species in Minnesota and are considered Species of Greatest Conservation Need throughout their range. The species was listed in the 2015-2025 MN State Wildlife Action Plan (SWAP) as a species with a limited ability to recover on its own. Populations in the southeastern portion of the state are considered to be at increased risk of extirpation due to a combination of factors, including habitat loss, nest predation, poor recruitment and adult mortality. Survey efforts initiated in the mid-1990s by the MN DNR Nongame Wildlife Program attempted to better characterize wood turtle distribution and relative abundance in the region. Early work also included limited but successful head-starting efforts in 2003-2004. In 2017, a number of sites in the southeast with historic wood turtle records were re-surveyed and four locations/populations were identified for telemetry/GPS monitoring to better understand habitat use patterns, receive more intensive surveys and focused conservation actions. Since 2017, collaborative conservation efforts between multiple divisions of the MN DNR, the MN Zoo, colleges/universities, non-profit organizations and private landowners have been implemented. Here we summarize the results of these efforts, which include: head-starting, nest protection, enhancement or creation of nesting and foraging habitat and detection improvement. We also describe how these conservation actions align with the goals of Minnesota's Wood Turtle Conservation Plan (2020).

### **Patterns of variation in Western Painted Turtle body condition within and between years**

Author(s): Heather Waye, Peter Dolan, Amy Dolan

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Turtle populations worldwide are declining, affected by direct anthropogenic impacts as well as habitat loss and changes in temperature and patterns of precipitation. Long-term monitoring of widespread species will provide better understanding of how populations might respond to changing habitats. We surveyed Western Painted Turtles (*Chrysemys picta bellii*) in Marshall Co. SD for six years at a lake subject to increasing human occupancy and usage. Over time the study has expanded from sampling one site in June to sampling two sites in May and June. The body condition index (BCI) for adult turtles was calculated for males and females separately, and was recalculated for comparison groups designed to detect differences between sites, months, and years. BCI of turtles sampled in June is higher than in May within the same year, particularly for females. BCI significantly decreases for males across years, but increases for females across the same time period. While BCI does not vary significantly between sampling sites, inclusion of the second site does influence results when comparing females across years. Our analysis has not found correlations between BCI and long-term total precipitation or with recent weather conditions such as weekly rainfall or temperature. The results of this analysis suggest directions for future data collection and comparisons, including incorporating other physiological measures of health to detect changes between capture sites and over time.

## Policy and Program Reviews

### **Mind the gap: Where Clean Water Act rulemaking fails to meet the science and legislative intent in defining waters of the United States.**

Author(s): Susan A. R. Colvin, Robert B. Keast, Leanne H. Roulson, Nayeli K. Sanchez, and Patrick D. Shirey

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The intent of the U.S. Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the nation's waters and achieve fishable and swimmable lakes, rivers, and streams. To accomplish this, the CWA aimed to eliminate pollutant discharges and restrict the dredging and filling of waters, including wetlands, to protect water quality for fish, wildlife, recreation, and human consumption. Yet, Congress did not specify which of the millions of miles of streams, rivers, and lakes would be the Waters of the United States (WOTUS), or those waters that required federal protection to achieve these goals. This definition was left to the executive branch and thereby the changing administrations to compose. In the past decade, WOTUS definitions have changed every several years, over time largely eroding to protections less than those of the mid-1980's, ultimately creating a "Gap" between protections and CWA goals. We review the intent of the CWA, the scientific consensus on needed protections, and the path towards achieving clean waters.

### **Taconite Mine Pit Water Discharges and Bioaccumulation of Methylmercury in Aeshnidae Larvae and Cyprinidae in the Dunka River (Babbitt MN)**

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Methylmercury is easily bioaccumulated and a powerful neurotoxin. Mercury in fish tissue (HgF) is a major route of human exposure to mercury, and a common waterbody impairment in the Rainy River Headwaters Watershed. Two taconite mining operations discharge sulfate into the lower reach of the Dunka River (Babbitt MN), which is an influent to Birch Lake. Sulfate plays an integral role in mercury cycling, fueling mercury methylation by sulfate-reducing bacteria, and indirectly, by non-sulfate-reducing bacteria. In addition to sulfate, other environmental and chemical factors like dissolved organic carbon (DOC) influence the production of methylmercury in aquatic systems. We investigated various water chemistry parameters and mercury concentrations in aquatic organism tissue at three locations in the Dunka River system -- one upstream and two downstream of mining discharge. Aeshnidae larvae and various Cyprinid species including Blacknose Dace (*Rhinichthys obtusus*) were collected and sent to an independent laboratory for whole organism analysis of mercury and methylmercury. At the downstream sites DOC concentrations were 60% lower and sulfate concentrations were 33 times higher than the upstream site. Total mercury concentrations in Blacknose Dace averaged 74% and 78% higher at downstream sites than at the upstream site. Methylmercury in aeshnidae larvae averaged 40% and 63% higher at downstream sites than at the upstream site. Overall, organisms in the two sites downstream of mining discharges had higher mercury concentration in tissue. Further investigation is required to determine the mechanisms behind the relationship between sulfate, DOC, mercury tissue concentration and mining discharges.

## Variation in Fish Mercury Contamination: Crafting Consumption Advisories

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Mercury in fish is a serious human health concern. Mercury is a widespread contaminant that exceeds health effect thresholds in many fish species and waterbodies. The objectives were to determine the spatiotemporal variation of mercury in fish tissue for several fish species across thousands of lakes and to assess the potential use of fish length standardization and statistical models to improve fish consumption guidelines and impairments determinations in lake-rich areas. The results showed that fish length, species, ecoregion, lake size, latitude, color dissolved organic matter, water clarity, and zebra mussel presence influenced mercury concentrations. Fish mercury concentrations were generally higher from 1967 to 1990, and since 1990 there was no obvious trend. We found that a statistical model provided estimates of mean mercury concentrations by fish total length that were unbiased and with greater confidence than those based solely on sample statistics. The use of fish length standardization and inclusion of predictive models could improve precision and consistency of fish consumption guidelines and impairments determinations.

## Use of Common Tern *Sterna hirundo* chick feathers and mercury isotopes to assess changes in methylmercury exposure and remediation effectiveness in an Area of Concern

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Pollution of coastal waters from industrial contaminants, including heavy metals such as mercury (Hg), pose serious risk to human and wildlife health. Dietary exposure to methylmercury (MeHg), a potent neurotoxin, is widespread. Because Hg in fish tissue exists primarily in a methylated form, MeHg risk can be directly associated with fish consumption. Waterbirds are useful bioindicators of habitat quality, revealing how food-web transfer of contaminants can impact wildlife populations. Common Tern *Sterna hirundo* are colonial-nesting piscivorous waterbirds and therefore at high risk for dietary exposure to MeHg. We collected chick feathers from two actively managed Common Tern nesting colonies on Lake Superior (Duluth, MN and Ashland, WI: 2016 - 2025) to assess Hg exposure relative to adult foraging location (river vs. lake) at each colony. We also used Hg stable isotopes ( $\Delta^{199}\text{Hg}$  vs.  $\Delta^{202}\text{Hg}$ ) as a tracer for identifying pollution sources. We determined that Hg obtained from prey items in the river were largely sediment-based in comparison to individuals feeding on lake-derived prey, suggesting that Hg from legacy sources was contributing to Hg exposure in fish and wildlife in this system. We also determined that Hg concentrations in chick feathers collected in 2023 & 2025 were significantly lower compared to previous collections (2016- 2017). We discuss how foraging location influences mercury exposure, how dynamic food web interactions can alter contaminant cycling, and the importance of long-term monitoring of this species in the system to continue to assess risk post-remediation and Area of Concern delisting.