

**Concurrent Session 1  
Wednesday February 28<sup>th</sup>  
10:00 am – 12:30 pm  
Lakeview Rooms 4 and 5**

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10:00 am – 10:30 am: PROFESSIONAL

**Industrial scale wind development: implications for land protection and avian and bat conservation in Minnesota**

David R. Trauba, Regional Wildlife Manager, Minnesota Department of Natural Resources, 21371 State Highway 15, New Ulm, MN 56073.  
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Industrial scale wind development is long-standing in Minnesota with over 2,600 wind turbines operating across southwest Minnesota alone. Wind development is expanding rapidly as Minnesota moves to a carbon-free electricity standard to combat climate change. Multiple industrial scale wind development projects are in the planning stages each covering hundreds of square miles of land secured by wind easements. Equally long-standing is the documentation that wind turbines kill birds and bats with indirect impacts on wildlife through habitat loss and fragmentation and by altering foraging, breeding, and migratory behaviors. Lesser known is that wind easements can prevent the acquisition of lands for conservation purposes limiting our ability to add additional wildlife habitat to offset population stressors including climate change. This presentation will discuss avian and bat mortality rates from wind turbines in Minnesota, the scale of wind energy development across southern Minnesota, impacts on land conservation strategies, current mitigation measures, and the need for policy reform to truly protect Minnesota's bird and bat populations and our wildlife heritage.

10:30 am – 11:00 am: PROFESSIONAL

**Invasive cattail removal in boreal lake systems as a means of improving wildlife habitat**

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Jerry Warmbold, Voyageurs National Park, 360 Hwy 11 E, International Falls, MN 56649

Adam A. Ahlers, Kansas State University, Manhattan, KS 66502

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Non-native (hybrid) cattails disrupt wetland ecosystems by creating dense monotypic stands which displace native species and reduce biological diversity. Hybrid cattail is the dominant plant species in many lacustrine wetlands in Voyageurs National Park, MN, an 88,000 ha protected area in the Southern Boreal Forest region along the US-Canada border. We initiated the Voyageurs Wetland Restoration Project in 2016 to reduce cattail abundance and restore wetlands to more spatially and botanically diverse habitats in the park. Using an Adaptive Management framework, we've tested various methods of cattail removal and re-seeding techniques to better understand the most cost-effective means to restore lacustrine wetlands. Annual monitoring of wetland plants, secretive marshbirds, and semi-aquatic mammals has been conducted in treated and control sites since the project was initiated. We report here on short-term response (1-5 years post-treatment) of these 3 taxonomic groups to cattail removal/wetland restoration as indicators of overall wetland health. We report here on short-term response (1-5 years) of wetland plants, secretive marshbirds, and semi-aquatic mammals to various restoration techniques we've employed.

11:00 am – 11:30 am: PROFESSIONAL

**Spatial use, habitat selection, and survival of spruce grouse in response to timber harvest in northern Minnesota**

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Cody Aylward, Fish, Wildlife, and Conservation Biology; University of Minnesota-Twin Cities, St. Paul, MN, 55108; [cmaylward@ucdavis.edu](mailto:cmaylward@ucdavis.edu)

We examined changes in spruce grouse (*Canachites canadensis*) survival and home ranges in response to timber harvest in northern Minnesota during 2019-2022. We captured spruce grouse in or near black spruce (*Picea mariana*) and jack pine (*Pinus banksiana*) stands scheduled for harvest in 2 study areas. We attached VHF transmitters and homed to spruce grouse at least once a week to determine spatial use and collect habitat measurements at each location. We used minimum convex polygons to estimate home ranges before and after timber harvest. We used Kaplan-Meier methods to estimate survival before and after harvest for birds near harvested stands and for birds that were near stands that did not get harvested. Importantly, spruce grouse avoided stands scheduled for harvest even before harvest, but home ranges overlapped 500-m buffers of harvested stands. After harvest, home ranges did not change, but survival of spruce grouse near harvested stands was lower after harvest. Reduced survival near harvested stands might occur indirectly through edge effects or from predator displacement from harvested stands producing greater predator densities in nearby stands used by spruce grouse. We predicted spruce grouse would avoid harvested stands after harvest, due to the loss of cover, but did not anticipate that harvested stands would be avoided before harvest. This avoidance suggests that many harvested stands were not suitable for spruce grouse before harvest. Many timber stands mature enough to harvest in Minnesota may lack the vegetation structure necessary to support spruce grouse. Timber harvest may increase spruce grouse mortality but may also be necessary at some level to promote regeneration of stands with denser vegetation structure that supports spruce grouse.

11:30 am – 12:00 pm: PROFESSIONAL

**Forest structure mediates occupancy and extinction of boreal forest prey on the trailing edge of the boreal forest**

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Cody Aylward, Fish, Wildlife, and Conservation Biology; University of Minnesota-Twin Cities, St. Paul, MN, 55108; [cmaylward@ucdavis.edu](mailto:cmaylward@ucdavis.edu)

Climate change is expected to shift the distributions of global biomes. High latitude biomes, such as the boreal forest, are among the most vulnerable and serve as a bellwether for the effects of climate change on other ecosystems. We examined patterns of occupancy, local extinction, and abundance of 3 boreal forest prey species on the southern margin of the boreal forest in Minnesota (USA). We used multi-season, multi-state, and multi-species occupancy modeling approaches to determine the effects of land cover, forest structural characteristics, and climatic variation on three boreal forest prey species. We examined two boreal-forest specialists; the spruce grouse (*Canachites canadensis*) and snowshoe hare (*Lepus americanus*), and also examined the deciduous forest-dependent ruffed grouse (*Bonasa umbellus*) within the boreal forest. Occupancy, abundance, and extinction of spruce grouse was strongly associated with landscape-scale characteristics. In particular, deciduous forest cover may govern their southern range limit. Broadly, forest vegetation structure played a significant role in occupancy, extinction, and abundance patterns of all three species, with ruffed and spruce grouse generally associated with vegetation density in the lower and mid-canopy layer (5.0-15.0 m) and snowshoe hare associated with density in the shrub layer (1.37-5.0 m). Co-occurrence varied annually but was greatest in mixed forests during an uncharacteristically warm and snow-sparse year. Climatic variables (winter temperature and snowfall) were associated with extinction probabilities for all three species, but the effect was generally weaker than that of forest structure. Our results suggest that forest management practices that promote dense understory structure may help provide climate refugia for vertebrate prey species in boreal ecosystems.

12:00 pm – 12:30 pm: STUDENT

### **Greater prairie-chicken nest success and vegetation response to conservation grazing in northwestern Minnesota**

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Conservation grazing is a grazing practice intended to meet conservation goals. More information is needed to understand applications of conservation grazing in fragmented midwestern prairies, where species such as the greater prairie-chicken (*Tympanuchus cupido pinnatus*), an indicator species for the tallgrass prairie ecosystem, have declined due to habitat loss and fragmentation. To understand how conservation grazing impacts prairie-chicken nest success, we located nests of hens at 10 grazing sites by nest-searching pastures that were grazed early (May-June), late (July-Aug), and control pastures that were not grazed. We collected nesting data in pre-grazing (2021), grazing (2022), and post-grazing (2023) treatment years. Visual obstruction readings of vegetation within pastures indicated early and late cattle grazing had a significant short-term (2021 vs. 2022) effect with a mean reduction in height of 1 dm in August of the grazing year. We observed short-term effects for new and residual grass, shrub, litter, and bare ground cover in August. During the nesting season in the post-grazing year, we found effects of grazing for all cover types except bare ground, with new grass increasing 2.5%, but effects dissipated by August of the post-grazing year. Nest survival was 56.5% (DSR=0.984 [SE=0.006]), 31.5% (DSR=0.968 [SE=0.006]), and 79.7% (DSR=0.994 [SE=0.004]) over the study years 2021, 2022, and 2023, respectively ( $\bar{x}$  = 55.9%), with the lowest survival during the grazing year, when there was also extensive flooding. The nest survival model including year outperformed a model with an interaction between grazing treatments and year, which likely reflected interannual variability in weather conditions rather than grazing activity. We did not detect impacts on nest survival or sustained changes in vegetation height or composition, however, more intensive grazing or less extreme weather differences might produce a different result.

**Concurrent Session 2**  
**Wednesday February 28<sup>th</sup>**  
**10:00 am – 12:30 pm**  
**Lakeview Rooms 6 and 7**

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10:00 am – 10:30 am: PROFESSIONAL

**Navigating *Your* Future: A 20-minute guide for students on the diverse pathways to professional happiness**

Nicole M. Davros, Farmland Wildlife Populations and Research Group, Minnesota  
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Figuring out what you want to do with the rest of your life is hard enough but can be even more daunting when you are choosing a career in the natural resources where so many career pathways exist. The good news is that there is no one right way to go about it! The bad news is that there are some wrong ways to do it... During this talk, we'll share our insights as wildlife research professionals who are each at various stages in our careers. We'll discuss both technical and soft skills that you should be developing along the way to be successful in the wildlife (or natural resources) field. We'll also provide some examples from our own experiences and highlight "lessons learned" for ensuring work/life balance throughout your career. Some of the questions we hope to shed light on include: What should you be doing now, during your college years, while simultaneously planning for the years ahead? What about mentorship and stretch opportunities? How should you go about getting field experiences to build your resume? Do you need to go to graduate school? If so, when will you be ready for graduate school and how do you find those opportunities? And perhaps the hardest question of all - Do you really need to move away from home?

10:30 am – 11:00 am: PROFESSIONAL

**MN DNR Wildlife, an overview and what a career in wildlife management entails**

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The goal of my presentation is to introduce undergraduate students to the MN Department of Natural Resources, Section of Wildlife. I'll give an overview of the Section, how it's divided largely into two groups, 1) Management and 2) Research. Will touch on how careers differ between the two groups as well as job prospects for each. Then I'll delve deeper into the Wildlife Management side of things. We will look at what a typical year entails for state wildlife managers, from habitat projects, facility work, depredation, to public education.

11:00 am – 11:30 am: PROFESSIONAL

### **Sandstone Wildlife Management Area pine and oak woodland restoration project**

Josh Koelsch, Assistant Area Wildlife Manager, Minnesota Department of Natural Resources, 305 Business Park Drive East Cloquet, MN 55720, 218-878-5666, [joshua.koelsch@state.mn.us](mailto:joshua.koelsch@state.mn.us)

The Sandstone WMA was historically a NWR which was transferred to the DNR in 2013. Much of the timber on the unit is dominated by either Northern Hardwoods Forest or Aspen Forest. Historically pre-settlement the project area was dominated by large White Pine, Red Pine, and Red Oak. Based on distance from corner to witness trees it is believed that the project area was historically a Pine/Oak Woodland which would have been maintained either by natural occurring or indigenous cultural fires in the understory which would have been low severity and low intensity. The site was impacted by the Hinckley Fire on September 1<sup>st</sup>, 1894, though the fire severity on the site is unknown it is assumed that the site saw extreme fire behavior like what was observed in and around Hinckley, Minnesota on that day. It has been assumed that the site had been logged of its large White Pine, Red Pine, and Oak by the Brennan Lumber Company. Today the site consists of Natural Origin Red Pine which date to just after the Hinckley Fire (~125 Years in Age based on tree cores), Red Oak, Birch, Maple, and Aspen. It is believed that the site historically would have been fire dependent but has seen mesofication due to the human removal of fire in the last 130 years from the system coupled with site response to fire severity of the Hinkley Fire. Under the stands of Red Pine are patches of blueberry. The project area was set up for a timber sale in 2022 with the following specifications. All Aspen, Maple, Ash, Basswood, and Elm would be harvested and all biomass would be required to be harvested as well by the operator. All Red Oak, Pine (Red and White), Birch, Cherry, and Hickory were reserved on the site.



11:30 am – 12:00 pm: PROFESSIONAL

12:00 am – 12:30 pm: PANEL DISCUSSION

### **Passing the drip torch: Leading and collaborating in a smokey future**

Josh Koelsch, Assistant Area Wildlife Manager, Minnesota Department of Natural Resources, 305 Business Park Drive East Cloquet, MN 55720, 218-878-5666, [joshua.koelsch@state.mn.us](mailto:joshua.koelsch@state.mn.us)

The use of fire to manipulate habitats has been documented in human culture dating back thousands of years, managers understand that the removal of natural fire in our ecosystems starting in the late 19<sup>th</sup> century created drastic changes in our habitats which influence native plant communities, wildlife species, and ecosystem functions. The current use of fire on the landscape ranges from site prep to habitat maintenance to habitat resilience in the face of climate change while policy and regulations around the use of fire have drastically changes in the last 30 years due to a variety of factors. The future of fire use by managers is dependent on mentoring upcoming leaders (in and out of fire), collaborating across a variety agencies and landownerships, and telling the story of why fire is important to our leaders within government and in the eyes of the public. It is up to current and upcoming leaderships to develop interagency partnerships across varying ownerships, conduct public outreach on the benefit of fire to wildlife species and habitats, and pass the drip torch and lessons learned to a new generation of fire practitioners. Panel Discussion to follow.

**Concurrent Session 3**  
**Thursday February 29<sup>th</sup>**  
**10:00 am – 12:45 pm**  
**Lakeview Rooms 4 and 5**

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10:00 am – 10:30 am: PROFESSIONAL

**The breeding ecology of boreal chickadees in the Red Lake Wildlife Management area in northern Minnesota**

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Robert Slesak, Department of Forest Research, University of Minnesota, 10B Green Hall, 1530 Cleveland Ave N, St Paul, MN 55108, [raslesak@umn.edu](mailto:raslesak@umn.edu), (651) 603-6756

Marcella Windmuller-Campione, Department of Forest Research, University of Minnesota, 330G Green Hall, 1530 Cleveland Avenue North, St Paul, MN 55108, [mwind@umn.edu](mailto:mwind@umn.edu), (612) 624-3699

Fragmentation is increasing in the boreal forests of North America due to increased timber harvesting and the impacts of climate change. Our current understanding of how fragmentation will affect breeding boreal bird species is limited. We examined the impacts of fragmentation on the breeding ecology of a boreal-obligate species, the Boreal Chickadee, (*Poecile hudsonicus*) in the Red Lake Wildlife Management Area in northern Minnesota. Boreal Chickadees are listed as a Species in Greatest Conservation Need (SGCN) by the MN DNR, with declines attributed to habitat loss, degradation and fragmentation. However, the specific impacts of fragmentation on this species are unknown and there exists critical knowledge gaps in their life history specifically related to nestling ecology. To investigate the effects of fragmentation on Boreal Chickadee breeding success and, in attempt to characterize high quality breeding habitat for the species, we compared arthropod (food) availability, provisioning rates, nestling growth rates and pre-fledge body condition in study sites which varied in their degree of fragmentation and forest composition. We modeled nest survival in relation to landscape, patch and nest site scale metrics of fragmentation. We found evidence that fragmentation negatively impacts nest survival, nestling growth rates and food availability. Additionally, to fill a large knowledge gap, we elucidated the diet of nestling Boreal Chickadees by extracting DNA from fecal samples and using DNA metabarcoding techniques. We found that Boreal Chickadee nestlings are primarily

being provisioned prey from the orders: Lepidoptera, Aranea and Diptera; and parents are likely actively selecting for Lepidoptera. This information can be used as a baseline to evaluate diet shifts in response to anthropogenic disturbances such as climate change and land-use changes. Overall, this information will help identify high quality habitats and inform species conservation plans and forest management decisions.

10:30 am – 11:00 am: PROFESSIONAL

**Habitat use and management strategies of the Connecticut Warbler during the nesting and post-fledging period**

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Widespread declines in breeding bird populations have been documented across North America since the 1970s and concerns for loss of avian biodiversity are growing. Species with narrow habitat preferences which are at the southern edge of their breeding range are of particular conservation concern. Connecticut Warblers (*Oporornis agilis*) breed in forests in central Canada and around the western Great Lakes; throughout much of its breeding range, this species is associated with lowland black spruce (*Picea mariana*) and tamarack (*Larix laricina*) forests. Population trends of Connecticut Warblers indicate they are one of the most rapidly declining bird species in North America. To better understand the breeding ecology of Connecticut Warblers, we studied their nesting and post-fledging habitat use and survival in northern Minnesota, USA at two study sites in 2019 and 2020. We mapped territories of 49 singing males, located and monitored 11 nests, and tracked the post-fledging movements of individuals from 5 broods. Nest sites were located in tamarack-dominated stands with a semi-open canopy and dense understory. The average fledging age was 7.5 days post-hatch and the individuals ( $n=14$ ) tracked during 0-7 days post-fledging had a mean daily distance from nests of 35.5 m and a maximum distance from nest of 104 m during that time period. Our findings indicate that micro-site areas with high stem density were important features for post-fledging birds and that the same habitats were used for breeding and

the post-fledging time period. Additionally, we discuss potential forest management strategies for Connecticut Warblers. Results from this study can be used by managers to develop conservation strategies that will provide critical habitat to support this species.

11:00 am – 11:30 am: STUDENT

**Influence of habitat type on nest success, fledgling survival, and habitat-use of the Golden-winged Warbler**

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The Golden-winged Warbler (*Vermivora chrysoptera*) is one of the most critically threatened birds in North America with a global population estimated at only 400,000 individuals of which 50% nest in Minnesota. The species relies on two distinct habitat types, shrub wetland and young forests, for breeding. To better understand the breeding ecology of Golden-winged Warblers, we studied their nest success, post-fledging survival, and post-fledging habitat-use across 10 study sites in northern Minnesota, USA from 2020 to 2023. We monitored a total of 91 nests and tracked the post-fledging movements of 60 individuals from 52 broods. We used these data to determine the influence of vegetation characteristics, habitat, and landscape factors on nest success, fledgling survival, and post-fledging habitat-use. Our results indicated that there was no difference in nest success and fledgling survival between young forests and shrub wetlands. Predation by sciurids, hawks, and mesocarnivores during the nesting period and the post-fledging period was the most common cause of mortality. Nest survival was lowest for nests that were close to forest edges and survival was lower for nests that were initiated later in the breeding season. Fledgling survival was also lower for birds near forest edges but increased as fledglings aged and became more mobile. Overall, our results show that forest management activities that promote structural diversity in young forest stands and conservation of shrub wetland habitats are necessary to maintain stable breeding populations of Golden-winged Warblers in the region.

11:45 am – 12:15 pm: PROFESSIONAL

### **Habitat use and movements of Boreal Chickadees during the post-fledging period**

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Marcella Windmuller-Campione, Department of Forest Resources, University of Minnesota, St. Paul, Minnesota, 55108. [mwind@umn.edu](mailto:mwind@umn.edu).

The Boreal Chickadee (*Poecile hudsonicus*) is a nonmigratory cavity-nesting species with a range that is strongly tied to the spruce forests of the North American boreal forest. This species is undergoing range contraction and associated population declines at the southern edge of its range, but the mechanisms driving this decline are poorly understood. One hypothesis is that bottlenecks in the post-fledging dispersal period are causing low levels of recruitment into the breeding population. Additionally, little is known about the post-fledging dispersal of resident and/or cavity-nesting species such as the Boreal Chickadee, and these life history strategies pose different challenges than those faced by migratory open-cup nesters. To better understand these knowledge gaps, we used radio telemetry to study post-fledging movements, cover type associations, and survival of 23 broods of Boreal Chickadees in northern Minnesota from 2019-2022. We used habitat measurements taken at fledgling locations and those at paired random points to compare use versus availability at the microhabitat scale. We also used compositional analysis, modified with age-specific movements, to assess cover type selection by fledglings during the post-fledging period. Fledgling Boreal Chickadees of all ages used habitat disproportionately with respect to its availability. Cover types that contained lowland black spruce were strongly preferred, and lands with tamarack or deciduous trees were strongly avoided. Within black spruce cover types, Boreal Chickadee fledglings selected microhabitats that contained higher percent canopy cover and, often, a higher number of overall black spruce trees. Fledglings did not switch cover types at any time in the post-fledging period, but some habitat requirements may have been slightly relaxed during the independent period after they left the care of the adults. Results from this study can be used by managers to develop conservation strategies that will provide and/or maintain critical habitat to support this species.

12:15 pm – 12:45 pm: PROFESSIONAL

### **Restoration of common loons (*Gavia immer*) in Minnesota**

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The Common Loon is the State bird of Minnesota and is recognized across the State for its environmental and cultural significance. Following the 2016 settlement of the 2010 Deepwater Horizons Oil Spill in the Gulf of Mexico, the Minnesota Loon Restoration Project began in 2019 to reduce mortality and increase productivity of common loons in Minnesota. The Minnesota Department of Natural Resources (MNDNR) has been coordinating with the United States Fish and Wildlife Service (USFWS), United States Geological Survey (USGS), and the Minnesota Pollution Control Agency (MPCA) to acquire loon nesting and foraging habitat, augment natural nesting with artificial nesting platforms (ANPs), advance stewardship and outreach, and monitor loons and project outcomes. As of 2024, 53 artificial nesting platforms have been deployed, 120 “Loon Friendly” Lake Management Plans have been developed, 52 active lake associations participate in a statewide Loon Friendly Lake Registry, and MN DNR along with federal partners continues to monitor 55 priority lakes. Common loons face a number of human-induced threats in both their breeding and non-breeding ranges, and continued adaptive management is important in supporting the species.



**Concurrent Session 4  
Thursday February 29<sup>th</sup>  
10:00 am – 12:45 pm  
Lakeview Rooms 6 and 7**

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10:00 am – 10:30 am: PROFESSIONAL

**Hunting wolves won't save Bambi: the life of a deer fawn is perilous — with or without predators**

Joseph Bump, Department of Fisheries, Wildlife and Conservation Biology, University of Minnesota Twin Cities

Thomas Gable, Department of Fisheries, Wildlife and Conservation Biology, University of Minnesota Twin Cities

Some groups in Minnesota are calling for wolf hunting and trapping seasons to save deer fawns from being eaten by wolves. But would a wolf hunting and trapping season save deer fawns? There is appealing and persistent thinking that because wolves and other predators kill fawns, fewer wolves/predators will therefore increase fawn survival. Such reasoning is as faulty as it is appealing. Fawns die from multiple causes and the causes of mortality can compensate for one another. Increased mortality due to one source often means less mortality from a different source and overall fawn survival can remain unchanged. Research examining fawn survival amid wolves in Michigan, Minnesota and Wisconsin shows that between 45-49% of fawns survive summer months. The average survival rate of fawns in North American forests when examined across 30 populations in 16 states was 41%, with the lowest survival rates occurring in areas without wolves. Even in some areas that are *entirely free* of large predators like wolves, bears, coyotes, and bobcats, only 44% of fawns may survive past three months. The best available scientific information indicates that killing wolves via recreational wolf hunting or trapping would not increase deer fawn survival in a significant way.

10:30 am – 11:00 am: PROFESSIONAL

### **Exploring the relationship between ambient temperature and heat stress in wild Minnesota moose**

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Andrew Tri, Forest Wildlife and Populations Research Group, Minnesota Department of Natural Resources, Grand Rapids, Minnesota, 55744, [Andrew.tri@state.mn.us](mailto:Andrew.tri@state.mn.us), 218-328-8879

The moose (*Alces alces*) population in Minnesota has experienced a rapid decline in the past 20 years. Climate change has been listed as one potential underlying cause. To better understand moose physiological and behavioral responses to increasing ambient temperatures, internal body temperatures of wild moose (n=41; 23 females, 18 males) were monitored at 15-min intervals from 2013-2017 using a rumen bolus (mortality implant transmitter [MIT]). We examined how frequently wild moose experienced ambient temperatures above published thresholds ( $\geq -5$  and  $-2.2^{\circ}\text{C}$ , and  $\geq 14$  and  $20^{\circ}\text{C}$  for increased metabolism and panting in winter and summer, respectively; Heat Days) shown to induce physiological responses in captive moose indicative of heat stress. During summer, moose experienced Heat Days on average 49.3-67% (depending on the year) and 81.8-92.5% of the time for panting and increased metabolism, respectively. Similarly, wild moose experienced winter Heat Days on average 36.3-60.2% and 49.2-78.5% of the time for panting and increased metabolism, respectively. However, moose rarely experienced elevated body temperature beyond their normal internal range ( $>39.17^{\circ}\text{C}$ ) during winter (0.3-1.2% of winter days), suggesting Heat Days during that season do not predict heat stress. Our models suggest, however, that moose are more likely to be heat stressed in the summer (44-50.9% of summer days) on Heat Days. Both the maximum daily MIT and the probability of moose being heat stressed increase significantly with increasing ambient temperatures in the summer. Predictions from our models suggest that wild moose may experience heat stress symptoms at maximum daily temperatures  $>25^{\circ}\text{C}$  in summer. We also found that moose experiencing heat stress  $>50\%$  of summer days were more likely to die within a year following that a summer. There may be behavioral tradeoffs moose have to make to mitigate heat stress that may reduce overall fitness and impact survival.

11:00 am – 11:30 am: PROFESSIONAL

**Collaborative planning to identify and overcome challenges facing large-scale moose habitat restoration in northeastern Minnesota.**

Megan Eiting, Minnesota Department of Natural Resources, 7979 Hwy 37, Eveleth, MN 55734, [megan.eiting@state.mn.us](mailto:megan.eiting@state.mn.us), 218-735-3956

Moose are an iconic species in Minnesota, with particular cultural importance to the Tribal Nations in northeastern Minnesota. However, Minnesota's moose population has declined about 50% in the past 20 years due to a number of overlapping issues including parasites, predation, habitat decline, and climate change. While small-scale habitat restoration continues, there is widespread agreement that large-scale habitat restoration (10,000+ acres) would be particularly beneficial to Minnesota's moose population. There has, however, been a lack of restoration at this scale due to a host of challenges, for example, the patchwork of tribal, federal, state, county, and private land ownership, conflicting habitat priorities, timber market challenges, and limited funding for forest management activities. This project, funded by a grant awarded by the National Fish and Wildlife Foundation's America the Beautiful Challenge, will facilitate collaborative planning to enhance moose habitat as a strategy to positively impact Minnesota's moose population and to inform long-term moose management. Activities include holding five facilitated, inclusive workshops with tribal, federal, state, county and non-governmental organizations to: 1) bring clarity to challenges and identify strategies; 2) identify three areas for moose habitat restoration and collectively agree upon an implementation plan; and 3) improve relationships among partners involved. This talk will provide an overview of the project activities since initiation in June 2023 and what comes next.

11:45 am – 12:15 pm: PROFESSIONAL

### **Carnivore-mediated secondary dispersal of mycorrhizal fungi**

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Understanding the factors that shape how forest communities respond to climate change is critical for developing effective management strategies for adaptation and mitigation. Mycorrhizal fungi, which are plant mutualists that colonize roots and allow trees to better access water and soil nutrients, can increase plant growth and make trees more resistant to climate-related threats such as drought and pathogens. Small mammals that consume fungal fruiting bodies (mushrooms and truffles) play a key role in dispersing fungal spores and increasing mycorrhizal fungal diversity. The carnivores that eat small mammals may also play a role in dispersing mycorrhizal fungi, but few studies have evaluated secondary fungal spore dispersal by carnivores. We evaluated the role of small mammals and carnivores in dispersal of mycorrhizal spores. We hypothesized that smaller carnivores would eat more small mammals and disperse higher quantities of fungal spores, while larger carnivores would move longer distances and disperse spores farther. To test these hypotheses, we collected small mammals and carnivore scats in three study areas in Minnesota and Wisconsin, extracted and identified fungal spores, and measured spore richness and density using fungal microscopy. Voles and squirrels dispersed more mushroom spores than shrews and mice, but all small mammals dispersed truffle spores. We found that fishers, red foxes, bobcats, coyotes, and wolves all dispersed fungal spores, but fishers and red foxes, which ate more small mammals, dispersed higher quantities of spores than carnivores that ate fewer small mammals. However, larger carnivores dispersed spores further. Our results suggest that carnivores are playing an important, yet underappreciated, role in maintaining mycorrhizal diversity in forest ecosystems.

12:15 pm – 12:45 pm: STUDENT

**Using environmental DNA methods to detect the four-toed salamander (*Hemidactylium scutatum*) in Minnesota**

Alyssa Roberts. Dept. of Biology, St. Cloud State University. 720 4<sup>th</sup> Avenue South, St. Cloud, MN. 56301 [alyssa.roberts.2@go.stcloudstate.edu](mailto:alyssa.roberts.2@go.stcloudstate.edu), 651-210-5968

Jennifer Y. Lamb. Dept. of Biology, St. Cloud State University, 720 4th Avenue South, St. Cloud, MN 56301, [jylamb@stcloudstate.edu](mailto:jylamb@stcloudstate.edu), 769-223-5925

The Four-toed Salamander (*Hemidactylium scutatum*) is a species of special concern in Minnesota. It can be elusive and is considered to be sensitive to habitat disruption. Understanding how populations are distributed across the state is important for forest management. Traditional sampling methods can be time-consuming, challenging, and possibly damage the fragile wetlands these salamanders use for reproduction. Environmental DNA survey methods have the potential to match detectability of traditional surveys, while simultaneously reducing harm to sensitive habitats. The goal of this study is to evaluate the efficacy of environmental DNA survey methods in comparison to traditional methods when surveying for the Four-toed Salamander in Minnesota. We are using novel, species-specific eDNA assays. We completed traditional nest and larval surveys in the spring and summer of 2023. We also collected and filtered three water samples *in situ* from each site. Traditional surveys detected Four-toed Salamanders at 24 of 29 survey visits. An average of 5 adults (range = 0 to 21) and 365 eggs (range = 0 to 2,831) were found across sites. Data collection is ongoing from filtered water samples. We have extracted eDNA from 116 filters from all 29 survey visits and are in the process of qPCR testing. eDNA from Four-toed Salamanders has been detected at nine out of 16 sites for which qPCR is complete. We will test for correlation between detection histories across sites and methods. We will also investigate whether salamander abundance and eDNA concentrations are correlated. If it is found that eDNA survey methods are effective for detection of Four-toed salamanders in Minnesota, we can provide the opportunity for land-based professionals in the state to utilize this innovative tool.

**Poster Session**  
**Wednesday February 28<sup>th</sup>**  
**9:00 am – 10:00 am**  
**Sanford Center Atrium**

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POSTER PRESENTATION 1: PROFESSIONAL

**Black-backed woodpecker (*Picoides arcticus*) monitoring on the Leech Lake Reservation**

Alyssa Sheffield, Leech Lake Band of Ojibwe, Division of Resource Management, 190 Sailstar Dr. NW, Cass Lake, MN 56633, [alyssa.myhrer@llojibwe.net](mailto:alyssa.myhrer@llojibwe.net), 218-335-7423

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Black-backed woodpeckers (*Picoides arcticus*) are a threatened species for the Leech Lake Band of Ojibwe. They are one of only two woodpecker species found in Minnesota that specialize in feeding on insects found in old growth coniferous forests and recently burned areas. Decades of fire suppression and logging have had a negative impact on black-backed woodpeckers across their range. Their presence and abundance across the Leech Lake Band of Ojibwe Reservation is unknown, but a few birds have been documented in the area. In 2023 the Leech Lake Wildlife Program conducted reconnaissance surveys for black-backed woodpeckers. Surveys consisted of meandering pre-selected forest stands and searching for foraging sign (flaking/scaling of trees) or presence of black-backed woodpeckers. Stands were selected by tree species (primarily conifers), age (>70 years old) and how recently the stand was burned (<5 years). Thirty-six stands totaling 1,373 acres were surveyed for black-backed woodpeckers from June-October 2023. Black-backed woodpecker foraging sign or sightings were found in seven red pine stands and one jack pine stand. Foraging sign was found at all of those stands and one stand had multiple sightings. Data from these surveys will help assess presence of black-backed woodpeckers, as well as, guide future survey efforts and conservation of black-backed woodpeckers on the Leech Lake Band of Ojibwe Reservation.

## POSTER PRESENTATION 2: STUDENT

### **Bobcat and fisher population trends in response to forest disturbance**

Michael C. McMahon, Integrated Biosciences Graduate Program, University of Minnesota Duluth, 5013 Miller Trunk Hwy, Duluth, MN 55811, [mcmah231@d.umn.edu](mailto:mcmah231@d.umn.edu), 651-500-6370

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Bobcats and fishers are ecologically, culturally, and economically important furbearer species in Minnesota. Over the past two decades fisher populations in Minnesota have declined by 50% while bobcat populations have nearly doubled in that same time period. Although bobcats and fishers co-occur over much of northern Minnesota, bobcats tend to be more strongly associated with young forests while fishers are associated with mature and old-growth forests. Given these habitat preferences, one hypothesis is that recent population changes are related to changing habitat quality due to forest disturbance yielding better quality bobcat habitat and decreased fisher habitat. The objectives of this study are to identify spatial trends in bobcat and fisher populations and to determine whether population trends are associated with changes in habitat quality and forest disturbance. We used spatial data on bobcat and fisher harvests from 2006 to present, corrected by trapper effort, to evaluate spatial variation in population trends for both species. Within each township, we used capture per unit effort to determine whether each species was stable, increasing, or decreasing. We will use existing habitat suitability models calculated using GIS and forest disturbance data to determine how habitat suitability and forest change correlate with population trends to test whether changes in habitat suitability can explain recent population trends for both furbearer species. This work will have important management implications for bobcats and fishers by informing land managers of the direct relationship between forest cover type and habitat quality for each species. Managing for a mix of quality habitat for both bobcats and fishers is essential for the prevalence of these furbearers in Minnesota, and is especially relevant given the observed fisher decline.

## POSTER PRESENTATION 3: STUDENT

### **A dangerous dinner? Scavenger communities and the risk of lead exposure at hunter-provided gut piles**

Kellie Suelter, University of Minnesota - Twin Cities, 2247 Louisiana Ave S, St. Louis Park, MN 55426, [kellie.suelter@gmail.com](mailto:kellie.suelter@gmail.com), 309-210-3262

Ellen Candler, University of Minnesota-Twin Cities, [belle130@umn.edu](mailto:belle130@umn.edu)

Joseph Bump, University of Minnesota-Twin Cities, [bump@umn.edu](mailto:bump@umn.edu)

Across the Midwest, species throughout the animal kingdom benefit from gut piles (also known as offal) that are left when hunters field-dress deer they kill. These gut piles are rich in nutrient-dense organs, such as intestines, stomach, and lungs, that humans rarely eat. Roughly 200,000 deer are killed every year in Minnesota making the presence of this offal a pulsed resource, or a resource that occurs in a large volume over a short period of time annually. In this project, volunteer hunters positioned trail cameras on gut piles and left them for 30 days. The images were then reviewed by participatory scientists on Zooniverse. Using these data, we aimed to determine if there was a hierarchy of avian groups that visited these gut piles. We hypothesized that Corvids such as crows and Raptors would arrive at the offal piles first. Using a Kruskal Wallace test of variance, we found a slight statistical difference between Corvid and Raptor arrival times, while Picidae and Passerines had no statistical difference. This information may be helpful when determining what species might be more susceptible to lead poisoning if lead-based ammunition was used to kill the hunted deer.



## POSTER PRESENTATION 4: PROFESSIONAL

### **Chippewa National Forest hunter walking trail project**

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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 populations in the state have generated a renewed interest in using forest management to create habitats that not only support breeding adults but also those that maximize juvenile survival and increase recruitment into the populations. Chippewa National Forest is planning a long-term habitat improvement project by implementing small-scale, frequent harvests (<5 acres, 5-year intervals) adjacent to hunter walking trails. Currently, there are more than 600 miles of hunter walking trails in Minnesota, and maintaining and enhancing these areas as productive hunting grounds is a priority. 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 four years, we used a combination of line transect surveys and Autonomous Recording Units (ARUs) to survey birds along approximately 34,000 meters of hunter walking trails before and after harvests are implemented and at control sites. Data obtained during the first and second years of line transect surveys provided a foundation for long-term monitoring within the project areas, and results from 2023 hinted at the effects of small-scale harvests on bird communities. In 2023, we detected 5,120 individuals of 70 bird species within 100 m of the trails during the summer transect surveys and recorded 6,234 Ruffed Grouse drums on 21 ARUs. The long-term nature of this monitoring program is important to determine the impacts of management on wildlife populations and will allow us to identify the impacts of these short-term harvests on breeding birds.

## POSTER PRESENTATION 5: STUDENT

### **Ecological parameters of fishers (*Pekania pennanti*) in an area of range expansion**

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Fishers (*Pekania pennanti*) are mid-sized carnivores with a complex history of extirpation and reintroductions of mixed success across much of the Northern United States. In Minnesota, fishers were historically distributed across most areas where forests were present before being extirpated in the late 1800s and early 1900s. Fisher populations recovered naturally in northern Minnesota by the 1970s, but fishers remained absent from southern Minnesota until the early 2000s. Over the last 5 years, verified reports of fishers in southern Minnesota have increased. Fishers in southern Minnesota are reoccupying a landscape with different forest types and a higher degree of fragmentation than their core population in northern Minnesota. The objective of this study is to describe basic ecological parameters of southern fishers and compare fisher ecology between southern and northern portions of the state. Specifically, I will compare fisher home range size and intensity of use along with diet composition between fisher populations in northern and southern Minnesota. Fishers are being captured and GPS-collared in three main study areas across Southeastern Minnesota with varying levels of fragmentation and human development. I will use radio telemetry to track fishers and download GPS locations to construct 95% kernel density home range estimates. I will also use area-probability curves to estimate intensity of use and delineate core areas. For diet analysis, I will pair stable isotope and scat analyses to establish an index of prey consumed by southern fishers, rank relative importance of prey items, and quantitatively measure differences between individual fishers and fisher populations. Understanding prey availability and diet composition could be beneficial in explaining preliminary trends showing that fishers utilize smaller home ranges in southern Minnesota. Our results will provide baseline information on fisher ecology in southern Minnesota and could be used to direct future conservation and management actions.

## POSTER PRESENTATION 6: STUDENT

### **Habitat selection and detectability of nests among woodpeckers at the Red Lake WMA and Beltrami Island State Forest**

Kaysie Maleski, Department of Biology, Bemidji State University, 1500 Birchmont Drive, Bemidji, MN 56601, 218-393-7489, [kaysie.maleski@live.bemidjistate.edu](mailto:kaysie.maleski@live.bemidjistate.edu)

Michael R. North, Minnesota Department of Natural Resources – Forest Wildlife Coordinator, 1601 Minnesota Drive Brainerd, MN 56401, 218-203-4339, [michael.north@state.mn.us](mailto:michael.north@state.mn.us)

Samantha Jones, Department of Geography, Bemidji State University, 1500 Birchmont Drive, Bemidji, MN 56601, 218-755-3946, [samantha.jones@bemidjistate.edu](mailto:samantha.jones@bemidjistate.edu)

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Currently nine species of woodpeckers regularly live and breed in Minnesota. Eight of these nine species occur in northwestern Minnesota in the Beltrami Island State Forest and Red Lake WMA areas. Woodpeckers are considered keystone species, in that they provide nesting and denning sites for other species, yet the breeding ecology of woodpeckers in Minnesota has not been extensively studied. Aspects such as tree selection and detectability of nests have likewise not been well studied and there are currently no known standardized protocols for finding nests or documenting woodpeckers in Minnesota. As part of a larger ongoing project, this study seeks to develop a standardized protocol starting with aspen forests. The Beltrami Island State Forest and Red Lake WMA areas consist of over a million acres and contain diverse habitat types ranging from peatlands, sandy upland pines, and aspen dominant stands. Previous work found that woodpeckers prefer aspen for nesting. Therefore, from mid-May to late July 2024, our study will target aspen stands for nest searching and monitoring of woodpecker species. One field season has been conducted in 2023 in which a total of 66 nests were found. These data will be analyzed to examine each species' nest tree selection (e.g., species, age, and diameter) and nest detectability. Anticipated results from this study will aid land managers, foresters, and wildlife biologists in managing forests to provide adequate habitat for woodpecker species nesting in aspen communities. Additionally, results will provide information for acceptable leave trees, and improve methods of detecting woodpecker nests in Minnesota.

## POSTER PRESENTATION 7: STUDENT

### **Northern and southern flying squirrel home range and nest site selection in northern Minnesota**

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Climate change is affecting the spatial distribution of northern and southern flying squirrels (*Glaucomys sabrinus* and *G. volans*, respectively) across North America, including in Minnesota. Warmer winters are allowing southern flying squirrels to move north into habitat that has previously been solely occupied by northern flying squirrels, potentially leading to increased competition for food and nesting habitat between the two species. Understanding how northern flying squirrels respond to the presence of southern flying squirrels in Minnesota is critical for evaluating their potential for coexistence. The objectives of this study are to characterize the impact of this new sympatry on both species' nest site selection and home ranges. Specifically, we are interested in understanding differences in nest site and home range traits both between northern and southern flying squirrels and in areas of sympatry and allopatry. We are deploying radio-collars on northern and southern flying squirrels at four field sites in northeastern Minnesota, including sites where only northern flying squirrels are present and sites where both species are present. We are using radiotelemetry to identify their active and inactive locations to construct home ranges. We are also identifying their nest sites and recording habitat characteristics at the site, structure and microsite levels. This will allow us to determine the nest site and home range characteristics that are most selected for by each species both with and without each other's presence. Being able to recognize newly emerging patterns in these traits will help determine if coexistence is a possibility for the two species and inform consequent management decisions. The project will inform larger questions about interactions between Minnesotan flying squirrels and provide data needed to better evaluate the status of northern flying squirrels in Minnesota.

## POSTER PRESENTATION 8: STUDENT

### Using acoustic detectors to map distributions of flying squirrels in Minnesota

Anna R. Peterson, Integrated Biosciences Graduate Program, University of Minnesota Duluth, 1035 Kirby Drive, Duluth, MN 55812, [hallx778@d.umn.edu](mailto:hallx778@d.umn.edu), 218-410-3830

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Climate change is causing shifts in animal populations which can lead to new interactions between species and changes in resource competition or selection. There are two species of flying squirrel in Minnesota, the northern flying squirrel (*Glaucomys sabrinus*) and the southern flying squirrel (*G. volans*). With climate change, there is a northward expansion of southern flying squirrels and a northern contraction of northern flying squirrels. Northern flying squirrels are a species of concern in nearby states, but in Minnesota neither flying squirrel species has an assigned conservation status. Acoustic detectors have historically been used for bats but have recently been shown to be an effective tool to survey flying squirrels as well because their ultrasonic vocalizations can be classified to species. Our objective is to compare historic and current distributions of the two flying squirrel species to better evaluate the conservation status of northern flying squirrels. A key component is establishing areas of sympatry as this can provide information about habitat or resource selection compared to non-sympatric areas. Historic distributions of flying squirrels will be determined using museum records and other occurrence records. Current distributions will come from re-analyzing acoustic survey data collected for bats from 2015-2023, a new acoustic survey in the area of sympatry, as well as concurrent live-trapping efforts from a companion study. Full spectrum detectors will be utilized using standard bat survey methodology. Visual inspection of call files as well as classification software will be used to assign species identification to the calls. Probability of detection and latency to detection will be calculated. Survey site habitat will be categorized using existing geospatial data on forest type and age. Results from this study will help to inform management decisions and will be compared to similar studies in different regions to assess overall trends.

## POSTER PRESENTATION 9: STUDENT

### **White-tailed deer spatial response to a controlled city archery hunt**

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Overabundant urban white-tailed deer (*Odocoileus virginianus*) populations result from high rates of annual survival combined with limited natural mortality. Hunter harvest has replaced natural predators as the primary limitation to population growth in many developed areas. Knowledge of demographic response is critical to assess whether hunting is an effective management option. A city archery hunt has been conducted in Bemidji, Minnesota since 2005 to help manage the overabundant deer population. Our objective is to better understand how hunting intensity influences deer movement and survival. We intend to investigate how white-tailed deer alter their behavior (movement and resource selection) in response to a controlled city archery hunt and how those changes relate to survivability. We will represent hunting intensity as a continuous variable (hunter hours within the home range) and as a categorical variable (presence or absence of a hunted property within the home range). We will capture and collar 20–30 female ( $\geq 6$  months old) deer during winters (Jan–Mar) 2024 and 2025 using netted cage traps and drop nets. We will evaluate the influence of hunting treatment areas (i.e., hunted and non-hunted), temporal periods of potential risk (pre-hunt, hunt, post-hunt) on deer movement patterns in relation to 2nd and 3rd order selection. We will estimate home ranges using Brownian bridge movement models. For survival, we will model the effect of landscape covariates, hunting pressure, and resource selection on annual survival for all deer using Cox proportional hazard models. This research will provide recommendations to improve the effectiveness of controlled urban hunts across the state of Minnesota.

## POSTER PRESENTATION 10: STUDENT

### **Characterizing nesting and foraging locations of eastern gray squirrels (*Sciurus carolinensis*) and American red squirrels (*Tamiasciurus hudsonicus*) in an urban environment**

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Urban development causes habitat fragmentation which can disrupt ecosystems and organisms that inhabit them. Through interruption of species movement, fragmentation causes species to react by modifying their behavior, habits, and specializations. Concordia College's campus is home to Eastern Gray Squirrels (*Sciurus carolinensis*) and American Red Squirrels (*Tamiasciurus hudsonicus*). The large amount of human activity, accessibility of both natural and anthropogenic food sources, and availability of natural and anthropogenic nesting (drey) sites make campus an ideal location for observing effects of urbanization on foraging habits and movement patterns of these squirrel species. The convenience of alternate, anthropogenic food sources may influence the patterns and strategies squirrels use to forage throughout the day. To analyze these effects, we used live-trapping and radio telemetry to track squirrels across campus and documented their locations and behavior. We also monitored the characteristics, locations, and density of gray squirrel dreys throughout campus. Using ArcGIS, we spatially analyzed the dreys on campus and telemetry data of squirrel movement going back to 2014 in comparison to the locations of different anthropogenic food sources. We found a significantly patterned relationship between drey locations and foraging telemetry locations on campus in comparison to garbage can locations indicating these anthropogenic food sources influence the movement patterns and nest use of urban squirrels.



## POSTER PRESENTATION 11: STUDENT

### **Advancing ocean literacy using an oceanarium located in the prairies**

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Ocean literacy among the public is generally low, especially for inland populations. In this presentation we report ocean literacy of youth aged 9-14 located in the center of the North American continent, before and after a 4-day program on ocean literacy hosted at the Minnesota State University Moorhead Oceanarium. The pre-test administered before the workshop showed average pre-knowledge across the seven principles of ocean literacy of 32.1%, which increased to 45.1% by the end of the workshop. The principles of ocean literacy (One big ocean, Ocean influences climate and Ocean is largely unexplored) had the highest rates of pre-knowledge and also the highest rates of learning gains suggesting either that (1) the workshop covered these areas particularly well, (2) these are easy concepts for youth to grasp, and/or (3) there was youth-to-youth transfer of knowledge during the workshop. Grade level (age) predicted pre-knowledge, with older participants scoring higher than younger ones, and female participants out-scored males. Neither age nor sex affected learning gain during the workshop. By the end of the workshop, there was a significant shift toward an increasingly positive attitude about oceans but no change in interest in ocean-related jobs.



## POSTER PRESENTATION 12: STUDENT

### **A field test of individual response to Black-capped Chickadee (*Poecile atricapillus*) dominance**

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Many bird species exhibit dominance hierarchies in foraging interactions. The prevailing hypothesis is that avoiding agonistic interactions with dominant birds results in fewer injuries and less energy wasted, both of which can increase future reproductive output. Research on dominance hierarchies in Black-capped Chickadees (*Poecile atricapillus*) has supported this hypothesis. One question is how individuals recognize dominant individuals. Previous studies have shown that information on dominance may be encoded in the territorial songs of males. We propose to experimentally test this hypothesis by identifying dominant and subordinate males, recording their songs, and using those recordings to conduct a playback experiment on unrelated birds. We predict that playback of dominant males will elicit less aggressive reactions than playback of subordinate males. To conduct this experiment, we propose to color-band Black-capped Chickadees at Minnesota State University Moorhead's Regional Science Center near Glyndon, MN. We will observe agonistic interactions at bird feeders to identify the dominant individual in each family group, which is typically the breeding male. We expect to have six to seven family groups visit the feeders. We will also attempt to identify hierarchies among the dominant males, identifying relatively dominant ones, and relatively subordinate ones. We will then map territories of banded birds and make audio recordings of the singing male in each territory. We will use Raven software to quantify any differences in song structure between dominant and subordinate males. Finally, we will conduct playback experiments on unrelated birds breeding in a separate area and observe their responses.

## POSTER PRESENTATION 13: STUDENT

### **Correlation between Merlin (*Falco columbarius*) and Crow (*Corvus brachyrhynchos*) populations in Moorhead, MN**

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Merlins (*Falco columbarius*) have nested in urban areas in Alberta and Saskatchewan for at 50 years ago, with the phenomenon gradually spreading south and east. The first recorded nest in the Fargo-Moorhead area was ~2003 and there are now approximately 80–120 nests in the metropolitan area each year. At the same time, winter numbers have also increased. It remains unclear why urban breeding has spread, or why populations have increased locally. Here we propose several hypotheses about the proximate and ultimate causes of urban breeding in Merlins, broadly categorized into food availability and nest availability hypotheses. Under the nest availability hypothesis, Merlins are responding to increased nest availability due to an increase in the number of American Crows, the primary source of Merlin nests in the region. We then propose a series of observational studies we plan to conduct to identify support for the various hypotheses. First, we will review Breeding Bird Survey, Christmas Bird Count, and eBird data from North Dakota and Minnesota to establish a population history of Merlins and crows in the area. Second, we will continue to map possible nest trees in the area. Third, we will conduct targeted surveys for nests in Moorhead, MN. Fourth, we will conduct standardized surveys for Merlins and crows in peri-urban and rural areas in western Minnesota. Here we lay out predicted results under each scenario.

## POSTER PRESENTATION 14: PROFESSIONAL

### **Collaborative conservation: Swabbing amphibians for disease and student learning**

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Students who want to work in conservation and wildlife biology need opportunities to develop field and other skills. One route for students to gain these skills is through faculty at colleges and universities mentoring student researchers. These opportunities may not be accessible due to constraints on both students and faculty. One solution is to incorporate hands-on research into courses. The Student Network for Amphibian Pathogen Surveillance (SNAPS) is an experiential learning network that mobilizes students to lead the search for emerging amphibian pathogens. Through SNAPS, students and faculty survey for disease in amphibian populations. SNAPS provides supplies for swabbing animals, processing samples, and optional lesson plans. I incorporated SNAPS into an upper-division, elective conservation biology class in the Dept. of Biology at St. Cloud State University in Fall of 2022 (N = 9 students) and 2023 (N = 11 students). The SNAPS program, learning outcomes, and optional curricula are flexible. I integrated methods training, fieldwork, and other process-of-science activities into 2-hour lab periods. Students explored global disease datasets through the Amphibian Disease Portal ([amphibiandisease.org](http://amphibiandisease.org)). The data we collected from Minnesota were also shared with others through that portal. Students reported that their confidence in collecting and interpreting scientific data improved. They noted that they learned from and enjoyed the field experiences. Additionally, they felt their understanding of amphibian biology and wildlife disease had increased. SNAPS recruiting new faculty for the upcoming field season. Collaborators and I have secured funding to grow the disease surveillance network of faculty and students in Minnesota. We hope that these activities will advance the field of amphibian conservation and help us manage an imperiled group of vertebrates.

## POSTER PRESENTATION 15: STUDENT

### **Ecological replacement of *Glaucomys sabrinus* across much of the range by *G. volans*, an ongoing study of flying squirrel habitat use in Itasca State Park**

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Itasca State Park (Clearwater and Hubbard Co.s, MN) is host to both the southern (*Glaucomys volans*) and northern (*G. sabrinus*) flying squirrel. *Glaucomys volans* prefers deciduous forest and is relatively new to the historically conifer-dominated park. However, anthropogenic impacts such as logging and fire suppression alongside a warming climate has been advantageous to deciduous trees, and in turn, *G. volans*. This has put ecological pressure on *G. sabrinus*. These two species prefer different nesting habitats but compete for the same niche in diet. Both species of squirrels are fungivorous, consuming fungi and lichen as well as seeds and tree nuts. Our study sought to capture, radio collar, and use radio telemetry to identify and document day nesting sites for both *Glaucomys* species to better understand their habitat segregation in the park. We used a combination of different trapping techniques and baits to trap squirrels. Once captured, we equipped the squirrels with a radio collar that enabled us to track them using radio telemetry. Both species of squirrel are nocturnal, so tracking them during the day allowed us to find nest sites. Once the day nesting sites were found, we took several qualitative and quantitative habitat measurements. We found several trends toward differences in nesting conditions, such as tree diameter at breast height (DBH) and preference for tree species, between flying squirrel species. However, our data should be taken cautiously, as we have a small sample size for *G. sabrinus*. Preliminary data may suggest that although these species are direct competitors, there may be enough differences in nesting preferences to allow coexistence within the park, as long as preferred habitats are sustained. We hope to catch additional *G. sabrinus* and expand our data set.

## POSTER PRESENTATION 16: STUDENT

### **Wild Rice Monitoring near Tamarac National Wildlife Refuge**

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Wild rice (*Zizania palustris*), a native plant found in Minnesota's water bodies, is both culturally and ecologically significant. Wild rice is of great cultural, historical, and spiritual importance for the Ojibwe people. The plant possesses a great ecological role within many ecosystems, providing food and shelter for many species of wildlife and fish. However, wild rice is being threatened by changes in water hydrology, climate change, pollution, and competition from native and invasive species. Due to the great cultural and ecological importance, ensuring the continued survival of wild rice populations in Minnesota is crucial. During the summer of 2023, I participated in the annual monitoring of wild rice populations in collaboration with the White Earth Nation Natural Resources Department and Tamarac National Wildlife Refuge. Sites of wild rice monitoring included Rice Lake, Blackbird Lake, South Tamarac Lake, Upper Rice Lake, and Lower Rice Lake, which have great cultural significance to White Earth Nation members. Methods used followed the Kjerland Wild Rice Monitoring Handbook and Field Guide. We paddled to 40+ sampling points on each water body, as defined by the Minnesota DNR on Field Maps. At each point, we measured stalk density, stalk height, water depth, and recorded the presence of disease and other species. After data was collected in the field, we compiled and analyzed the results for every variable monitored. In addition, following the established protocol to estimate wild rice biomass, we found that Lower Rice Lake had the highest average biomass per square meter, followed by Blackbird Lake, Upper Rice Lake, Rice Lake, and South Tamarac Lake. All data found will inform management decisions and the annual harvesting of wild rice by White Earth Nation members. This is an ongoing project that will support the sustainability of wild rice populations in Minnesota for future generations to come.

## POSTER PRESENTATION 17: STUDENT

### **Comparative analysis of microlitter abundance in the proventriculus, gizzard, and intestines of North American waterfowl**

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Plastic pollution is pervasive, breaking down into microplastics (fragments  $\leq 5\text{mm}$ ) over time and often accumulating into animal organs through ingestion. Recent studies have detected microplastics in terrestrial soils and aquatic environments, yet limited investigation has focused on waterfowl. To address this research gap, we analyzed the proventriculus, gizzard, and intestines of North American waterfowl. Gastrointestinal (GI) tracts from diverse waterfowl species and feeding habits were provided by local hunters, significantly expanding our sample size. During the dissection of the GI tracts we quantified microlitter abundance. We then performed a hot needle test to confirm suspected microplastics. Our hypothesis explored variations in microlitter abundance based on species and GI tract location. Of the samples analyzed, we found that 58% contained microlitter. Our findings also revealed a significantly higher microlitter abundance in the intestines compared to the proventriculus and gizzard. This suggests consistent consumption of microlitter before waterfowl harvest. While these results shed light on microlitter prevalence, additional research is crucial to quantify it further and identify specific plastic types. Ongoing research findings can help inform resource managers about the presence of microlitter in waterfowl, aiding in the implementation of measures to protect these populations.

## POSTER PRESENTATION 18: STUDENT

### **Annual Habitat Use of snowshoe hare on the Leech Lake Reservation**

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Snowshoe hare are a culturally significant species to the Leech Lake Band of Ojibwe and are a species of management concern on the Band's list of Threatened, Endangered, and Sensitive Species, however populations in Minnesota have been declining for decades, often resulting from insufficient habitat. We studied the habitat use of snowshoe hare on the Leech Lake Band of Ojibwe Reservation from 2022 to 2023. Fifteen snowshoe hares were captured, and GPS collared to investigate hare movement and habitat use during the day and at night-time hours. Data points were recorded approximately every four hours. We generated minimum convex polygon home range estimates and compared the size of home ranges using a paired t-test. We examined habitat use using a resource selection framework for both day and nighttime locations. The mean home range size of snowshoe hare in this region was 37.428ha during the daylight, and 34.597ha during the night. We observed no difference in the size of day or nighttime home ranges. Snowshoe hare selected for forested wetlands and mixed forests during the daytime and selected for mixed forests at night. These findings suggest that snowshoe hare selection for mixed forests and forested wetlands may be due to a decreased risk of predation. Our findings highlight the importance of forest stand diversity within snowshoe hare home ranges. Future research on snowshoe hare habitat selection should investigate seasonal differences in resource use.