

**Jim and Katie Krause CNR
Student Research Symposium
2022**



Jim and Katie Krause CNR Student Research Symposium

This booklet and event have been made possible by support from the
James and Kathleen Krause Student Research Endowment

Cover Photo: Andrew Thometz
Booklet Layout: Grace Wieland

MISSION

The University of Wisconsin-Stevens Point College of Natural Resources provides education, research and outreach in integrated natural resources management, environmental education, and in paper science and engineering. The College of Natural Resources:

1. Provides undergraduate and graduate instruction that combines theoretical concepts with practical experience, such as laboratory and field-oriented courses, internships and special projects.
2. Promotes scholarly activities that enhance the creation or application of knowledge or contributes to the resolution of environmental and natural resource management issues, especially through student research.
3. Shares faculty and student expertise with citizens, communities, agencies and industries through outreach, scholarship, and consulting.

PHILOSOPHY

The University of Wisconsin-Stevens Point College of Natural Resources embraces the philosophy of integrated natural resource management. All students in the college, regardless of major, need to understand and appreciate relations between natural resources and human needs. They need to understand the scientific method and its application to environmental problem solving. Critical thinking and problem solving strategies based on integrated resource management and education will be promoted through the college's teaching, scholarship, and outreach activities.

The college is composed of faculty, staff, and students, each with their own expertise, strengths, attitudes, and values. This diversity contributes to the education offered by the college because of our integrated philosophy. Responsibilities and appointments vary among college faculty and staff. Most have teaching appointments, some have extension appointments, while others serve mainly in research or administrative capacities. Faculty and administrators will capitalize on the strengths and diversity of College personnel to promote integrated resource management through teaching, scholarship, and outreach

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Acknowledgments

Special thanks to all those who helped make this year's event possible:

Dean Brian Sloss
Chancellor Thomas Gibson
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Tom Charlesworth - Photography
Symposium Support Volunteer

Clive A. David Memorial Research Scholarship Award



Dr. Clive A. David was a driving force in establishing the CNR Student Research Symposium in 2000 (now called the Jim & Katie Krause CNR Student Research Symposium). Dr. David passed away in November 2004 after a lengthy illness. He taught in the CNR from 1989 – 2003 and was considered by his colleagues and students a true champion of student research and cutting edge technology. His leadership and vision were important in making the symposium a success. Throughout his years of teaching, Dr. David encouraged participation in undergraduate research. Some of his projects related to deforestation and soil erosion prevention, windbreaks, and solid waste. Dr. David's excellence in teaching was recognized several times during his career by both colleagues and students, including being named a UW- System Teaching Fellow in 2000.

This award is funded by the Clive and Beverley David Research Scholarship Endowment, made possible through generous gifts in Clive's Memory from the David family, alumni, and friends.

The 2022 recipient of the Clive A. David Memorial Research Scholarship is:

Jeffrey Edwards

Hometown: Roscoe, IL

Major: Wildlife Ecology and Management

Completed projects:

- CNR Student Research Symposium
- Deer Vehicle Collisions in Association with Temporal Variation
- Nest Site Selection and Nest Survival of the Blue Winged Teal in Agriculturally Dominant landscapes
- Deer Project – White Tail Deer Behavior in Schmeeckle Reserve
- Adopt-A-Wildlife Area Project – Analysis of inventory & biodiversity at Buena Vista Wildlife Area
- Woodcock Project - measuring the effects of timber management on woodcock occupancy and abundance at Sandhill Wildlife Area
- Bumble Bee Project - identifying species diversity and abundance on six local wildlife areas

"I cannot emphasize enough what a wonderful independent researcher Jeffrey has become."

-Marie Perkins, PhD.



"Jeff is a natural leader and I have no doubt that he will go far and make significant contributions to our field."

-Ben Sedinger, PhD.



March 23, 2022

Welcome to the 23rd Annual Jim and Katie Krause CNR Student Research Symposium! You are about to participate in a rich tradition at the University of Wisconsin-Stevens Point, one that is both an educational experience and an academic celebration.

Student participants—I hope you will find the symposium to be one of your most memorable learning experiences. There is little question your research will enhance the academic value of your overall education at the University of Wisconsin-Stevens Point. You have gained a greater understanding of the world around you, a deeper learning of the subject matter taught in your classes and possibly the opening of new opportunities beyond college.

Attendees and observers, please join me in applauding the drive and initiative of these students. Their work represents exactly what our university means when we encourage our students to “Discover Your Purpose.”

Whether you are here to make a presentation or to witness them, you will be participating in the celebration of these academic achievements. This is a special opportunity for students to share the results of their hard work participating in investigations, projects and research activities. This year’s event features an outstanding group of student researchers representing projects from across CNR majors, a fitting tribute to the level of faculty and student collaboration in and out of the classroom at UW-Stevens Point. Thank you to the faculty members for their mentorship to our students.

Welcome, and congratulations to all of you! I wish you success in presenting your work today and at future symposiums and conferences.

Sincerely,

A handwritten signature in black ink, appearing to read "Thomas Gibson".

Thomas Gibson
Chancellor



March 21, 2022

Welcome to the College of Natural Resources! I am pleased to present the 23rd annual Jim and Katie Krause CNR Student Research Symposium, featuring and celebrating the scholarly achievements of many of UWSP's finest natural resource students. Congratulations to our student participants, not only for taking the time and initiative to extend their learning beyond the traditional classroom by depicting their research contributions in these excellent poster and oral presentations. Student participants are building on the knowledge and skills they develop within the College's multi-discipline and integrated curriculum that emphasizes practical and in-the-field learning opportunities. These experiences will help prepare these students for rewarding careers, and ultimately may empower and inspire them to be effective leaders for solving natural resource challenges in the communities they will serve.

Special thanks and congratulations to our Symposium planning committee for their extensive work and commitment to making this event happen. One of the few symposia of its kind that is planned and organized by students – this year's event features another large turnout of participants: over 106 students presenting 45 poster presentations and 13 oral presentations. This continues a long tradition of success at this annual event. Since 2000, more than 1,500 CNR students who have presented research results in posters and oral presentations at this event.

We salute participants for their excellence in critical thinking, inquiry, research and communication demonstrated in the abstracts contained in this booklet and in their virtual presentations prepared for this event. Let us also recognize the outstanding faculty members who have mentored and motivated students to do their best.

Finally, special thanks to Dr. Jim Krause (BS-Biology, '74) and his wife, Kathleen "Katie" (BS-Mathematics, '75), whose 2017 endowment gift makes this event possible. We are grateful for their belief in the value of higher education, undergraduate research, their alma mater, and the beautiful natural resources of their home state of Wisconsin.

Thank you for participating in this wonderful celebration of scholarly achievement and hands-on, experiential learning. Enjoy the day!

A handwritten signature in black ink, appearing to read "B. L. Sloss".

Brian L. Sloss
Dean and Professor of Fisheries and Aquatic Science

From the Student Research Symposium Committee...

From the Student Research Symposium Committee...

Welcome to the 23rd annual University of Wisconsin-Stevens Point Jim and Katie Krause CNR Student Research Symposium. This year's program features students who have invested considerable time conducting research in areas such as fisheries and water resources, forestry, human dimensions of natural resource management, paper science and engineering, soil and waste management, and wildlife ecology and management. The symposium allows students to present data they have collected, explored, and analyzed during the course of their research. Faculty mentors played an essential role in guiding students through the process in a spirited and educational fashion which expands beyond the traditional bricks and mortar of the classroom.

As we proceed with this year's poster and oral presentations, we honor the memory of Dr. Clive A. David, a true friend to students and faculty. David was extremely significant in building and strengthening the undergraduate research program. Although he passed in November 2004, Dr. David's influence remains to this day. The positive atmosphere he fostered created a venue for students to learn to conduct and present their research. The hundreds of students who have benefited from the symposium over the past 23 years can credit Dr. David for his pioneering efforts.

This year is among the highest for student participation, due largely to the students' initiative, faculty encouragement, and other sources of support including the work of the Student Research Symposium Committee. Our constant challenge is to meet the needs of the student presenters and promote and encourage participation in research and the symposium all year long.

We would like to thank our primary benefactors, Jim and Katie Krause, all of our volunteer evaluators, faculty and staff members in the College of Natural Resources and in the Department of Biology, CNR student organizations, Dean Brian Sloss, Chancellor Thomas Gibson, and the UW-Stevens Point administration.

Congratulations to all our student presenters. Your work is truly outstanding! Our hope is that today can be as enjoyable as it is educational for you, and that you inspire more students to step up to the challenge of undergraduate research.

Cheers,

CNR Student Research Symposium Committee

Amber Smith (Chair), Brady Roberts (Vice Chair/Secretary), Kaylee Woelfel (Web Designer), Sam Andres (Judge Liaison), Jacob Tepsa (Communications Coordinator), Anna Mathews (Logistics Coordinator), Avantika D'Cruz (Secretary), Grace Wieland (Booklet Manager), Dr. Richard Hauer (Advisor), Dr. Rob Michitsch (Clive A. David Award Chair), Alyssa Gunderson (Coordination and Moderation), Dan Connolly (Logistics and Good Humor), Brian Stezenski-Williams (Engagement and Fundraising)

Presentations

Presenters	Title
Emily Knaack, Luke Trittelwitz	Analysis of Age Class and Migratory Timing of Northern Saw-whet Owls (<i>Aegolius acadicus</i>)
Ryan Michalesko	Analyzing Location Suitability and Land Conversion of Large-Scale Solar Sites in Wisconsin
Eli Halverson, Noelle Vallee	Analysis of Key Soil Nutrients and Physical Properties on a Managed Grazing Operation in Junction City, WI
Claire Harwood, Jeffrey Edwards, Harrison Stasik, Trevor Pike, Amber DeValk, Samantha Stellmacher	Behavior of Urban White-tailed Deer in Relation to Trail Proximity in Schmeeckle Reserve, Stevens Point, Wisconsin
Jaden Kerkhoff, Kursha Baier, Harrison Stasik	Black Bear (<i>Ursus americanus</i>) Den Site Selection and Reuse in Northern Wisconsin, 1989-2015
Hal Edwards, Calvin Filer, Jared Horvath	Brook Trout Spawning Site Selection in the Little Plover River, WI
Celia Puleo	Using RGB Color Space as a Predictor of Soil Organic Matter in Wisconsin's Agricultural Soils
Tess Bigalke, Katie Stough, Amber Smith	Capture Probability of Female and Male Southern Flying Squirrels in Schmeeckle Reserve 2020-2021
Patrick Catalano, Isaac Cavanaugh, Darian Woller, Colton Sime, Cole Weede	Central Wisconsin: Least Darter Stronghold
Grace Eide	Comparison of Nitrogen and Trace Organic Compounds in Two Headwater Streams
Allison Plesha	Determining the Origins of Pollutants in Collins Lake by Analyzing Chemical Tracers in Groundwater
Eli Halverson, Jacob Buettner	Does Landscape Position and Plant Productivity Influence Soil Organic Carbon in Prairies of the Wisconsin Driftless Region?
Elizabeth Belmont	Effects of Adjacent Land Use on Nitrate Levels in a Wisconsin Stream

Presentations

Presenters	Title
Madisen Hartlaub, Kaylee Woelfel, Abby Mueller, Nicole Luoma, Parker Kreie, Molly Moder, Adam Tess	Effects of Habitat and Environmental Variables on Urban Eastern Gray Squirrels (<i>Sciurus carolinensis</i>) in Schmeeckle Reserve, Stevens Point, WI
Selina Walters, Rachael Valeria	Effects of Riparian Habitat Type on Macroinvertebrate Drift in the Little Plover River, Wisconsin
Arua Yaym de Castro Ferreira	Evaluating Statistical Performance in Predicting Total Soil Nitrogen Using Mid-Infrared Spectroscopy in Wisconsin Soils
Austin Mannigel	Genetic Evidence for Introgression of Two Wisconsin Steelhead Strains in Lake Michigan
Amanda Krieg	Impact of Land Fragmentation on Buckthorn Abundance and Occurrence in Wisconsin Forests
Michael Kluz	Impacts of Climate Change on Wisconsin County Forestry Planning and Management Practices
Abi Smrz, Liam Mayhew, Mya Dailing	Industrial Ethyl Acetate Production: A Process
Madisen Hartlaub, Shelby Sterken, Parker Kreie, Abby Mueller, Molly Moder, Adam Tess	Influence of Calorically Dense Bait on Urban Eastern Gray Squirrel (<i>Sciurus carolinensis</i>) Body Condition in Schmeeckle Reserve, Stevens Point, WI
Kayla Reed	Initial Insights on the Thermal Ecology of Lake Whitefish in Northwestern Lake Michigan
Connor Jaloszynski, Brett Peabody, Gregor Willms	Little Plover River Headwaters Wetland Restoration Remnant Seedbank Study, Plover, Wisconsin
Brilyn Brecka, Andrew Greenawalt	Methods for Using Light-level Geolocation Data to Examine Breeding Behaviors of Wood Ducks (<i>Aix sponsa</i>) in Central Wisconsin
Xander Lamping	Models to Predict Abundance and Resiliency of Wild Steelhead Populations in Fish Creek Idaho
Jeffrey Edwards	Nest-site Selection of Blue-Winged Teal (<i>Spatula discors</i>) in Agriculturally Dominant Landscapes of Southeast Wisconsin

Presentations

Presenters	Title
Nicole Wagner, Gina Magro, Kao Lee Thao	Parasite Communities in Populations of Greater and Lesser Scaup in Green Bay, WI
Alayna Corbisier, Jessica Bjornson, Stephen Van Horne, Harrison Stasik, Ben Shutt, Tristan Stanton	Parasite prevalence in Bobcats (<i>Lynx rufus</i>) Harvested in Southern Wisconsin.
Madisen Hartlaub, Parker Kreie, Shelby Sterken, Molly Moder, Abby Mueller, Nicole Luoma, Kaylee Woelfel	Population Estimate and Effects of Environmental Variables on Trap Success of Urban Eastern Gray Squirrels (<i>Sciurus carolinensis</i>) in Stevens Point, WI
Brenden Elwer	Post Stocking Analysis of Extended Growth Fingerling Walleye (<i>Sander vitreus</i>) in Northern Wisconsin Lakes
Cecelia Giesen, Will Watry, Sam Andres, Alayna Reynolds, Amber Smith, Abby Mueller, Hayden Walksuh	Post-Release Movement and Behavior of Rehabilitated Orphan Black Bears in Northern Wisconsin
Gage Krause, Noah Aandexler, Jacob Schiefelbein, Sam Jennings, Tess Bigalke, Quentin Bosshard	Preliminary Study Investigating Fisher Presence in George W. Mead State Wildlife Area
Emily Knaack, Thomas Priefer, Jesse Tucker, Grant Kock	Preliminary Study of Hairy and Downy Woodpecker Plumage Variations
Brady Roberts, Catrina Johnson, Ava Weisbeck, Zach Cason	Preliminary Study of Ruffed Grouse Survival in Northern Wisconsin
Brady Roberts, Catrina Johnson, Ava Weisbeck, Zach Cason	Occupancy Modeling and Detection Probability of Ruffed Grouse Auditory Surveys in Northern Wisconsin
Kayla Reed, Hailey Trompeter, Kaj Fritsch, Lizzi Gizzi, Isabel Dunn, Eliza Suchan	Reconnecting a Riverine Wetland: Conducting a Hydrologic Budget for a Restored Wetland

Presentations

Presenters	Title
Rachael Valeria, Selina Walters, Logan Cutler	Riparian Habitat Effects on Macroinvertebrate Drift and Brook Trout Diets in the Little Plover River, Wisconsin
Alayna Corbisier, Jessica Bjornson, Stephen Van Horne, Harrison Stasik, Ben Shutt, Tristan Stanton	Roundworm prevalence in bobcats (<i>Lynx rufus</i>) harvested in Southern Wisconsin
Blake Raymer, Kayla Reed	Smallmouth Bass Diet Analysis in Warmwater Central Wisconsin Streams Using Aquatic Community Assemblages
Mark Cook	Texture Based Modeling Approach to Predict Soil Organic Matter with Portable X-Ray Fluorescence Spectroscopy
Elizabeth VanDomelen, Roiya Meyer, Nicole Wagner, Gina Magro, Kao Lee Thao	The Correlation of Parasites between Ducks and Snails Collected from Mead Wildlife Area.
Theodore Rickman	The Effectiveness of Various Types of Deer Browse Protection Methods on <i>Quercus rubra</i> Seedlings
Noah Andexler	The Effects of Variable Food Intake on the Development of Gyrfalcon Nestlings
Carter Freymiller, Aiden Gehrke, Nicole Luoma, Cole Suckow, Sophie Reid	The Influence of Lunar Phases on Autumn Capture Probabilities of Northern Saw-Whet Owls (<i>Aegolius acadicus</i>) Recorded at Sandhill Wildlife Area
Aiden Gehrke, Victoria Fasbender, Jacob Tepsa, Grace Wieland, Will Smith, Casey Baye	The Influence of Statewide Abundance on Nest Box Use of Cavity-Nesting Waterfowl Species in Central Wisconsin
Sydnee Brunette	Trail Use Trends Concerning COVID-19 in Stevens Point
Jeremy Murray, James Doss, Kody Woodcock, Pam Reagan	Tree Species Composition in Relation to Southern Flying Squirrel Density in Schmeckle Reserve 2020-2021

Presentations

Presenters	Title
Brilyn Brecka, Andrew Greenawalt	Use of Light-level Geolocators to Determine Nest Attentiveness of Wood Ducks (<i>Aix sponsa</i>) Breeding in Central Wisconsin
Hannah Lukasik	Using acesulfame to determine septic impact to Wisconsin lakes
Hayden Walkush	Using Snapshot Wisconsin Trail Camera Sex Ratios to Predict Fall Harvest Demographics of Adult Eastern Wild Turkeys
Jeremy Murray	Whitetail Deer Habitat Selection and Predator Encounters
Hayden Funk	Zooplankton and Larval Fish Community Relationships Along the Asian Carp Invasion Front in the Upper Mississippi River

Analysis of Age Class and Migratory Timing of Northern Saw-whet Owls (*Aegolius acadicus*)



Emily Knaack
Wildlife Ecology and Management



Luke Trittelwitz
Wildlife Ecology and Management

Northern saw-whet owls (*Aegolius acadicus*) (NSWO) are sexually dimorphic owls, males range in size from 18 to 20 cm in length, weighing 75 grams and females are 20 to 21.5 cm in length and weighing 100 grams. NSWOs migrate in the fall from September until December to their wintering grounds, with a peak in migration being mid-October. Data regarding sex ratios for migrating NSWOs are lacking, but females often outnumber males at banding stations during fall migration. While migrating, NSWOs are trapped using auditory lures (male NSWO call), possibly rendering females more susceptible to capture. Additionally, timing of migration of the different age groups varies from year to year and by location. Most individuals migrate at night. However, data show capture peaks in the 4-hour period before sunrise. Our data suggest a possible second peak in captures earlier in the night. We collected autumn migration data from Linwood Springs Research Station in Stevens Point, Wisconsin to help us identify correlation between physical traits and age classes, throughout the migratory period.

Advisors: Benjamin Sedinger, Gene Jacobs

Poster

Consider for Judging

Analyzing Location Suitability and Land Conversion of Large-Scale Solar Sites in Wisconsin



Ryan Michalesko
Natural Resource Planning

Wisconsin is currently undergoing a rapid shift in its energy production profile. While the state's solar resources in 2020 contributed only a modest 4% of the state's renewable net generation (U.S. Energy Information Administration), there is swift movement toward increased development of large-scale (greater than 100 megawatts) solar production. Through an executive order in 2019, Wisconsin Governor Tony Evers pledged that all electricity consumed in Wisconsin be 100 percent carbon-neutral by 2050. Utility companies are beginning to follow suit. Wisconsin-based provider Alliant Energy announced plans in 2020 to eliminate coal from its generation portfolio by 2040 and achieve net-zero CO₂ emissions by 2050. In doing so, they have simultaneously set about increasing their solar production. They are on track to add over 1,000 megawatts of solar power by the end of 2023 with the creation of 12 solar farms across nine Wisconsin counties. WEC Energy Group, the state's largest utility, plans to add approximately 800 megawatts of solar. One megawatt produces enough electricity to offset the needs of about 190 average Wisconsin homes (RENEW Wisconsin). As utility companies begin to grow their solar portfolios, there is also the increased demand for suitable land, with each megawatt requiring an approximate 5-7 acres. Given this rapid shift in trends, this study seeks to assess the suitability of Wisconsin land for large-scale solar siting and estimate the related land conversion. Suitability analysis was conducted in GIS to examine multiple datasets and criteria, including land ownership, proximity to critical infrastructure, terrain, and natural features. The output suitability model allows for the estimation of available land area and locations suitable for large-scale solar siting.

Advisors: Anna Haines, Lynn Markham, Doug Miskowiak

Poster

Consider for Judging

Analysis of Key Soil Nutrients and Physical Properties on a Managed Grazing Operation in Junction City, WI



Eli Halverson
Natural Resource Planning



Noelle Vallee
Soil Science and Land Management

Rotational grazing is an agricultural practice that provides long-term ecological and soil benefits. Our project objective is to assess soil quality on a rotational grazing farm over a 20-year period. We hypothesize that the longer a field is rotationally grazed, the more improved soil quality and greater fertility there will be. This long-term research project, conducted through the UW-Stevens Point Soil and Water Conservation Society, analyzes a rotationally grazed operation in Junction City, Wisconsin. The fields are broken up into five-acre parcels and grid points are randomly allotted to each parcel. A control field that is not rotationally grazed, as well as newly converted conventionally farmed fields, are also sampled. Soil samples (6") were collected within a ten-meter radius around each grid point in fall 2015. Physical and chemical testing has been completed for 2015 soil samples, which includes: bulk density, Carbon:Nitrogen ratio, total Carbon and Nitrogen, pH, Phosphorus, Potassium, electrical conductivity, organic matter, and biomass yield. Fields are to be resampled every four years and tested for the same soil properties as listed above. 2019 samples are currently undergoing testing with bulk density, pH, organic matter, and electrical conductivity completed. Phosphorus and Potassium are currently being analyzed in spring 2022. Testing of 2019 samples will conclude in fall 2023, when resampling will occur again.

Advisors: Rob Michitsch, Daniel Keymer, Jacob Prater, Bryant Scharenbroch, Alyssa Gunderson
Poster
Consider for Judging

Behavior of Urban White-tailed Deer in Relation to Trail Proximity in Schmeckle Reserve, Stevens Point, Wisconsin



Jeffrey Edwards
Wildlife Ecology and Management

Claire Harwood
Wildlife Ecology and Management

Harrison Stasik
Wildlife Ecology and Management

Trevor Pike
Wildlife Ecology and Management



Amber DeValk
Wildlife Ecology and Management

Samantha Stellmacher
Wildlife Ecology and Management

White-tailed deer (*Odocoileus virginianus*) are the most abundant ungulate species in the United States. During the past 30 years, white-tailed deer have adapted to the presence of people and inhabited urban and suburban areas to take advantage of available anthropogenic habitat and to escape predation. Schmeckle Reserve, located in northern Stevens Point, Wisconsin, has an estimated population of 60-140 white-tailed deer from a 2016 survey. The objective of this study was to evaluate deer behavior in response to human presence, in particular to proximity of walking trails in Schmeckle Reserve. We used four independent trails that were approximately 0.8 kilometers long and 0.32 kilometers apart within four ecologically unique landcovers, including open wetland, sedge meadow, controlled cut and burn forest, and mixed-stand forest. Each trail was walked by observers in 1 hour increments to simulate the presence of common trail users. We rated the level of attentiveness to the observer through categorical variables such as unaware, inattentive, searching, foraging, walking away, and running away. We recorded the sex and estimated age, injuries, markings (collars or ear tags) and group size of focal deer, as well as orientation to and distance from the trail, and associated landcovers. We compared the behavior of deer to their proximity to a trail, landcover, and weather conditions. The data will be translated into graphic models to study the trends. These results will illustrate the effects of urbanization on deer behavior while informing urban wildlife managers on the acclimation and habituation of deer within Schmeckle Reserve.

Advisors: Scott Hygnstrom, Cady Sartini

Poster

Consider for Judging

Black Bear (*Ursus americanus*) Den Site Selection and Reuse in Northern Wisconsin, 1989-2015



Kursha Baier

Wildlife Ecology and Management



Jaden Kerkhoff

Wildlife Ecology and Management



Harrison Stasik

Wildlife Ecology and Management

Black Bears (*Ursus americanus*) in Wisconsin are known to use various den types such as excavation, nest bowls, blowdown, brush piles, caves, rock cavities, tree cavities/roots, beaver dams, and more during hibernation. However, little is known about den type selection and reuse. The objective of this study is to establish the determining factors during den type selection, and the influences parental care can have on cubs the following year. Female black bears were collared with VHF transmitters and located each winter in the Chequamegon-Nicolet National Forest from 1989-2015. Dens were classified on type by surrounding vegetation and structure. In total, 116 female black bears were collared during the study. The most common den type used was excavation ($n = 69.3\%$) followed by nest bowl ($n = 14.4\%$). The least observed den types were beaver dam ($n = 0.8\%$) and nest dens ($n = 0.4\%$). Dens that were used in previous years were more likely to be used the following year. However, parental care did not have a significant influence on the cub's den type selection in the following year. Data from this study can be used to help managers understand den type selection, use, and reuse throughout a black bear's life, as well as the behavioral patterns during hibernation.

Advisor: Cady Sartini

Poster

Consider for Judging

Brook Trout Spawning Site Selection in the Little Plover River, WI



Hal Edwards

Fisheries and Aquatic Sciences



Calvin Filer

Fisheries and Aquatic Sciences



Jared Horvath

Fisheries and Aquatic Sciences

Brook Trout (*Salvelinus fontinalis*) are a popular sportfish and the only trout native to Wisconsin streams. They require cold, well oxygenated water and are sensitive to disturbance and changes in water quality. These specific habitat requirements can make managing Brook Trout difficult as anglers' expectations sometimes clash with biological limits. In the Little Plover River (LPR) in central Wisconsin, extremely low summer flows in the late 2000's led to fish kills and reduced Brook Trout abundance. Although the population has recovered and various restoration efforts have occurred in the LPR, thorough monitoring can evaluate and inform restoration efforts and provides baseline data of healthy conditions to compare against potential future low flow events. Successful reproduction is essential for self-sustaining populations, so our objective was to determine if Brook Trout selected certain factors for spawning in the LPR. We conducted weekly spawning redds surveys in late fall 2021, recording location, depth, dominant substrate, and nearby cover at all located redds and immediately adjacent sites. We statistically compared data from redds and adjacent sites to evaluate selection. We surveyed 155 redds over the spawning season, with a weekly high of 55 in mid-November. Redds were more common in upstream reaches that typically have more groundwater input. Brook Trout redds were dominated by fine or coarse gravel even though sand was the dominant stream substrate, indicating selection or removal of sand during redd construction. Redds tended to be in deeper water and more likely near cover, especially woody cover. Understanding these factors allows managers to more effectively restore Brook Trout habitats and provides insight into how disturbance might affect their reproduction. Future stream restoration projects can use this information to focus their efforts on factors like substrate availability and cover over factors that are less important to spawning fish.

Advisor: Joshua Raabe

Oral

Consider for Judging

Using RGB Color Space as a Predictor of Soil Organic Matter in Wisconsin's Agricultural Soils



Celia Puleo
Soil Science and Land Management

Soil organic matter (SOM) is composed of decomposed organisms and is critical to soil quality and health. For example, SOM holds water and nutrients, sequesters carbon, increases CEC and contains and supports organisms. Agronomic soil management is often directed towards improving SOM; therefore, its measurement is necessary. Some laboratory SOM assessments are time-consuming and expensive. Another way to measure SOM more efficiently with minimal cost and equipment is in-field color evaluations. Soils tend to be darker with greater SOM contents; therefore, soil color can be used to estimate SOM content. A relatively inexpensive digital color sensor (Nix Pro, 350 U.S. dollars) has been found to be useful for non-subjective and accurate estimation of soil color and SOM. The Nix Pro camera measures a variety of color spaces including red, green, and blue (RGB) which this research uses. The goal of this research is to determine if SOM can be predicted in Wisconsin agricultural soils with the Nix Pro, and if so, what soil moisture conditions are best for SOM estimation with this color sensor. This research uses 1,793 soils collected from the first 20 cm of agricultural fields across Wisconsin. Soil RGB colors were determined with the Nix Pro. Loss on ignition (LOI) was used to determine SOM contents. Linear regression analyses with SOM and soil color in both wet and dry conditions was assessed with R^2 and root mean square error (RSME). High R^2 values will show that there is a strong correlation between SOM and color, indicating that SOM can be accurately predicted. Furthermore, higher R^2 values in our wet soils than in our dry soils, show that wet soils can more accurately predict SOM than dry ones. If SOM can be strongly correlated with RGB values taken from the Nix Pro, then SOM can be accurately predicted using RGB values with the Nix Pro. Wisconsin professionals who work with agricultural soil can use this practical tool to immediately assess the SOM and the management actions towards improved improving SOM.

Advisor: Bryant Scharenbroch

Poster

Consider for Judging

Capture Probability of Female and Male Southern Flying Squirrels in Schmeeckle Reserve 2020-2021



Tess Bigalke

Wildlife Ecology and Management



Katie Stough

Biology



Amber Smith

Wildlife Ecology and Management

The southern flying squirrel (*Glaucomys volans*) inhabits hardwood forests in Wisconsin, and two litters are produced each year, one in May and the other later in the summer. During our trapping season, female flying squirrels are still nursing their young, as their offspring are not independent until they reach four months of age. Female flying squirrels do not allow any other flying squirrels, even males, within the immediate vicinity of their nests. Male southern flying squirrels play no role in raising young, and therefore may be harassed away from nests by females, rendering them less likely to be trapped if traps are in close proximity to nests. We aim to investigate if female squirrels are trapped more often than male squirrels in Schmeeckle Reserve. Over two seasons, 2020 and 2021, we trapped 16 individuals but only five of them were female. Our trapping grid was in the Berard Oaks of Schmeeckle Reserve, which was unmanaged during our 2020 trapping season and managed with significant timber thinning before and during our 2021 trapping season. Southern flying squirrels were caught in 20 Sherman traps within a trap line using a bait consisting of peanut butter, bacon grease, and oats in 2021 and a bait consisting of just peanut butter and oats in 2020. Traps are set and baited in the early evening and checked in the late evening, and we had a total of 805 trap nights over two seasons. We anesthetize squirrels with isoflurane, affix a uniquely numbered ear tag, identify sex, and weigh all individuals upon capture. Analyses are ongoing, but we will determine population estimates by sex and will identify likelihood of capturing male or female flying squirrels.

Advisors: Shelli Dubay, Ben Sedinger

Poster

Consider for Judging

Central Wisconsin: Least Darter Stronghold



Patrick Catalano
Fisheries and Aquatic Sciences



Isaac Cavanaugh
Fisheries and Aquatic Sciences



Darian Woller
Fisheries and Aquatic Sciences



Colton Sime
Fisheries and Aquatic Sciences

Not Pictured: Cole Weede
Aquatic Biology

Least darters (*Etheostoma microperca*) are listed as a species of special concern by the Wisconsin Department of Natural Resources. Least darters feed on small invertebrates and in turn are forage for piscivores like trout and sculpin. Few studies have examined the biology and ecology of the least darter. We wish to better understand the factors affecting the distribution, abundance, and biology of this rare species in central Wisconsin. Sampling efforts throughout central WI have revealed a single robust population of least darters in Spring Creek (Portage County). First, the substrate of Spring Creek appears to be optimal for least darters. Second, the abundance of *Nitella* spp. could provide ample habitat. Third, the abundance of least darters in this system could indicate that they are able to outcompete other fish species that utilize similar habitat requirements. Substrate characteristics, the presence of aquatic plants like *Nitella* spp., and interspecific competition with other darters may be affecting the distribution of least darters. High-capacity wells, climate change, sedimentation, and eutrophication may all be threats to the least darter. Future sampling efforts in summer 2022 will provide additional data on least darter distributions, habitat associations, and biology.

Advisors: Justin Sipiorski, Jered Studinski

Poster

Consider for Judging

Comparison of Nitrogen and Trace Organic Compounds in Two Headwater Streams



Grace Eide
Fisheries and Aquatic Sciences

Concentrations of nitrogen found in the baseflow of a stream are influenced by land use in the watershed. Nitrate is a mobile form of nitrogen that moves readily from the soil to groundwater. At high concentrations it is a surface water pollutant that can excessively fuel the growth of algae and plants, and a drinking water pollutant that can cause health effects on humans and animals (Turyk et al. 2019). Because nitrate contributions to baseflow can come from a variety of different land uses, this research compared the nitrate concentrations in baseflow to the concentrations of compounds that could identify the source of nitrate. It is expected to find a correlation between the concentrations in each study site. We have sampled the Tomorrow River located in Portage County, Wisconsin that is predominantly a forested watershed and the Fever River located in Platteville, Wisconsin with a watershed driven by agriculture. Nitrate sensor data tells us about the concentrations for both streams. As expected, the Tomorrow River has a lower nitrate (NO_3^-) concentration ranging from 0.5-4.1 mgL^{-1} NO_3^- and the Fever River ranged from 2.0-11.1 mgL^{-1} NO_3^- . We focused on three groups of trace organics. Neonicotinoids are classified as an insecticide, applied to agricultural seeds or soil (Boisvert et al. 2022). These, along with metabolites of chloroacetanilide herbicides (CAAMs) used to control weeds for agriculture such as row crops, would indicate impact from farming practices. Artificial sweeteners and human antibiotics belong to a group of chemicals found in septic or other human waste sources. Trace Organics were analyzed through liquid chromatography-mass spectrometry (LC/MS). We expect to find the headwater streams with higher concentrations of nitrate will have a higher concentration of trace organics located in the baseflow. These trace organics detected will help us understand the source of nitrate.

Advisors: Amy Nitka, Paul McGinley

Poster

Consider for Judging

Determining the Origins of Pollutants in Collins Lake by Analyzing Chemical Tracers in Groundwater



Allison Plesha
Hydrology

The influence of groundwater on lake health is underrecognized. Contaminants from land use, such as agriculture and septic systems, enter groundwater and travel to the lake, where they mix with surface water. Comparing and analyzing facets of a lake's groundwater chemistry can thus be used to determine relative sources of pollutants. Our study location was Collins Lake, a 43-acre seepage lake in Portage County, Wisconsin. It is an example of a lake that has become more eutrophic and developed lower water clarity in recent years, which can indicate pollution. The high permeability of its surrounding sandy soils, combined with its seepage lake classification, made Collins Lake suitable for using chemical tracers in groundwater to determine the relative origins of its contaminants. A series of 25 site samples were taken from 1.5' deep into its northern shoreline and analyzed for geochemical parameters, including nitrate, chloride, and metals, as well as contaminant source tracer compounds. Detection of herbicide metabolites would indicate impact from agricultural activities, while artificial sweeteners and caffeine would point to septic sources. Ion specific electrode measurements were also conducted along the same shoreline to further clarify nitrate and chloride concentrations. Geospatial technology (ArcGIS Pro) was used to map the locations of the samples and the additional measurements relative to their chemical tracers. The differences in the chemical profiles of the sites corresponded with their locations, which aided in predicting where the pollution was sourced from in different parts of the lake. We hope our research will contribute to the growing interest in using groundwater chemistry as a predictor of lake health.

Advisors: Paul McGinley, Amy Nitka

Poster

Consider for Judging

Does Landscape Position and Plant Productivity Influence Soil Organic Carbon in Prairies of the Wisconsin Driftless Region?



Eli Halverson
Natural Resource Planning



Jacob Buettner
Soil Science and Land Management

The driftless region is a Midwestern geological region of landscapes that have not been impacted by glacial events. This region contains native prairie ecosystems with unique soil and vegetation communities. Soil organic carbon (SOC) is important for soil quality and is a major ecosystem pool of sequestered carbon. SOC content is a result of C additions from primary production and C losses from decomposition. We hypothesize that total SOC contents will be greater in wet lowland sites due to slower decomposition. Furthermore, we hypothesize that total SOC contents will also be greater in areas with greater plant productivity. In this research, we study prairies of the Wisconsin driftless region to see if SOC stock increases with plant biomass and whether lower landscape positions have epipedon SOC. Twelve soil profiles along toposesquences in five different prairie ecosystems were sampled. The SOC stock was determined on each pedon and the total plant biomass was determined on each site as well as the landscape position of the prairie. This study provides insight into the magnitudes and mechanisms for SOC sequestration in prairie soils of the Driftless region of Wisconsin.

Advisor: Bryant Scharenbroch
Poster
Consider for Judging

Effects of Adjacent Land Use on Nitrate Levels in a Wisconsin Stream



Elizabeth Belmont
Hydrology

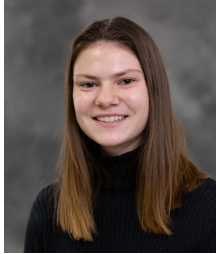
Nitrogen based fertilizers are widely used in central Wisconsin agricultural systems and can be transported into ground and surface waterbodies as nitrate. As rain falls some of it infiltrates the ground and moves deeper into the groundwater, this water is then transported through the system and released to surface water in groundwater fed streams and lakes. Nitrogen leaching occurs when this water carries mobile nitrate in the soil past the root zone of the crops into groundwater. This can be amplified by various conditions such as soil properties and crop type. Nitrate in water bodies can be of concern for humans as levels greater than $10 \text{ mg NO}_3\text{-N L}^{-1}$ can cause health problems in infants and pregnant women. Excess nutrients entering surface water bodies are also of concern as this can lead to harmful algal blooms and eutrophication. This study compared the levels of nitrate entering a gaining stream in central Wisconsin that has two different land uses on either side. North of the stream was a field with a potato, pea, and corn rotation (planted with potato in 2021) and south of the stream consisted of a meadow/wetland land type. This area is dominated by sandy soils which have high infiltration rates. This coupled with the fact the adjacent field has one of the most nitrogen intensive crops prone to leaching, it makes this a good study area for the effects land use has on baseflow dominated streams. For this study mini piezometers were used to create temporary wells across the stream for collection of baseflow entering the stream to be analyzed. This data can be used to determine the influence of adjacent land use on shallow groundwater flow entering streams. This study determined that nitrate levels of water entering Isherwood Creek from the different sides are statistically significant ($p = 8.2 \times 10^{-4}$), and higher levels are coming from the side adjacent to the farm field compared to the meadow.

Advisor: Kevin Masarik

Poster

Consider for Judging

Effects of Habitat and Environmental Variables on Urban Eastern Gray Squirrels (*Sciurus carolinensis*) in Schmeeckle Reserve, Stevens Point, WI



Kaylee Woelfel
Wildlife Ecology and Management

Abby Mueller
Wildlife Ecology and Management

Nicole Luoma
Wildlife Ecology and Management

Madisen Hartlaub
Wildlife Ecology and Management



Parker Kreie
Wildlife Ecology and Management

Molly Moder
Wildlife Ecology and Management

Shelby Sterken
Wildlife Ecology and Management

Not Pictured: Adam Tess
Wildlife Ecology and Management

The Eastern Gray Squirrel (*Sciurus carolinensis*) frequently inhabits urban parks, where densities are higher than rural sites. Gray squirrel activity varies with temperature, but exact variables influencing activity periods are unknown. Previous analyses have shown that time of day and temperature affect the likelihood that we will catch a gray squirrel in Schmeeckle Reserve. We aim to investigate environmental variables that influence trap success while calculating a population estimate for gray squirrels in Schmeeckle. We hypothesized that more squirrels would be caught 1) when temperatures exceed -4°C and 2) early in the trapping session. Since 2020, we have trapped gray squirrels in two sites of Schmeeckle Reserve, recording age, sex, and weight of the squirrels as well as marking them with uniquely numbered ear tags. We also record environmental variables such as temperature, wind speed, and cloud cover to determine their influences on trap success. Traps are opened when temperatures are between -13.5°C and 9.4°C , then checked at 9am, 12pm, and 3pm to reduce the risk of hypothermia from snow melt. We trap in late February and March each year. We estimate the likelihood of squirrel capture using competing models that explain capture probability using an AIC. The 2021 analysis showed 47 individuals trapped, and temperature and time of day influenced trap success. Results will help future squirrel trappers set traps when squirrels are more likely to be encountered and assist with future urban eastern gray squirrel research.

Advisors: Shelli Dubay, Ben Sedinger

Poster

Consider for Judging

Effects of Riparian Habitat Type on Macroinvertebrate Drift in the Little Plover River, Wisconsin



Selina Walters
Fisheries and Aquatic Sciences



Rachael Valeria
Fisheries and Aquatic Sciences

Not Pictured: Logan Cutler (Fisheries and Aquatic Sciences)

Cold-water streams and salmonid food webs are heavily dependent on critical elements from surrounding riparian habitats. Riparian habitats are buffer zones in between fully terrestrial and aquatic ecosystems that contribute to stream ecological activity. These fragile habitats are impacted by land management practices; poor riparian management may lead to stream degradation in the form of lack of prey and habitat availability for cold-water stream inhabitants. Many benthic macroinvertebrates are indicators of factors affecting stream health; therefore, composition and abundance of aquatic and terrestrial macroinvertebrates may reflect the impact of riparian habitats. Research into riparian habitats and corresponding terrestrial macroinvertebrate availability is important because many stream fishes, such as the economically and ecologically important Brook Trout (*Salvelinus fontinalis*), rely on macroinvertebrates that fall from riparian areas, drift, or are aquatic for part of their life cycle to promote a healthy diet and growth. The study objective was to determine if the composition and abundance of aquatic and terrestrial macroinvertebrate drift varied among differing riparian areas; forested, wetland restoration, and agriculture/grassland in the Little Plover River in Central Wisconsin. In the falls of 2019 and 2021, two drift nets were deployed in previously selected sites at each riparian condition for 24 hours to collect and preserve aquatic and terrestrial macroinvertebrates. Macroinvertebrate drift composition and abundance was compared among each of the riparian habitats and analyzed. Results from the drift samples showed the percentage of terrestrial macroinvertebrates in the forested site; all three locations exhibited a higher proportion of aquatic invertebrates than terrestrial. This research provides insight into how riparian land use may affect stream macroinvertebrate populations and Brook Trout prey availability.

Advisors: Jeffrey Dimick, Jered Studinski, Joshua Raabe

Poster

Consider for Judging

Evaluating Statistical Performance in Predicting Soil Total Nitrogen Using Mid-Infrared Spectroscopy in Some Wisconsin Soils



Aruã Yaym de Castro Ferreira
Ecosystem Restoration and Management

Not Pictured: Garret Klepitsch (Master of Science in Natural Resources)

Soil nitrogen (N) is a limiting plant macronutrient and potential environmental contaminant. Consequently, soil N measurements are common and important. Measuring soil N is time-consuming, expensive, destructive, and wet chemistry methods to determine soil N result in chemical waste. Mid-infrared spectroscopy (MIR) is a quantitative analysis tool that measures the light absorbance or reflectance of functional chemical groups in the infrared region of the electromagnetic spectrum. It is a nondestructive, low cost, and fast way to predict chemical compounds in an array of materials. Recently, MIR spectroscopy has found to accurately estimate soil N and other soil properties (e.g., organic matter and carbon) in some soils. More research is needed to show that MIR can be used to predict soil N in a wide variety of soils. Furthermore, soil N estimations with MIR might be improved by stratifying the data set into organic and mineral. This research will test whether MIR can accurately predict soil N in some of Wisconsin soils. Secondly, this research will test whether soil N predictions with MIR improves with stratification. If estimations of soil N with MIR are accurate for Wisconsin soils, this methodology would be a valuable tool for fertility management and environmental protection.

Advisor: Bryant Scharenbroch

Poster

Consider for Judging

Genetic Evidence for Introgression of Two Wisconsin Steelhead Strains in Lake Michigan



Austin Mannigel
Fisheries and Aquatic Sciences

The Great Lakes were first stocked with steelhead, *Oncorhynchus mykiss*, in the latter part of the 1800's to create a new sport fishery. Steelhead are an anadromous form of rainbow trout that is native to the west coast of the United States. The steelhead in the Great Lakes begin to use the tributaries to spawn once they reach the age of three or four. These spawning runs provide a popular angling opportunity. Therefore, the Wisconsin DNR stocks multiple strains of steelhead, such as the Chambers Creek and Ganaraska strains, that spawn at different times, thereby increasing angling opportunities. The peak of the Chambers Creek strain spawning run is usually during March or early April, while the Ganaraska strain run usually peaks in April or early May. However, in recent years the steelhead runs from Lake Michigan for these two strains have tended to overlap in their timing. We hypothesized that the increasing similarity between run timings is associated with introgression between the two strains. To test our hypothesis, we used RAD (restriction-site associated DNA) sequencing to genotype steelhead presumed to be from each strain. Afterwards, we used Sparse Non-negative Matrix Factorization (SNMF) in the R package LEA to assess whether the genetic clusters present in the data are associated with the distinct strains and infer the amount of introgression among clusters. Although the results support that the two strains are genetically distinct, introgression between the strains has occurred in the majority of individuals. For this reason, the results support our hypothesis that increasingly overlapping spawning runs may coincide with introgression between the Ganaraska and Chambers Creek strains.

Advisors: Jared Homola, Paul Albosta

Oral

Consider for Judging

Impact of Land Fragmentation on Buckthorn Abundance and Occurrence in Wisconsin Forests



Amanda Krieg
Forest Management

Common and glossy buckthorn are invasive species that commonly take over forest understories by outcompeting native species which threatens biodiversity and disrupts normal ecosystem functions. Past studies suggest land fragmentation creates favorable habitat for buckthorn due to higher light availability and soil exposure for wind and animal seed dispersal. In this study, we assessed the effect of land fragmentation on buckthorn abundance by examining several independent variables including distance to forest edge, housing density, and edge to interior area ratio. We sampled 680 plots in 44 school forests across Wisconsin. Subsequent analysis was focused on 132 plots among 21 forests that contained buckthorn. For each plot, we calculated the distance from plot center to the nearest edge and housing density within a one km radius using ArcGIS Pro. Microsoft Excel was used to calculate the edge to interior area ratio. Over 50% of plots containing buckthorn were within 50 meters of the forest edge suggesting that buckthorn populations increased nearer to edges. A total of 101 plots contained less than 50 residential properties within a one-kilometer radius suggesting that many plots were in rural areas. However, there was no correlation between housing density and buckthorn abundance. Finally, there was no discernible trend observed between edge/interior area ratio and buckthorn abundance. The findings from this study can be applied to current management practices by focusing effort on forest edge, overall slowing the spread of buckthorn invasion in forests across Wisconsin.

Advisors: Shuva Gautam, James Cook, TJ Boettcher
Oral and Poster
Consider for Judging

Impacts of Climate Change on Wisconsin County Forestry Planning and Management Practices



Michael Kluz
Natural Resource Planning

The impacts of climate change are becoming increasingly more apparent, with the publication of the Wisconsin Initiative on Climate Change Impacts 2021 Assessment report in early February of this year, the vital role Wisconsin forests play in mitigating climate change has never been clearer. The report notes, “Forests cover nearly half of Wisconsin. They provide a unique opportunity to address climate change because they can both reduce concentrations of greenhouse gases while simultaneously providing essential social, environmental, and economic benefits” (WICCI). County managed forests represent the largest amount of managed forest in Wisconsin. To understand not only the impacts of climate change but the implementation of management strategies targeting climate change in Wisconsin’s forests, we surveyed those working in county forests across Wisconsin. This research builds upon prior findings from a 2019 study conducted by University of Wisconsin Stevens Point students on climate change planning in Wisconsin county forests. It also draws comparisons to a 2021 Yale survey on climate change policy and public opinion. The objective of this research is to seek a better understanding of the implementation of management strategies targeting climate change as well as the inclusion of such management strategies into county forestry planning documents and practices.

Advisor: Anna Haines
Poster
Consider for Judging

Industrial Ethyl Acetate Production: A Process



Mya Dailing
Chemical Engineering



Liam Mayhew
Chemical Engineering



Abigail Smrz
Chemical Engineering

The senior design project for Chemical Engineering majors this year required the design of a process to manufacture ethyl acetate using ethanol and acetic acid as the raw materials. As a raw material, acetic acid is highly corrosive and will directly impact the overall design process and the equipment selected. Ethanol, the second raw material, is a highly flammable material and an irritant. The product, ethyl acetate, is a colorless, moderately polar solvent with a strong, fruity odor. Ethyl acetate, like ethanol, is also a highly flammable material and an irritant when it comes in contact with the eyes, nose, or throat. Regardless, ethyl acetate is used in a wide variety of products. Areas of application include packaging materials, flavoring in food and beverages, entomology, thinners, and prescription drugs. Our poster will describe our preliminary design for the production of 10,000 metric tons of ethyl acetate per year. We will describe the process flow diagram, the details of the process chemistry, safety and environmental issues, and a preliminary economic analysis. The final process design will include further optimization to improve energy efficiency and reduce the cost of production. The final design will be presented to the Paper Science and Chemical Engineering Academic Advisory Committee in May.

Advisor: Karyn Biasca
Poster
Consider for Judging

Influence of Calorically Dense Bait on Urban Eastern Gray Squirrel (*Sciurus carolinensis*) Body Condition in Schmeckle Reserve, Stevens Point, WI



Madisen Hartlaub
Wildlife Ecology and Management

Shelby Sterken
Wildlife Ecology and Management

Parker Kreie
Wildlife Ecology and Management

Kaylee Woelfel
Wildlife Ecology and Management

Abby Mueller
Wildlife Ecology and Management

Molly Moder
Wildlife Ecology and Management

Nicole Luoma
Wildlife Ecology and Management

Not Pictured: Adam Tess
Wildlife Ecology and Management



Small and medium-sized mammals often are trapped to affix radio-collars, assess reproductive status, measure body mass and condition, and to evaluate food web dynamics. Traps are baited with peanut butter and oats or some other attractant containing high calorie or high fat components. Certain Eastern gray squirrels (*Sciurus carolinensis*) can become accustomed to traps and often are recaptured while trapping. We aim to determine if body condition of recaptured squirrel's changes over time since they are eating bait containing attractants. We hypothesize that body condition of recaptured squirrels will change over time, likely increasing. Schmeckle Reserve in Stevens Point, WI is 113-hectare urban park that is owned by the University of Wisconsin-Stevens Point. Since 2020, we have trapped gray squirrels in two sites of Schmeckle Reserve, recording age, sex, and weight of the squirrels as well as marking them with uniquely numbered ear tags. This year, we are measuring ear length to evaluate body condition (weight standardized by ear length). Traps are baited at 6am with peanut butter and oat balls and then checked at 9am, 12pm, and 3pm to reduce the risk of hypothermia from snow melt. We trap from late February through early March 2020-2022. So far, we have captured 133 squirrels and 74 have been recaptures. If body condition changes over the trapping season, the overall weights of squirrels might not reflect true wild weights over time.

Advisors: Shelli Dubay, Ben Sedinger

Poster

Consider for Judging

Initial Insights on the Thermal Ecology of Lake Whitefish in Northwestern Lake Michigan



Kayla Reed
Fisheries and Aquatic Sciences

Lake whitefish *Coregonus clupeaformis* is a native species supporting important recreational and commercial fisheries in the Great Lakes. Climate-related changes in water temperatures have important implications for the future sustainability of these fisheries. However, projecting future availability of suitable thermal habitat is difficult because little is known about lake whitefish thermal ecology in the Great Lakes. To address this lack of information, archival temperature loggers were implanted into 400 lake whitefish that were captured by boat electrofishing and commercial netting from locations in and around Green Bay during October-November 2017. These locations included Big Bay de Noc, the Fox, Menominee, and Peshtigo rivers, and North and Moonlight Bays along the lakeside of the Door Peninsula. These fish were part of an acoustic telemetry study. Fish were released with a \$100 reward loop tag to encourage return of acoustic transmitters and thermal loggers. Temperatures were recorded for 11 months at 4-hour intervals. Seventeen temperature loggers were returned, but three contained thermal data for fish caught prior to the logger start date and were not used in analysis. During the summer (June-mid September) lake whitefish inhabited water temperatures between 3.5 and 20.5°C, with an average of 6.1% of observations from lake whitefish (N=9) being above the optimal thermal maximum of 16°C described in laboratory studies. The three fish with the highest percent of observations above the optimal thermal maximum spent the summer in southern Green Bay (12.5%, 15%, and 24%), while fish that spent the summer in northern Green Bay or Lake Michigan had less than 3% of observations above the optimal thermal maximum. Differences in temperature records indicate that fish were moving among areas of different temperatures on some dates in the summer. Lake whitefish thermal ecology data was also analyzed in relation to movement data determined from acoustic transmitters. Further analysis will be conducted to identify availability of thermal habitat during summer in both northern and southern Green Bay. Results from this work provide a baseline understanding of lake whitefish thermal ecology, along with a better understanding of methods that might be used to obtain this data.

Advisors: Daniel Isermann, Lisa Izzo, Daniel Dembkowski, Tom Binder, Todd Hayden, David Caroffino, Christopher Vandergoot, Scott Hansen
Oral

Consider for Judging

Little Plover River Headwaters Wetland Restoration Remnant Seedbank Study, Plover, Wisconsin



Brett Peabody
Ecosystem Restoration and Management

Connor Jaloszynski
Soil Science and Land Management

Not Pictured: Gregor Willms
Soil Science and Land Management

This study took place near the city of Plover on agricultural land within the headwaters of the Little Plover River which has been drained and farmed for over 100 years. Portage County and Stantec are restoring drained muck soil units within the headwaters to restore pre-settlement wetland and stream habitats, improve water quality and groundwater recharge within the Little Plover River watershed. The purpose of this study is to determine the extent of muck soil units and remnant native seedbank to inform site restoration strategies. Three hypotheses were developed before the start of the sampling: Hypothesis 1: Determine differences in richness and composition of the seed bank in upland vs. muck soil areas of the site. Samples from upland soils are expected to have lower richness and a less viable wetland seed bank, whereas muck soil is expected to have higher richness and a greater number and proportion of wetland species. Hypothesis 2: Determine density and richness of species germination based upon the different hydroperiods. 50 percent of the samples were saturated for the first two weeks while the remainder was watered without saturation. More obligate species are expected to germinate in saturated samples and more facultative wetland species are expected to germinate in watered samples. Hypothesis 3: Determine whether there is a difference in species density and richness based upon whether the seed is found within (0 – 25 cm) of the soil surface or at a depth of (25 – 45 cm) from the soil surface. Higher density and richness of germinated seed is expected to be found within the (0 – 25 cm) of the soil surface. Upland soil samples and muck soil samples, 19 and 20 samples respectively, were collected across the site to obtain comparable data between the upland and muck soils. At each sampling point two sets of cores were taken to provide for half of the samples to be saturated and half to be watered normally. Samples were taken from the plow layer (0 - 25 cm from soil surface) and below the plow layer (25 - 45 cm from soil surface). Upland sample points were determined based on systematic random sample with 18 sections and one completely random upland sample point. Muck samples were taken in north to south transects to determine if there was a gradient within the seed density and richness as muck soil depth increased. All potted soil samples are being maintained, monitored, and watered in the greenhouse at University of Wisconsin – Stevens Point. All species will be identified and recorded as they grow. Six control pots were used to determine if there were airborne seeds or seeds in the planting media and were excluded from the results if found. Potted samples were checked regularly and photographed to determine which pots showed the first signs of germination and which species were found in each pot. We have identified four plants to the species level so far in the study which all of them are facultative upland, undesirable in our study. The plants are Common Dandelion (*Taraxicum officinale*), Red sorrel (*Rumex acetosella*), White goosefoot (*Chenipodium album*) and Common Purslane (*Portulaca oleracea*). As the plants continue to grow in the greenhouse, we suspect that later germination species will grow and are obligate or facultative wetland. Germination of very few seeds taken from below the plow layer (25 – 45 cm) have resulted in the study. The plow layer has the most species richness and density so far in the study. This leads us to believe that the plow layer is the most active in viable seeds which can be due to seeds being continuously upturned from agricultural practices.

Advisors: James Cook, Jon Gumtow, Joshua Sulman

Poster

Methods for Using Light-level Geolocation Data to Examine Breeding Behaviors of Wood ducks (*Aix sponsa*) in Central Wisconsin



Brilyn Brecka

Wildlife Ecology and Management

Not Pictured: Andrew Greenawalt (Master of Science in Natural Resources)

Waterfowl nests are typically monitored via physical nest checks or by using temperature dataloggers or video cameras. Light-level geolocators provide alternate methods to examine breeding ecology of nesting waterfowl. Breeding propensity and associated behaviors including prospecting for nest sites, egg laying, incubation, and brood rearing behavior can be examined by looking at light-level graphs downloaded from the archival geolocators that are attached to leg-bands. Understanding these life history traits can influence decisions about habitat management and hunting regulations. Using swim-in traps, we caught and fitted female wood ducks (*Aix sponsa*) with light-level geocator bands at several sites in central Wisconsin. Bands were recovered via hunter harvests or recapture during trapping to download archival data. Single-day light-level curves were manually examined using Intiproc software©. We recorded data on events from 10 individuals related to prospecting, egg laying, and incubation to better understand the breeding habits of wood ducks in central Wisconsin and investigate relationships between their behaviors and environmental factors.

Advisor: Ben Sedinger

Poster

Consider for Judging

Models to Predict Abundance and Resiliency of Wild Steelhead Populations in Fish Creek Idaho



Xander Lamping
Fisheries and Aquatic Sciences

Due to the construction of hydroelectric dams, the Snake River wild steelhead populations have been on a decline and are currently classified as a threatened species. The goal of this study was to expand knowledge about steelhead spawning and parr survival to aid management efforts. The first objective was to determine if parr abundance in farther upstream reaches of a drainage are less affected in the event of a low adult return in the prior year. The second objective of this study was to determine if the low adult steelhead return rates lead to lower parr abundance in the subsequent years. Steelhead parr abundance was collected using snorkel surveys from 2009 to 2021 excluding the 2020 field season. The steelhead adult return rates were determined using a picket weir that captured adults. Linear regressions were used to examine potential relationships between adult return rates and parr abundance. Three regressions were used at each site to account for 3 age classes of parr likely present in the river. A t-test assuming unequal variance was used to determine differences in resiliency between the upstream and downstream sites using >100 adults as the cutoff for a high return year. For the downstream site, parr abundance was best described when compared with the sum of the 2 previous years adult returns. For the upstream site, parr abundance was best described when compared to only the prior year adult return. This study also found that in a high adult return year there was no statistical difference in parr abundance in upstream and downstream sites, but during a low adult return year there was significantly higher parr abundance in the downstream site compared to the upstream site. This study will provide data to managers that can be used to help improve wild steelhead populations in the Pacific northeast.

Advisor: Joshua Raabe

Poster

Consider for Judging

Nest-site Selection of Blue-Winged Teal (*Spatula discors*) in Agriculturally Dominant Landscapes of Southeast Wisconsin



Jeffrey Edwards
Wildlife Ecology and Management

Continually, blue-winged teal (BWTE) populations have exhibited dramatic increases following declines in the 1970s and 1980s. However, breeding BWTE numbers in Wisconsin never recovered and remain below historic levels. Reasons for the decline of breeding BWTE in Wisconsin are not fully understood but removal of upland grassland and emergent wetland landscapes for agricultural production is thought, in part, to reduce available nesting and brood-rearing habitat. Therefore, a clear understanding of how current habitat composition influences nest site selection and nest success is needed to provide managers with specific habitat management objectives. We analyzed BWTE nesting data collected by the Wisconsin Department of Natural Resources in 2008, 2009, and 2012 across 6 study sites in southeast Wisconsin to model nest-site selection as a function of landcover composition. First, we extracted the proportion of landcover classes from publicly available landcover data within proximate (200-meter) and landscape scale (800-meter) buffers centered on each nest site ($n = 118$) and randomly selected locations. We then investigated nest-site selection patterns by building generalized linear mixed regression models to determine selection in relation to our measured covariates. Within our top model, percent composition of emergent wet meadow (EWM) (800-m scale) and percent composition of grassland (200-m) had the strongest positive relationship on nest selection. Increased distance to EMW and percent composition of forested landcovers (200-m) had the strongest negative relationship with nest selection. Data from these analyses will provide insight into BWTE nesting behavior and habitat characteristics affecting BWTE breeding production in Wisconsin to help guide BWTE breeding habitat management for the state of Wisconsin and the Upper Mississippi River/Great Lakes Region Joint Venture.

Advisors: Ben Sedinger, Drew Fowler, Marie Perkins, Jason Winiarski
Oral and Poster
Consider for Judging

Parasite Communities in Populations of Greater and Lesser Scaup in Green Bay, WI



Nicole Wagner
Biology



Gina Magro
Biology



Kao Lee Thao
Biology

Across North America Greater and Lesser Scaup populations have declined since the mid 1980s. In Wisconsin, major die-offs of scaup along the Mississippi River have been linked to non-native trematode (flatworm) parasites. Scaup have diverse and abundant parasite communities because of their habitat use, behavior and diet. Our research goal is to survey parasites of scaup, including potentially pathogenic trematodes, in the Green Bay, WI area because of a lack of data collected on scaup parasites in this region of the state. We predict that scaup with higher parasite loads could potentially suffer from pathology or mortality. We obtained waterfowl carcasses donated from hunters during the 2019, 2020, and 2021 seasons. A total of 42 birds were dissected into their major organs and each was inspected for parasites using standardized protocols. Any parasites we found were separated by major taxonomic group, counted, and identified the lowest taxonomic level possible using morphological traits. We found a diversity of different parasites in scaup with cestodes (tapeworms) being the most abundant endoparasites. Arthropods including lice and mites were detected on feathers. Specimens from the Phyla Acanthocephala and Nematoda were also identified. In our focal parasite group of trematodes, we found representatives of 9 families and all three of the pathogenic introduced trematodes: *Leyogonimus* sp., *Cyathocotyle* sp. and *Sphaeridotrema* sp. The prevalence of these three trematodes was 12% and 6% with a mean intensity of 26.3 and 6 in 2020 and 2021, respectively. Our research uncovered a high diversity and abundance of parasites within the scaup population. Further research into environmental factors, including parasites, that are potentially causing population declines is necessary for the conservation of scaup. Monitoring parasites in scaup is important for waterfowl management to better describe the distribution of pathogenic species as well as understand the species interactions with the native parasite community.

Advisor: Sarah Orlofske
Oral and Poster
Consider for Judging

Parasite Prevalence in Bobcats (*Lynx rufus*) Harvested in Southern Wisconsin.



Alayna Corbisier
Wildlife Ecology and Management

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Not Pictured: Tristan Stanton
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Bobcat (*Lynx rufus*) populations are increasing throughout the Midwestern United States. As a result, the Wisconsin Department of Natural Resources opened up the entire state to bobcat harvest in 2013 and approximately 550 bobcats were harvested in 2017-2018. Bobcats serve as hosts for parasites that are pathogenic or even fatal in other felines including domestic cats. We aimed to use harvested bobcats to test the hypothesis that male bobcats would have a higher prevalence of parasites than females because males have larger home ranges and testosterone affects the immune system. Specifically, we wanted to determine if prevalence of tapeworms (*Taenia*) and roundworms (*Toxocara cati*) varied with sex of bobcat. We acquired the heart, lungs, stomach, and intestines from bobcats that were trapped and harvested in the Southern zone of Wisconsin. Human population density is higher in the Southern Zone and may increase the risk of parasite transfer from an infected bobcat to a human or a pet. Moreover, the Southern zone contains more agricultural land cover and has a slightly warmer climate which is more hospitable for parasites that cannot survive harsh winters outside hosts. We identified tapeworms and roundworms in the intestines of 21 of the 31 bobcats processed. We found parasites in 66.7% of males and 58.3% of females. A Fisher exact showed that prevalence did not differ with sex ($p=0.582$), but small sample size might have influenced the results. Further research with larger sample sizes may further clarify parasite prevalence in female and male bobcats.

Advisors: Shelli Dubay, Sarah Orlofske

Poster

Consider for Judging

Population Estimate and Effects of Environmental Variables on Trap Success of Urban Eastern Gray Squirrels (*Sciurus carolinensis*) in Stevens Point, WI



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Not Pictured: Adam Tess
(Wildlife Ecology and Management)

The Eastern Gray Squirrel (*Sciurus carolinensis*) is commonly found in forests and urban settings, including Schmeckle Reserve in Stevens Point, WI. Squirrel density is often higher in urban parks when compared to rural sites because squirrels are not hunted in urban centers and natural predators are at lower densities. Schmeckle is 113-hectare urban park that is owned by the University of Wisconsin-Stevens Point. Our goals are to 1) calculate a population estimate of urban eastern gray squirrels in Schmeckle Reserve and 2) investigate environmental variables that influence trap success and gray squirrel activity. We trap squirrels in two sites of Schmeckle Reserve and record age, sex, and weight of the squirrels as well as marking them with uniquely numbered ear tags. We also record environmental variables such as temperature, wind speed, and cloud cover to determine their influence on trap success. Traps are opened when temperatures are between -13.5°C and 9.4°C , then checked at 9am, 12pm, and 3pm to reduce the risk of hypothermia from snow melt. Since 2020, we have trapped squirrels in late February and March and estimate squirrel abundance using the Huggins' closed capture with individual random effects in Program MARK. The 2021 analysis showed 47 individuals trapped, with temperature and time of day influencing trap success. Therefore, we hypothesize that more squirrels will be trapped earlier in the trapping day and when temperatures exceed -4°C . Results will help future squirrel trappers set traps when squirrels are more likely to be encountered and assist with future urban eastern gray squirrel research.

Advisors: Shelli Dubay, Ben Sedinger

Oral

Consider for Judging

Post Stocking Analysis of Extended Growth Fingerling Walleye (*Sander vitreus*) in Northern Wisconsin Lakes



Brenden Elwer
Fisheries and Aquatic Sciences

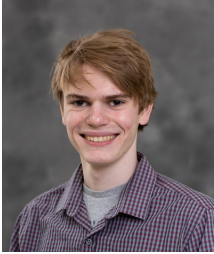
Walleye *Sander vitreus* are a prized sportfish in Wisconsin that have been experiencing recent recruitment and population declines. In 2013, the Wisconsin Walleye Initiative began to offset declining populations by increasing stocking efforts. Determining which factors may be affecting the survival of these stocked Walleyes is important to maximize success. The objectives of this study were to (1) determine if differences in natural mortality of stocked Walleye existed among stocking densities, and lake recruitment codes and conductivity, (2) determine if resulting adult Walleye abundances differed among stocking densities, (3) estimate cost to reach a harvestable size and (4) determine the number of stocking events required to reach desired adult densities. Natural mortality rates were estimated by comparing age-0 Walleye abundance estimates from fall electrofishing with estimated age-1 abundances the following year. Natural mortality of Walleye from age-0 to age-1 was very high and dependent on both conductivity and recruitment code of a lake. Significant differences in natural mortality rates were found for 3 of 6 comparisons of recruitment codes (supplementally stocked lakes being different), 2 of 6 tests comparing conductivity (low conductivity lakes being different), and 1 of 3 tests for stocking densities (5 vs 10/acre). Cost to survival to a harvestable size ranged from \$19.23 to \$38.47. Lakes stocked at 10 fish/acre had the lowest cost to harvestable size. No lake-specific conditions or stocking rates were likely to achieve the management goal of 3 fish/acre or a fishable population of 1.5 fish/acre in a single stocking event; for most lakes 2-5 stocking events are required to reach 1.5 fish/acre and the 3 fish/acre goal is not met. Our results suggest stocked fish have high natural mortality rates and multiple stocking events are required to reach management goals. Hence stocking events should be carefully planned to maximize return on investment.

Advisor: Justin VanDeHey

Poster

Consider for Judging

Post-Release Movement and Behavior of Rehabilitated Orphan Black Bears in Northern Wisconsin



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Wildlife Ecology and Management

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Alayna Reynolds
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Abby Mueller
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Orphaned Eastern American Black Bears (*Ursus americanus*) have become an increasingly relevant issue. These cubs can be rehabilitated and released into the Northwoods of Wisconsin. In the last decade, many studies have been conducted to monitor the movements and behavior after the release of many types of bears. However, there have not been many published studies regarding this from the state of Wisconsin. We are investigating the post-release movements, behavior, and cause of mortality of orphaned yearling female black bears in northern Wisconsin with the use of GPS collars. In addition, we will also be exploring other metrics necessary to determine if species-typical behaviors occur such as land cover selection and denning chronology. We have tracked two individuals released in Clam Lake area in October 2019 and two other individuals released in Rhinelander, WI, in October in 2021. We plan to add more to the study in upcoming fall seasons. Information we gain from these movements of rehabilitated orphan black bears can be used help inform the state on how we should integrate rehabilitated bears back into the Northwoods landscape and if it is a beneficial management practice.

Advisor: Cady Sartini

Poster

Consider for Judging

Preliminary Study Investigating Fisher Presence in George W. Mead State Wildlife Area



Noah Andexler
Wildlife Ecology and Management

Jacob Schiefelbein
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Sam Jenniges
Forest Management

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Wildlife Ecology and Management

Previous literature surrounding fishers (*Pekania pennanti*) focuses on populations primarily on the West Coast where their life history is well documented. Knowledge of fishers in Wisconsin and the Midwest, however, is lacking. Due to the ever-changing landscape of Wisconsin, preferred fisher habitat, such as old growth forests, are increasingly unavailable due to agriculture and logging. Yet, fishers have continually been able to adapt to the variable landscape of Central Wisconsin and continue to expand their range farther south. The ability to understand their spatial movements throughout a landscape is challenging because fishers are elusive, highly mobile, and inhabit large home ranges. We conducted a preliminary study focusing on the occupancy and distribution of fishers within the George W. Mead State Wildlife Area in Milladore, WI. We used hair snare boxes (280 trap nights) and game cameras (367 trap nights) to detect fishers and other mesocarnivores. Trap locations were chosen based on current habitat suitability index (HSI) models. These methods provided photos and hair samples to be analyzed. The data collected provided preliminary data of intraspecific and interspecific mesocarnivore activity which will refine future study focus areas. Future seasons of this project will aim to study the presence, as well as the relation of fishers and other mesocarnivores within the Mead Wildlife Area.

Advisor: Cady Sartini
Poster

Preliminary Study of Hairy and Downy Woodpecker Plumage Variations



Emily Knaack
Wildlife Ecology and Management

Not Pictured: Thomas Prier
Ecosystem Restoration and Management

Not Pictured: Jesse Tucker
Wildlife Ecology and Management

Not Pictured: Grant Koch
Wildlife Ecology and Management

Sandhill Wildlife Area located in Babcock, Wisconsin is home to a variety of species year-round. The focus of this study is on the Hairy Woodpeckers (*Leuconotopicus villosus*) and Downy Woodpeckers (*Picoides pubescens*) that are permanent residents of Sandhill Wildlife Area. Hairy and Downy Woodpeckers are common inhabitants of woodlands throughout North America. They are cavity nesters who will excavate tree trunks and create a new nest every year. Both species will peck into trees looking for insects, but will also eat berries, seeds, and nuts. These two species of woodpecker express similar plumage. They have black feathers with white spots on their wings, and a black head with two white stripes. Males exhibit a red spot on the back of their head, where females do not. We investigated the variations seen in head plumages between males and females of each species. Some of these birds were noted to have continuous white stripes around their head, while others had a vertical black stripe that separates the stripe into two white sections on the back of the head. Woodpeckers were trapped in a grid of wire tree traps and captured between February and March 2022. This banding project started in 2013 and has banded 11 Hairy Woodpeckers and 12 Downy Woodpeckers. This is a preliminary study that aims to identify areas of future research to explain noticeable variations within each species. This includes goals for genetic research, and a larger study area.

Advisor: Jason Riddle
Poster
Consider for Judging

Preliminary Study of Ruffed Grouse Survival in Northern Wisconsin



Brady Roberts

Wildlife Ecology and Management



Catrina Johnson

Wildlife Ecology and Management



Ava Weisbeck

Wildlife Ecology and Management

Not Pictured: Zach Cason (Ecosystem Restoration and Management)

Ruffed grouse (*Bonasa umbellus*) are an important game bird in the Great Lakes region. They are also a common prey species for many Wisconsin predators including great horned owls, goshawks, coyotes, foxes, and bobcats. Food scarcity, lack of thermal cover, and winter severity are also causes of mortality. Physical characteristics such as age and plumage color phase, as well as temporal factors such as time of year, may impact vulnerability of male ruffed grouse in a given year. We estimated the survival rates of male ruffed grouse on a non-huntable property in northern Wisconsin as part of a UW-Stevens Point Wildlife Society undergraduate research project. Male ruffed grouse perform auditory breeding displays on downed logs and were captured using mirror box traps placed on these logs between March and May of 2021. Telemetry was conducted weekly between April and August of 2021 and monthly between October of 2021 and January of 2022. Once a mortality signal was detected, we located the collar and confirmed the death. We will estimate survival rates and consider color phase and age as a covariate in our models. This information could be used to gain better knowledge of male ruffed grouse survival factors and provide more components to improve population dynamic calculations.

Advisor: Jason Riddle

Poster

Consider for Judging

Occupancy Modeling and Detection Probability of Ruffed Grouse Auditory Surveys in Northern Wisconsin



Brady Roberts

Wildlife Ecology and Management



Catrina Johnson

Wildlife Ecology and Management



Ava Weisbeck

Wildlife Ecology and Management

Not Pictured: Zach Cason (Ecosystem Restoration and Management)

Ruffed grouse (*Bonasa umbellus*) are an important game bird in the Great Lakes region. Males perform a unique auditory display, known as drumming, atop fallen logs to attract females and maintain their territory throughout the spring. Environmental factors may have an effect on grouse activity and in turn, detection probability and occupancy. Auditory drumming surveys were collected on weekends in April and May of 2021 in northern Wisconsin. Multiple observers visited 39 sites, beginning at sunrise to record the presence or absence of drumming males. Sky code, or percent cloud cover, and temperature were recorded for each day surveyed. Determining detection probability and its relationship to environmental covariates can improve occupancy estimates for these surveys and better inform management decisions for ruffed grouse populations.

Advisors: Ben Sedinger, Jason Riddle

Poster

Consider for Judging

Reconnecting a Riverine Wetland: Conducting a Hydrologic Budget for a Restored Wetland



Kayla Reed
Fisheries and Aquatic Sciences



Hailey Trompeter
Hydrology



Kaj Fritsch
Hydrology

Lizzie Gizzi
Hydrology



Not Pictured: Isabel Dunn
Water Resources

Not Pictured: Eliza Suchan
Water Resources

Restored wetlands can help connect the river to its floodplain and likewise serve as areas for water storage and potentially groundwater recharge. As such, understanding the hydrology of these wetlands is critical for restoration efforts and sustainability. We are seeking to construct a hydrologic budget for a restored riverine wetland in the floodplain of the Little Plover River, and are currently working to accurately estimate each component of the wetland's water budget to determine water storage capacity and the successfulness of its reconnection to the Little Plover River. We hypothesize that surface water inflow from the Little Plover River will be the major input in the hydrologic budget of the restored wetland, and are currently monitoring stream discharge, depth to groundwater, precipitation, and evapotranspiration to determine this. The results of this project will help us to better understand the hydrology of this wetland so that future management and restoration projects can be implemented more successfully. This project also provides hands-on opportunities for undergraduate students to learn field techniques in hydrology in addition to serving as a public demonstration site for the values of reconnecting streams and rivers to wetlands. As this project progresses, we also plan to do soil profiling to determine soil development, stored carbon, and microbial biomass compared to the surrounding unrestored woodlands.

Advisor: Kyle Herrman

Poster

Consider for Judging

Riparian Habitat Effects on Macroinvertebrate Drift and Brook Trout Diets in the Little Plover River, Wisconsin



Rachael Valeria
Fisheries and Aquatic Sciences



Selina Walters
Fisheries and Aquatic Sciences

Not Pictured: Logan Cutler (Fisheries and Aquatic Sciences)

Riparian habitat and groundwater inputs are critical components to maintaining high quality, headwater streams for cold-water species. Brook Trout (*Salvelinus fontinalis*) feed on both aquatic and terrestrial invertebrates that drift downstream, where availability and importance of such prey potentially varies by habitat type. Our study objectives were to compare Brook Trout diets with macroinvertebrate drift composition and to compare variation in Brook Trout diet composition among three riparian habitats (forested, restored wetland, and agricultural grassland) for two years along the Little Plover River in central Wisconsin. In fall 2019 and 2021, drift nets were deployed for 24 hours at three specific site locations representative of the differing riparian habitats. A few days later, eleven Brook Trout from each site were collected using backpack electrofishing and diets were obtained through gastric lavage. Macroinvertebrates collected from drifts and diets were preserved, sorted, and identified to family. Results exhibited much variation among samples, with taxa that were abundant in drift but absent in Brook Trout diets, and other taxa that occurred more often in diets than in drift nets. The forested site drift had the highest percentage of terrestrial invertebrates overall, but the agricultural site displayed the highest percentage of terrestrials over all diets. This study provides an understanding of invertebrate drift and Brook Trout diets relative to riparian habitat and associated Brook Trout selectivity towards available prey in a cold-water stream.

Advisors: Jeffrey Dimick, Joshua Raabe, Jered Studinski

Poster

Consider for Judging

Roundworm prevalence in bobcats (*Lynx rufus*) harvested in Southern Wisconsin



Stephen Van Horne
Wildlife Ecology and Management

Harrison Stasik
Wildlife Ecology and Management

Ben Schutt
Wildlife Ecology and Management

Alayna Corbisier
Wildlife Ecology and Management



Jessica Bjornson
Wildlife Ecology and Management

Not Pictured: Tristan Stanton
Wildlife Ecology and Management

Bobcat (*Lynx rufus*) populations are increasing throughout the Midwestern United States. As a result, the Wisconsin Department of Natural Resources opened up the entire state to bobcat harvest in 2013 and approximately 550 bobcats were harvested in 2017-2018. Bobcats serve as hosts for many parasites that are pathogenic or even fatal in other felines—including domestic cats—and can infect humans. We used harvested bobcats to test the hypothesis that male bobcats would have a higher prevalence of parasites than females because males have larger home ranges and testosterone affects the immune system. Specifically, we wanted to determine if prevalence of roundworms (*Toxocara cati*) varied with host sex. We acquired gastrointestinal tracts from bobcats trapped and hunted in the Southern zone of Wisconsin. We identified roundworms in the intestines of 11 of the 31 bobcats processed. We found roundworms in 42.8% of males and 18.2% of females. A Fisher exact showed that prevalence did not vary with sex ($p=0.158$), likely because of small sample size. The Southern zone contains more agricultural land cover, and a more hospitable climate for parasites that cannot survive harsh winters outside the hosts. There is also the possibility of increased risk of parasite transfer to domestic animals from higher human population density.

Advisors: Shelli Dubay, Sarah Orlofske
Oral
Consider for Judging

Smallmouth Bass Diet Analysis in Warmwater Central Wisconsin Streams Using Aquatic Community Assemblages



Blake Raymer
Fisheries and Aquatic Sciences



Kayla Reed
Fisheries and Aquatic Sciences

Smallmouth bass (*Micropterus dolomieu*) are an important top predator, highly sought-after gamefish, and one of the only warmwater gamefish in smaller lotic systems. They are habitat generalists, opportunistic predators, and exhibit both sedentary and potamodromous life histories. The number of streams suitable for smallmouth bass is expected to increase as water temperatures rise with climate change. However, there is limited information regarding habitat use, important diet items, and annual movements in small streams. We plan to study smallmouth bass diets in warmwater streams in central Wisconsin that vary in species richness and evenness of fishes and aquatic invertebrates, along with examining if individuals are resident at sites. We plan to sample two warmwater wadable streams containing smallmouth bass. Within each chosen stream, we plan to sample two separate reaches, totaling four sites. We will electrofish study reaches in spring and fall of 2022 and 2023. We will sample, identify to species level, and enumerate all stunned fish. For each stream site, smallmouth bass over 130 mm will have a PIT (passive integrated transponder) tag inserted ($n = 100 - 125/\text{stream}$). We will perform gastric lavage on smallmouth bass individuals 130 – 240 mm ($n = 15/\text{season}$) and individuals >250 mm ($n = 15/\text{season}$) at each site. In addition, macroinvertebrate collection will also occur at sites using a kick net to examine species richness and evenness of available prey. We will compare diet and movement results between streams and species richness and evenness of the fish and invertebrate communities. Our study results will contribute to baseline data on smallmouth bass in small streams including important diet items, available prey, and movement across habitats, aiding future management as small streams respond to climate change impacts.

Advisors: Joshua Raabe, Jeffrey Dimick

Poster

Consider for Judging

Texture Based Modeling Approach to Predict Soil Organic Matter with Portable X-Ray Fluorescence Spectroscopy



Mark Cook
Chemistry

Soil organic matter (SOM) is an important soil characteristic that affects many properties including water/nutrient storage, carbon sequestration, and increases in crop yields. Currently used methodology requires either harmful chemical reagents or high temperature combustion which limits their uses to only a lab setting. Here we propose a possible field-based method for quantifying SOM in soils using portable X-Ray Fluorescence (pXRF) spectroscopy. Elemental data from the pXRF was stratified by texture and used to build statistical models for SOM prediction. An all-texture model will be built along with five others for the different texture classes established (mineral, sandy, loamy, clayey, and organic). A principal component analysis (PCA) was done on the elemental data and then multiple linear regression was used to create the models. To compare the model's ability to predict SOM we will look at r-squared (R^2) and the root mean square error (RMSE). We hypothesize two things, one being that pXRF model prediction of SOM is possible and two that prediction will improve with texture stratification. If these hypotheses are supported, we can both easily take spectral data and measure texture in the field leading to further development of a field-based SOM prediction with pXRF.

Advisor: Bryant Scharenbroch
Oral and Poster
Consider for Judging

The Correlation of Parasites between Ducks and Snails Collected from Mead Wildlife Area



Elizabeth VanDomelen
Biology



Roiya Meyer
Biology



Nicole Wagner
Biology



Gina Magro
Biology



Kao Lee Thao
Biology

Wetlands provide feeding habitats for birds and management efforts include maintaining food resources necessary to support diverse and abundant populations. Parasites are one promising way to track species feeding interactions. Trematodes have complex life cycles involving a series of hosts including snails, a variety of invertebrate and vertebrate intermediate hosts such as insects, crustaceans, amphibians, fish, and vertebrate final hosts including birds and mammals. These parasites infect their vertebrate hosts through being consumed, so knowing what the host is infected with can help provide evidence of diet. Furthermore, parasite infection in snails provides long-term evidence of the presence of the final hosts. We conducted a pilot study to compare parasite communities between snails and waterfowl collected from three sites in the George W. Mead State Wildlife Area. We hypothesized that parasite communities in snails will reflect the presence of waterfowl using the same habitats. We collected 76 snails and 11 waterfowl samples and screened them for parasites. Any parasites found were collected, counted, and identified to the lowest taxonomic level possible. We observed 2-5 parasite morphotypes and a total prevalence of 36-40% infection in the snails. In comparison, waterfowl hosts had 1-5 parasite morphotypes and all were infected with at least one species of flatworm. Our study did reveal overlap in the parasite communities of snails and waterfowl. Echinostomes and Ribeiroia were found in both snails and waterfowl at two sites. Armatae was the most abundant parasite morphotype in the snails and could be one of several species that infect passerines like Red-winged Black birds or Swallows. The differences in parasite communities could be due to the presence of other final hosts or birds becoming infected from other locations while migrating. Identification of parasites to the species level will allow us to detect host-specific species that could be used as biological indicators for waterfowl or other wetland bird presence and more precisely identify diets.

Advisors: Sarah Orlofske, Robert Jadin

Poster

Consider for Judging

The Effectiveness of Various Types of Deer Browse Protection Methods on *Quercus rubra* Seedlings



Theodore Rickman
Wildlife Ecology and Management

Northern red oak (*Quercus rubra*) is a commercially and ecologically important species to Great Lakes Region. Red oak is also a preferred browse for white tailed deer (*Odocoileus virginianus*) and high densities of deer can cause problems for oak regeneration. Repeated browsing of buds can cause regeneration failure. Forest managers have tried varying methods to control or prevent deer browse on northern red oak, but it is unclear which methods are the most effective. In this study we compared the effectiveness of rigid mesh tree shelters, paper bud caps, and Plantskydd deer deterrent spray to a control in preventing deer browse on northern red oak seedlings. Six hundred eighty seedlings were planted in 2020 at the Treehaven field station in Tomahawk, WI in a two hectare seed tree harvest unit. A complete randomized block design was used with 17 blocks of 40 trees with 10 trees in each treatment. The seedlings were observed in the spring and then in the fall for survival, browse, height growth, and dieback. We used a logistic regression model to test if differences in browse occurrence, dieback and survival were statistically significant. While the experiment is ongoing, current data suggest tree shelters provide strong protection against terminal bud browse. Bud caps and Plantskydd provide only moderate protection from browse. We also found that seedlings in tree shelters had reduced risk of dieback, while bud capped seedlings had increased risk. These results suggest that the use of tree shelters may allow seedlings to escape deer browse faster than other methods and that bud capping oaks maybe counterproductive due to increased risk of dieback.

Advisor: Eli Anoszko
Poster
Consider for Judging

The Effects of Variable Food Intake on the Development of Gyrfalcon Nestlings



Noah Andexler
Wildlife Ecology and Management

As climate change impacts communities worldwide, the Arctic is particularly vulnerable to these drastic climatic events, affecting wildlife species that are highly susceptible to changes in the environment. In the sub-Arctic region, Gyrfalcons (*Falco rusticolus*) are diet and habitat specialists, rendering them model species for assessing the effects of climate change on Arctic wildlife. Additionally, Gyrfalcons do not migrate and therefore are unable to escape environmental changes through migration. Due to extreme environmental stressors in the Arctic tundra, nestling survivorship is typically low. With knowledge and understanding of the factors that affect recruitment, researchers can estimate chick survival in current nests and gauge the effects climate and environmental changes have on gyrfalcon populations. Anderson et al. (2017) developed a photographic guide used by Gyrfalcon researchers to age nestlings, primarily based on feather development. However, the reliability and accuracy of this guide has not been tested. We aim to assess the accuracy of this guide by evaluating Gyrfalcon nestling feather growth rates and their variability with the abundance of food biomass delivered to a nest. Through the establishment of distinct physiological benchmark dates, we compared natural growth rates in 28 randomly selected gyrfalcon nests over 5 years from the Seward Peninsula in Alaska. We are currently in the preliminary stages of analyzing data and will be illustrating initial trends through a subset of our sample data.

Advisors: Travis Booms, Michael Henderson, Shelli Dubay, Ben Sedinger

Poster

Consider for Judging

The Influence of Lunar Phases on Autumn Capture Probabilities of Northern Saw-Whet Owls (*Aegolius acadicus*) Recorded at Sandhill Wildlife Area



Carter Freymiller

Wildlife Ecology and Management



Aiden Gehrke

Wildlife Ecology and Management



Nicole Luoma

Wildlife Ecology and Management

Not Pictured: Cole Suckow (Wildlife Ecology and Management), Sophie Reid (Wildlife Education)

The Northern Saw-whet Owl (*Aegolius acadicus*) (NSWO) is a nocturnal mesopredator that can be found within upland ecosystems as far north as Central Canada and Alaska and will migrate as far south as Central Mexico. From 2006 to 2021, we have conducted research at Sandhill Wildlife Area—a 3,642-hectare wildlife refuge in Babcock, WI. NSWOs migrate in the fall from September until December, peaking around mid-October. There are many factors related to NSWO migration that are not entirely understood; this study aims to contribute to the knowledge of migration by examining the potential effects of the lunar cycle on nightly and annual scales. Our researchers have captured 1,257 NSWOs at Sandhill throughout the project's duration. NSWOs were captured using call-playback devices and mist-nets, then banded using #4 USGS aluminum leg bands, contributing to national banding data on NSWOs. Anticipated results predict that the higher lumination will result in lower capture probabilities of NSWOs.

Advisor: Jason Riddle

Poster

Consider for Judging

The Influence of Statewide Abundance on Nest Box Use of Cavity-Nesting Waterfowl Species in Central Wisconsin



Aiden Gehrke
Wildlife Ecology and Management



Victoria Fasbender
Wildlife Ecology and Management



Jacob Tepsa
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Grace Wieland
Wildlife Ecology and Management



Will Smith
Wildlife Ecology and Management



Casey Baye
Natural Resource Planning

Cavity-nesting birds rely on nest boxes, especially in areas where natural cavities are not available. In Wisconsin, two native cavity-nesting waterfowl species, wood ducks (*Aix sponsa*) and hooded mergansers (*Lophodytes cucullatus*), use natural nesting cavities and nest boxes, primarily for their protection from the environment and from predators. Since 2002, data on approximately 130 nest boxes and their occupancy by cavity nesting species has been collected by the UWSP Student Chapter of The Wildlife Society at George W. Mead State Wildlife Area (MWA), a 13,354-ha wetland in Marathon County. Variance in annual nest box use suggests the influence of both biotic and abiotic variables. In an effort to evaluate potential factors, we used regression analysis to examine the relationship between waterfowl abundance estimates modeled by the Wisconsin Department of Natural Resources and nest box use at MWA. Few studies on this exist, especially studies using similar long-term data. Our results indicate that there is no relationship between these wood duck abundance and nest box use at MWA. We did, however, find that nest box use at MWA has been increasing through time, which has important implications and suggests greater influence of local factors. With this research, we hope to contribute data to isolate these important factors that affect waterfowl nest use and ultimately recruitment.

Advisor: Ben Sedinger

Poster

Consider for Judging

Trail Use Trends Concerning COVID-19 in Stevens Point



Sydnee Brunette
Forest Recreation

Recreation involvement within state and national parks across the nation boomed during the height of the COVID-19 pandemic. This study explores the changes in recreation use in our own community over the course of the pandemic. Stevens Point is home to the 27-mile Green Circle Trail (GCT), along with UW-Stevens Point's 280-acre natural area, Schmeeckle Reserve. The GCT loops around the city of Stevens Point, connecting many of the parks, with 80% of the trail being located within natural settings, varying from the Wisconsin River waterfront to Plover Pines, and the Moses Creek Meadows. A monitoring program has been in place since 2013 to track visitor use of Schmeeckle and the GCT. Data is collected via TRAFx Infrared Trail Counters, with 12 counters placed between the GCT and Schmeeckle Reserve to assess the usage in different sections of the trails. Trail use within the past three years (2019-2021) has varied greatly, in respects to the pandemic and public access availability. Between 2019 and 2020 there was a near 200% increase of trail use on the GCT, with over half a million individuals utilizing the trail system. In 2021, with the return of some pre-pandemic activities, trail use remained high at over 400,000 users on the GCT alone. This presentation will consider overall use levels, along with changing patterns along trail segments, relative to broader trends in outdoor recreation during COVID-19.

Advisor: Laura Anderson McIntyre

Poster

Consider for Judging

Tree Species Composition in Relation to Southern Flying Squirrel Density in Schmeeckle Reserve 2020-2021



James Doss
Wildlife Ecology and Management



Jeremy Murray
Wildlife Ecology and Management



Kody Woodcock
Wildlife Ecology and Management



Pam Reagan
Environmental Education and Interpretation

Southern flying squirrels (*Glaucomys volans*) are arboreal and nocturnal and generally inhabit hardwood forests with larger trees and snags. From our observations, they seem to select forest pine (*Pinus* spp.), oak (*Quercus* spp.), and maple (*Acer* spp.) trees. The TWS flying squirrel project has been trapping squirrels in the Berard Oaks and surrounding woods of the Schmeeckle Reserve for several years. Our research team affixes traps to the same trees in Berard Oaks each fall, allowing for micro-habitat characteristics that increase trap success to be assessed. We hypothesized that southern flying squirrels would be trapped more often in mixed deciduous stands containing pine. We also predicted that the squirrels would be trapped more often at trap sites which contain larger DBH trees and snags in the existing area. We set 20 Sherman traps baited with peanut butter, bacon grease, and oats in September and October of 2020 and 2021. We checked them approximately 5 days a week, opening the traps around 6:00 p.m. and checking them from approximately 9:00 to 11:00 p.m. Analysis is ongoing, but we trapped 11 squirrels total in 2021. Seven (35%) of the traps in our trapping grid caught squirrels, and 3 (65%) of the traps failed to capture squirrels. In comparison, we trapped 35 total squirrels in 2020. Thirteen (65%) of the traps caught squirrels, and 7 (35%) of the traps failed to capture squirrels. Our goal is to improve our success in future trapping efforts by analyzing the variables that affect ideal trap placement and using that information as a guide in modifying our trapping grid, as appropriate.

Advisors: Shelli Dubay, Benjamin Sedinger

Poster

Consider for Judging

Use of Light-level Geolocators to Determine Nest Attentiveness of Wood Ducks (*Aix sponsa*) Breeding in Central Wisconsin



Brilyn Brecka

Wildlife Ecology and Management

Not Pictured: Andrew Greenawalt (Master of Science in Natural Resources)

For waterfowl (dabbling ducks), incubating females must spend time off the nest to maintain body condition throughout a period where much of their time and energy is devoted to caring for developing eggs. However, taking nest breaks results in a trade-off between meeting individual energetic demands to maintain survival and those demands associated with reproduction. Identifying factors that influence nest attendance and the frequency and duration of nest breaks can impact management decisions about critical habitat needs for incubating birds to balance energetic demands and the needs of their young. Because wood ducks (*Aix sponsa*) are cavity nesters, light-level geocator data can be used to determine time spent incubating and time spent off the nest. We analyzed raw geocator data from female wood ducks banded in central Wisconsin during 2020-2021 to examine factors that influence how individual females time their nest breaks. While incubating, females generally took two nest breaks per day, one in the morning and one in the evening. We investigated if there were significant differences between morning and evening breaks, as well as other factors that could determine duration and timing of these breaks. Preliminary results indicate that daily temperature, incubation stage, and body size influence incubation break timing and suggest that females are attempting to balance a tradeoff between their own maintenance and survival, and survival of their nests.

Advisor: Ben Sedinger

Oral

Consider for Judging

Using acesulfame to determine septic impact to Wisconsin lakes



Hannah Lukasik
Hydrology

Artificial sweeteners such as acesulfame in groundwater are helpful indicators of human waste source contamination in water. Sweeteners enter groundwater through septic system effluent and are later carried to surface waters. The sweeteners' slow rate of decay allows them to persist in groundwater and to be found in measurable concentrations in lakes across Wisconsin. The purpose of this study is to determine the relative contribution of septic system effluent to the water budget of a lake by measuring the concentration of acesulfame in lake water. Since septic system usage and impact on surface water quality is difficult to estimate, we sought to develop a chemical method that accurately quantifies the concentration of sweeteners in the water and reveals the impact of septic system drainage to the lakes' water budgets. Laboratory methods were refined to improve the recovery of acesulfame through solid phase extraction by pH adjustment and addition of ethylenediaminetetraacetic acid (EDTA) with liquid chromatography–mass spectrometry (LC-MS/MS) analysis. In this study, surface water samples were collected from lakes in central Wisconsin. The concentrations of artificial sweeteners in the lakes will be compared to septic system density and watershed size. A lake with a higher septic system density in its groundwater contributing area relative to the amount of the lake's groundwater inflow are expected to contain higher concentrations of acesulfame.

Advisors: Paul McGinley, Amy Nitka

Oral

Consider for Judging

Using Snapshot Wisconsin Trail Camera Sex Ratios to Predict Fall Harvest Demographics of Adult Eastern Wild Turkeys



Hayden Walkush
Wildlife Ecology and Management

Wisconsin's eastern wild turkey (*Meleagris gallapavo silvestris*) population has flourished since the species' reintroduction in the 1970s. Despite the success, Wisconsin and other Midwestern states have experienced declining spring and fall harvests since the region's peak in the 2000s. Fall harvest sex ratios are used as an indice of wild turkey population demographics by the Wisconsin Department of Natural Resources (WDNR). Over the last decade, Wisconsin has experienced declining fall harvest participation which could impact the use of harvest ratios as an indice. Because of this, it is important to explore alternative methods such as Snapshot Wisconsin (SSWI) for monitoring wild turkeys. SSWI is a community-based trail camera wildlife monitoring project which has more than 2,000 trail cameras located across the state and the seven Turkey Management Zones (TMZ). Our research objective is to determine if a predictive relationship exists between SSWI male-to-female ratios and WDNR adult male-to-female fall harvest ratios statewide and for each TMZ. Simple linear regression with an alpha of 0.05 will be used to determine if a predictive relationship exists. We hypothesize that yearly fall harvest adult male-to-female ratios are positively related to SSWI male-to-female ratios. If our prediction is supported, SSWI could be used to predict fall harvest demographics and inform hunting management decisions

Advisors: Hannah Butkiewicz, Jason Riddle, Jennifer Steglein, Christopher Pollentier
Oral
Consider for Judging

Whitetail Deer Habitat Selection and Predator Encounters



Jeremy Murray
Wildlife Ecology and Management

White-tailed Deer (*Odocoileus virginianus*) interact with their habitat and the predators with which they co-occur. White-tailed deer may select habitat based on seasonal thermal differences. For example, deer may select habitat in the summer that is cool, while choosing habitat that is warmer in the winter. Regardless of the habitat type, predators may be influenced by deer abundance. Camera studies allow one to observe prey and predators in a variety of habitat types. I used 35 trail cameras to study the relationship between deer, habitat, and predators in northern Michigan. I hypothesize deer habitat use will change seasonally. I also hypothesize there is higher predator activity when there is higher Whitetail Deer activity.

Advisor: Jason Riddle
Poster
Consider for Judging

Zooplankton and Larval Fish Community Relationships Along the Asian Carp Invasion Front in the Upper Mississippi River



Hayden Funk
Fisheries and Aquatic Sciences

Larval fish first feed on zooplankton, so the availability of zooplankton can influence fish recruitment, but potential relationships between zooplankton and larval fish in freshwater environments are relatively unknown. Invasive Asian Carp *Hypophthalmichthys* spp. are large planktivorous filter feeders that change zooplankton community composition and can cause a substantial decline in zooplankton biomass, thus competing with larval fish and other planktivores. Long-term monitoring data are necessary to understanding how the Asian Carp invasion will influence zooplankton communities and native larval fish population dynamics. The objectives of this study were 1) to determine if there is a significant relationship between zooplankton density and larval fish density in the Upper Mississippi River (UMR), 2) to evaluate how zooplankton and larval fish densities vary by habitat in the UMR, and 3) to establish a baseline as to areas in the UMR Asian Carp larvae are present, indicating successful spawning and initial survival. Sampling was accomplished with ichthyoplankton tows and integrated zooplankton samplers at 18 sampling sites throughout pools 14-18 of the UMR and its tributaries in backwater, thalweg, and channel border habitats during the summer of 2018. A weak but significant positive relationship was found between larval fish density and zooplankton density. Backwater habitats were found to have significantly higher densities of larval fish on average compared to thalweg and channel border habitats. Having an in-depth understanding of the zooplankton community within different habitats in the Upper Mississippi River could increase our understanding of how larval fish use these same habitats. Establishing this baseline study for zooplankton and larval fish community dynamics in the Upper Mississippi River Basin will also be critical to understanding how Asian Carp influence native ecosystems as the invasion progresses.

Advisors: Joshua Raabe, Michael Weber, David Yff
Oral and Poster
Consider for Judging

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