ANNUAL REPORT OCT 2020 - SEPT 2021

NEBRASKA COOPERATIVE

FISH & WILDLIFE RESEARCH UNIT

Wetlands of Nebraska: An Outreach and Education Project



Also See

Nebraska Outdoor Enthusiast Juniper Invasions and Landscape Intervention

Population Demographics and Movement Patterns of Silver Carp and Bighead Carp We extend our appreciation to the staff and students of the Nebraska Cooperative Fish and Wildlife Research Unit, University of Nebraska–Lincoln for photographs and images.

Editor and Design Production: Wilma Gerena

Copy Editors: Caryl Cashmere, Kevin Pope, Sarah Sonsthagen, and Jon Spurgeon

Graphic Design: Abigail Ahmed



Scan the QR code above with your smart device for an electronic copy of this report.

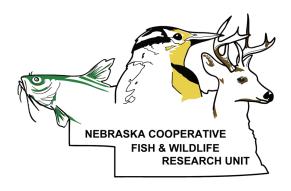
Cover: Wetlands of Nebraska, North Platte, NE

Photo: Ethan Freese, Platte Basin Timelapse

ANNUAL REPORT OCT 2020 - SEPT 2021

NEBRASKA COOPERATIVE

FISH & WILDLIFE RESEARCH UNIT



University of Nebraska–Lincoln School of Natural Resources 422 Hardin Hall 3310 Holdrege Street Lincoln, Nebraska 68583-0984 Phone: (402) 472-0449

> Fax: (402) 472-2946 Email: necru@unl.edu

University website: http://www.necoopunit.unl.edu Federal website: https://www1.usgs.gov/coopunits/unit/Nebraska

Social media: > @NECFWRU













TABLE OF CONTENTS

Introduction	1
Personnel & Cooperators	3
Unit Personnel	4
Graduate Degree Candidates	4
Theses and Dissertations	5
Coordinating Committee Members	6
Cooperating Organizations	7
Awards & Recognitions	11
Milestones & Highlights	15
Outreach Activities	23
Research Projects	29
Angler Behavior in Response to Management Actions on Nebraska Reservoirs - Part III	30
Aquatic Invasive Species (AIS) Prevention Program	33
Assessment of Angler Use and Catch During 2020 at Sutherland Reservoir, Nebraska	34
Bat Conservation and Recovery in Nebraska and Wyoming	35
Comprehensive Evaluation of the Nebraska Outdoor Enthusiast	36
Development of a Molecular Approach to Age Pacific Walruses: a Novel Application of Epig for Close-kin Mark-recapture	genetic Aging 37
Development of a Reservoir Habitat Sampling Framework in Arkansas	38
Genes Across the Landscape: Evaluating Migratory Connectivity in the Rusty Blackbird	39
Improving our Understanding of the Population Structure and Harvest Composition of Ame Common Eiders	erican 40
Influence of Multi-scale Habitat Characteristics on Paleback Darter Occupancy	41
Inventory and Assessment of Stream Crossings and their Influence on Movement of Species Conservation Concern within Ouachita Highlands Ecoregion in Arkansas	s of Greatest 42

Investigating the Role of Hybridization in the Decline of Gray-Headed Chickadees	43
Juniper Invasions and Landscape Intervention Potential: A Statewide Assessment	44
Monitoring, Mapping, Risk Assessment, and Management of Invasive Species in Nebraska	45
Population Demographics and Movement Patterns of Silver Carp and Bighead Carp in the Arka White Rivers, Arkansas	nsas and 46
Rainwater Basin Joint Venture Science	47
Vegetative and Large Carnivore Responses in an Encroached Landscape	48
Wetlands of Nebraska: An Outreach and Education Project	49
Professional Activities	51
Teaching	52
Graduate Committee Service	52
Professional and Faculty Service	53
Training Assistance, Workshops, and Outreach Activities	54
Presentations	55
Data Releases	56
Peer-Reviewed Publications	57

Photo: Meghan Manary

INTRODUCTION

What is the Nebraska Cooperative Fish and Wildlife Research Unit?

A simple answer: The Nebraska Cooperative Fish and Wildlife Research Unit (NECFWRU) is a formal partnership between the University of Nebraska–Lincoln (UNL), Nebraska Game and Parks Commission (NGPC), U.S. Geological Survey (USGS), U.S. Fish and Wildlife Service (USFWS), and Wildlife Management Institute (WMI).

A more profound answer: The NECFWRU is a complex system comprised of people working across difficult-to-define scales within difficult-to-define boundaries. A complex system has many interacting components with no central control or global communication, and the interactions give rise to emergent behaviors. The NECFWRU has a tripartite mission: technical assistance, applied research, and graduate education. This mission carries with it some implied temporal scales (e.g., M.S. students generally operate on a 2-3 year scale), but does not define all temporal or spatial scales in which the unit is to operate. The NECFWRU is one of 41 units that compose the national Cooperative Research Unit (CRU) program. The CRU program is poised to address natural-resource issues on regional and national scales.

Components of the NECFWRU include three federal scientists, two state administrative assistants, and grant-funded graduate students, coordinators, and technicians. Also included are biologists, managers, and decision makers of government agencies, faculty members, administrators of universities and colleges, and personnel of non-governmental agencies.

Oversight on broad direction of NECFWRU is provided by a five-member (representative from each signatory agency) coordinating committee. Oversight on safety is provided by CRU Headquarters and UNL safety committees. Oversight on publications is provided by USGS. Oversight on laboratories is provided by each scientist, though broad oversight of research is generally provided by granting agencies and university review boards (i.e., IACUC and IRB). Oversight on each graduate project is provided by graduate committees.

You are, in some way big or small, part of the Nebraska Cooperative Fish and Wildlife Research Unit. We thank you for your valuable contributions. You are what makes us great.





Individual, community, and habitat conservation Photos: Ethan Freese, Platte Basin Timelapse



PERSONNEL & COOPERATORS



UNIT PERSONNEL

Staff – U.S. Geological Survey, Cooperative Research Units Program

Kevin Pope, Unit Leader

Sarah Sonsthagen, Assistant Unit Leader Wildlife

Jonathan Spurgeon, Assistant Unit Leader Fisheries

Staff - University of Nebraska-Lincoln

Caryl Cashmere, Unit Staff Assistant

Wilma Gerena, Unit Administrative Assistant

Christopher Fill, Coordinator

North American Bat Monitoring Project

Derek Kane, Coordinator Angler Survey Project Mariah Lundgren, Producer and Project Manager

Platte Basin Timelapse

Dana Varner, Science Coordinator Rainwater Basin Joint Venture

Allison Zach, Coordinator

Nebraska Invasive Species Program

Research Technicians

Dakota Altman

Meghan Manary

Jackson Sash

Ethan Freese

Benjamin Mordhorst

Brooke Talbott

Marcila Goben

Alyssa Noble

Josh Johnson

Grant Reiner

GRADUATE DEGREE CANDIDATES

Master of Science

Brandon Barlow

School of Natural Resources August 2020 – present

Kyle Hansen

School of Natural Resources August 2021 – present Connor Hart

School of Natural Resources August 2021 – present

Caroline LaPlante

School of Natural Resources August 2021 – present Benjamin Mordhorst

School of Natural Resources August 2021 – present

Joseph Spooner

School of Natural Resources August 2021 – present

Pool portion of Over-the-Water training, Lincoln, NE

Photo: Brandon Barlow

Doctor of Philosophy

Dillon Fogarty
Department of Agronomy
January 2017 – present

Michael Whitby School of Natural Resources January 2014 – January 2021

THESES AND DISSERTATIONS

Hugh Ellerman, M.S., December 2020

Vegetation and Large Carnivore Responses in an Encroached Landscape University of Nebraska–Lincoln, Natural Resources. Advisor(s), Craig R. Allen, Dirac Twidwell.

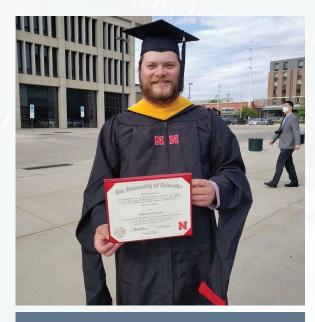
Derek Kane, M.S., May 2021

Conceptual Framework Linking Resource Size and Recreational Use
University of Nebraska–Lincoln, Natural Resources. Advisor(s), Kevin L. Pope, Mark Kaemingk.

Chadwin Smith, Ph.D., December 2020

A Conceptual Model Evaluation Framework for Adaptive Governance and Adaptive Management in Large-Scale Restoration Programs

University of Nebraska-Lincoln, Natural Resources. Advisor(s), Craig R. Allen.



Derek Kane, M.S.Photo: Kane Family



COORDINATING COMMITTEE MEMBERS

U.S. Geological Survey

Barry Grand, Regional Supervisor Cooperative Research Units Program Dadeville, AL 36853 (334) 200-8458

University of Nebraska-Lincoln

Mike Boehm, Vice Chancellor Institute of Agriculture and Natural Resources 202 Agriculture Hall Lincoln, NE 68583–0708 (402) 472-2871

Wildlife Management Institute

Bill Moritz, Midwest Field Representative 1608 Packwood Road Fairfield, IA 52556

Nebraska Game and Parks Commission

Jim Douglas, Director 2200 N. 33rd Street Lincoln, NE 68503–0370 (402) 471-0641

U.S. Fish and Wildlife Service

Samantha Brooke, Interim Representative Assistant Regional Director for Migratory Birds & Science Applications 134 Union Blvd. #400 Lakewood, CO 80228 (303) 236-5231 Greg Watson, Chief (October 2006 - June 2021)
Office of Landscape Conservation
Mountain–Prairie Region
134 Union Blvd., PO Box 25486
Denver, CO 80225
(303) 236-4602

Photo: Meghan Manary

COOPERATING ORGANIZATIONS

Alaska Department of Fish and Game

Threatened, Endangered, and Diversity Program

Arkansas Game and Fish Commission

Association of Fish and Wildlife Agencies

Canadian Forest Service

Northern Forestry Centre

Cooperative Research Unit Program

Arizona Cooperative Fish and Wildlife

Research Unit

Missouri Cooperative Fish and Wildlife

Research Unit

New York Cooperative Fish and Wildlife

Research Unit

Pennsylvania Cooperative Fish and Wildlife

Research Unit

Vermont Cooperative Fish and Wildlife

Research Unit

Cornell University

Ducks Unlimited

Environment and Climate Change Canada

Canadian Wildlife Service

Iowa Department of Natural Resources

Iowa State University

Leibniz-Institute of Freshwater Ecology and Inland

Fisheries

Loyola University

Missouri Department of Conservation

Nebraska Department of Agriculture

Nebraska Department of Environment and Energy

Nebraska Department of Transportation

Nebraska Forest Service

Nebraska Game and Parks Commission

Nebraska Invasive Species Council

Nebraska Natural Resources Districts

Nebraska Public Power District

Nebraska Weed Control Association

New York State Department of Environmental

Conservation

North Dakota Game and Fish Department

Oklahoma State University

Ontario Ministry of Natural Resources and

Forestry

Oregon State University

Pennsylvania Game Commission

Pheasants Forever, Inc.

Platte River Recovery Implementation Program

Platte River Whooping Crane Maintenance Trust

Rainwater Basin Joint Venture Partnership

Sea Duck Joint Venture

Simon Fraser University

Tennessee Wildlife Resources Agency

The Nature Conservancy

Universidad Autónoma del Estado de Morelos

Université de Sherbrooke

University of Arkansas at Pine Bluff

University of Georgia

University of Glasgow

University of Maine

University of Minnesota

University of Montana

University of Nebraska at Kearney

University of Nebraska at Omaha

University of Nebraska-Lincoln

Bureau of Sociological Research

Center for Resilience in Agricultural Working

Landscapes

College of Journalism and Mass

Communications

Daugherty Water for Food Institute

Nebraska Water Center

Department of Agronomy and Horticulture

Department of Animal Science

Department of Computer Science

Platte Basin Timelapse

School of Biological Sciences

School of Natural Resources

University of North Dakota

University of Texas at El Paso

U.S. Department of Agriculture

Animal and Plant Health Inspection Service

National Institute of Food and Agriculture

U.S. Department of Defense

U.S. Air Force

Offutt Air Force Base

U.S. Department of Interior

National Park Service

Homestead National Monument of America

U.S. Fish and Wildlife Service

Alaska Region

Aquatic Nuisance Species Task Force

Atlantic Region

Branch of Migratory Bird Surveys

Marine Mammals Management

Migratory Bird Management

Northeast Region

Patuxent Wildlife Research Center

Science Applications and Migratory Bird

Program

Valentine National Wildlife Refuge

Wildlife and Sport Fish Restoration

U.S. Geological Survey

Alaska Science Center

Fort Collins Science Center

National Climate Adaptation Science Center

Northern Prairie Wildlife Research Center

Science Support Partnership

Upper Midwest Environmental Sciences Center

U.S. Environmental Protection Agency

Utah State University

Vermont Fish and Wildlife Department

Virginia Department of Wildlife Resources

Virginia Polytechnic Institute and State University

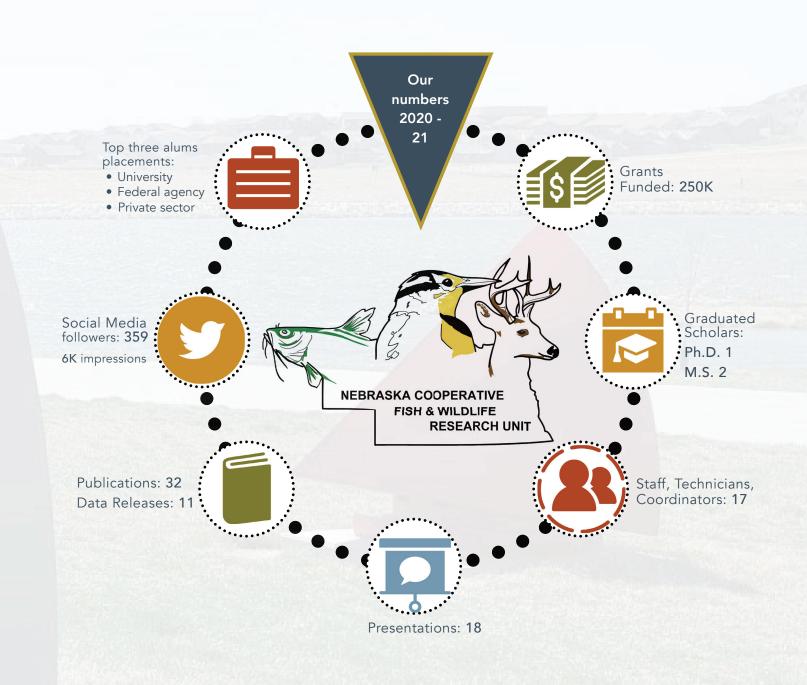
Washington State University-Vancouver

Wildlife Ecology Institute

Wisconsin Department of Natural Resources

Wyoming Game and Fish Department

Flanagan Lake, Omaha, NE Photo: Brandon Barlow





AWARDS & RECOGNITIONS





Scholarships, Fellowships & Grants

Dillon Fogarty was awarded the Arthur Sampson Fellowship for the academic year 2020 – 2021. This \$5,000 fellowship is through the Center for Grassland Studies at UNL in support of students conducting research and conservation of rangeland ecosystems. This award is the second year in succession.

Golden Pillar Award

Shakespeare's Juliet asked "What's in a name?" We believe that much is in a name, and that a rose by any other name would not smell as sweet. Our Unit's name, the Nebraska Cooperative Fish and Wildlife Research Unit, conveys meaning and direction. Our Unit is located in Nebraska—we serve the citizens of Nebraska and the United States of America. Our Unit's focus is graduate-research education within the arena of fish and wildlife science. Most importantly, our Unit is a cooperative endeavor among a diverse array of stakeholders.

The staff and scientists of the Nebraska Cooperative Fish and Wildlife Research Unit recognize and appreciate that cooperator support is essential to our success. Unit support comes in many shapes and sizes. Though support of our Unit is provided by an army of individuals, there are a select few supporters that go well beyond the call of duty. A tradition started by Nebraska unit scientists in 2010, the Golden Pillar Award honors and recognizes outstanding individuals who are "pillars of support"; their support is essential to the success of the Nebraska Cooperative Fish and Wildlife Research Unit. Award recipients are recognized at our annual



Jim Douglas Photo: Nebraska Game and Parks Commission

unit meeting and presented with a token of appreciation. Golden Pillar Awards were given in 2010 to Kirk Nelson, John Owens, and Steve Riley, in 2015 to Valerie Egger, and in 2016 to Don Gabelhouse and Scott Taylor.

We once again recognize an individual who has worked endlessly to ensure continued success and impact of the Nebraska Cooperative Fish and Wildlife Research Unit. It brings us great joy to award Jim Douglas the Golden Pillar Award. Jim has a stellar, 47-year career with the Nebraska Game and Parks Commission, spending the last nine years as Agency Director. Throughout his career, Jim has been a strategic visionary. Jim applied his talent to shape the vision of the Nebraska Cooperative Fish and Wildlife Research Unit, which is most evident through our recent Assistant Unit Leader hires. What is not so evident is all the work Jim performs behind the scenes. Thanks Jim for your unwavering support, which we know will continue for many years to come!

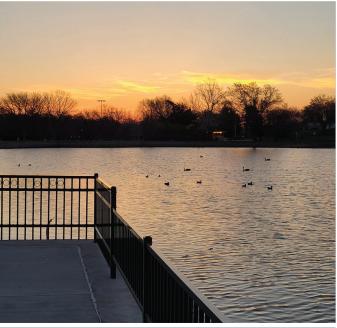
We take this opportunity to recognize our Golden Pillars, and to thank them for their tireless support of the Cooperative Research Unit Program.

Additional Recognitions

The production of this annual report could not be possible without contribution of the staff and students of the Nebraska Cooperative Fish and Wildlife Research Unit. We extend our appreciation for project photographs and all the worthy visual submissions of our Nebraska sunsets.



Sutherland Reservoir, Sutherland, NE *Photo: Meghan Manary*



Fontenelle Lake, Omaha, NE Photo: Josh Johnson



Windmill silhouette, Dickens, NE *Photo: Christopher Fill*



Walnut Creek Lake, Omaha, NE Photo: Alyssa Noble





Nebraska Invasive Species Program



Allison Zach, sampling at Zorinsky Lake, Omaha, NE *Photo: Eric Zach, NGPC*

Allison Zach, coordinator of the Nebraska Invasive Species Program, was elected in 2020 to the North American Invasive Species Management Association (NAISMA) Board for a 3-year term. NAISMA is comprised of federal, state, local, and non-governmental invasive species experts that work with all taxa of invasive species.

In addition to NAISMA, Zach was selected to the Executive Committee of the Western Regional Panel on Aquatic Nuisance Species a subcommittee of the Federal Aquatic Nuisance Species Task Force.

NE Unit Producing Professionals for Today's Conservation Workforce

The Nebraska unit generated a number of new professional staff for the University of Nebraska–Lincoln, and assistant unit leaders for the Cooperative Research Unit Program.

First up, Christopher Fill began the appointment as Coordinator for the Nebraska North American Bat Monitoring Program in late 2020. The Nebraska program is in partnership with the USGS National Bat Monitoring Program, the University of Nebraska-Lincoln (UNL), and the Nebraska Game and Parks Commission. Fill received his B.S. in Biology from the University of Massachusetts-Lowell in 2015. Since then he has worked on a variety of research projects for university, federal, and non-profit organizations across the country in the study of prairie grouse and bats that included several threatened and endangered bat species. He joined the Nebraska Cooperative Fish and Wildlife Unit via the National Science Foundation, National Research Training Program (NRT) established in 2018 under the oversight of Craig Allen. As a graduate student, Fill researched bat spatial and temporal movements in agriculturally dominated Nebraskan landscapes, completing his degree in December 2020. In the Nebraska NABat program, Fill manages equipment, oversees volunteers, and is responsible for data collection.

Our second student (pictured on the next page) is Dillon Fogarty. Fogarty is a Ph.D. candidate, and was hired in May 2021 as Coordinator for the Working Lands Conservation Program. The program focuses on a strategic, threat-based approach to manage for rangeland resilience at large scales. The coordinator position is within the Department of Agronomy and Horticulture at UNL under the supervision of Dirac Twidwell. This program is a partnership the U.S. Department of Agriculture Natural Resources Conservation Service and is funded with assistance of the Nebraska Environmental Trust.



Christopher Fill selfie at Chimney Rock, NE Photo: Christopher Fill



Dillon Fogarty (left) and Dan Uden (right)
Photo: UNL Dept. of Agronomy and Horticulture

Pictured above next to Fogarty is Dan Uden, Ph.D., a 2017 Unit graduate, now faculty member and Resilience Spatial Scientist at UNL. Uden's teaching interests, reside in the areas of spatial science, regime shift, landcover change, and bioenergy.

Also starting an appointment at UNL in 2021 is Derek Kane, hired to fill in the vacancy created in the Angler Survey Project after Mark Kaemingk's departure. Although Derek had big shoes to fill, he has stepped in and stepped up to the challenges of conducting in-person surveys amidst a pandemic. Kane currently supervises three creel clerks conducting surveys of recreational anglers in the Omaha metro area and one clerk at Sutherland. At a young age Kane developed a passion for fishing and understanding others who fish. Kane earned his B.S. in Fisheries and Wildlife from UNL in 2018 and his M.S. in Natural Resource Sciences from UNL in 2021, where his work focused on improving our understanding of angler effort, fulfilling a childhood interest.



Photo: Taylor Richert

Caleb Roberts, Ph.D., a 2019 alum joined the Arkansas Unit as **Assistant Unit** Leader with a focus on Invasive Species. At the University of Arkansas, Roberts created the Living Landscapes Lab with research interest in landscape ecology, invasive



Caleb Roberts
Photo: Twitter
@calebproberts

species, community ecology, resilience theory, and complexity theory.

Equally noteworthy to mention is the addition of Erica Stuber, Ph.D., as assistant unit leader at the Utah Unit. Stuber fulfilled a research assistant professor position at our Unit. She worked on developing methods to quantify the spatial 'scales-of-effect' of environmental

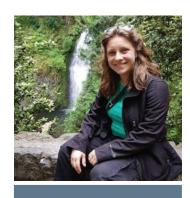


Erica Stuber
Photo: Twitter @efstuber

predictors commonly used in spatial modeling. At Utah State University, Stuber created the <u>X-Scale</u>

Ecology Lab pulling in a 2018 Nebraska Unit alum Nadya Mirochnitchenko.

It is our sincere desire to see our alums rise and succeed in their respective fields. Congratulations!



Nadya Mirochnitchenko Photo: Fontaine Lab

Budding Fisheries Biologist

This summer Jonathan Spurgeon hosted his first American Fisheries Society, Hutton Junior Fisheries Biology Program scholar. Ella Humphrey of Omaha, Nebraska, participated in a summer internship designed to inspire and engage high school students to become the next generation of fisheries professionals. Spurgeon spent a great part of June mentoring Humphrey who obtained experience in fish sampling, fisheries theory, and

data systems. Humphrey has a promising career ahead of her, and we are excited to watch her personal and professional growth.



Data and day's briefing Photo: Wilma Gerena





Fish-handling experience Photo: Jonathan Spurgeon

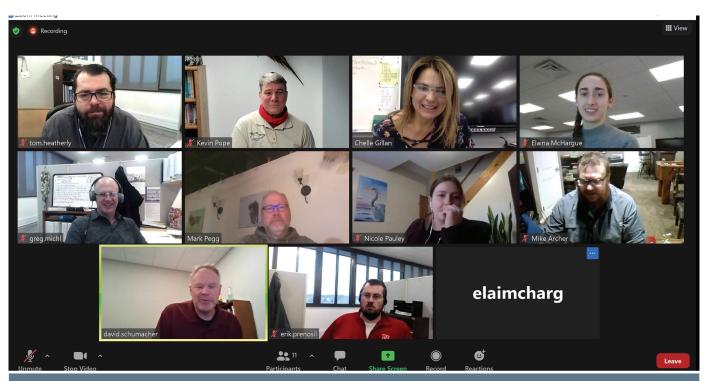
Practice with Professionals Pays Out

Not every high school student is fortunate to have an opportunity to practice a presentation with professionals in their respective fields. But Elaine McHargue from Central City Nebraska did! McHargue prepared for the Kansas-Nebraska-Oklahoma regional Junior Science and Humanities Symposium (JSHS) competition with scientists from the University of Nebraska -Lincoln and the Nebraska Department of Environment and Energy. She presented, An Analysis of the Effects of Wetland Area on Algae Growth in Nearby Lakes in Eastern Nebraska to panel members, including our unit leader Kevin Pope. Panel members provided McHargue recommendations on presentation and poster details. McHargue's practice time and dedication paid off. She provided a virtual presentation, placed third at the symposium, and received a \$1,000 scholarship. She also qualified for the national JSHS competition. "The National JSHS was a really great experience," said McHargue. "It was held virtually, but they did an amazing job

of making it feel almost like it was in person, and I learned a lot of new things."

Since participating in the Junior Science and Humanities Symposium competition, McHargue entered in two other science fairs; the Greater Nebraska Science and Engineering Fair (GNSEF), and the regional Nebraska Junior Academy of Science (NJAS) Fair. At the regional NJAS fair, McHargue qualified for the state science fair where the top ten students advanced to the national science fair. Although McHargue did not advanced to the national level, she received several special recognitions, and was a medallion winner.

Panel members agreed that assisting McHargue prepare was a refreshing experience and feel encouraged for the future of conservation in Nebraska because undoubtedly McHargue has a bright future ahead as a scientist.



Pictured from left to right: Tom Heatherly, Kevin Pope, Chelle Gillan, Elaina McHargue, Greg Michl, Mark Pegg, Nicole Pauley, Mike Archer, David Schumacher, and Erik Prenosil.

Photo: Kevin Pope

New textbook edited by School of Natural Resources team spotlights social aspects of fish, wildlife harvest management

When you receive a state fishing or hunting license, you will be informed of harvest limits connected with the activity. You can bag up to five rainbow trout in a day. You can keep a walleye if it's 15 inches long. You can only bag two white-fronted geese per day during their season, but can keep up to 50 light geese per day during theirs.

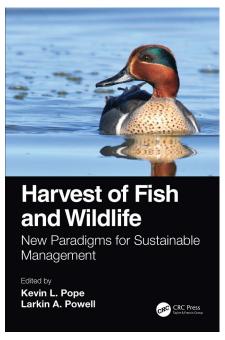
Making harvest management decisions like these is a challenging, ever-evolving process that is done with sustainability, population dynamics and people in mind, said Larkin Powell, professor of conservation biology and animal ecology at the University of Nebraska–Lincoln (UNL), School of Natural Resources. The body of research centered on the social aspect has grown in recent years, he said, and it is reflected in a new textbook co-edited by Powell and Kevin Pope, biologist with U.S. Geological Survey and director of the Nebraska Cooperative Fish and Wildlife Research Unit.

"Harvest of Fish and Wildlife: New Paradigms for Sustainable Management" was released June 7, 2021. The textbook features chapters authored by 24 teams of scientists and game managers with expertise about the subject, and an interest in exploring harvest management issues from angles that Pope and Powell said have not been represented in previous textbooks.

"Historically, we considered harvest management in biological or ecological contexts," Pope said. "That's how we were trained, but now we're encouraging people to think about harvest management as occurring in a social-ecological system. Ecology is important, but so is the social aspect, the politics and actual actions and behaviors of hunters and anglers."

The authors include many who represent UNL's School of Natural Resources, and Nebraska as a whole. Chapter authors include five UNL faculty

members, one UNL adjunct faculty member, two UNL grad students, two UNL staff members and two Nebraska Game and Parks Commission biologists. The book also includes scientists and experts who are colleagues of Pope's and hail from four U.S. Geological Survey Cooperative Fish and Wildlife Research Units from across the country.



"This book is a welcome addition to the literature on harvest management, integrating both terrestrial and aquatic perspectives and engaging the social as well as biological sciences," said Jonathan R. Mawdsley, chief of the U.S. Geological Survey's Cooperative Fish and Wildlife Research Units Program. "The chapter authors are a veritable 'Who's Who' of thought leaders in fisheries, wildlife management and decision science, and the book will undoubtedly be of broad interest to state, federal, academic, NGO and private-sector professionals."

Numerous chapters directly address human elements of the harvest management decision process. Subjects include an exploration of engaging hunters in selecting duck season dates, the social and political context of harvest management and how marketing and ecological models can help predict permit-purchasing behavior of sportspersons.

"Management decisions can be pretty tricky,"
Powell said. "It involves population dynamics,
but also a lot of stakeholder engagement. And I
think that's what emerged in the book. The book
tries to bring all those things together, and give
guidance to people that are managing these
populations. The tricky thing was trying to find
the threads that go between all those things.
And, for us, that was one of the fun things. It
was a challenge, but it was rewarding to help the
authors incorporate that into their chapters."

Timothy McCoy, Nebraska Game and Parks Commission deputy director, said that the textbook provides "great insight" into the complex information that agencies consider when making harvest management recommendations and decisions.

"We must continue to adapt, challenge, apply and improve our wildlife science, social science and decision science in harvest management approaches for wildlife and people," McCoy said.

In the preface to the textbook, Pope and Powell wrote that they developed the idea for it with the idea of providing new insights into a traditional area of emphasis for fisheries and wildlife managers.

"We are now in a new era of harvest management," they wrote in the preface.
"Population biologists have new modeling tools that can be applied to harvest questions.
Evolutionary biologists have measured effects of harvest that go beyond simple changes in population size, and we can evaluate the potential for selective mortality through harvest to affect populations and species. Social scientists have begun to look reflectively at behaviors of anglers and hunters, especially as anglers and hunters respond to changing densities of fish and game.
And, tenets of decision science have proven useful as improved frameworks to select regulations for

harvested species in social and political climates that are often hostile toward consumptive uses of fish and wildlife. In sum, harvest management has broadened beyond its traditional roots to embrace information provided by genetics and advanced population-dynamics modeling as well as insights obtained through consideration of human dimensions."

The textbook explores how harvest management can help ensure a sustainable future, while promoting intentional, thoughtful and transparent justification for fishing and hunting regulations. Pope said that the textbook has appeal not only in fisheries and wildlife classrooms but also for population biologists, evolutionary biologists, social scientists and on-the-ground fish and wildlife managers. It is a valuable resource now, and will be for years to come, said John Carroll, director of the School of Natural Resources.

"Harvest can be one of the most controversial aspects of both fisheries and wildlife management," Carroll said. "Dr. Pope and Dr. Powell using their respective expertise in population biology led a thorough review of this topic in this textbook. They also embrace a much broader view that includes focus on some traditional harvest topics relative to population biology, but also evolutionary implications and socio-ecological ramifications of wildlife use. There is no doubt that their book is critical now, but will only increase in importance over time as humans continue to dramatically impact fish and wildlife populations on a global scale. These faculty at the University of Nebraska are demonstrating how our natural resources programs not only have a local impact, but also significance at national and international levels."

"Harvest of Fish and Wildlife: New paradigms for Sustainable Management" is published by CRC Press, an imprint of Taylor and Francis Group. To purchase a copy or request a copy for inspection, visit Routledge, Taylor and Francis Group.

Cory Matteson, School of Natural Resources
 Communications





Nebraska Invasive Species Program

Allison Zach, Nebraska Invasive Species
Program Coordinator (NISP) is serving on the
North American Invasive Species Management
Association's "Play, Clean, Go" Campaign
Committee. The organization aims to educate
resource agency staff and the public how to
prevent the spread of invasive species.

Nebraska's Governor, Pete Ricketts, issued a proclamation making February 22-28, 2021 Nebraska Invasive Species Awareness Week. During the week the NISP, in collaboration with the Nebraska Game and Parks Commission, conducted a series of webinars that covered invasive species of all taxa.

During 2020 – 2021 the NISP produced and presented to various audiences including: the Nebraska Game and Parks Commission Outdoor Discovery Days, the Izaak Walton League, Conservation Nebraska, the School of Natural Resources, and the Institute for Agriculture for Natural Resources. And as in previous years, the NISP disseminated and provided partners with invasive species outreach materials on invasive species of all taxa and the program's website was updated with current species information, guidance materials, and range information, including recorded presentations and easy to print educational resources.



Coffee and Conservation Photo: Video Clip

SNR Coffee & Conversation: Let's Talk Invasive Species!

Allison Zach presented "Let's Talk Invasive Species" to an audience that included students, staff, other project collaborators, faculty, and public. The presentation was part of the School of Natural Resources' (SNR), <u>Coffee and Conservation</u> seminar series produced by Andy Little. The series' goal is to expand conservation knowledge and awareness to people whose careers or life paths are not in the conservation realm. The invasive species seminar was well received with audience interaction during the "Question and Answer" portion.

When You Do What You Love...

Derek Kane had the opportunity to speak on the Natural Resources and Wildlife Careers Panel for the Careers in Agriculture section of the Nebraska Agricultural Youth Institute's annual conference. Delegates from Nebraska high schools participated in two separate 35 minute sessions with the panelists. In each session the panelists explained their background, education, and careers, finalizing with a "Question and Answer" session. Kane shared his enjoyment for natural resources conservation and how the education background and experiences at UNL lead him to a great first official appointment after earning his degree.



Speaking about careers in conservation Photo: Nebraska Agricultural Youth Institute, Facebook

Discovery Days

The Institute for Agriculture and Natural Resources at the University of Nebraska–Lincoln premiered a new event focused on sharing campus' science with the local community while building relationships. The "East Campus Discovery Days and Farmers Market" debuted in June with one additional Saturday in July and one in August. Representing the Unit on its inaugural day was Allison Zach with Nebraska Invasive Species Program literature, information microsessions, and giveaways highlighting the program as well as the Unit.

In July, Kevin Pope and Derek Kane joined Zach in the fun of experiencing a steady flow of visitors who checked in the booth, while others waited to hear first hand about the Nebraska Invasive Species Project and the Nebraska Cooperative Research Unit Program.

Our Unit leader and coordinators have several takeaways from the experience they hope to develop for future open air public events.



Unit booth on East Campus Mall Photo: Wilma Gerena



Nebraska Invasive Species Program Coordinator, Allison Zach, introducing young audience to terrestrial invasive species at the Institute for Agriculture and Natural Resources, inaugural Discovery Days and Farmer's Market, Lincoln, NE

Photo: Wilma Gerena

There's an App for that Creel Survey

Each academic year, the Department of Computer Science and Engineering at the University of Nebraska-Lincoln provides undergraduate students in the Senior Design Project course the opportunity to focus on a design-centered project employing application software and systems engineering principles to solve difficult problems. Angler Survey Project Principal Investigators Kevin Pope, Chris Chizinski, Mark Kaemingk (University of North Dakota) and Keith Hurley (Nebraska Game and Parks Commission) pitched the idea for a mobile app as a solution to replace antiquated technologies in the current database management and to allow field-based data entry for in-person interviews and on-site counts of anglers. Five industrious seniors enlisted for the challenge: Aaron Byington (Team Leader), Sam Curley, Hunter Dorhout, Daniel Rudebusch, and Josh Wendland. This team was mentored by professor Brady Garvin (Computer Science and Engineering) and project manager William Browning (Computer Science and Engineering).

The project, titled "Remote Creel Data Entry and Reconciliation," produced a mobile app using Progressive Web Application allowing the app to function on a variety of devices, whether connected or not to the internet. In that manner, clerks can still run the app through a web browser to enter data even while off line. Once online, the system interacts with the creel database in the designated server to "transfer" the data collected. The Progressive Web Application allows identification and capture -pun intendedof common entry errors, such as unreasonably large fish sizes; thus, facilitating quality assurance of data. Though the app still has room for improvement, it has improved efficiencies for clerks in the field.

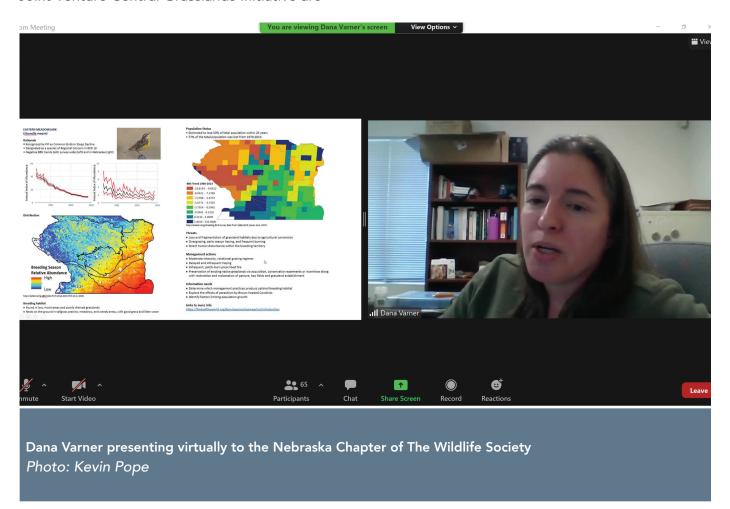


Sneak peek for the birds

Dana Varner, Science Coordinator at the Rainwater Basin Joint Venture (RWBJV), facilitated a "sneak peek" presentation on the landbird plan she and her colleagues have been working on for over a year. Although not quite ready for primetime, here is your opportunity to read about the "Planning for the Future of landbirds in the Rainwater Basin Joint Venture Region."

"A recent report that found a loss of 3 billion birds over the past 50 years sparked our interest in revising the RWBJV Landbird Plan, which was initially completed in 2013," said Varner. "We are using new information from the Partners in Flight Population Estimates Database, Breeding Bird Survey, and eBird to document the current status of and recent changes in priority breeding grassland bird species in our region. Geospatial data from the Rangeland Analysis Platform and Joint Venture Central Grasslands Initiative are

being used to map grassland habitats, document eastern red cedar encroachment, and determine direct grassland conversion to cropland." Varner continued stating that "the writing team has selected eight Planning Species and has developed population estimates, trends, and objectives and habitat objectives for each species. We've also identified 15 additional Stewardship Species." The team is currently compiling information on all these priority species in a set of species accounts that will contain information that can be used to help target conservation. The team has also hosted a threats ranking workshop where a group of experts specifically identified and described issues that negatively impact priority species. The goal is to have a final plan vetted through the RWBJV Workgroups, partners, and external reviewers for approval by the RWBJV Management Board before the end of 2021.







ANGLER BEHAVIOR IN RESPONSE TO MANAGEMENT ACTIONS ON NEBRASKA RESERVOIRS - PART III

Principal Investigator(s): Kevin L. Pope, Christopher J. Chizinski, Mark A. Kaemingk Graduate Student(s): Brandon Barlow, M.S., Kyle Hanson, M.S., Derek Kane, M.S. (2021), Caroline LaPlante, M.S., Ben Mordhorst, M.S.

Project Coordinator(s): Derek Kane

Duration: January 2019 – December 2023

Funding: Nebraska Game and Parks

Commission

Location: Statewide Nebraska FISHHUNT.UNL.EDU

Recreational angling, a billion-dollar industry, is the most influential factor structuring fish populations in inland systems. Given its importance and the reliance in North America on sportspersons to fund conservation activities (i.e., the North American Model of Wildlife Conservation), natural resource agencies invest substantial resources to manage angler-fish interactions to ensure long-term sustainability. Arguably, most of our current understanding and management efforts of recreational fisheries have been directed toward larger fisheries in rural environments. These waterbodies are highly visible resources and often attract many anglers from long distances. However, we know less about anglers in urban environments and how they interact locally with smaller waterbodies. It is important to understand angler behavior in metropolitan areas because the distribution of people on the landscape is becoming more urbanized. We anticipate that urban fisheries function differently than their rural counterparts.

Project goals are to understand 1) the participation patterns of anglers on multiple spatial and temporal scales; 2) how participation patterns of anglers' influence fish populations and associated communities; 3) how management actions influence angler participation patterns and, in turn, fish communities; and 4) interactions

and feedback mechanisms between and among angler groups and fish communities.

The project currently has five study components.

- 1. Omaha Angler Survey. Anglers were interviewed April through October onsite at Prairie Queen, Schwer, Halleck, and Standing Bear during 2019, and at Benson, Flanagan, Fontenelle, and Walnut Creek during 2021. These interviews are intended to add to statewide angler survey datasets that are valuable for assessing changes in angler participation. These extended datasets allow for relational assessments of changes in angling participation while considering environmental conditions and management actions on large spatiotemporal scales. In 2019, extrapolated angler effort estimates ranged from 1,100 hours of effort at Schwer to 34,933 hours of angler effort at Prairie Queen between April and October. Creel Clerks conducted 944 angler counts and completed 2,773 angler interviews in 2019.
- 2. Omaha Angler Effort. Anglers were counted at 22 public waterbodies in the Omaha metropolitan area from February 2019 through January 2020. In addition, the Nebraska Game and Parks Commission continued angler counts at ten of the waterbodies from April 2020 through October 2020. Angler effort was highly variable with most angler effort occurring in west Omaha. Larger waterbodies typically received the most fishing effort. Angler effort generally peaked from May through July and remained low during winter months, likely given poor ice conditions. Most anglers accessed waterbodies from the bank rather than from a boat. Half of the waterbodies surveyed received more

- than 20,000 hours of angling effort with four of these waterbodies receiving more than 60,000 hours comparable to some of our larger, rural fisheries in the state. Towl Pond and Halleck received the most angler effort per unit of area, with approximately 7,500 angler hours per acre. This magnitude of angler effort broke a previous record set at Bowling Lake in Lincoln, Nebraska.
- 3. Omaha Recreation Survey. Recreational anglers express a variety of preferences, motivations, and specializations across Nebraska, making angling forecasting and management difficult. We surveyed 2019 angler license holders in Omaha during February and March 2020 using mailsurveys (email and pre-paid envelopes) in collaboration with the University of Nebraska's Bureau of Sociological Research, with an intent to quantify demographics, preferences, motivations, and visitation rates to the Omaha metropolitan waterbodies (and other prominent Nebraska reservoirs) during 2019, and to gather information about anglers' recreational budgets (e.g., complementary or competing recreational activities to fishing). We understand that demography changes across a region, but it is unclear whether angling behaviors change with this demographic gradient. We are working to understand the heterogeneous nature of angler behavior across Nebraska by evaluating responses across residential tapestries, or geographic regions with similar demographic characteristics like average age and median income. Tapestries with similar demographics are expected to express similar predominant angler behaviors like number of days fished, targeted species, and gear used. Data gathered in this study will be combined with historic data already collected by the Nebraska Cooperative Fish and Wildlife Research Unit (or the Nebraska Game and Parks Commission)
- and used to compare patterns in angler participation between urban and rural fisheries. This information may also be used to assess responses of anglers to periodic management actions (such as fish stockings). We believe this knowledge will be useful to managers, as it will provide valuable insight on both understanding current angler activity and predicting future angler activity according to demographic characteristics and landscape changes (i.e., urbanization) across a region.
- 4. Understanding Variation of Recreational Angler Effort. Waterbody size (i.e., surface area) accounted for 60% of the variance in angler effort across 73 Nebraska waterbodies between 2009 and 2019. The relationship between the size of a resource and the amount of use the respective resource receives can be utilized by natural resource managers to produce broad-scale estimations of resource system use, guide the allocation of management resources according to expected resource system use, predict how changes in resource system size may affect the amount of use, and highlight how different user groups may interact with resource systems of various sizes. For instance, utilizing the waterbody

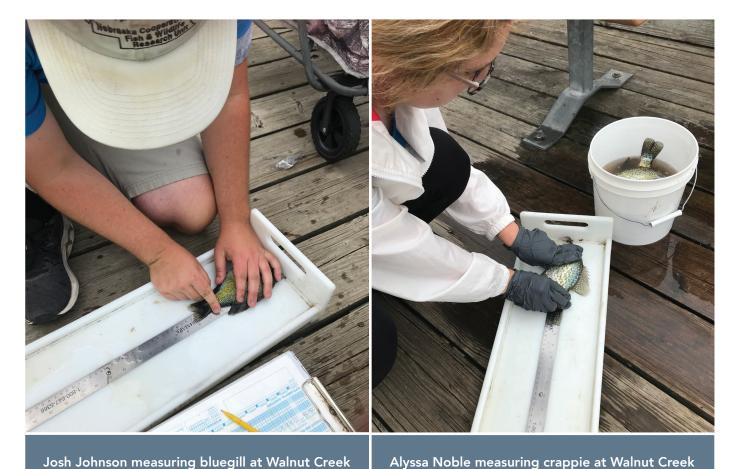


Catch at Walnut Creek Lake, Omaha, NE *Photo: Alyssa Noble*

size-angler effort relationship allows us to predict that over 4,750,000 hours of angler effort are exerted annually on public waterbodies in Nebraska. The relationship between waterbody size and angler effort also differs based on how angler access the waterbody (i.e., via the bank or a boat). Boat angler effort increases at a higher rate as waterbody size increases compared to bank angler effort.

5. Recreational Use of Valentine National
Wildlife Refuge. Valentine National
Wildlife Refuge is an important socialecological system that provides a variety
of recreational opportunities for visitors.
However, the types and frequency of
activities that occur on the refuge and the
sociodemographic characteristics of visitors
are poorly understood. We used 789
completed surveys (from 2,251 distributed

windshield surveys; 35% response rate) to understand participation and potentials for social conflicts and ecological impacts of hunting, fishing, and wildlife watching (including touring, hiking, photography, and environmental education) groups. The fishing group was the predominate group (78%) on the refuge from July 2017 to July 2018. Social and ecological intensities varied across lake types (e.g., fishing vs. non-fishing) and seasons, highlighting intense impact areas and periods on the refuge. Accounting for the diverse recreational activities and social and ecological intensities will allow managers of Valentine National Wildlife Refuge and other social-ecological systems the ability to concomitantly preserve ecological resources, prioritize conservation efforts, and minimize visitor conflicts.



Lake, Omaha, NE

Photo: Derek Kane

32

Lake, Omaha, NE

Photo: Derek Kane

AQUATIC INVASIVE SPECIES (AIS) PREVENTION PROGRAM

Principal Investigator(s): Kevin L. Pope Project Coordinator(s): Allison Zach Duration: April 2011 – December 2022 Funding: U.S. Fish and Wildlife Service;

Nebraska Public Power District **Location:** Statewide Nebraska **NEINVASIVES.COM**

The Nebraska Invasive Species Program has facilitated development and implementation of a Nebraska Aquatic Invasive Species Prevention Program. Goals are to:

- Decrease the risk of introductions of aquatic invasive species in Nebraska through a watercraft inspection and decontamination program;
- Increase public awareness of aquatic invasive species through an integrated outreach and education program; and
- Increase local and regional collaborations for prevention and management of aquatic invasive species through directed and coordinated communications.

Boater surveys, watercraft inspections and outreach activities have been conducted since 2011 to increase public awareness of aquatic invasive species and promote prevention actions among watercraft users. These efforts continued during 2021 focused in Lincoln and Omaha utilizing the Regional Watercraft Inspection and Decontamination Data Sharing System which includes more than 200 locations in the USA and Canada.

In addition, the Coordinator served on regional aquatic invasive species panels to coordinate prevention and management efforts across state lines, delivered webinars to various audiences, provided over 15,000 outreach materials to

partners, and collected water samples as assistance to the U.S. Geological Survey eDNA pilot study on zebra mussel detection.

Nebraska had three zebra mussel infested waterbodies in June 2021: Lewis and Clark Lake, Missouri River, and Offutt Air Force Base Lake. The water level at Glenn Cunningham Lake in Omaha was drawn down during 2018 in an effort to freeze and kill a zebra mussel infestation; this lake reopened during 2021 and will be closely monitored to determine if the eradication effort was successful.

Advertisements were ran in Nebraska Game and Parks Commission's guides and other printed publications, and on two billboards. A trailered CD3 waterless watercraft cleaning station was purchased during 2021; a stationary unit was already in place at Lewis and Clark Lake. We monitor use of both units through an online platform.



Jackson Sash performing a motor boat inspection, and CD3 unit (insert)

Photo: Marcila Goben (inspection), Allison
Zach (CD3 unit)

Assessment of Angler Use and Catch During 2020 at Sutherland Reservoir, Nebraska

Principal Investigator(s): Kevin L. Pope Project Coordinator(s): Derek Kane Duration: March 2020 – January 2022 Funding: Nebraska Public Power District Location: Sutherland Reservoir, Nebraska

The Nebraska Public Power District is a publicly-owned utility and a political subdivision of the State of Nebraska. Its chartered service territory is vast, including all or parts of 86 of Nebraska's 93 counties. The utility works through partnerships to help serve more than an estimated 600,000 Nebraskans with retail and wholesale electric power and energy-related services. The Nebraska Public Power District owns and manages Sutherland Reservoir, a 3,000-surface-

acre reservoir located three miles south of the Interstate 80 Exit at Sutherland, Nebraska, as part of its hydropower system with the Nebraska Game and Parks Commission overseeing most of the recreation areas at this reservoir. The purpose of this study is to estimate angler use and catch at Sutherland Reservoir, Nebraska, from April through October 2021 (intended 2020, but delayed due to pandemic). Specifically, we obtained monthly estimates of angler pressure, catch, and harvest. This information will allow the Nebraska Public Power District to evaluate angler use and influence of the fishery at Sutherland Reservoir, and is a required component of its hydropower operating license.





Angler Interviews at Sutherland Reservoir, Sutherland, NE *Photo: Meghan Manary*

BAT CONSERVATION AND RECOVERY IN NEBRASKA AND WYOMING

Principal Investigator(s): Dirac Twidwell,

Kevin L. Pope

Project Coordinator(s): Baxter Seguin (February 2019 – June 2020), Christopher Fill

Duration: February 2019 – January 2022 **Funding:** Nebraska Game and Parks Commission; U.S. Fish and Wildlife Service **Location:** Statewide Nebraska, statewide Wyoming

There are mounting concerns for North American bats due to continuing and emerging threats from disease, habitat loss, fragmentation, and wind-energy development. Though these threats are likely to increase in severity, there is an opportunity to improve our knowledge of bat occurrence and habitat use, to learn how landscape changes impact local bat populations, and to establish regional monitoring that can inform local and national resource management decisions. This is especially true across Nebraska, which encapsulates edges of several bat species' ranges.

Acoustic microphone for transect survey, Jefferson County, NE Photo: Christopher Fill We implemented the North American Bat Monitoring Program (NABat) in Nebraska to survey statewide bat species distributions and activity. Thirty-five monitoring areas were established across the state to sample with bat acoustic detectors each year, comprising about 120 sites, and involving about 100 landowners. Much of these data are collected by volunteers (citizen scientists); we held workshops and training sessions to teach these novice scientists how to operate survey equipment. We are excited by our successes for building an extensive and reliable citizen science network for bat monitoring.

Thus far, we have documented 12 bat species during our monitoring efforts, including some that have experienced dramatic population declines in other parts of the country from the invasive fungal disease that causes white-nose syndrome. Some species have been found statewide, whereas other species were detected only in certain areas of Nebraska. Overall bat activity is generally greatest in eastern parts of the state, and least in central and southwestern parts of the state, perhaps an effect of fewer available tree roosts. We will continue to sample these areas for evidence of activity changes and range expansions by these bat species.



Bat detector in Jefferson County, NE *Photo: Christopher Fill*

COMPREHENSIVE EVALUATION OF THE NEBRASKA OUTDOOR ENTHUSIAST

Principal Investigator(s): Christopher J. Chizinski, Joseph J. Fontaine, Kevin L. Pope **Data Scientist:** Nathaniel Price (September

2016 – October 2019)

Duration: September 2016 – June 2022 **Funding:** Nebraska Game and Parks

Commission

Location: Statewide Nebraska FISHHUNT.UNL.EDU

Fishing and hunting license sales and taxes on fishing and hunting equipment are vital sources of funding for wildlife management agencies, and in many cases, management objectives are met under the stewardship of sportspersons. The dependence on hunters and anglers by management agencies makes the North American Model of Conservation unique, but vulnerable to declining participation in outdoor recreation.

The U.S. Fish and Wildlife Service supports the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation Survey in a nationwide effort to understand the sporting public. Conducted every five years, the National Survey identifies generalizations concerning patterns of outdoor enthusiast participation in the USA. Although useful for setting broad policy, the spatial and temporal scales of this National Survey limit the capacity for state fish and wildlife agencies to affect local participation within their states. To overcome these limitations, many state agencies conduct surveys of individual license holders. However, state surveys are often highly directed, limiting their applicability across user groups and state boundaries.

Given the challenges of both national and state surveys, there is a need to bridge the information gap and understand sportspersons at spatial and temporal scales that may more directly assist in creating hunting and angling opportunities. We are analyzing a comprehensive database on license holders in Nebraska with the goal of helping inform and direct wildlife and fisheries management, as well as recruitment and retention efforts within the state. To date, we have documented that movement of sportspersons across activity groups (hunting only, fishing only, a combination of hunting and fishing, and inactive), inferred from license purchases, is limited and

varies little based on initial group participation.

In addition, we developed a customizable, open-source, web-based application—huntfishapp—that allows users to easily interact with a license database. The HuntFish app serves as an informational resource, provides a framework for sharing information on license sales across an agency, and allows agencies and non-governmental organizations to become more knowledgeable of their customer base.

DEVELOPMENT OF A MOLECULAR APPROACH TO AGE PACIFIC WALRUSES: A NOVEL APPLICATION OF EPIGENETIC AGING FOR CLOSE-KIN MARK-RECAPTURE

Principal Investigator(s): Sarah A.

Sonsthagen, Robert Wilson, William Beatty

(U.S. Geological Survey)

Duration: October 2019 – October 2023 **Funding:** U.S. Fish and Wildlife Service; U.S.

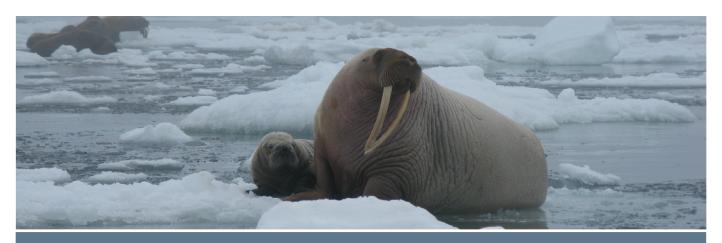
Geological Survey

Location: Bering Sea, Chukchi Sea, Alaska

The Pacific walrus is an ice-associated pinniped that ranges over continental shelf waters in the Bering and Chukchi Seas. Sea ice provides habitat for numerous Pacific walrus life history events and provides a platform for animals to rest between foraging bouts at productive, remote offshore areas. Estimating abundance and vital rates of the Pacific walrus population is, therefore, logistically and scientifically challenging. In 2013, the U.S. Fish and Wildlife Service initiated a five-year genetic mark-recapture project to test the efficacy of an alternative approach to estimating population abundance, survival, and reproduction. Age is an important piece of information in mark-recapture studies that can reduce uncertainty

and increase precision of parameter estimates. Although a method to age walrus based on facial characteristics is available, preliminary results indicated a high level of observer error. An improved aging technique is needed to allow development of more complex traditional mark-recapture models and aid development of close-kin mark-recapture models.

We are developing an approach to age walruses based on epigenetic signatures, which only requires DNA from sampled individuals. We have identified potential age-related epigenetic markers in walrus by whole methyl DNA sequencing samples derived from calves (0 year old) and adults (≥6 years old) with museum specimens of known age based on tooth cementum annuli analyses. We are partnering with coastal communities to obtain samples from hunter harvested walrus to quantify the accuracy and precision of age-related markers across age classes.



Walrus with pup on ice floe, Alaska Photo: Sarah Sonsthagen

DEVELOPMENT OF A RESERVOIR HABITAT SAMPLING FRAMEWORK IN ARKANSAS

Principal Investigator(s): Jonathan Spurgeon **Graduate Student(s):** Jamie Kindschuh, M.S.

(University of Arkansas at Pine Bluff) **Duration:** August 2018 – June 2021 **Funding:** Arkansas Game and Fish

Commission; University of Arkansas at Pine

Bluff; U.S. Department of Agriculture

Location: Arkansas

Reservoirs are complex man-made systems with ecosystem processes characteristic of both lotic and lentic systems. As reservoirs age, degradation of physical habitat may occur at faster rates compared to lotic or lentic systems individually. For instance, wood structure remaining in reservoirs following impoundments is broken down in time through biologic (e.g., decomposition) and environmental (e.g., winddriven waves) conditions. Limited input of wood structure from the surrounding riparian zones may occur in reservoirs given potential decoupling of source material at the water-reservoir interface through time. Furthermore, open-water habitats may become limiting following sedimentation of reservoirs whereby an increase of shallow water may facilitate rapid expansion of submergent and emergent vegetation. As physical habitat conditions change within a reservoir, management interventions may be necessary to maintain or increase fish population production and species diversity to desired levels.

Distance sampling is a technique used to estimate density and abundances of plant and animal populations. The perpendicular distances from a line transect to individuals are used to estimate density and abundance within a defined area. Multiple transects can be placed over a survey area to increase sample size, decrease error, and gain greater accuracy of population densities and abundances. Distance sampling performed in

terrestrial systems requires the use of an observer that follows a predefined transects and visualizes or hears individuals. The perpendicular distance from the transect line to the individual is then measured or estimated. However, aquatic systems usually require the use of a boat to navigate and objects of interest often lie beneath the water's surface, thus, making distance sampling methods difficult to apply. Furthermore, divers may lack the ability to see sufficient distances on either side of transects given water clarity. Side-scan sonar technology enables visualization beneath the water's surface and may enable the use of distance sampling methods to estimate density and abundance of habitat components including physical structure in reservoir systems. Combining side-scan sonar with established distance survey techniques may enable quantitative estimates of physical-structure distribution and abundance at reservoir-wide spatial scales. Advancements in remote sensing have provided ecologists with a quick and inexpensive way to survey habitat. Satellite remote sensing has been used to monitor wetlands, forests, land use changes, agriculture, and harmful algae blooms. Recently, mapping using remote sensing equipment has evolved from satellites to aerial drones. Aerial drones are easy to maneuver and can provide high resolution images at large scales, thus, potentially making whole reservoir habitat surveys possible. Wholereservoir habitat surveys can then be compared over spatiotemporal scales to assess changes in habitat quantity and quality. Combining orthomosaic imagery from aerial drones and supervised classification techniques in Graphic Information System (GIS) programs may provide management agencies with a quick and accurate method to identify vegetation.

GENES ACROSS THE LANDSCAPE: EVALUATING MIGRATORY CONNECTIVITY IN THE RUSTY BLACKBIRD

Principal Investigator(s): Sarah A.

Sonsthagen, Robert Wilson, Steve Matsuoka (U.S. Geological Survey), Jim Johnson (U.S. Fish and Wildlife Service), Dean Demarest (U.S. Fish and Wildlife Service), Luke Powell (University of Glasgow)

Duration: October 2017 – October 2023 **Funding:** U.S. Fish and Wildlife Service; U.S.

Geological Survey

Location: Boreal region of North America and

eastern United States of America

The rusty blackbird has lost 90% of its global population since 1970 and is predicted to lose another 50% in the next 19 years. The rusty blackbird has an immense migratory range (breeding in remote areas across the continental boreal biome, wintering over the eastern half of United States of America) and the many stressors suspected to be contributing to its decline are hypothesized to vary widely across the annual cycle. More comprehensive knowledge of migratory connectivity is needed to understand the causes of decline and efficiently link conservation efforts across this species' annual cycle. A foundational step in evaluations of migratory connectivity are assessments of population genomic structure, as those data provide a basis for researchers to infer the natal origins of birds sampled at key migration stopover sites and important wintering areas.

The population decline raised the following questions, "Are breeding areas structured across their range?", "How are breeding areas linked across the annual cycle?", and "What breeding areas may be more susceptible to environment induced population declines?"



Rusty Blackbird Photo: David Tessler

By applying a population genomics approach, we were able to determine that rusty blackbirds are structured across their breeding range with areas in the east experiencing greater restrictions in dispersal than western counterparts. Given the presence of genetic structure, we are obtaining samples from stopover sites and winter areas to evaluate migratory connectivity by assigning birds back to natal areas. We are testing for genotypeenvironment association to evaluate the adaptive capacity of rusty blackbirds and identify areas of high conservation value and genomic vulnerability. We partnered with the Rusty Blackbird International Working Group, Alaska Department of Fish and Game, Audubon New Hampshire, Canadian Wildlife Service, Biological Research Institute, and researchers to obtain samples.

IMPROVING OUR UNDERSTANDING OF THE POPULATION STRUCTURE AND HARVEST COMPOSITION OF AMERICAN COMMON EIDERS

Principal Investigator(s): Sarah A.

Sonsthagen, Chris Dwyer (U.S. Fish and Wildlife Service), Scott Gilliland (Environment and Climate Change Canada)

Duration: October 2013 – October 2022 **Funding:** U.S. Fish and Wildlife Service; Sea Duck Joint Venture; U.S. Geological Survey;

Canadian Wildlife Service

Location: Coastal regions in northeastern

North America

Each year, common eiders migrate from nesting areas along the northern coastlines to ice-free waters farther south where birds from several different breeding areas form winter flocks.

Along the Atlantic coast, there are differences in population trends among the main eider breeding areas; numbers of breeding birds in northern Canada are increasing, those in central Canada are stable, whereas numbers of birds in the Gulf of Maine are declining. Declines in the Gulf of Maine raised concerns among biologists and hunters. As common eiders are susceptible to overharvest, in

Female Common Eider Photo: Kyra Harvey, USGS - Eastern Ecological Science Center

2016, management agencies augmented harvest regulations in an attempt to reduce hunting pressure on eiders that breed in the Gulf of Maine.

Differences in population trends and changes in harvest regulations raised two questions, "Where are birds from different breeding areas harvested, and in what proportion?" and "Have changes in hunting regulations affected harvest rates differently among populations?"

The tendency of female common eiders to breed in the area where they hatched is so strong that each breeding population has a unique genetic fingerprint. Therefore, we applied genetic methods to determine the population structure of American common eiders and to probabilistically assign sport-harvested common eiders to their breeding (source) areas. This information will help determine whether this subspecies should be managed differently across its range and if changes in harvest composition occurred following the implementation of harvest regulation changes for sea ducks in the Atlantic Flyway.

The project is finalizing genetic information collected from common eiders harvested in the USA and Canada for the 2013 – 2014 to 2019 – 2020 seasons (n = 1210) and 30 breeding reference locations (n = 810). We partnered with the Nunastsiavut Government and the NunatuKavut Community Council to collect samples from Labrador. Hunter harvested wings were provided by the U.S. and Canadian Parts Collection Surveys.

INFLUENCE OF MULTI-SCALE HABITAT CHARACTERISTICS ON PALEBACK DARTER OCCUPANCY

Principal Investigator(s): Jonathan J. Spurgeon, Steve Lochmann (University of Arkansas at Pine Bluff)

Graduate Student(s): Katie Morris, M.S., Maxwell Hartman, M.S. (University of

Arkansas at Pine Bluff)

Duration: May 2020 – June 2023 **Funding:** Arkansas Game and Fish

Commission; U.S. Fish and Wildlife Service

Location: Arkansas

Freshwater fishes are in decline at a global scale following wide-spread anthropogenic alteration including extensive habitat change. Conservation of freshwater fishes is limited, in part, due to deficiencies in understanding regarding how local- and broad-scale habitat characteristics influence species' occupancy across landscapes. Identification of multiscale habitat characteristics that drive species' occupancy may inform the types and scale of habitat management projects needed to facilitate species' expansion into historical distributions or identify areas suitable for potential translocation within a species' native range. Furthermore, information is needed regarding how species complete parts of their life history including reproduction. The proposed objectives of this project are to 1) quantify regional occupancy and capture probability, 2) model the relative influence of local- and broadscale habitat characteristics on occupancy and capture probability, and 3) assess local- and broad-scale habitat characteristics associated with spawning of Paleback Darter (Etheostoma pallididorsum). The proposed study will occur in the headwater and upper Ouachita (including the Caddo River) drainages within west-central Arkansas. We will use a standard occupancy study design (i.e., all sites visited a minimum number

of times) to estimate occupancy and detection probability for Paleback Darter. Local-scale (e.g., streambed gradient, substrate, in-stream and riparian habitat features, water temperature, and water flow) and broad-scale (e.g., stream order, stream fragmentation, location within watershed, watershed land-use) habitat characteristics will be estimated using in-stream measurements and geographic information system (GIS) software. Predictions of species' occupancy and detection probability along with the habitat-specific model coefficients estimated with this study can provide quantifiable measures to guide state and federal conservation designations for Paleback Darter and inform future habitat rehabilitation projects designed to increase habitat availability for multiple life stages including spawning.



Paleback Darter
Photo: roughfish.com

Inventory and Assessment of Stream Crossings and their Influence on Movement of Species of Greatest Conservation Concern within Ouachita Highlands Ecoregion in Arkansas

Principal Investigator(s): Jonathan J.

Spurgeon

Graduate Student(s): Katie Morris, M.S. (University of Arkansas at Pine Bluff) Duration: May 2020 – June 2023 Funding: Arkansas Game and Fish

Commission; U.S. Fish and Wildlife Service

Location: Arkansas

There is growing concern that fishes of conservation concern are limited by their ability to move and access habitats necessary to complete key aspects of their life history. Fish movement is affected to an unknown degree due to thousands of low-water road crossings that are part of Arkansas' rural road networks. Movement among habitats is particularly necessary for fishes of conservation concern that exhibit restricted ranges from endemism, anthropogenic alteration, or a combination of the two. Restricted movement of individuals may severely influence the ability of species to recolonize areas within a watershed following localized extirpations within watersheds. Stream crossings are an anthropogenic alteration that may greatly reduce fish movement within and among streams due to physical metrics of the crossing (i.e., perch height, width/depth ratio, entrenchment ratio, and water velocity). At the same time, Arkansas has great diversity of stream fishes, many which are endemic to few watersheds where stream crossings are prevalent. There is a great need to replace barriers with new structures that improve movement for fishes as a means to facilitate conservation of species of greatest conservation concern. However, limited understanding exists regarding the combination

of metrics that create barriers for many species of greatest conservation concern including the Paleback Darter, Caddo Madtom, Ouachita Darter, Beaded Darter and more common species with very distinct genetic lineages including the Ouachita strain of Smallmouth Bass. Capacity and funding are limited to remove barriers and it is imperative that our resources are utilized efficiently and effectively to maximize ecological benefits for species of greatest conservation need. Two major needs exist to ensure ecological benefits are obtained with barrier removal and that limited resources for barrier removal are used effectively. First, we lack a sufficient stream crossing inventory populated with stream-crossing metrics from which to categorize stream crossings as likely barriers. Second and related, we lack a predictive tool that uses inventory metrics to prioritize crossings based on the likelihood a crossing prevents fish movement. We anticipate a multi-phase project over the next several years to address the information gap regarding the limited inventory of stream crossing metrics, the lack of a predictive tool to assess crossing probability of being a barrier, and assessment of the influence of barrier removal on colonization of habitats by species of greatest conservation need throughout Arkansas. Our goal for phase-I of the project is to develop a predictive tool (e.g., random forest model) based on variables derived from the Southeast Aquatic Resources Partnership (SARP) for use in prioritizing stream crossings that pose significant threats to disrupting fish community structure in Arkansas streams.

Investigating the Role of Hybridization in the Decline of Gray-Headed Chickadees

Principal Investigator(s): Sarah A.

Sonsthagen, Robert Wilson, Jim Johnson (U.S. Fish and Wildlife Service), Travis Booms (Alaska Department of Fish and Game), Steve Matsuoka (U.S. Geological Survey)

Duration: March 2020 – October 2023

Funding: U.S. Geological Survey

Location: Alaska and northwestern Canada

The gray-headed chickadee was historically common in Alaska and northwestern Canada. In recent years, populations have been extirpated or declined. Based on a thorough review of best available information, species numbers are in the hundreds to low thousands and are scattered across Alaska and the Yukon Territory. Coincident with the decline of gray-headed chickadees, the boreal chickadee has increased in abundance or recently colonized areas once occupied by gray-headed chickadees.

The shift in the most common chickadee species present in areas where gray headed-chickadees were once common, raised the following questions, "Has interspecific competition for resources lead to the decline and extirpation of gray-headed chickadees?" and "Are gray-headed chickadees hybridizing with boreal chickadees resulting in demographic or genetic swamping and subsequent population decline?"

Understanding the role, if any, hybridization has on the decline of gray-headed chickadees is an important first step in defining and prioritizing appropriate and effective conservation recovery actions. Investigators are evaluating the extent of hybridization between the declining gray-headed chickadee and the recent colonizer the boreal chickadee with two analytical approaches – estimating gene flow between species and temporal changes in genetic diversity within

boreal chickadees – and reduced representation genomic data. Project investigators are partnering with museums and the Canadian Wildlife Service to obtain samples.



Gray-headed Chickadee Photo: Alaska Department of Fish and Game



JUNIPER INVASIONS AND LANDSCAPE INTERVENTION POTENTIAL: A STATEWIDE ASSESSMENT

Principal Investigator(s): Dirac Twidwell **Graduate Student(s):** Dillon Fogarty, Ph.D.

Duration: January 2016 – May 2022 **Funding:** Nebraska Game and Parks

Commission

Location: Statewide Nebraska
CEDARLITERACY.UNL.EDU

Eastern redcedar invasion is a major threat to grasslands in the central Great Plains. Our overall objective is to:

- Assess the vulnerability of Nebraska's imperiled grasslands to redcedar invasion;
- Develop predictive tools that enhance the potential to implement landscape interventions that prevent the spread of redcedar or restore degraded wildlife habitat following transformation to a woody-dominated state.

Over the last year we have developed a spatially explicit risk assessment tool for woody encroachment in rangelands, quantified effective seed dispersal distance for redcedar invasions, developed a spatially explicit framework to assess statewide vulnerability to redcedar invasions, and developed a guide for reducing risk and vulnerability to woody encroachment in rangelands.

Development and integration of these technical products has allowed us to work directly with stakeholders on the co-production of new strategies for implementing landscape interventions. Our spatially-explicit risk assessment model uses remotely sensed data on the co-occurrence of grass and woody plants to provide a risk assessment of woody transitions in rangelands. Overall, this model shows the growing risk of woody transitions and helps to identify where landscape interventions can be implemented to avoid large-scale woody transitions. This product has garnered interest among a diverse mix of conservation agencies and was adopted as a key component of the Rangeland Analysis Platform to inform large-scale conservation planning in the Great Plains. Our vulnerability framework and guide for managing woody encroachment identifies how landscape interventions are most effectively used to reduce risk and vulnerability. This framework breaks down risk and vulnerability across all stages of the woody encroachment process and provides a road map for more integrated management. This framework now serves as a foundation for statewide and regional strategies for tackling woody encroachment used by Nebraska Game and Parks Commission and the Natural Resources Conservation Service, Working Lands for Wildlife.





Eastern redcedar (Juniperus virginiana) invasion and grassland landscape in the Nebraska Sandhills Photo: Dillon Fogarty

Monitoring, Mapping, Risk Assessment, and Management of Invasive Species in Nebraska

Principal Investigator(s): Kevin L. Pope
Program Coordinator(s): Allison Zach
Duration: January 2020 – December 2024

Funding: Nebraska Game and Parks

Commission

Location: Statewide Nebraska **NEINVASIVES.COM**

The Nebraska Invasive Species Program continues to administer a multi-institutional program to:

- Provide outreach to and facilitate communication among stakeholders regarding biological invasions, coordinate the Nebraska Invasive Species Council, and assist as needed with any additional legislation regarding invasive species;
- Develop management tools including an invasive species adaptive management plan, a risk analysis for high-risk invasive species in Nebraska, a multi-agency prevention protocol for preventing the spread of invasive species (terrestrial and aquatic), and identification of invasive species introduction pathways.

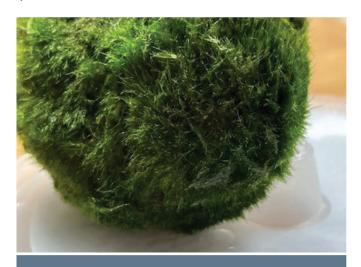
The Nebraska Invasive Species Program coordinated meetings of the Nebraska Invasive Species Advisory Council, which was created by a law in 2012. This Council has 32 members and evaluates invasive species issues and develops watch lists and management plans. It acts as an advisory council to the Nebraska Legislature and Governor on invasive species issues. The Council created a 2-sided outreach card in 2020 and updated its adaptive management in 2021.

The Nebraska Invasive Species Program (Program) coordinated with the Nebraska Game and Parks Commission, the Nebraska Department of Agriculture, the U.S. Department of Agriculture, and the U.S. Fish and Wildlife Service when moss

balls were found with zebra mussels attached during March 2021 in Nebraska. The Program website has a reporting tool; new infestations of zebra mussels and other invasive species have been confirmed following reports by concerned citizens. Reports are referred to an appropriate invasive species expert for investigation and guidance.

The Program Coordinator, Allison Zach, serves on regional invasive species panels and organizations to coordinate invasive species efforts across state lines, and was elected to the North American Invasive Species Management Association during 2021. Zach attended and presented at invasive species conferences, workshops and meetings with local and regional groups. The Program coordinated with the Nebraska Game and Parks Commission to conduct invasive species webinars and disseminate technical-assistance materials.

In addition, the Program provided technical assistance to a variety of agencies and organizations during 2020 and 2021 to increase early detection and management of invasive species.



Moss ball
Photo: Idaho State Department of Agriculture

POPULATION DEMOGRAPHICS AND MOVEMENT PATTERNS OF SILVER CARP AND BIGHEAD CARP IN THE ARKANSAS AND WHITE RIVERS, ARKANSAS

Principal Investigator(s): Jonathan J. Spurgeon, Steve Lochmann (University of Arkansas at Pine Bluff)

Graduate Student(s): Andrew Althouf, M.S., Jeffery Stevens, M.S. (University of Arkansas at Pine Bluff)

Duration: January 2021 – September 2023

Funding: Arkansas Game and Fish

Commission; U.S. Fish and Wildlife Service

Location: Arkansas

Silver Carp and Bighead Carp have invaded much of the Mississippi River basin and pose threats to ecological functioning. However, despite much work on the two species in some locations (i.e., upper Mississippi River basin), there is a paucity of knowledge regarding basic population demographics in the lower Mississippi River basin. We will assess demographics including age structure, size structure, survival, and relative abundance of both Silver Carp and Bighead Carp in the Arkansas River and the White River. Furthermore, we will assess movement at local and broad spatial scales using a combination of passive and active tracking methods. Results from this study will aid in defining population boundaries, provide baseline demographic parameters for population modeling, and assess potential areas (e.g., lock and dam complexes or backwater areas) where management actions, including removal, may be feasible.



Large group of silver carp jumping out of water Photo: U.S. Geological Survey

RAINWATER BASIN JOINT VENTURE SCIENCE

Principal Investigator(s): Kevin L. Pope, Andy A. Bishop (Rainwater Basin Joint Venture Partnership)

Science Coordinator: Dana Varner

Duration: October 2014 – December 2023 **Funding:** Rainwater Basin Joint Venture

Location: Statewide Nebraska

RWBJV.ORG

The Rainwater Basin Joint Venture's (RWBJV) mission includes science-based conservation efforts for all priority bird habitats throughout Nebraska's mixed-grass prairie region. The Management Board of the Rainwater Basin Joint Venture is committed to implementing the U.S. Fish and Wildlife Service's Strategic Habitat Conservation model. This science-based model requires a commitment of resources and time to develop a strong biological foundation for delivering conservation planning and designing research and monitoring efforts. To fulfill this commitment, the University of Nebraska-Lincoln hired Dana Varner as Science Coordinator for the Rainwater Basin Joint Venture in October 2014. Varner works with Rainwater Basin Joint Venture science staff to develop models and

decision support tools that help identify areas where conservation is most likely to benefit migratory birds and other wildlife. In addition, the Coordinator helps monitor and evaluate the success of ongoing and past habitat conservation projects, collaborating with researchers from various federal and state agencies and nongovernmental conservation organizations.

Varner recently worked with a group of partners to complete a revision of the Rainwater Basin Joint Venture Landbird Plan. This new plan includes population objectives for eight priority species, grassland habitat objectives, and conservation strategies to help guide partnership efforts. She is a member of the North American Waterfowl Management Plan Integration Steering Committee, and has helped organize a series of webinars that explore the societal benefits and ecosystem services provided by waterfowl and wetland conservation work (see nawmp.org for more information). Varner is involved with several other projects currently in progress including an annual spring waterfowl survey in the Rainwater Basin region and an inventory of eastern red cedar in the Central Loess Hills.



Rainwater Basin Joint Venture website landing page banner, https://rwbjv.org Web photo clip

VEGETATIVE AND LARGE CARNIVORE RESPONSES IN AN ENCROACHED LANDSCAPE

Graduate Student(s): Hugh Ellerman, M.S. (2020)

Duration: August 2017 – December 2020 **Funding:** University of Nebraska–Lincoln; Nebraska Game and Parks Commission

Location: Statewide Nebraska

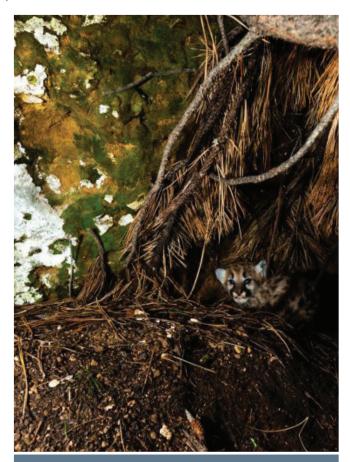
This project concerns vegetative and large carnivore responses to tree encroachment in Nebraska and is split into three parts with distinct goals.

First, the efficacy of grassland restorations by tree removal in southeast Nebraska was determined by revisiting sites where tree removals were used in grassland restorations in 2006, to determine if these sites have been re-invaded or not. Vegetative community composition (particularly invasive tree species) and structure (measured with visual obstructing readings) were quantified. Results indicate, in the absence of continued management, these sites were re-invaded in a relatively short period. This suggests that incentives to cost share tree removals should include requirements for future management.

Second, the efficacy of oak recruitment following tree removal in northeast Nebraska was determined to assess oak survival and subsequent tree invasion. This strategy is part of an effort to increase oak regeneration in riparian woodlands where such regeneration has suffered, particularly due to shading by encroaching invasive trees and high herbivory rates. Sites where tree removals occurred and oaks were planted along the Niobrara River were revisited a decade later to quantify oak survival and invasive tree presence to determine whether this method of tree removal followed by oak planting is effective for restoring oak presence in Nebraska's riparian woodlands at

the sites. Herbivory led to a near complete failure of oak recruitment; cedar removal enhanced oak establishment.

Third, mountain lion use of encroaching Eastern redcedar in the sandhills. Data from two mountain lions in the Niobrara Valley, were analyzed, one a probable young male without an established home range, and a second cat with an established home range. Both animals largely utilized areas in the Valley, with high topographic relief and tree cover (Ponderosa pine and cedar). Both cats also traveled out of the valley on occasion, and utilized invasive and planted red cedar, and crop center pivots, among other habitats.



Mountain lion den under a rock overhang Photo: Justin Haag, NEBRASKAland

WETLANDS OF NEBRASKA: AN OUTREACH AND EDUCATION PROJECT

Principal Investigator(s): Kevin L. Pope,

Michael Farrell, Michael Forsberg

Producer and Project Manager: Mariah

Lundgren

Producer(s): Ethan Freese, Grant Reiner,

Brooke Talbott

Duration: October 2019 – December 2022 **Funding:** Environmental Protection Agency;

Nebraska Game and Parks Commission

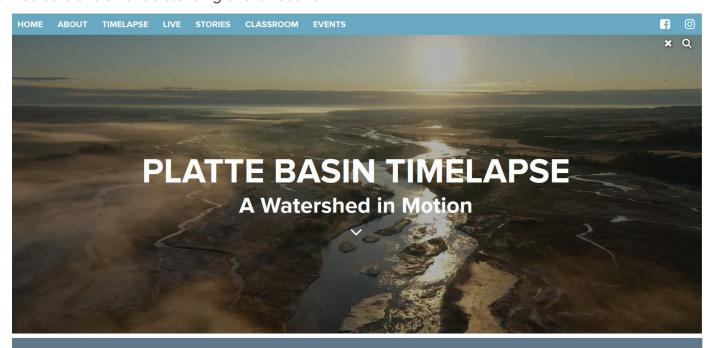
Location: Statewide Nebraska

PLATTEBASINTIMELAPSE.COM

Informing people about Nebraska's wetland resources and the important services these systems provide is a keystone to continuing to develop and refine our state's wetland program. The main objective of this project is to produce and distribute a series of integrated wetland outreach and education products to increase awareness of the importance of wetlands in Nebraska and an understanding of the need for

wetland conservation. These products will include an updated Guide to Nebraska's Wetlands, a Student/Teacher Wetland Activity Booklet (Wetland-ology), an array of multi-media products about wetlands, and an updated wetlands section of the Nebraska Game and Parks Commission's website hosting, or providing links to, much of the information generated. These products will provide up-to-date information about Nebraska's wetlands, which will be aligned with the Nebraska Statewide education standards and will deliver information in a format that is favorable to today's audiences.

Partners on the project include Nebraska Game and Parks Commission's award-winning NEBRASKAland Magazine (outdoornebraska. gov), the Platte Basin Timelapse (PBT) group at the University of Nebraska–Lincoln (UNL), the Nebraska Cooperative Fish and Wildlife Research Unit at UNL, and Ducks Unlimited.



Platte Basin Timelapse website landing page, https://plattebasintimelapse.com/ Web photo clip





TEACHING

Kevin Pope

Spring 2021: Natural Resources (NRES) 965, Managed Aquatic Systems

Anthropogenic disturbances are common place in inland waters of developed and developing countries. Team taught with Mark Pegg (UNL-SNR) and Samodha Fernando (UNL-Animal Science), this course is designed to increase students' understanding of ecological processes that occur in regulated river basins along with associated problems and opportunities that arise with fishery management. The focus is primarily on fishes and microbes, with an emphasis on understanding how structure, process and function of aquatic systems are influenced by human activities. Topics covered include river continuum concept, Thornton's reservoir continuum model, nutrient cycling, population dynamics, biotic interactions, and river-reservoir interfaces. A unique aspect of this course is the presence of all three professors in the classroom; that is, this course is truly team-taught, providing students the formal opportunity to interact with three faculty members that have differing experiences and sometimes differing opinions.

GRADUATE COMMITTEE SERVICE

Kevin Pope

Quintin Dean (M.S., School of Natural Resources, UNL) (Graduated December 2020)

Paula Guastello (Ph.D., School of Natural Resources, UNL)

Matthew Larréy (M.S., School of Natural Resources, UNL)

Matt Reichenbach (Ph.D., Department of Mathematics, UNL) (Graduated December 2020)

Ryan Ruskamp (M.S., School of Natural Resources, UNL)

Jake Werner (M.S., School of Natural Resources, UNL) (Graduated December 2020)

Sarah Sonsthagen

Joshua Brown (Ph.D., University of Texas at El Paso)

Jonathan Spurgeon

Andrew Althouf (M.S., University of Arkansas at Pine Bluff)

Maxwell Hartman (M.S., University of Arkansas at Pine Bluff)

Jamie Kindschuh (M.S., University of Arkansas at Pine Bluff)

Katie Morris (M.S., University of Arkansas at Pine Bluff)

Jeffery Stevens (M.S., University of Arkansas at Pine Bluff)

PROFESSIONAL AND FACULTY SERVICE

Dillon Fogarty

- Contributor. Nebraska Legislature on Cedar Invasions (LR 387)
- Coordinator. Eastern Redcedar Working Group
- Director. Eastern Redcedar Science Literacy Video Series: Overcoming misconceptions
- Journal Peer Reviewer. Frontiers in Zoology

Derek Kane

Panelist. Nebraska Agricultural Youth Institute

Kevin Pope

- Member. American Fisheries Society, Research Web Tool Design Team
- Member. American Fisheries Society, Advisory Panel for "Assessing the state of fisheries research
 agendas in the United States and outlining best practices for development of agendas" project
- Member. Book Editorial Advisory Board, American Fisheries Society
- Member. Federal Fisheries Summit Team
- Member. Nebraska Conservation Roundtable
- Member. Nebraska Invasive Species Council
- Member. UNL School of Natural Resources, Graduate Committee
- Facilitator. University of Nebraska Prairie Streams Working Group
- USGS Representative. Reservoir Fisheries Habitat Partnership

Sarah Sonsthagen

- Associate Editor. Ornithological Applications
- Member. Applied Ecology Graduate Curriculum Committee, UNL, SNR

Jonathan Spurgeon

Associate Editor. North American Journal of Fisheries Management

Dana Varner

 Member. Executive Committee of the North American Waterfowl Management Plan Science Support Team

Angler Survey training during pandemic at Hardin Hall, Lincoln, NE

Photo: Allison Zach

Allison Zach

- Board Member. North American Invasive Species Management Association
- Coordinator. Nebraska Invasive Species Advisory Council
- Coordinator. Western Invasive Species Coordinating Effort
- Executive Committee Member. Western Regional Panel on Aquatic Nuisance Species
- Representative. Water Resources Development Act Upper Missouri & South Platte River Basins
- Representative. Mississippi River Basin Panel on Aquatic Nuisance Species
- Representative. Missouri River Basin Panel on Aquatic Nuisance Species
- Representative. Missouri River Asian Carp Grant Planning Team

TRAINING ASSISTANCE, WORKSHOPS, AND OUTREACH ACTIVITIES

Christopher Fill

- Guest Speaker. The Ecology of Bats, Conservation Nebraska Webinar, Lincoln, NE
- Guest Speaker. Bats in Nebraska, Crane Trust Nature Center and Conservation Nebraska Webinar, Wood River, NE
- Instructor. Nebraska North American Monitoring Program Training, Virtual Training, Lincoln, NE
- Instructor. Nebraska North American Monitoring Program Volunteer Training, Pioneers Park, Lincoln,
 NE

Dillon Fogarty

- Teacher Assistant. Ecosystem Monitoring and Assessment (AGRO/NRES 444/844) UNL, Spring 2021
- Presenter. Defending rangelands in a battle for a biome. Pheasants Forever and Nebraska Grazing Lands Coalition, Landowner Meeting, Enders, NE
- Presenter. Large-scale rangeland planning to halt woody plant encroachment in the Great Plains.
 Kansas Grazing Lands Coalition, Range School, Elmdale and Tipton, KS

Kevin Pope

- Instructor. Over-the-Water training course, Lincoln, NE
- Instructor. Motorboat Operators Certification Course, Lincoln, NE

Sarah Sonsthagen

• Instructor. Application of Genomic Methods in Wildlife Workshop, Lincoln, NE

Jonathan Spurgeon

Co-Instructor. Over-the-Water training course, Lincoln, NE

Allison Zach

- Presenter. AmeriCorps Conservation Section, Lincoln, NE
- Presenter. Izaak Walton League, Lincoln, NE
- Presenter. University of Nebraska–Lincoln, Biological Invaders Course, Lincoln, NE

PRESENTATIONS

Barshinger, C., J. J. Spurgeon, and M. Eggleton. 2021. Identification of Silver Carp origin within the Lower Mississippi River Basin. Annual Arkansas American Fisheries Society Chapter Meeting. Little Rock, Arkansas.

Bonar, S. A., N. Mercado-Silva, and K. L. Pope. 2020. The American Fisheries Society standard methods for sampling North American freshwater fishes project: overview, design and use. 8th World Fisheries Congress, Adelaide, South Australia, Australia (Virtual).

Fogarty, D. T., and D. Twidwell. 2020. Rethinking grassland conservation strategies in an era of woody plant encroachment. The Nebraska Natural Legacy Conference (Virtual).

Hartman, M., S. Lochmann, J. Spurgeon, M. Cole, and K. Morris. 2021. Paleback Darter occupancy and detection probability. Annual Arkansas American Fisheries Society Chapter Meeting. Little Rock, AR.

Kaemingk, M. A., K. L. Pope, R. Arlinghaus, M. H. Birdsong, R. Lyach, and K. L. Wilson. 2021. Valuing recreational fisheries according to waterbody size. 8th World Fisheries Congress, Adelaide, South Australia (Virtual) (Invited presentation).

Kane, D. S., M. A. Kaemingk, and K. L. Pope. 2021. How angler-access types differ in terms of their angler effort-waterbody size relationship. Annual Meeting, Nebraska Chapter, American Fisheries Society (Virtual).

Kindschuh, J., and J. J. Spurgeon. 2021. Evaluation of drone imagery and supervised classification to quantify coverage of floating and emergent vegetation in Arkansas reservoirs. Annual Arkansas American Fisheries Society Chapter Meeting. Little Rock, Arkansas.

Morris, K., and J. Spurgeon. 2021. Paleback Darter seasonal habitat use and development of a predictive stream-barrier model in the Ouachita Mountain Ecoregion in west-central Arkansas. Annual Arkansas American Fisheries Society Chapter Meeting. Little Rock, Arkansas.

Pope, K. L., M. A. Kaemingk, C. J. Chizinski, and K. L. Hurley. 2020. Catch and harvest of fish by recreational anglers in Nebraska: the value of a fishing license. 8th World Fisheries Congress, Adelaide, South Australia, Australia (Virtual) (Invited presentation).

Pope, K. L., E. Tracy, S. Bonar, and N. Mercado-Silva. 2020. Progression of AFS standard methods for sampling freshwater fish in North America. 8th World Fisheries Congress, Adelaide, South Australia (Virtual).

Bat detector overlooking creek in Stuart, NE

Photo: Christopher Fill

Pope, K. L., K. L. Hurley, T. J. Barada, C. J. Chizinski, and M. A. Kaemingk. 2021. Fishing for greater understanding. 150th Annual Meeting, American Fisheries Society, Columbus, Ohio (Invited presentation).

Sonsthagen, S. A., R. E. Wilson, S. Matsuoka, L. Powell, J. Johnson, and D. Demarest. 2020. Genes on the landscape: population genomics of Rusty Blackbirds. Rusty Blackbird – Recent Research to Fuel Conservation Strategies Symposium, The Wildlife Society (Virtual).

Spurgeon, J. 2021. Characteristics of two trout populations in an Arkansas tailwater. Annual Nebraska American Fisheries Society Chapter Meeting. Lincoln, Nebraska.

Stevens, J. N., C. E. Barshinger, J. J. Spurgeon, M. A. Eggleton, and S. E. Lochmann. 2021. A comparison of population dynamics of invasive bigheaded carp from established populations. Southern Division American Fisheries Society Annual Meeting. Virginia.

Tracy, E., S. Bonar, N. Mercado-Silva, and K. L. Pope. 2020. AFS Standard Sampling Online Fisheries Database: lessons learned in designing a simple and effective tool that fisheries professionals will actually use. 8th World Fisheries Congress, Adelaide, South Australia, Australia (Virtual).

Varner, D. 2021. Planning for the Future of Landbirds in the Rainwater Basin Joint Venture Region. Midwest Fish and Wildlife Conference (Virtual).

Varner, D. 2021. Planning for the Future of Landbirds in the Rainwater Basin Joint Venture Region. The Wildlife Society, Nebraska Chapter, Annual Meeting (Virtual).

Wilson, R. E., S. A. Sonsthagen, and S. L. Talbot. 2020. Comparative genomic structure within Alaskan Galliforms. The Wildlife Society (Virtual).

DATA RELEASES

Greiman, S. E., B. J. Pierson, D. M. Menning, S. A. Sonsthagen, and S. L. Talbot. 2020. Shrew (*Sorex sp.*) gut contents identified by DNA metabarcoding, North America, 1968-2016: U.S. Geological Survey data release, https://doi.org/10.5066/P9YH4C20

Krejsa, D. M., B. J. Pierson, S. L. Talbot, G. K. Sage, and S. A. Sonsthagen. 2020. Genetic data from wolverine (*Gulo gulo luscus*) of North America (ver. 1.0, October 2020): U.S. Geological Survey data release, https://doi.org/10.5066/P908DV91

Sage, G. K., B. J. Pierson, S. A. Sonsthagen, M. C. Gravley, and S. L. Talbot. 2020. Genetic data for merlin (*Falco columbarius*) and cross-species microsatellite amplification in select falco species, North America, 2020 (ver. 1.0, August 2020): U.S. Geological Survey data release, https://doi.org/10.5066/P9BOU6CP

Sonsthagen, S. A., and S. L. Talbot. 2020. Genetic data from Cooper's Hawks, North America, 2009-2019: U.S. Geological Survey data release, https://doi.org/10.5066/P914SGB1

Sonsthagen, S. A., and R. E. Wilson. 2020. Genomic data from ptarmigan and grouse, Alaska, 2015-2019: U.S. Geological Survey data release, https://doi.org/10.5066/P9DDB01R

Sonsthagen, S. A., B. J. Pierson, R. E. Wilson, and S. L. Talbot. 2020. Scoter (*Melanitta sp.*) ddRAD SNP and microsatellite genetic data, North America and Europe, 1977-2012: U.S. Geological Survey data release, https://doi.org/10.5066/P9W7H2JK

Sonsthagen, S. A., R. E. Wilson, P. Lavretsky, and S. L. Talbot. 2021. Genomic data of North American Sea Ducks: U.S. Geological Survey data release, https://doi.org/10.5066/F7T43RK9

Sonsthagen, S. A., R. Cornman, A. Fischbach, C. Jay, J. M. Grebmeier, and S. L. Talbot. 2020. Walrus (*Odobenus rosmarus*) prey identified by DNA metabarcoding, Alaska, 2012–2015. U.S. Geological Survey data release, https://doi.org/10.5066/P9WWMPLT

Sonsthagen, S. A., C. L. Haughey, M. G. Sexson, D. Solovyeva, M. R. Petersen, and A. N. Powell. 2019. Spectacled eider (*Somateria fischeri*) microsatellite and mitochondrial DNA data, Alaska and Russia: U.S. Geological Survey data release, https://doi.org/10.5066/P9F8DV8O

Sonsthagen, S. A., R. E. Wilson, S. M. Matsuoka, J. A. Johnson, D. W. Demarest, D. Stralberg, and L. L. Powell. 2021. Rusty blackbird (*Euphagus carolinus*) genetic data, North America: U.S. Geological Survey data release, https://doi.org/10.5066/F7T43R9Q

Sonsthagen, S. A., P. Lavretsky, C. L. Haughey, R. E. Wilson, W. S. Boyd, D. N. Esler, J. I. Brown, and S. L. Talbot. 2020. Genetic data from Barrow's Goldeneye and Common Goldeneye: U.S. Geological Survey data release, https://doi.org/10.5066/P9D8CN8M

Talbot, S. L., B. J. Pierson, S. A. Sonsthagen, and C. L. Haughey. 2020. Genetic data from three accipiter species, North America, 1996-2014: U.S. Geological Survey data release, https://doi.org/10.5066/P9U28F8X

PEER-REVIEWED PUBLICATIONS

Brown, J. I., P. Lavretsky, R. E. Wilson, C. L. Haughey, W. S. Boyd, D. N. Elser, S. L. Talbot, and S. A. Sonsthagen. 2020. High fidelity does not equate to population structure and low inter-specific gene flow for common goldeneye and barrow's goldeneye in North America. Journal of Avian Biology 51:e02600.

Fill, C. T., C. R. Allen, J. F. Benson, and D. Twidwell. 2021. Roost use and movements of northern longeared bats in a southeast Nebraska agricultural landscape. The American Midland Naturalist 185:241-248.

Fogarty, D. T., C. P. Roberts, D. R. Uden, V. M. Donovan, C. R. Allen, D. E. Naugle, and D. Twidwell. 2020. Woody plant encroachment and the sustainability of priority conservation areas. Sustainability 12: 8321.

Fogarty, D. T., C. de Vries, C. Bielski, and D. Twidwell. In Press. Rapid re-encroachment by *Juniperus virginiana* following a single restoration treatment. Rangeland Ecology and Management.

Gaughan, S. J., K. L. Pope, J. A. White, C. A. Lemen, and P. W. Freeman. 2020. Mitochondrial genome of northern long-eared bat. Mitochondrial DNA, Part B 5:3610-3611.

Greiman, S. E., J. A. Cook, T. Odom, K. Cranmer, S. W. Liphardt, D. M. Menning, S. A. Sonsthagen, and S. L. Talbot. 2020. Microbiomes from biorepositories? 16S rRNA bacterial amplicon sequencing of archived and contemporary intestinal samples of wild mammals (Eulipotyphla: Soricidae). Frontiers in Ecology and Evolution 8:555386.

Haughey, C. L., A. Nelson, P. Napier, R. N. Rosenfield, S. A. Sonsthagen, and S. L. Talbot. 2020. Genetic confirmation of a natural hybrid between a Northern Goshawk (*Accipiter gentilis*) and a Cooper's Hawk (*A. cooperii*). The Wilson Journal of Ornithology 131:838–844.

Hull, J. M., G. K. Sage, S. A. Sonsthagen, M. C. Gravley, B. L. Martinico, T. L. Booms, T. Swem, and S. L. Talbot. 2020. Isolation and characterization of microsatellite loci in merlins (*Falco columbarius*) and cross-species amplification in gyrfalcons (*F. rusticolus*) and peregrine falcons (*F. peregrinus*). Molecular Biology Reports 47:8377–8383.

Kaemingk, M. A., C. N. Bender, C. J. Chizinski, A. J. Bunch, and K. L. Pope. 2021. Temporal invariance of social-ecological catchments. Ecological Applications 31(2):e02272.

Kane, D. S., M. A. Kaemingk, C. J. Chizinski, and K. L. Pope. 2020. Spatial and temporal behavioral differences between angler-access types. Fisheries Research 224:105463.

Krejsa, D. M., S. L. Talbot, G. K. Sage, S. A. Sonsthagen, T. S. Jung, A. J. Magoun, and J. A. Cook. 2021. Dynamic landscapes in northwestern North America structured populations of wolverines (*Gulo gulo*). Journal of Mammalogy 102:891–908.

Lavretsky, P., R. E. Wilson, S. L. Talbot, and S. A. Sonsthagen. 2021. Phylogenomics reveals ancient and contemporary gene flow contributing to the evolutionary history of sea ducks (Tribe Mergini). Molecular Phylogenetics and Evolution 161:107164.

Osborne, D. C., R. E. Wilson, L. G. Carlson, S. A. Sonsthagen, and S. L. Talbot. 2019. DNA sequencing confirms Tundra Bean Goose (*Anser serrirostris serrirostris*) occurrence in the Mississippi Alluvial Valley in Arkansas, USA. Waterbirds 42:333–342.

Pearce, J. M., P. L. Flint, M. E. Whalen, S. A. Sonsthagen, J. Stiller, V. P. Patil, T. Bowman, S. Boyd, S. S. Badzinski, H. G. Gilchrist, S. G. Gilliland, C. Lepage, P. Loring, D. McAuley, N. R. McLellan, J. Osenkowski, E. T. Reed, A. J. Roberts, M. O. Robertson, T. Rothe, D. E. Safine, E. D. Silverman, and D. Spragens. 2019. Visualizing populations of North American Sea Ducks—Maps to guide research and management planning: U.S. Geological Survey Open-File Report 2019-1142, 50 p., plus appendixes.

Perrion, M. A., M. A. Kaemingk, K. D. Koupal, C. W. Schoenebeck, and N. A. Bickford. 2020. Use of otolith chemistry to assess recruitment and habitat use of a white bass fishery in a Nebraska reservoir. Lake and Reservoir Management 36:64-74.

Pope, K. L., and L. A. Powell. Editors. 2021. Harvest of fish and wildlife: new paradigms for sustainable management. CRC Press, Boca Raton, Florida, USA.

Price, N. B., C. J. Chizinski, J. J. Fontaine, K. L. Pope, M. Rahe, and J. Rawlinson. 2020. An open-sourced, web-based application to improve our ability to understand hunter and angler purchasing behavior from license data. PLoS ONE 15(10):e0226397.

Rosenfield, R. N., S. A. Sonsthagen, A. E. Riddle-Berntsen, and E. Kuhel. 2021. Record fledging count from a seven-egg clutch in the Cooper's hawk (*Accipiter cooperii*). The Wilson Journal of Ornithology 132:460-463.

Rosenfield, R. N., A. C. Stewart, W. E. Stout, S. A. Sonsthagen, and P. N. Frater. 2019. Do British Columbia Cooper's Hawks have big feet? British Columbia Birds 30:10–14.

Sonsthagen, S. A., C. Jay, R. S. Cornman, A. Fischbach, J. Grebmeier, and S. L. Talbot. 2020. DNA metabarcoding to infer summer diet of Pacific walrus. Marine Mammal Science 36:1196-1211.

Sonsthagen, S. A., C. Haughey, M. G. Sexson, D. V. Solovyeva, M. R. Petersen, and A. Powell. 2020. Temporal variation in genetic structure within the threatened spectacled eider. Conservation Genetics 21:175–179.

Sonsthagen, S. A., R. E. Wilson, P. Lavretsky, and S. L. Talbot. 2019. Coast to coast: High genomic connectivity in North American scoters. Ecology and Evolution 9:7246–7261.

Spurgeon, J. J., M. A. Pegg, K. L. Pope, and L. Xie. 2020. Ecosystem-specific growth responses to climate pattern by a temperate freshwater fish. Ecological Indicators 112:106130.

Spurgeon, J. J., M. A. Pegg, S. Siddons, and H. Hansen. 2020. Retention of T-bar anchor tags for channel catfish (*Ictalurus punctatus*) in the Red River of the North. North American Journal of Fisheries Management 40:330-334.

Spurgeon, J. J., M. Rhodes, J. W. Neal, and K. Evans. 2021. Aquatic habitat changes within the channelized and impounded Arkansas River, Arkansas, USA. River Research and Applications 37:462–474.

Sweet, A. D., R. E. Wilson, S. A. Sonsthagen, and K. P. Johnson. 2020. Lousy grouse: Comparing evolutionary patterns in Alaska galliform lice to understand host evolution and host-parasite interactions. Ecology and Evolution 10:8379–8393.

Wilson, R. E., S. A. Sonsthagen, J. M. DaCosta, C. R. Ely, M. D. Sorenson, and S. L. Talbot. 2019. Identification of single nucleotide polymorphisms for use in a genetic stock identification system for greater white-fronted goose (*Anser albifrons*) subspecies wintering in California: U.S. Geological Survey Open-File Report 2019-1040, 18 p.

Wilson, R. E., S. A. Sonsthagen, N. Sme, A. J. Gharett, A. Majewski, K. Wedemeyer, R. J. Nelson, and S. L. Talbot. 2020. Mitochondrial genome diversity and population mitogenomics of Polar cod (*Boreogadus saida*) and Arctic dwelling gadoids. Polar Biology 43:979–994.

Wilson, R. E., G. K. Sage, K. Wedemeyer, S. A. Sonsthagen, D. M. Menning, M. C. Gravley, M. G. Sexson, R. J. Nelson, and S. L. Talbot. 2019. Micro-geographic population genetic structure within Arctic cod (*Boreogadus saida*) in Beaufort Sea of Alaska. ICES Journal of Marine Science 76:1713–1721.

Wilson, R. E., S. M. Matsuoka, L. L. Powell, J. A. Johnson, D. Demarest, D. Stralberg, and S. A. Sonsthagen. 2021. Implications of historical and contemporary processes on genetic differentiation of a declining boreal songbird: the rusty blackbird. Diversity 13:103.

Zentner, D. L., J. J. Spurgeon, S. E. Lochmann, C. L. Graham. 2021. Tag type and location-dependent retention impart varied levels of bias on mark-recapture parameter estimates. North American Journal of Fisheries Management 41:474-483.



