



NORTH CAROLINA WILDLIFE RESOURCES COMMISSION

UNDERSTANDING OUR WILD LIFE **COLLABORATIVE RESEARCH IN THE NC WILDLIFE RESOURCES COMMISSION**

2021-2022



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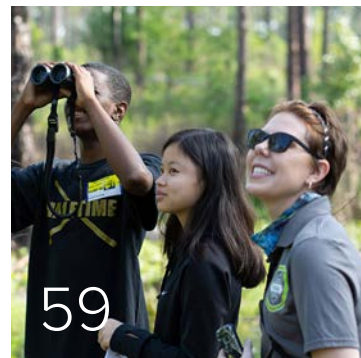
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NCWRC

Since the agency's inception in 1947, our Wildlife Resources Commission staff have managed and protected the wildlife resources of our state to perpetuate our terrestrial and aquatic species and habitats. In doing so, they have provided opportunities for our citizens to enjoy and benefit from these resources. Achieving this goal requires a balance in understanding the biology of our fish and wildlife resources, attitudes and opinions of our citizens, local and statewide economies, and political realities. Research is a key to achieving this understanding and making science-based management decisions.

Herein, are summaries of research projects in which our agency staff have been engaged for the past year. Our research endeavors span multiple agency divisions and involve many partners across the state and country. While much early research in the agency focused on game species, our focus has expanded, and we currently conduct research on many game and nongame species and their habitats. Please read about the projects that interest you and contact the listed points-of-contact for further information. In this our seventy-fifth year, research continues to be a vital part of our agency, and I hope you enjoy learning more about the breadth and depth of these efforts.

David T. Cobb, PhD.
Research Director

NC Bird Atlas

In this five-year study, we will provide distribution and abundance data for the majority of North Carolina bird species while providing outreach opportunities. The standardized Atlas methodology has a long history of success around the world. In North Carolina, survey efforts focus on 937 10-square mile priority blocks distributed evenly across the state. Volunteers are collecting behavior observations during spring and summer to confirm breeding status and location information during the winter to establish distribution. More formal point counts are being conducted by skilled technicians to augment these data. Volunteer data are collected through the eBird program, providing a familiar, standardized, accessible format while contributing to a larger dataset of worldwide bird data. Study results are expected to aid in:

- evaluating species for listing and de-listing and informing resulting conservation plans,
- evaluating species for Species of Greatest Conservation Need and Knowledge Gap status,
- increasing the breadth and scope of data on 81 species tracked by the NC Natural Heritage Program, and
- providing baseline population and distribution status for accurately tracking future trends.

Study Location: Statewide

Project Status: Year 2 of 5



John Carpenter

Collaborators:

Wildlife Resources Commission (WRC);
NCSU Cooperative Fish & Wildlife Research
Unit; Audubon North Carolina; UNC
Wilmington; US Fish and Wildlife Service;
NC Natural Heritage Program

Principal Investigators:

Scott Anderson, John Carpenter (WRC)

WRC Point of Contact:

Scott Anderson, Science Support Coordinator
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John Carpenter, Eastern Landbird Biologist
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Funding:

Pittman-Robertson Grant matched with in-kind volunteer hours \$2,172,785



Migration Ecology and Demographics of Eastern North American Mallards Throughout the Full Annual Cycle

During the mid-1990s, eastern mallard breeding populations peaked at approximately 1.4 million breeding birds followed by a steady decline of approximately 1% annually. Although the overall trend is worrisome to managers, the greater concern is that the sub-population of breeding mallards in the northeastern US is declining rapidly, while the sub-population in eastern Canada remains relatively stable. The Eastern Mallard Research Cooperative is a collaborative group partnered to derive more reliable estimates of productivity and seasonal survival among different mallard stocks in eastern North America.

Over five years, 180 adult female mallards in eastern Canada and 857 adult female mallards in the US portion of the eastern mallard range will be captured and fitted with Global System for Mobile Communication (GSM) transmitters to better understand demographic rates, migration chronology, and habitat usage differences between the two sub-populations throughout the annual cycle.

Understanding demographic rates of eastern mallards and potential important differences between populations in eastern Canada and the eastern US is imperative for managers to effectively model population dynamics and to develop subsequent harvest strategies.

Study Location: Atlantic Flyway in eastern North America (includes Mackey Island National Wildlife Refuge in North Carolina)

Project Status: Year 1 of 4



WRC



WRC

Collaborators:

State University of New York (SUNY Brockport); University of Saskatchewan (USask); Atlantic Flyway States & Provinces, (includes Wildlife Resources Commission (WRC); Ducks Unlimited; Environment and Climate Change Canada – Atlantic, Ontario, and Quebec Regions

Principal Investigators (in NC):

Jacob Straub (SUNY-Brockport); Mitch Weegman, Marie Racioppa (USask); Doug Howell (WRC)

WRC Point of Contact:

Doug Howell, Migratory Game Bird Coordinator
doug.howell@ncwildlife.org; 252-287-5694

Funding:

Cooperating states, provinces and Ducks Unlimited will provide approximately \$1.5 million in funding. North Carolina's contribution will be paid from the Waterfowl Fund and totals \$93,600 over 4 years (2021-2024).

Native Bee Sampling to Determine Baseline Diversity

This study began in June 2019 as a pilot project. Because essential spring months were not captured in 2019, the project officially began in April 2020.

Primary objectives are to determine baseline native bee diversity on select game lands in the Mountains, Piedmont, Sandhills and Coastal Plain regions of the state, as well as determine the impact of prescribed fire on native bees.

In this study, researchers are investigating the differences in diversity among sites that have been burned on a three-year cycle. Secondary objectives will determine if there is significant difference between the second and third year of a burn rotation.

Recommendations from the study will help the WRC make informed land management decisions that will guide conservation-minded actions. It will also allow staff to know what is on the landscape in the likelihood that certain native bee species are federally listed in the future. This information may also act as a template for other government agencies and private landowners managing their landscape.

Study Location: Sandy Mush, Butner-Falls of Neuse, Sandhills, Holly Shelter, and Neuse River game lands

Project Status: Year 3 of 3

Collaborators:

Wildlife Resources Commission (WRC);
NC State University (NCSU);
US Fish and Wildlife Service

Principal Investigators (in NC):

Elsa Youngsteadt (NCSU);
Gabriela Garrison (WRC)

WRC Point of Contact:

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Conservation Coordinator
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910-409-7350

Funding:

Total funding: WRC \$60,000, NCSU approximately 240 hours in non-federal match



Melissa McGaw



Melissa McGaw



Melissa McGaw

Winter Population Biology of Saltmarsh and Seaside Sparrows in Southeastern North Carolina: Density, Abundance, Space Use, Survival, and Migratory Status

In this four-year study, we are examining the winter biology of saltmarsh (SALS) and seaside sparrows (SESP) in southeast North Carolina.

Primary objectives are to 1) determine winter population density and abundances of SALS and SESP at study sites, 2) quantify winter home range size and habitat use, and 3) refine estimates of winter survivorship. Secondary objectives include determining migratory status and timing of locally breeding SESP.

Additionally, in this study we are using automated telemetry stations that monitor daily movements of SALS and SESP to estimate home range sizes, migration timing, and site fidelity.

The winter biology of these species is poorly known, particularly in North Carolina, therefore results from this study will inform future management recommendations, habitat protection, and federal listing decisions.

Study Location: Rachel Carson Reserve, Hammocks Beach State Park, and Masonboro, Zeke's, and Bird islands.

Project Status: Year 4 of 4

Collaborators:

Wildlife Resources Commission (WRC);
UNC-Wilmington (UNCW)

Principal Investigators (in NC):

Ray Danner, Marae Lindquist, Evangelyn Buckland (UNCW); John Carpenter (WRC)

WRC Point of Contact:

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Funding:

\$313,255 (including \$78,776 non-federal match)



WRC



Saltmarsh sparrow (WRC)



Seaside sparrow (WRC)

Demography and Recruitment Dynamics of Atlantic Sturgeon Populations in North Carolina

The objectives of this study are to sample Atlantic sturgeon in the Cape Fear River basin and the Albemarle Sound region to confirm the existence of spawning populations, identify spawning behavior and population demographics within each river, estimate passage success rates at the Lock and Dam #1 fishway located on the Cape Fear River, and establish methods for calculating a juvenile abundance index. In 2021, researchers collected 15 adult sturgeon and tagged 13 of them with acoustic telemetry transmitters. Additionally, they collected 286 juvenile/sub-adult sturgeon and tagged 31 with transmitters. The movements of these tagged fish will be tracked throughout the state and Atlantic Coast using a large network of receivers. This research project will inform the recovery process of the federally endangered Carolina Distinct Population Segment of Atlantic sturgeon and will provide genetic material that is vital to the accurate characterization of Atlantic sturgeon population structure.

Study Location: Cape Fear River basin in Bladen, Pender, Columbus, Brunswick and New Hanover counties. Albemarle Sound region in Halifax, Northampton, Martin, Bertie, Washington, Chowan, Hertford and Gates counties

Project Status: Year 2 of 3

Collaborators:

Wildlife Resources Commission (WRC); UNC-Wilmington (UNCW); Virginia Commonwealth University (VCU); NC Division of Marine Fisheries; National Marine Fisheries Service

Principal Investigators:

Fred Scharf (UNCW); Greg Garman, Matt Balazik (VCU); Jeremy McCargo (WRC)

WRC Point of Contact:

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Funding:

NOAA Fisheries Species Recovery Grant to States provides all funding for the sturgeon project. Non-federal match is provided by universities with in-kind services and reduced fees.



WRC



WRC

Multi-scale Assessment of Wild Turkey Ecology

This four-year study is providing a comprehensive understanding of spatial and temporal variation in wild turkey demography in three regional study areas across the state.

Primary objectives are to determine nesting chronology, nesting success, and seasonal and annual survival rates partitioned by cause and age/sex class in each region. Secondary objectives are to: provide blood, tissue, or other samples necessary to establish baseline disease and genetic information and determine if the WRC Summer Wild Turkey Observation Survey provides useful trend or index information for reproductive output or gobbler harvest rates; and provide recommendations for improvement of the survey methodology or data analysis.

Recommendations from the study will serve as a solid foundation to inform future hunting and habitat management actions.

Study Location: Statewide, with emphasis on monitoring in Moore County (Piedmont), Mitchell, Avery, Madison, Yancey, McDowell, and Burke counties (Mountains), and Sampson, Duplin, and Bladen counties (Coastal Plain)

Project Status: Year 3 of 4



Natlyia Zozula

Collaborators:

Wildlife Resources Commission (WRC); NC State University (NCSU); Louisiana State University (LSU); National Wild Turkey Federation (NWTF), North Carolina Chapter – NWTF; numerous private landowners

Principal Investigators:

Chris Moorman, David Moscicki (NCSU); Bret Collier (LSU); Chris Kreh (WRC)

WRC Point of Contact:

Hannah Plumpton, Upland Game Bird Biologist; hannah.plumpton@ncwildlife.org
984-800-7222

Funding:

Wildlife and Sport Fish Restoration Grant – \$997,689, NCSU – \$218,833, North Carolina Chapter of NWTF – \$117,761

Publications:

Moscicki, D. J., C. E. Moorman, B. A. Collier, C. Kreh, and K. Pacifici. 2021. Spatial and temporal variation in survival of female wild turkeys. 28th Annual Conference of The Wildlife Society, virtual meeting.

Moscicki, D. J., K. Pacifici, B. A. Collier, C. Kreh, and C. E. Moorman. 2022. Spatial and temporal variation in survival of female wild turkeys. 12th National Wild Turkey Symposium, Asheville, North Carolina, poster.

Pilot Study on the Population Status, Hybridization, and Diseases of Woodrat Populations in Western North Carolina

This three-year study is a 20-year follow up of the occurrence and distribution of both Allegheny and Southern Appalachian woodrats in western North Carolina.

Primary objectives are to 1) determine the best camera trap techniques for long-term monitoring of Allegheny woodrat colonies, 2) determine the genetics of Allegheny woodrat hybridization with Appalachian woodrat, and 3) determine presence and potential exposure of woodrat colonies to raccoon roundworm.

Secondary objectives are to gather tissue, hair, and ectoparasites for disease testing, diet analysis via stable isotope analysis, and archive tissue samples at the NC Museum of Natural Sciences for future genetic work. We also documented breeding status of each colony.

The team has captured 41 woodrats: 26 females and 15 males. Age classes were not evenly distributed: 25 adults and 14 sub-adults. We confirmed breeding occurrence at nine of 17 sites. Genetic analyses for species identification are underway. Additional trapping is occurring this summer and fall to wrap up all historical sites where woodrats were captured. Results from this pilot will be used to develop recommendations for future research and conservation actions.

Study Location: Mountain Region

Project Status: Year 3 of 3



WRC



WRC

Collaborators:

Wildlife Resources Commission (WRC);
NC Museum of Natural Sciences (NCMNS)

Principal Investigators:

Andrea Shipley, Danny Ray, Colleen
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WRC Point of Contact:

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Funding:

Wildlife and Sport Fish Restoration Grant

Black Bass Genetics Investigations in North Carolina

Unauthorized movement of black bass species, particularly Alabama bass, is occurring in aquatic resources across North Carolina. These introductions are influencing population genetics of existing bass fisheries. A baseline black bass genetics investigation was implemented to determine the extent of unauthorized black bass introductions and level of hybridization in black bass fisheries, as well as assess the frequency of introgression between Florida bass and largemouth bass, and to guide and prioritize future black bass management objectives.

Objectives of this on-going research are to determine genotype of introduced black bass species and quantify levels of hybridization between Alabama bass, Florida bass, largemouth bass, smallmouth bass, and spotted bass populations in North Carolina waterbodies. Biologists clip a piece of fin from collected specimens and send the tissue to a genetics lab where extracted DNA is analyzed to determine species. Fine scale analysis is used to determine the allele frequency and level of hybridization, and conclusively confirm the identity of all black bass sampled by biologists.

Study Location: Statewide

Project Status: Year 4 of on-going statewide investigation



WRC



Sample Code	Collected Date	Waterbody	ALB	LMB	CSB	SHB	SMB	SPB	Species (STRUCTURE)	PIT Number
CJB_014	3/10-24/2021	Catawba-James	0.002	0.044	0.069	0.002	0.741	0.142	CSB/SMB/SPB	989.001039168597

WRC

Collaborators:
Wildlife Resources Commission (WRC); Auburn University (AU)

Principal Investigators:
Scott Loftis, Kevin Dockendorf, Kelsey Roberts, Lawrence Dorsey (WRC); Eric Peatman (AU)

WRC Point of Contact:
Scott Loftis, Mountain Aquatic Habitat Coordinator, scott.loftis@ncwildlife.org
828-558-6012

Funding:
Wildlife and Sport Fish Restoration Grant – (\$120,000 federal; \$40,000 state)

American Woodcock Migration Ecology in Eastern North America

The American woodcock is a migratory forest bird that has experienced population declines of 1.1% per year for the past five decades. Migration remains a period of limited information for woodcock. The Eastern Woodcock Migration Research Cooperative is a collaborative group partnered to understand the phenology, biology, and migratory ecology of American woodcock in eastern North America.

After biologists attached satellite transmitters on 463 captured woodcock from 2017-22, 422 migration attempts and 379 migration paths have been documented. The study objectives are to 1) describe departure and arrival phenology for migrating woodcock, 2) describe stopover ecology including distance between stopover sites, number of stopover events, and location of stopover events, 3) evaluate migratory connectivity for woodcock, including movements between the Central and Eastern Management Regions via migration, and 4) quantify the survival of migrating woodcock.

A more thorough understanding of the phenology of woodcock migration will also allow wildlife managers to evaluate and adjust the timing of existing woodcock hunting seasons.

Study Location: Eastern North America (includes capture sites in eastern and central North Carolina)

Project Status: Year 4 of 5

Collaborators:

University of Maine (UMaine); Atlantic and Mississippi Flyway States & Provinces, (includes Wildlife Resources Commission (WRC)); US Fish and Wildlife Service; Canadian Wildlife Service; numerous Non-governmental Organizations

Principal Investigators:

Eric Blomberg, Amber Roth, Alexander Fish, Liam Berigan (UMaine); Doug Howell, Chris Baranski (WRC)

WRC Point of Contact:

Doug Howell, Migratory Game Bird Coordinator
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 252-287-5694

Funding:

From WRC for work in NC: \$75,000 from the Wildlife Management Division's operating funds



WRC



Spencer Haakman

Long-term Study on the Wildlife Community Response to Compensatory Stream and Wetland Mitigation

Compensatory mitigation is the restoration, establishment, enhancement, or preservation of streams and wetlands to offset unavoidable adverse impacts to aquatic resources. The purpose of compensatory mitigation is to repair a degraded system by improving the geomorphology, hydraulic, hydrology, and ecological function of an aquatic resource. This functional uplift can be achieved by restoring or enhancing aquatic habitat; maintaining or improving water quality functions; improving floodwater retention; modifying or enhancing a structural feature, such as bank stabilization; and planting native vegetation. Except for riparian vegetation establishment, the ecological uplift is typically not measured and is thought to be an indirect benefit of compensatory mitigation.

The first objective of the study is to investigate the response of wildlife communities to compensatory stream and wetland mitigation. At five sites at the NC Division of Mitigation Services' Stinking Quarter Mitigation Site, researchers will determine relative abundance, species richness, and diversity of multiple taxa for nine years, two years prior to construction and seven years' post-construction. Researchers will survey mammals, birds, reptiles, amphibians, mollusks, crayfish, bees, butterflies, and benthic macroinvertebrates, as well as measure water quality. These surveys will indicate whether community composition patterns differ through time and among various mitigation types, which include restoration, reestablishment, enhancement, rehabilitation, and preservation. The second objective is to determine if mitigation provides ecological uplift, not only in the aquatic system, but also in the terrestrial community that relies upon it. Third, we will establish protocols and processes for field work, data management, analyses, and data interpretation for future wildlife studies at mitigation sites in North Carolina.

Results of this study will be used to develop recommendations for improving compensatory mitigation practices to benefit wildlife communities and increase biodiversity, thereby achieving ecological uplift.

Collaborators:

Wildlife Resources Commission (WRC); Greensboro Science Center (GSC); University of North Carolina – Chapel Hill (UNC); University of North Carolina – Greensboro (UNCG); North Carolina Department of Environmental Quality, Division of Mitigation Services (DMS); Restoration Systems, LLC (RS)

Principal Investigators:

Olivia Munzer (WRC); Lindsey Zarecky (GSC); Rada Petric (UNCCH)

WRC Point of Contact:

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Funding:

Wildlife and Sport Fish Restoration Grants – \$195,000
 UNC non-federal match – \$205,000
 GSC non-federal match – \$78,000
 RS – \$6,000
 DMS – \$5,000

Study Location: Stinking Quarter Stream and wetland mitigation site in Guilford County

Project Status: Year 2 of 9

Restoring Pocosin Hydrology to Improve Flood Resiliency and Wildlife Habitat in Southeastern North Carolina

Site elevation surveying and the project's first-year baseline hydrology monitoring have been completed. Based upon drainage modeling, the consultant Kris Bass Engineering has formulated a restoration plan to the 90% completion level. Survey work discovered the landscape is not as flat as might be expected for a southern North Carolina coastal plain site. According to the assessment, achieving ideal management conditions will tentatively require 36 water control structures, involving a combination of flashboard risers, weirs and ditch plugs to stair step water levels across the restoration area. Assessment of different material options for cost and durability is underway, which will contribute to a finalized plan that will allow the implementation phase to begin.

One of the challenges is to achieve soil rewetting goals yet maintain vehicular access around and through the restoration unit for management opportunity and public use. This will entail raising the base elevation to some degree of an estimated 14 miles of road, while staying within the planned budget.

Approximately 14% of the project area was planted in loblolly pine for timber production purposes by the prior landowner. Under the restored hydrology regime, loblolly pine won't be a viable species for management. Consequently, removal of all stems within the plantation units is underway through commercial timber harvests slated to be completed before site rewetting. To facilitate timber hauling, road improvements are being made to selected areas with poor road conditions. The road work will address long-term restoration needs as well since the substandard road conditions coincide with some of the road sections that will require raising under the restoration plan to accommodate wetter conditions and remain traversable.

The harvested areas will enable establishment of species better suited to the restored hydrological conditions either through planting or natural regeneration by seed source from adjacent units.

Study Location: Angola Bay Game Land, Pender County

Project Status: Year 2 of 3

Collaborators:

Wildlife Resources Commission (WRC);
The Nature Conservancy (TNC);
Kris Bass Engineering, PLLC (KBE)

Principal Investigators:

Kris Bass (KBE), Eric Soderholm (TNC),
Brent Wilson (WRC)

WRC Point of Contact:

Brent Wilson, Coastal EcoRegion Supervisor
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Funding:

\$123,464 from TNC, NC Chapter Operations,
and Duke Energy; \$96,850 from WRC as in-kind labor



Brent Wilson

White Bass Spawning Migration Study

White bass is a popular sportfish during spring spawning migrations and is also used as broodfish to produce Bodie bass. The fish's variable spawning behavior and declining populations have made both angling and broodfish collections difficult in recent years.

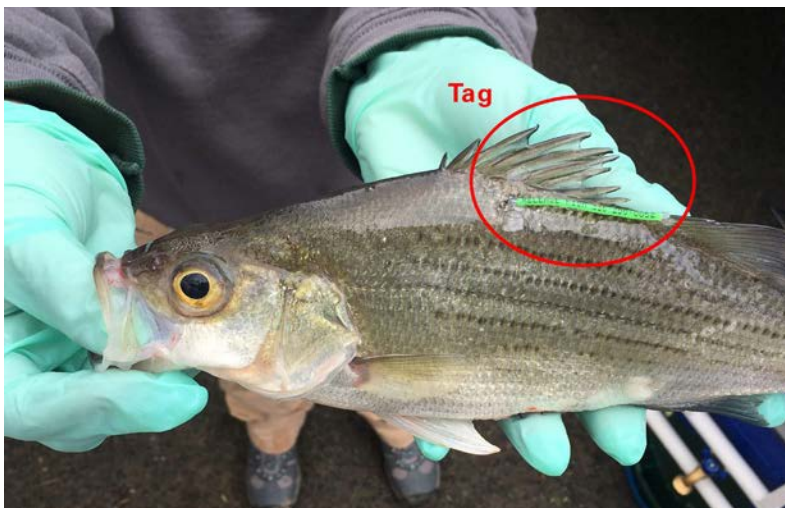
The primary objectives in this study are to use telemetry to identify spawning habitat and to evaluate spawning movement patterns in relation to various environmental factors.

Staff implanted 50 white bass with acoustic telemetry tags in spring 2019 and tagged an additional 30 white bass in spring 2020. Spawning migrations are being tracked in two tributaries to Falls Lake by using an array of passive receivers. Receivers will be downloaded and removed by the end of summer 2022.

Results from this study will allow biologists and anglers to better predict peak spawning conditions, improving both angler and broodfish collection success rates across the state. Identifying key habitat used for spawning could also aid in future habitat restoration efforts.

Study Location: Flat and Eno Rivers in Durham County, Piedmont Region

Project Status: Year 3 of 3



WRC



WRC

Collaborators:

Wildlife Resources Commission (WRC)

Principal Investigators:

Kelsey Roberts, Seth Mycko (WRC)

WRC Point of Contact:

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919-618-7945

Funding:

\$40,000 from WRC

Conservation Status and Management of Henslow’s Sparrow at the VOA Game Land and in Eastern NC

This three-year study focuses on the Henslow’s sparrow (HESP) breeding population at the Voice of America Game Land (VOAGL).

Primary objectives are to 1) estimate population growth of HESP at the VOAGL, 2) quantify the response of graminoids, woody stems, and HESP to prescribed fire rotations, and 3) evaluate the genetic distinctiveness of HESP in North Carolina and across its range.

Additionally, in this study, we are using automated telemetry stations that monitor daily movements of HESP to estimate territory and home range sizes, migration timing, and site fidelity.

Recommendations from the study will inform future habitat management actions and necessary sampling effort for long-term monitoring of Henslow’s sparrows.

Study Location: Voice of America Game Land, Beaufort County; less intensive sampling will also take place at Voice of America Site B, Pitt County

Project Status: Year 2 of 3

Collaborators:

Wildlife Resources Commission (WRC);
NC State University NC Cooperative Fish and Wildlife Research Unit (NCSU)

Principal Investigators (in NC):

Jaime Collazo, Emily Nastase (NCSU);
John Carpenter (WRC)

WRC Point of Contact:

John Carpenter, Eastern Landbird Biologist
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Funding:

Wildlife and Sport Fish Restoration Grant –
\$318,132 (inc. \$79,533 match)



John Carpenter



Frode Jacobsen



John Carpenter

Trout Stocking and Changes in Angler Use

Brook trout, brown trout, and rainbow trout have been stocked by the WRC into rivers and creeks in the mountain region of the state since the 1940s, but few trout fishing opportunities have existed in other regions. In winter 2016, the WRC began stocking trout into publicly accessible, small impoundments across western and central parts of North Carolina.

The goal of this project was to determine changes in angler effort before and after trout were stocked. At one impoundment, a trail camera was used in the winters of 2015–16 (no trout stockings) and 2019–20 (first year of trout stocking) to estimate angler effort. Prior to initiation of the stocking program, total angler effort was 179.75 angler hours (angler-h) from December to March. After trout stockings began, total angler effort increased to 833.5 angler-h over the same period.

At another small impoundment, license sales were analyzed to determine changes in use. License sales were 250% higher during the three-year period of trout stockings compared to the three previous years when no trout stocking occurred.

Results of this study demonstrated that trout stockings significantly increased angler effort at these impoundments during the winter months. Thus, the winter trout stocking program was successful at increasing angler effort and participation in these impoundments, and the program should be continued and expanded.

Study Location: Indian Camp Lake (Richmond County), Frank Liske Park (Cabarrus County)

Project Status: Completed



WRC



WRC

Collaborators:

Wildlife Resources Commission (WRC);
Cabarrus County Active Living and Parks
Department

Principal Investigators:

Casey Joubert, Lawrence Dorsey (WRC)

WRC Point of Contact:

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Funding:

Wildlife and Sport Fish Restoration Grant –
\$8,500

Publications:

Joubert, C. G., L. G., Dorsey. 2022. Changes in
Angler Use Associated with Trout Stocking
in Two North Carolina Small Impound-
ments. *Journal of the Southeastern Associ-
ation of Fish and Wildlife Agencies* 9:73-78

Harris Lake Habitat Enhancement Project

Harris Lake is a 4,100-acre reservoir in southwestern Wake and southeastern Chatham counties and has been one of the premier sport fishing opportunities in North Carolina for the last three decades. The combination of hydrilla management, water quality changes, and other environmental factors has resulted in a decrease in submerged aquatic vegetation, a major source of habitat in Harris Lake. While the removal of hydrilla does not typically affect the abundance or growth rates of sportfish species, there are observed changes in fish behavior. In 2018, the WRC partnered with Duke Energy, Harris Lake County Park, N.C. B.A.S.S. and other angler groups to improve habitat in Harris Lake. Additionally, the WRC received a grant from the Reservoir Fisheries Habitat Partnership in 2020 (www.friendsofreservoirs.com) to help implement the habitat enhancement strategy.

The project's goal is to address aquatic habitat needs in Harris Lake and maintain a balanced and popular fishery. To meet this objective, the WRC developed a five-year habitat enhancement plan with public input, proposed to enhance aquatic habitat by deploying approximately 30 acres of artificial and natural structure (400 to 700 fish attractors and at least 20 felled shoreline trees), and establish founder colonies totaling 1 acre of native vegetation.

Prior to 2018, there were five fish attractor reef sites in Harris Lake; today, there are more than 65 sites across the lake consisting of over 780 individual fish attractors, including three shallow water fishing coves filled with fish attractors. Twenty-one shoreline trees were cut and cabled to their stumps in approximately 10 feet of water and pose no navigational hazard, yet provide excellent fish habitat. Additionally, the WRC has established founder colonies of native aquatic vegetation such as American lotus, water willow, maidencane, pickerelweed, soft-stem bulrush, white water lily, spatterdock, watershield, eelgrass and, pondweed totaling over 0.5 acre. So far, more than 4,000 native plants have been planted at 84 locations around the lake.

The WRC continues to survey sportfish populations, while Duke Energy continues to survey whole lake fish communities. Sport fish populations of largemouth bass and crappie remain stable. Fish communities have shifted from a diverse assemblage to being dominated by planktivores such as threadfin shad and gizzard shad. Nutrient dynamics will continue to change as

Collaborators:

Wildlife Resources Commission (WRC); Duke Energy; Harris Lake County Park; N.C. B.A.S.S. Conservation; other angler groups

Principal Investigators (in NC):

David Belkoski, Kirk Rundle, Mark Fowlkes (WRC)

WRC Point of Contact:

David Belkoski, District Fisheries Biologist I, david.belkoski@ncwildlife.org, 910-580-2288

Funding:

\$40,200 – Wildlife and Sport Fish Restoration grants, \$30,000 Reservoir Fisheries Habitat Partnership grant

Publications:

North Carolina Wildlife Resources Commission. 2022. Harris Lake 5-year aquatic habitat enhancement plan 2018-2023. Raleigh, North Carolina.

a shift toward algal dominance occurs without the presence of dense native vegetation. These ecosystem changes will be monitored to ensure optimal reservoir health.

The WRC will continue to plant native vegetation until founder colonies become self-sustaining and will continue working with the public and stakeholder groups to identify areas in the lake that need habitat enhancement

Study Location: Harris Lake in Chatham and Wake counties, Piedmont Region

Project Status: Year 5 of 5

Conservation Genetics of the Black-throated Green Warbler in Eastern North America

In this study, we examine the genetic distinctiveness of the black-throated green warbler (*S. virens*) complex, with an emphasis on Wayne's warbler (*S. v. waynei*), across its North American breeding range.

Primary objectives are to determine 1) whether *S. v. waynei* cluster independently from other populations, 2) if differentiation is clustered into regions of the genome, and 3) approximately when and where *S. v. waynei* separated from the nominate form.

Results from this study will increase conservation efforts for Wayne's warbler and its habitat and will also contribute to advancements in avian genetics research.

Study Location: Arkansas, Indiana, New York, Tennessee, and central and coastal North Carolina

Project Status: Complete



Black-throated green warbler - Jack R. Perry Photography



Wayne's black-throated green warbler - John Carpenter

Collaborators:

Wildlife Resources Commission (WRC); Penn State University (PSU); Arkansas State University (ASU); Catawba College (CC)

Principal Investigators:

John Carpenter (WRC); Alexander Worm (WRC/ASU); Than Boves (ASU); David Toews, Andrew Wood (PSU); Joe Poston (CC)

WRC Point of Contact:

John Carpenter, Eastern Landbird Biologist
john.carpenter@ncwildlife.org; 910-742-7231

Funding:

\$5,468

Publications:

J.P. Carpenter, A.J. Worm, T.J. Boves, A.W. Wood, J.P. Poston, and D.P.L. Toews. In press. Genomic variation in the Black-throated Green Warbler (*Setophaga virens*) suggests divergence in a disjunct Atlantic Coastal Plain population (*S. v. waynei*). *Ornithology*

Deer Ecology Across an Urban-Rural Continuum

In this four-year study, we are examining several key components of deer ecology across the urban-rural continuum in the Durham area.

Primary project objectives include describing deer habitat selection, movement, survival, primary mortality causes, population dynamics, and public perception of the deer population. The range of these factors as they vary from urbanized city of Durham to rural northern Durham County is of utmost importance as this spatial variation captures shifts in deer management options that occur in developing landscapes.

Project data will be collected by capturing, collaring, and monitoring adult deer and fawns on private and publicly owned properties across this continuum. Population estimates will be generated using DNA sequencing from fecal pellet surveys, and public perceptions of the deer population will be assessed using mail, phone, and online surveys sent to residents, hunters, and industrial landowners.

Results from this project will inform deer management decisions across the state and will be particularly insightful for managing deer in urbanized landscapes.

Study Location: Durham County and eastern Orange County

Project Status: Year 1 of 4

Collaborators:

Wildlife Resources Commission (WRC);
NC State University (NCSU); NC Museum of
Natural Sciences; US Forest Service (USFS)

Principal Investigators:

Nathan Hostetter, Chris Moorman, Mikiah
Carver, Nils Peterson, Liz Kierepka, Hannah
Desrochers, Ashley Lynn (NCSU); John Kilgo
(USFS); Heather Evans, Moriah Boggess
(WRC)

WRC Point of Contact:

Moriah Boggess, Deer Biologist
910-548-1886
moriah.boggess@ncwildlife.org

Funding:

Wildlife and Sport Fish Restoration Grant –
\$1,975,620, including \$493,905 in non-
federal match from NCSU



WRC



Darren Strickland

Population Demographics and Trophic Ecology of Invasive Catfish in Southeastern North Carolina

In this six-year study, we are providing a comprehensive overview of the life history and population dynamics of flathead catfish and blue catfish, both invasive catfish species when found in the Cape Fear River and coastal rivers.

Primary objectives are to estimate abundance and biomass of both catfish species and analyze age-and-growth, fecundity, seasonal migration, and diet composition.

A secondary objective is to assess changes in abundance and biomass estimates following hurricane-induced fish kills.

Recommendations from the study will serve as a baseline to inform fisheries management actions for invasive catfish species in the Cape Fear River and future research and survey efforts in the coastal region.

Study Location: Cape Fear River and tributaries

Project Status: Year 6 of 6



WRC

Collaborators:

Wildlife Resources Commission (WRC); UNC-Wilmington (UNCW); NC Division of Marine Fisheries; SC Department of Natural Resources; Pennsylvania State University; NC State University, Got 'em on Live Bait Club

Principal Investigators:

Fred Scharf (UNCW); Kevin Dockendorf, Kyle Rachels (WRC); David Belkoski (UNCW, now WRC); Claire Pelletier, Mitch Kinz (UNCW)

WRC Point of Contact:

Kevin Dockendorf, Fisheries Research Coordinator – Coastal Region; 252-312-6122 kevin.dockendorf@ncwildlife.org

Funding:

Wildlife and Sport Fish Restoration Grant – \$267,956, including non-federal match from UNCW

Publications:

Belkoski, D. J., M. Drzewicki, and F.S. Scharf. 2021 Specialized Feeding Patterns and Marine Resource Use by Nonnative Catfishes in a Coastal River Ecosystem Revealed by Dietary and Stable Isotopic Analyses. *Marine and Coastal Fisheries* 13:564-582.



WRC

Population Abundance and Growth of Elk

In this five-year study, we are measuring metrics about the North Carolina elk herd, including a population estimate, survival estimates, recruitment, growth rates, and sex ratio of the herd. This information is critical for monitoring changes in the elk population and to make hunting and other management decisions.

Three research questions are being addressed:

1. Does the elk herd within the boundaries of the Great Smoky Mountains National Park (GSMNP) serve as the source for animals moving off the Park to other public and private lands in North Carolina?
2. Are elk movements off the GSMNP, survival, and recruitment sufficient to enable a sustainable hunt outside GSMNP boundaries in North Carolina?
3. Can a technique be developed that is practical, cost-effective, and reliable for population estimation and long-term monitoring of the variables that determine the size of the elk population in North Carolina?

Study Location: Western North Carolina, specifically, the NC elk zone, which comprises Madison, Haywood, Swain, and Jackson counties

Project Status: Year 4 of 5



WRC

Collaborators:

Wildlife Resources Commission (WRC); University of Tennessee (UT); Great Smoky Mountains National Park; Eastern Band of Cherokee Indians; numerous private landowners

Principal Investigators (in NC):

Joe Clark, Jessica Braunstein (UT); Justin McVey (WRC)

WRC Point of Contact:

Justin McVey, District Wildlife Biologist
justin.mcvey@ncwildlife.org; 828-273-7980

Funding:

Wildlife and Sport Fish Restoration Grant – \$548,158, including \$182,719 in non-federal match from UT

Publications:

Braunstein, J., J. D. Clark, and J. M. McVey. 2020. Estimating population abundance and growth of elk in North Carolina using spatially explicit capture-recapture methods. The Wildlife Society 27th Annual Conference, Sept. 28 - Oct. 2, 2020, virtual. Poster presentation.

Braunstein, J., J. D. Clark, and J. M. McVey. 2020. Estimating population abundance and growth of elk in North Carolina using spatially explicit capture-recapture methods. SPARKS: Smoky Mountains, Sept. 10, 2020, virtual. Oral presentation.

Braunstein, J., J. D. Clark, and J. M. McVey. 2020. Estimating population abundance and growth of elk in North Carolina using spatially explicit capture-recapture methods. The 23rd Eastern Elk Workshop, July 16, 2020, virtual. Oral presentation.

Apalachia Reservoir Trout Fishery

Located near the Tennessee-North Carolina border, Apalachia Reservoir maintains suitable trout habitat throughout the year. In 2012, the WRC initiated a multi-year project to evaluate the best size and species of trout to create a trophy put-grow-and-take fishery in the reservoir. Today, the impoundment is classified as Special Regulation Trout Waters.

Although the initial research project has concluded, we utilized the project’s fish-marking data to evaluate retention of visible implant elastomer (VIE) in the brown trout and rainbow trout stockings. The long-term performance of VIE-guided management recommendations for the new Apalachia Reservoir fishery will provide novel insight into the utility of this mark in evaluating salmonid stocks.

Study Location: Cherokee County

Project Status: Complete, but additional research on the fishery is ongoing



WRC



WRC



WRC

Collaborators:

Wildlife Resources Commission (WRC)

Principal Investigators:

Amanda Bushon, Jacob Rash (WRC)

WRC Point of Contact:

Amanda Bushon, District 9 Fisheries Biologist I, amanda.bushon@ncwildlife.org
828-558-6017

Funding:

Inland Fisheries Division – \$1,500

Publications:

Bushon, A. M., and J. M. Rash. 2021. Retention of postocular visible implant elastomer in two sizes of adult Brown Trout and Rainbow Trout. *North American Journal of Fisheries Management* 41:1384–1389.

Restoration of Dwarf Wedgemussel Habitat in Mable Branch Using Beaver Pond Levelers

This is a two-year study focused on determining if the use of pond leveler systems can restore adequate flow to Maple Branch to allow for the survival of mussels despite heavy impacts from beaver activity. This stream has historically supported the federally listed dwarf wedgemussel, but large sections of the stream have become impounded by beaver dams.

Primary objectives of this study are to track changes in physical habitat, flow and water quality within the creek before and after installation of pond levelers into the seven beaver dams, and determine if these devices may be used to restore suitable conditions for the dwarf wedgemussel.

Secondary objectives include assessing how the devices lead to general changes in stream ecology and biological assessment measures, including insect macroinvertebrate and mussel abundance and assemblages.

Anticipated outcomes of this study will provide guidance on beaver management in other impacted streams with the potential to support state and federally listed mussel species.

Study Location: Mable Branch on the Shocco Creek Game Land in Warren County

Project Status: Year 2 of 2



Dwarf wedgemussel - US Fish and Wildlife Service



WRC

Collaborators:

Wildlife Resources Commission (WRC)

Principal Investigators:

Mike Walter, Michael Fisk (WRC)

WRC Point of Contact:

Mike Walter, Eastern Aquatic Listed Species Biologist, michael.walter@ncwildlife.org
984-227-3017

Funding:

WRC Aquatic Species Funds – \$500

Restoration of Brook Trout Populations

As North Carolina’s only native salmonid, brook trout is a fish of considerable ecological and cultural significance in the state, but anthropogenic alterations to the landscape and introductions of nonnative salmonids have fragmented and reduced its native range. As a result, the WRC has made numerous efforts to help conserve this species.

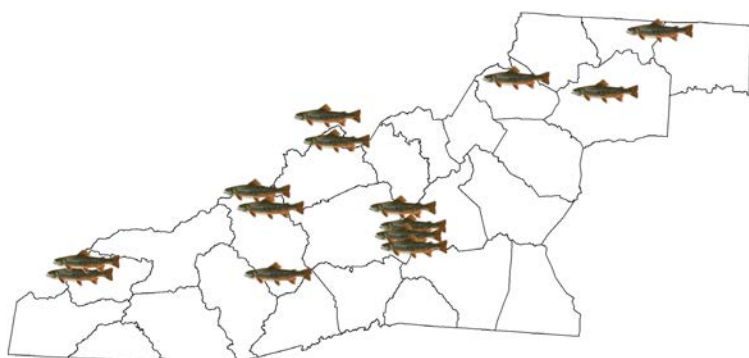
One of these efforts includes restoring populations in waters where brook trout once lived. Guided by our extensive genetic information, the WRC has worked with partners to conduct 17 population projects during the last 15 years.

Study Location: Western North Carolina

Project Status: Ongoing



WRC



Collaborators:

Wildlife Resources Commission (WRC)

Principal Investigators:

Amanda Bushon, David Goodfred, Kin Hodges, Thomas Johnson, Jacob Rash, Powell Wheeler, Chris Wood (WRC)

WRC Point of Contact:

Jacob Rash, Coldwater Research Coordinator
jacob.rash@ncwildlife.org, 828-803-6033

Funding:

Inland Fisheries Division – \$2,500

Publications:

White, S. J., T. C. Johnson, J. M. Rash, B. A. Lubinski, and D. C. Kazyak. (2022). Using genetic data to advance stream fish reintroduction science: a case study in brook trout. Restoration Ecology [online early].



Powell Wheeler

Wildlife Viewer Survey: Enhancing Relevancy and Engaging Support from a Broader Constituency

Compared to traditionally served constituents (hunters, anglers, boaters, shooters, etc.), state fish and wildlife agencies across the United States know relatively little about wildlife viewers and have given them less attention. However, from 2011 to 2016 the number of wildlife viewers grew by 14 million, while hunters declined or remained stable. To better engage with this important group, agencies first need to understand more about them. To fill this nationwide information gap, researchers at Virginia Tech are leading a project to understand wildlife viewers and provide engagement recommendations for managing agencies. Many state fish and wildlife agencies are involved in the planning process, which will help ensure a strong research product. These recommendations have the potential to enhance agency communications and enhance relevancy.

Study Population: Wildlife viewers

Project Status: Year 1 of 1

Collaborators:

Wildlife Resources Commission (WRC); other state fish and wildlife agencies; Association of Fish & Wildlife Agencies; Virginia Tech (VT)

Principal Investigators:

Ashley Dayer (VT)

WRC Point of Contact:

Carrie Ruhlman, Senior Policy Analyst
carrie.ruhlman@ncwildlife.org; 919-707-0011

Funding:

Wildlife and Sport Fish Restoration Grant – \$18,000



WRC

Species Identification of Hunter-harvested Cottontail Rabbits from the Western North Carolina Mountains

There is a considerable lack of information available regarding the current distribution and the impact of hunting mortality on Appalachian cottontails in North Carolina. This is due, in part, to the difficulty in distinguishing the species from the more widely distributed eastern cottontail.

Primary objectives are to 1) obtain Appalachian cottontail records to develop population distribution maps and 2) estimate the proportion of Appalachian cottontails in the total hunting harvest.

Forty-two rabbit hunters enrolled as volunteers in 2014, with 13 hunters enrolling in 2015. One-hundred and ninety heads were submitted from the 2014-15 (110 samples), the 2015-16 (73 samples), and the 2016-2017 (seven samples) hunting seasons. Based on initial morphological examinations, six Appalachian cottontail samples (3.3%) were identified from hunter harvests. Nineteen samples were unidentifiable based on morphological comparisons and appeared to be hybrids. However, we did not test for hybridization. All other identifiable hunter-harvested and roadkill samples were identified as eastern cottontails. Based on genetic testing, nine samples (5.0%) were identified as Appalachian cottontails in hunter-harvested samples.

Morphological examinations suggest a fair amount of variation within species and overlapping similarities between the two species. Species identifications based solely on exterior and skull characteristics may underestimate the actual proportion of Appalachian cottontails when hunter-harvested samples are used for harvest rate studies. Based on our results, hybridization could prove to be a confounding factor during species identification.

Results from this survey are being used to develop sample sites for the Appalachian cottontail 2.0 project.

Study Location: Avery, Alexander, Alleghany, Ashe, Buncombe, Burke, Cherokee, Caldwell, Clay, Graham, Haywood, Henderson, Jackson, Macon, Madison, McDowell, Mitchell, Polk, Rutherford, Swain, Surry, Transylvania, Watauga, Wilkes, and Yancey counties

Project Status: Completed

Collaborators:

Wildlife Resources Commission (WRC);
NC Museum of Natural Sciences (NCNMS)

Principal Investigators:

Andrea Shipley, Brandon Sherrill, Heather Evans, Ryan Myers (WRC); Lisa Gatens (NCMNS)

WRC Point of Contact:

Andrea Shipley, Mammalogist,
andrea.shipley@ncwildlife.org, 919-495-4001

Funding:

Data unavailable



WRC



WRC

Evaluation of Muskellunge Habitat Use, Population Characteristics and Stocking Contribution in the Upper French Broad River

Anthropogenic alterations to the upper French Broad River watershed have resulted in entrenched mainstem reaches with little remaining connectivity to the floodplain. Historic electrofishing surveys suggest that muskellunge do not reproduce in the French Broad River upstream of Asheville. The population has been maintained through annual stockings for almost 50 years. Paucity of off-channel spawning habitat likely limits reproductive success; therefore, we developed a floodplain connectivity and backwater slough restoration project with conservation partners. The Mouth of Mud Creek habitat restoration project is the first large-scale floodplain restoration project in North Carolina aimed at improving muskellunge spawning and nursery habitat on the French Broad River. In this study, we are evaluating juvenile and adult use of the restored backwater sloughs.

We are evaluating the use of the restored off-channel sloughs by injecting Passive Integrated Transponder (PIT) tags in juvenile and adult muskellunge. Antenna arrays that detect the low frequency radio signal from PIT tags are being deployed at each slough to confirm use. Evidence of muskellunge using the restored backwater slough habitat would strengthen the need for additional habitat restoration initiatives to improve channel connectivity with floodplain sloughs in the upper French Broad River watershed. The tagging study is also being used to evaluate management practices (stocking) and biological characteristics of the muskellunge population. Currently, we have a paucity of data pertaining to age structure, growth, condition, relative abundance, survival, and hatchery contribution of muskellunge in the upper French Broad River. This information will steer future muskellunge management decisions, including regulations and stocking rates.

Study Location: French Broad River, Henderson County

Project Status: Year 3 of 5

Collaborators:

Wildlife Resources Commission (WRC);
Coastal Carolina University, Derek Crane

Principal Investigators:

Scott Loftis, Amanda Bushon (WRC)

WRC Point of Contact:

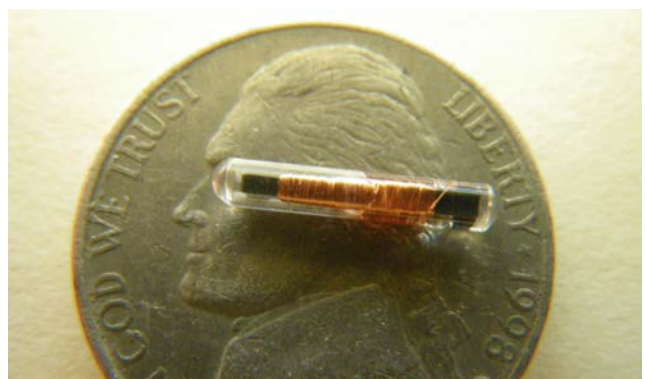
Scott Loftis, Mountain Aquatic Habitat
Coordinator, scott.loftis@ncwildlife.org
828-558-6012

Funding:

Wildlife and Sport Fish Restoration Grant –
\$123,250



WRC



Passive Integrated Transponder (PIT) tag - WRC

Brood Movements, Survival, and Habitat Selection of American Black Ducks in Coastal North Carolina

In this study, we examined brood movements, brood survival, and habitat selection of American black ducks, a Species of Greatest Conservation Need, breeding within coastal marshes of eastern North Carolina — the southern extent of the species' breeding range.

In partnership with the University of Delaware, the WRC recently completed a two-year nesting ecology study with a goal of understanding nest initiation and causes of nest failure in coastal North Carolina. In this current study, we will build on those results by addressing significant knowledge gaps that remain regarding brood survival, brood movements, and habitat selection in coastal North Carolina.

Objectives of this study are to: mark adult hen black ducks and their broods at their nest site during spring nesting; quantify movement patterns of broods traveling away from the nest to brood-rearing areas; quantify selection of brood-rearing areas at the home range and microhabitat scale with a goal of creating a predictive model of brood-rearing habitat selection in coastal marshes; and better understand the variables affecting black duck brood survival to 19-43 days post-hatch.

Results of this study will provide WRC biologists with data useful for modeling populations, determining black duck population goals, and organizing habitat management projects. Additionally, it will assist other state wildlife agencies in the Atlantic Flyway in developing plans to estimate brood survival, as it varies regionally.

Study Location: Hyde County

Project Status: Year 2 of 3

Collaborators:

Wildlife Resources Commission (WRC);
University of Delaware (UDel)

Principal Investigators:

Chris Williams, Amanda Hoyt (UDel);
Doug Howell (WRC)

WRC Point of Contact:

Doug Howell, Migratory Game Bird Coordinator
doug.howell@ncwildlife.org, 252-287-5694

Funding:

WRC Waterfowl Fund – \$157,189



WRC

Brook Trout Population Genetics

As reported previously, the WRC led an effort to identify and genetically type wild brook trout populations within North Carolina. In partnership with the King Conservation Genetics Laboratory at the US Geological Survey (USGS), we used microsatellite markers to generate a suite of genetic baseline data critical to our management of wild, native brook trout populations. These data have provided insight into evolutionary relationships across spatial scales, population demography, hatchery introgression, and the fundamental unit of management for brook trout: the population. The initial project spanned six years, but efforts continue to collect innovative data to expand our genetic baseline and inform management decisions by the WRC and its partners.

Study Location: Western North Carolina

Project Status: Additional research is ongoing



WRC



WRC

Collaborators:

Wildlife Resources Commission (WRC);
United States Geological Survey (USGS)

Principal Investigators:

Dave Kazyak, Shannon White, (USGS);
Jacob Rash (WRC)

WRC Point of Contact:

Jacob Rash, Coldwater Research Coordinator
jacob.rash@ncwildlife.org, 828-803-6033

Funding:

Wildlife and Sport Fish Restoration Grant –
\$40,000

Publications:

Kazyak, D. C., B. A. Lubinski, M. A. Kulp, K. C. Pregler, A. R. Whiteley, E. Hallerman, J. A. Coombs, Y. Kanno, J. M. Rash, R. P. Morgan II, J. Habera, J. Henegar, T. C. Weathers, M. T. Sell, A. Rabern, D. Rankin, T. L. King. 2022. Population genetics of Brook Trout in the southern Appalachian Mountains. *Transactions of the American Fisheries Society* 151:127–149.

White, S. L., D. C. Kazyak, R. C. Harrington, M. A. Kulp, J. M. Rash, T. C. Weathers, and T. J. Near. 2021. Phenotypic variation in Brook Trout *Salvelinus fontinalis* (Mitchill) at broad spatial scales makes morphology an insufficient basis for taxonomic reclassification of the species. *Ichthyology & Herpetology* 109:743–752.

Improving Regional Conservation of Southeastern SGCN through the Development of Shared SWAP Databases & Prioritization Tools

Southeastern Association of Fish and Wildlife Agencies (SEAFWA) members used different species assessment approaches, threat and conservation action terminology, and different approaches to describe and prioritize conservation areas during their last state wildlife action plan (SWAP, Plan) revision cycle. A consequence of this variable approach is the inconsistent criteria used to identify Species of Greatest Conservation Need (SGCN), which has been identified as a barrier to implementation of conservation actions at range-wide and regional scales.

North Carolina is joining Arkansas and Georgia in developing a secure database that can be used to identify consistent threats, status ranks, and conservation actions for SGCN. North Carolina will also test the draft database by completing 35 species assessments spanning different taxonomic groups (five species each from seven taxa groups), focusing on regional SGCN so results can be assessed for consistency across states. Relational tables with standardized data field values will be utilized to facilitate rapid and consistent data entry during taxa team species assessment meetings. A copy of the final database will be provided to all SEAFWA states by fall 2022 for use during upcoming SWAP revisions.

As part of this project, Georgia will also lead efforts to create a dynamic web application that maps conservation priorities identified in SWAPs and tracks SWAP conservation actions. This component of the project will use a GIS platform and include existing data sets available for the entire or major portions of the SEAFWA geographic area. The final product will build upon the Conservation Opportunity Area tool developed for the WRC by NC State University and available online at <http://tecumseh.zo.ncsu.edu/coa/>.

Study Location: Southeastern Association of Fish and Wildlife Agencies member states (AL, AR, FL, GA, KY, LA, MS, MO, NC, OK, PR, SC, TN, TX, VA, WA, WV)

Project Status: Year 1 of 3

Collaborators:

Wildlife Resources Commission (WRC);
Arkansas Game and Fish Commission (AGFC);
Georgia Department of Natural Resources,
Wildlife Resources Division (GDNR)

Principal Investigators (in NC):

Allison Fowler (AGFC); Brett Albanese (GDNR);
Cindy Simpson (WRC)

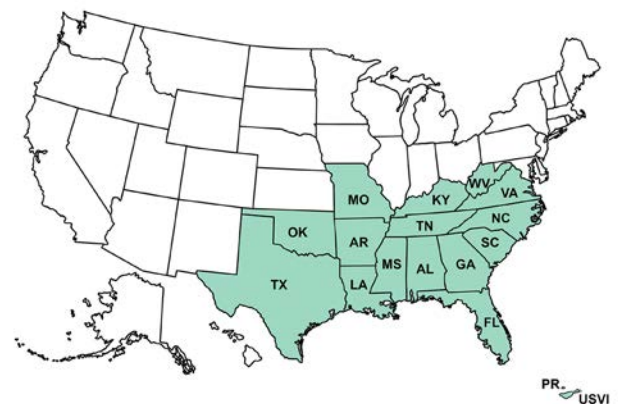
WRC Point of Contact:

Cindy Simpson, Wildlife Action Plan Coordinator
919-707-0227, cindy.simpson@ncwildlife.org

Funding:

State and Tribal Wildlife Grant – \$57,251

Southeastern Association of Fish & Wildlife Agencies Member State Boundaries



Legend

SEAFWA Member States

Landowner Perceptions of Elk in Western North Carolina

Elk were reintroduced in the Great Smoky Mountains National Park in the early 2000s. Since then, their population has expanded, and the elk have moved beyond the boundaries of the national park into neighboring communities. In 2013, the WRC assessed local resident attitudes and perceptions toward elk in western North Carolina. At that time, relatively few residents in the area had seen elk near their properties, and the majority supported having elk in the region. Roughly 10 years later, a follow-up study is being conducted to understand landowner views of elk now that the population has increased and expanded its range.

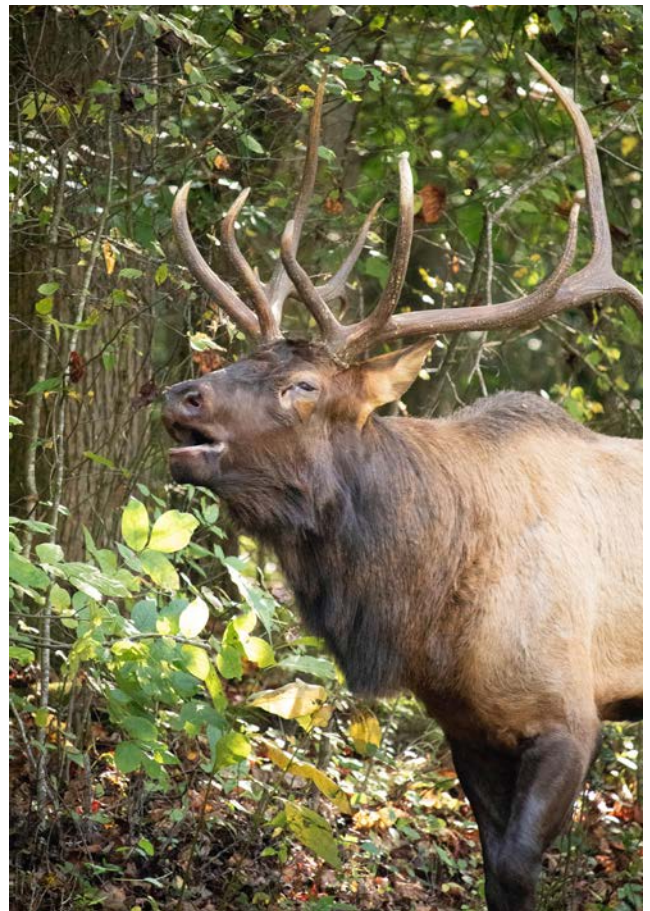
This study will survey a random sample of landowners in eight western North Carolina counties, with a focus on landowners in close proximity to the elk herds. The specific objectives are to assess landowner experiences with elk, opinions about possible outcomes and management actions, and likelihood of participation in elk viewing, hunting, and habitat management. By comparing results with the 2013 study with results from this study, staff will be able to assess changing attitudes toward elk over time. Findings from this project will inform elk management in western North Carolina. The survey was administered in summer 2022.

Study Population: Western North Carolina landowners

Project Status: Year 1 of 1



WRC



WRC

Collaborators:

Wildlife Resources Commission (WRC)

Principal Investigators:

Cristina Watkins, Kathryn Jewell, Justin McVey (WRC)

WRC Point of Contact:

Brad Howard, Wildlife Management Division Chief, brad.howard@ncwildlife.org

Funding:

Wildlife and Sport Fish Restoration Grant – \$41,000

Timber Rattlesnake Populations: Genetic Connectivity and Diversity

The timber rattlesnake resides in temperate deciduous forests of eastern North America and faces growing and varied range-wide conservation challenges. These conservation challenges are exacerbated by the reproductive characteristics of females, which include late age at maturity and infrequent reproduction. The greatest threats to the species in North Carolina are the loss and fragmentation of remaining habitats because of anthropocentric encroachment. Direct correlates of these threats are the loss of genetic diversity due to population isolation (genetic drift) and inbreeding (loss of heterozygosity) due to reductions in population size from road mortality. Reductions in allelic diversity and heterozygosity are the two major factors determining a population's likelihood to persist. Few populations in North Carolina are unaffected by these threats, yet currently no efforts are underway to evaluate population genetic diversity.

The objectives of this project are to utilize microsatellite loci to examine the genetic diversity and population structure of timber rattlesnake populations in North Carolina. We expect our study to make available the means to assess and compare genetic diversity as it relates to the effects of anthropocentric activities on populations. We expect study findings to provide a basis for the development of effective conservation and management programs for threatened populations of the timber rattlesnake in the state.

Study Location: Statewide

Project Status: Year 3 of a long-term project with undetermined duration



Jeff Hall



Jeff Hall



Jeff Hall

Collaborators:

Wildlife Resources Commission (WRC); Appalachian State University (ASU); NC Timber Rattlesnake Conservation Project (NCTRCP)

Principal Investigators:

Matt Estep (ASU); John Sealy (NCTRCP); Jeff Hall (WRC)

WRC Point of Contact:

Jeff Hall, PARC Biologist
jeff.hall@ncwildlife.org, 252-917-1683

Funding:

Operational budgets of individual collaborators

The Bridgewater Tailrace Brown Trout Fishery

Bridgewater Tailrace is a 18-mile waterway extending from Lake James to Lake Rhodhiss on the Catawba River in western North Carolina. An 11.1-mile reach of the stream is classified as Special Regulation Trout Waters by the WRC and is managed as a put-grow-and-take brown trout fishery.

Although the initial study spanned from 2011–2015, staff continue to explore the population dynamics of the fishery. Collaboration with Francis Marion University researchers supported the development of an integrated population model that incorporates monitoring data and low-cost batch mark-recapture data.

Study Location: Burke and McDowell counties

Project Status: Complete, but additional research on the fishery is ongoing



WRC



WRC

Collaborators:

Wildlife Resources Commission (WRC);
Francis Marion University (FMU)

Principal Investigators:

Jason Doll (FMU); Chris Wood, David Goodfred,
Jacob Rash (WRC)

WRC Point of Contact:

Chris Wood, District 8 Fisheries Biologist
chris.wood@ncwildlife.org, 828-437-3003

Funding:

Wildlife and Sport Fish Restoration Grant –
\$1,000

Publications:

Doll, J. C., C. J. Wood, D. W. Goodfred, and J. M. Rash. 2021. Incorporating batch mark-recapture data into an integrated population model of Brown Trout *Salmo trutta*. North American Journal of Fisheries Management 41:1390–1407.



WRC

Hunter Perspectives on Chronic Wasting Disease Management in North Carolina

In this two-year study, we are determining hunter knowledge and perspectives of Chronic Wasting Disease (CWD) through the use of online and phone surveys.

The study objectives are to measure the overall knowledge of CWD among deer hunters and measure their risk perception of CWD, and to determine hunting behaviors related to CWD and acceptance levels of various management actions.

While the need for this project was identified several years ago and work officially began in summer 2021, the initial detection of CWD in North Carolina has further heightened the importance of this project. Work in year one included the development and pre-testing of the survey followed by the full survey, which was shared with prospective respondents in early spring 2022.

Results from this study will identify gaps in hunter knowledge regarding CWD and help guide management actions necessary to combat the spread of the disease.

Study Location: Statewide with results applicable to the each of the five deer hunting zones

Project Status: Year 1 of 2



WRC



WRC

Collaborators:

Wildlife Resources Commission (WRC);
NC State University (NCSU)

Principal Investigators:

Nils Peterson, Catherine Lerosé, Lincoln Larson (NCSU); Cristina Watkins, Moriah Boggess (WRC)

WRC Point of Contact:

Moriah Boggess, Deer Biologist
moriah.boggess@ncwildlife.org, 910-548-1886

Funding:

Wildlife and Sport Fish Restoration Grant – \$174,110, including \$43,528 in non-federal match from NCSU

Communications Preferences among Constituents with Disabilities

In 2019, the Conservation Policy & Analysis Office conducted a project with the Land and Water Access Division to identify barriers faced by people with disabilities in accessing WRC game lands, infrastructure, and wildlife-associated recreational opportunities. The 2019 project showcased an interest in increased access to Trackchairs (all-terrain motorized chairs for users with mobility impairments) for WRC license holders with disabilities. As the agency prepared to update the Trackchair program, the Communications, Marketing, and Digital Engagement Office (CMDE) proposed conducting research with disabled constituents to develop inclusive marketing and communications materials for Trackchairs and the entire Disabled Sportsman program.

Three virtual focus groups with disabled constituents were conducted in late October and early November 2021. Specific language and image preferences were shared with CMDE and have been used to update the website and outreach materials. Another primary outcome of the focus groups was the consensus that disabled constituents desire more and improved access to resources. Additional recommendations included developing a shared and consistent terminology, distributing information in varied places with clear descriptions and instructions, using consistent symbology like the universal symbol for disabled resources or icons that show a specific activity alongside descriptive text, and using photos where appropriate to demonstrate resource use. The WRC will benefit from continued engagement with this community of constituents in evaluation and improvement of access to wildlife-associated recreation in North Carolina.

Study Population: Disabled constituents

Project Status: Year 1 of 1

Collaborators:

Wildlife Resources Commission (WRC)

Principal Investigators:

Fairley Mahlum, Julia Whitten, Luis Suau, Kathryn Jewell (WRC)

WRC Point of Contact:

Carrie Ruhlman, Senior Policy Analyst
carrie.ruhlman@ncwildlife.org

Funding:

WRC State Funds – \$4,500



WRC

Combining NABat and NCBAMP for Statewide Long-term Bat Acoustic Monitoring

In this multi-year study of bats, we integrate two monitoring programs and guide WRC staff to coordinate the citizen science component of the North American Bat Monitoring Program (NABat) to improve management of the resource.

Primary objectives are to collect, manage, and use NABat data to determine population trends with statistical sensitivity, determine local occurrence of species, particularly those with poorly understood distributions, and identify and separate factors/ threats that affect population and distribution.

Secondary objectives include developing protocols and education materials for engaging the public in bat surveys and collaborating with WRC education specialists to develop a statewide network of volunteers and participants by integrating NABat and the North Carolina Bat Acoustic Monitoring Program.

Study Location: Statewide

Project Status: Year 3 of 3



WRC



WRC

Collaborators:

Wildlife Resources Commission (WRC);
University of North Carolina Greensboro (UNCG); US Forest Service

Principal Investigators:

Han Li (UNCG); Katherine Etchison (WRC)

WRC Point of Contact:

Katherine Etchison Wildlife Diversity Biologist
katherine.etchison@ncwildlife.org
828-545-8328

Funding:

Wildlife and Sport Fish Restoration Grant –
\$221,991, including \$55,498 in non-federal
match from UNCG

Determining the Effects of Prescribed Burn Methods on Eastern Black Rail Occupancy through Callback Surveys and Acoustic Monitoring

Eastern black rails have undergone severe population declines within the past several decades due to human-induced habitat fragmentation, and it is now crucial to learn more about this species' distribution and habitat requirements before they face extinction. In this study, we are surveying parcels of potentially suitable habitat through standardized callback surveys, then deploying acoustic recording units to passively monitor the vocalization activity in areas with successful callback results. Specifically, we will be comparing activity in recently burned and unburned sites over the course of two breeding seasons (year of burn, 1 year post-burn).

Study Location: Game lands with suitable black rail habitat

Project Status: Year 1 of 2

Collaborators:

Wildlife Resources Commission (WRC);
East Carolina University (ECU)

Principal Investigators:

Susan McRae, Bailey Kephart (ECU)

WRC Point of Contact:

Carmen Johnson, Waterbird Biologist
carmen.johnson@ncwildlife.org
252-489-1061

Funding:

Wildlife and Sport Fish Restoration Grant –
\$60,560



Carmen Johnson



Carmen Johnson

Habitat Use of Hybrid Striped Bass (Bodie Bass)

This is a three-year study to determine the habitat use of hybrid striped bass in Lake Norman. Our collaborator, Duke Energy, has provided funding for telemetry tags as well as logistical support.

The primary objective of this study is to quantify the movements of hybrid striped bass in Lake Norman, with an emphasis on location during the summer months when suitable physical habitat is limited.

We implanted telemetry tags in 50 fish in May 2020 and 64 fish in May 2021 that can transmit temperature and depth data in real time. To detect fish movements, we are actively tracking fish using boat-mounted receivers and passively tracking using fixed location receivers. Results from summer 2021 indicate hybrid striped bass in the lower portion of the lake avoid the metalimnion and hypolimnion as predicted during summer months when those zones become anoxic. Passive and active tracking will continue through October 2022.

The results of this study will allow us to understand what habitats hybrid striped bass are found in throughout the year as well as provide information that may be applicable in predicting hybrid striped bass utility in other reservoirs.

Study Location: Lake Norman (Catawba, Lincoln, Mecklenburg, and Iredell counties)

Project Status: Year 3 of 3



WRC



WRC



WRC

Collaborators:

Wildlife Resources Commission (WRC);
Duke Energy

Principal Investigators:

Lawrence Dorsey, Kelsey Roberts, Corey Oakley (WRC); Scott Fletcher (Duke Energy)

WRC Point of Contact:

Kelsey Roberts, Piedmont Fisheries Research Coordinator, kelsey.roberts@ncwildlife.org
919-618-7945

Funding:

Wildlife and Sport Fish Restoration Grant – \$137,000, including \$32,000 in non-federal match from Duke Energy

Distribution, Habitat Preferences, and Landscape Genetics of Appalachian Cottontail in Western North Carolina

This study was to investigate the distribution, habitat preferences, and population genetic structure of the Appalachian cottontail in western North Carolina.

Primary objectives were to 1) assess habitat selection and home range size from scat transect surveys and telemetry data from radio-collared individuals. From these data, we created a predictive occupancy map of Appalachian cottontails. These data were used to a) determine the distribution of Appalachian cottontail within western North Carolina, b) highlight potential survey areas for monitoring, and c) determine habitat preferences to guide in habitat management; and 2) conduct a genetic analysis on Appalachian cottontails with ear punches from live captured individuals and scat collected from scat transects to determine population genetic structure and migration patterns, potential hybridization with the sympatric eastern cottontail, and estimates of populations parameters. These data were also used to determine impacts that habitat modification and climate change are having on eastern cottontail encroachment into Appalachian cottontail habitat.

Over the course of 5,488 trap nights, we captured 52 cottontails (40 Appalachian cottontails, 12 eastern cottontails) and collared 26 of those individuals (14 males, 12 females). For Appalachian cottontails, average home range estimates were non-normally distributed. Average 50% and 95% home ranges were 2 acres and 8.4 acres, respectively. At high-elevation sites, we found cottontails most closely associated with shrub balds. At low-elevation sites, we found cottontails significantly closer to pine/hemlock habitats.

All approaches used to identify population genetic structure showed strong support for four populations when all samples from both species were included. Not surprisingly, these approaches identified eastern cottontail as one of the groupings and three populations of Appalachian cottontails.

Results from this survey were used to develop the Appalachian Cottontail 2.0 project.

Collaborators:

Wildlife Resources Commission (WRC);
Tangled Bank; Virginia Tech;
Warren Wilson College

Principal Investigators:

JJ Apodaca (Tangled Bank); Liesl Erb
(Warren Wilson College); Cordie Diggins
(Virginia Tech); Andrea Shipley (WRC)

WRC Point of Contact:

Andrea Shipley, Mammalogist
andrea.shipley@ncwildlife.org, 919-495-4001

Funding:

Wildlife and Sport Fish Restoration Grant –
\$262,596

Study Location: Blue Ridge Mountain subregion of the southern Appalachian physiographic province in western North Carolina

Project Status: Completed



WRC

Wildlife Control Agent Training Preferences

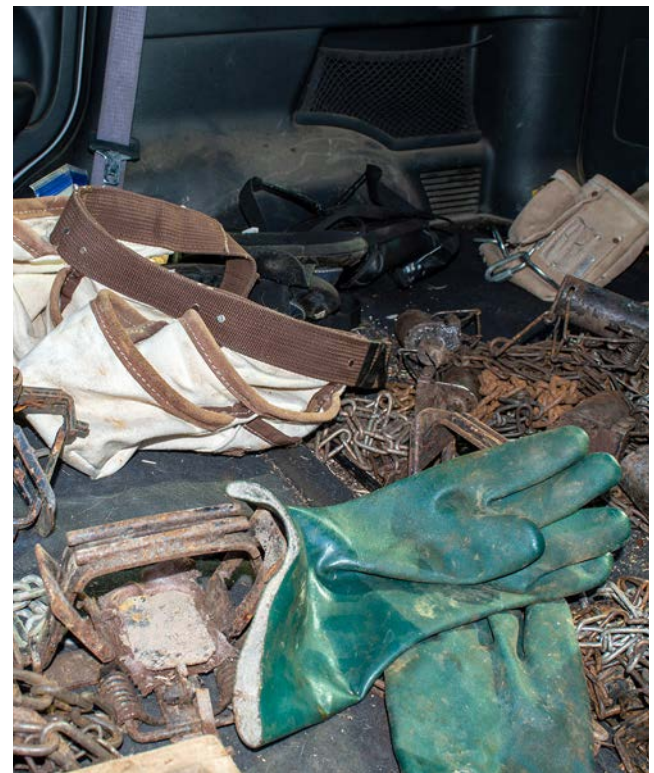
In March 2022, social scientists surveyed Wildlife Control Agents (WCAs) to help prepare for the incoming Wildlife Control Technicians (WCTs) certification and training from Regulated Activities and Permits and the Wildlife Education Division. Staff sent 500 surveys to all active and recently certified WCAs. Of those, 150 were returned, resulting in a 30% respondent rate. Half of the respondents are the sole employee of their company, and 27% of respondents work with technicians. Respondents have around 154 technicians total, but extrapolating to all WCAs, there are around 540 who will need to attend a training to become certified. Technicians are most commonly responsible for trapping and exclusions, and while there are several topics that will be important for WCTs to learn from the WRC, rules and regulations, personal safety, and responsibilities of being a WCT had the highest interest. Respondents also evaluated their own training, with mostly favorable opinions. Overall, respondents shared good ideas and suggestions on both WCA and WCT training. Results from this survey will help set the agenda for WCT trainings and improve future WCA trainings.

Study Population: Current Wildlife Control Agents

Project Status: Year 1 of 1, completed



Janet Griffin



Shutterstock

Wildlife Law Enforcement Recruitment

In December 2021, Social Scientists surveyed Wildlife Law Enforcement Officers (WLEOs) who had recently graduated from training to assess their experiences with the recruitment process to assist the Office of Communications, Marketing and Digital Engagement improve recruitment materials. Staff sent 33 surveys to all graduates from the two most recent training classes. In terms of the recruitment process, the majority of respondents rated their experience finding the position, the interview process, and basic training very good or excellent, while fewer felt similarly about the length of the entire process. When asked what positions they were looking for, the majority of respondents were mostly interested in wildlife law enforcement positions, but several were considering other positions in law enforcement. Being outdoors and working in law enforcement were the main aspects that drew them to the position. Overall, respondents were complimentary of the position and of the recruitment process and described how the new challenges and seasonal variety allow them to enjoy their positions. Results from this survey provided suggestions for a new WLEO recruitment video and marketing materials.

Study Population: 2019 and 2021 Law Enforcement graduates

Project Status: Year 1 of 1, completed



WRC



WRC

Collaborators:

Wildlife Resources Commission (WRC)

Principal Investigators:

Kathryn Jewell, Malorey Henderson, Mindy Wharton, Forrest Orr (WRC)

WRC Point of Contact:

Malorey Henderson, Internal Communications Specialist, malorey.henderson@ncwildlife.org

Funding:

WRC State Funds

Species Delimitation and Identity of Largemouth Bass and Florida Bass in North Carolina

In this study, we are providing phylogenetic insights into the distribution of Florida bass, generally considered to only be in Florida. Recent genetic analysis of largemouth bass in North Carolina suggests that Florida bass alleles are dominant in wild largemouth bass in the coastal region.

Inland Fisheries Division coastal region staff collected largemouth bass tissue samples and whole specimens in fall 2021 as a part of a regional study to assess the phenotype and genotypes of largemouth bass in systems below the Fall Line and in coastal systems of the southeastern United States.

Results of this study will provide a better understanding of why these Florida bass alleles are in higher proportion in these systems compared to research conducted in the 1940s.

Study Location: Tar River, Neuse River, New River, Chowan River, Lake Phelps, Lake Mattamuskeet

Project Status: Year 1 of 2

Collaborators:

Wildlife Resources Commission (WRC);
Yale University (Yale)

Principal Investigators:

Tom Near and Daemin Kim (Yale); TD Van-Middlesworth, Katy Potoka, Chris Smith, Ben Ricks, Kevin Dockendorf (WRC)

WRC Point of Contact:

Kevin Dockendorf, Fisheries Research
Coordinator – Coastal Region, 252-312-6122
kevin.dockendorf@ncwildlife.org

Funding:

Yale – \$23,000, WRC Inland Fisheries Division
Operational Funds



WRC



WRC

Egret Ecology in Eastern Carteret County

Wildlife population changes can be mysterious. For the last few decades, the breeding populations of snowy egrets, tricolor herons, and little blue herons have been declining in the southeastern USA. Ecologists with 1000 Herons (a non-profit that focuses on egret and heron ecology and education) and Lenoir-Rhyne University are beginning a multi-year effort to try to understand these declines. Nests are being monitored with trail cams, and foraging flight directions are being documented as are foraging locations.

Study Location: Carteret County

Project Status: Year 1 of 2



1000 Herons

Collaborators:

Wildlife Resources Commission (WRC);
1000 Herons; Lenoir-Rhyne University (LRU)

Principal Investigators:

John Brzorad (1000 Herons); Carmen Johnson, Sara Schweitzer (WRC);
Alan Maccarone, Dawn Rennick (LRU)

WRC Point of Contact:

Carmen Johnson, Waterbird Biologist
carmen.johnson@ncwildlife.org
252-489-1061

Funding:

Wildlife and Sport Fish Restoration Grant –
\$19,000



Tagged Great Egret - John Brzorad

Fine-scale Resource Selection, Diet, and Reproduction of Urban Black Bears and a Before-After Design to Evaluate the Impacts of BearWise® Outreach

In this five-and-a-half-year study, we build on the initial objectives of the first urban-suburban bear study and will provide a better understanding on fine-scale resource selection and diet of urban/suburban black bears; how diet influences black bear movements and reproduction; and the effectiveness of implementing the BearWise outreach program to address human-bear interactions. The objectives of the study are 1) to quantify landscape attributes and fine-scale variables associated with foraging events, 2) assess resource selection, 3) determine diet composition to assess the contribution of anthropogenic foods and how diet may influence movements, reproductive success and timing of den entry and emergence, and 4) determine if BearWise outreach causes changes in public perceptions about bears, bear management behaviors, bear-human encounters, and compliance with BearWise practices. Results from this study will help guide management decisions that meet the WRC's black bear management goal: *“Use science-based decision making and biologically-sound management principles to manage black bear populations in balance with available habitats and human expectations to assure long-term existence and hunting opportunities.”*

Study Location: In and around Asheville

Project Status: Year 3 of 5



Colleen Olfenbittel



Colleen Olfenbittel

Collaborators:

Wildlife Resources Commission (WRC); NC State University (NCSU); numerous private landowners

Principal Investigators (in NC):

Chris DePerno, Jen Strules (NCSU); Colleen Olfenbittel (WRC)

WRC Point of Contact:

Colleen Olfenbittel, Black Bear and Furbearer Biologist, colleen.olfenbittel@ncwildlife.org

Funding:

Wildlife and Sport Fish Restoration Grant – \$1,123,526, including \$282,340 in non-federal match from NCSU

Publications:

“An Education in Black Bears”, Jennifer Strules, Christopher DePerno, and Colleen Olfenbittel, *Wildlife in North Carolina*, May/June 2022

Lake Norman F-1 Largemouth Bass Evaluation

This is a five-year study to examine the efficacy of stocking F-1 largemouth bass in Lake Norman. F-1 largemouth bass are a hybrid cross between Florida and northern strain largemouth bass that are produced in commercial fish hatcheries. These hybrids have been shown to grow larger than wild largemouth bass in other systems outside North Carolina.

Our primary objectives are to 1) determine the persistence of these stocked fish in Lake Norman over time and 2) to determine if they grow faster and/or larger than wild-spawned largemouth bass.

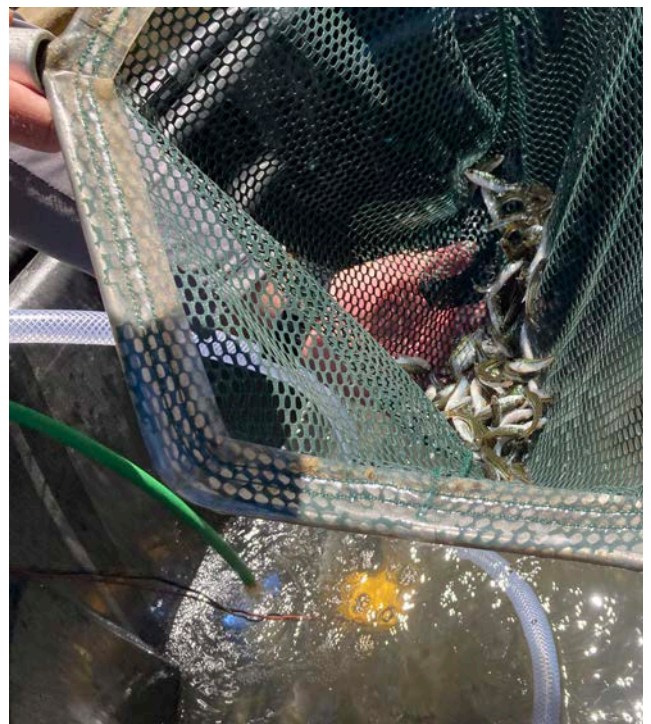
In 2020, we stocked 2,000 sub-adult largemouth bass followed by stockings in 2021 of 40,000 fingerlings and 2,000 sub-adults. An initial evaluation of these stockings was conducted via an electrofishing survey in April 2022. Genetic results to determine if any stocked F1 fish were captured are pending. Additional fingerling stockings are scheduled for summers 2022-2026. It will take several years for these fish to reach harvestable size and for conclusions to be made regarding the effects of stocking F1 hybrids in Lake Norman.

Study Location: Lake Norman (Catawba, Lincoln, Mecklenburg, and Iredell counties)

Project Status: Year 2 of 5



WRC



WRC

Collaborators:

Wildlife Resources Commission (WRC);
Lake Norman Legends angling group

Principal Investigators:

Casey Joubert, Lawrence Dorsey, Kelsey Roberts (WRC)

WRC Point of Contact:

Casey Joubert, District 6 Fisheries Biologist
casey.joubert@ncwildlife.org, 910-729-0872

Funding:

Wildlife and Sport Fish Restoration Grant –
\$369,000

North Carolina Fishing, Hunting, and Wildlife-Associated Recreation Survey

The US Fish and Wildlife Service (USFWS) has conducted a national survey of fishing, hunting, and wildlife-associated recreation (FHWAR) roughly every five years since 1955, with the most recent editions of the survey released in 2011 and 2016. The survey has typically consisted of a national survey, along with increased sampling efforts in individual states to provide more accurate state-level data, though the state-level data collection was not performed in 2016.

The survey is occurring again in 2022 but will be performed by a new contractor. Due to recent decreases in response rates for these surveys, the methodology for the 2022 statewide FHWAR survey differs from past surveys, including less robust non-probability sampling. Additionally, states will be required to pay for state-level sampling this year. Because of these requirements, the WRC decided to conduct a comparable statewide study in-house.

The WRC FHWAR study will survey a random sample of the North Carolina public to assess participation and expenditures for wildlife-associated recreational activities. The survey will ask the public about its hunting, fishing, and wildlife-associated recreation habits, trip profiles, species preferences, equipment usage, and more. In addition to the items included in the national FHWAR survey, other questions of particular interest to the agency will be added in collaboration with representatives throughout the WRC. Results from this survey will help assess the number of constituents and value of wildlife-associated recreation to the North Carolina economy.

Study Population: North Carolina general public

Project Status: Year 1 of 1

Collaborators:

Wildlife Resources Commission (WRC)

Principal Investigators:

Cristina Watkins, Kathryn Jewell,
Carrie Ruhlman (WRC)

WRC Point of Contact:

Carrie Ruhlman, Senior Policy Analyst
carrie.ruhlman@ncwildlife.org

Funding:

WRC State Funds – \$51,000



Sydney Brown



John Henry Harrelson

Population Genetics Assessments of Two Conservation Priority Fish in the Upper Dan River Basin

The rustyside sucker, (NC state endangered) and orangefin madtom (NC state endangered, Federal species of concern) are two conservation priority freshwater fish native to the upper Dan River basin in North Carolina and Virginia. Both species can be found in the Dan River headwaters of North Carolina and Virginia, as well as the headwaters of the Mayo and Smith Rivers in Virginia, both major tributaries to the Dan River. Neither species has been recorded from outside these three isolated headwaters, suggesting that rustyside suckers and orangefin madtoms are not able to utilize the mainstem Dan River for migration and that these populations are therefore strongly isolated. While this may be the case historically and populations of these species could have been isolated through geologic phenomena, water quality declines, as well as multiple dams on each river, also pose significant physical and abiotic barriers to upstream migration and population connectivity for both species and preclude natural reestablishment of these species from streams where they once may have lived.

In 2021, we collected tissue samples from approximately 80 individuals of both species in the Dan River basin of both states for genetics assays to 1) assess the overall genetic diversity of each population, 2) examine the genetic connectivity among populations, and 3) identify potential source populations for reintroductions and/or translocations. Findings from this research will allow WRC biologists to utilize sound science and hard data to help establish these unique fish species into more North Carolina streams.

Study Location: Multiple sites in the Dan River in Stokes County, NC; and Smith River and Mayo River in Patrick County, VA.

Project Status: Year 1 of 2



WRC

Collaborators:
Wildlife Resources Commission (WRC);
Virginia Department of Wildlife Resources

Principal Investigators:
Michael Perkins, William Russ, Heather Evans
(WRC)

WRC Point of Contact:
Michael Perkins, Foothills Aquatic Wildlife
Diversity Biologist, 828-559-7202
michael.perkins@ncwildlife.org

Funding:
State Wildlife Grant – \$30,000



Rustyside sucker - WRC



Orangefin madtom - WRC

Common Carp Biomass Removal at Mattamuskeet National Wildlife Refuge

An Integrated Pest Management Strategy for Common Carp Removal project will begin in October 2022. In May 2021, carp barrier installation was completed at four water control structures managed by the US Fish and Wildlife Service (USFWS). The barriers are successfully preventing common carp from entering the lake as observed by WRC and USFWS staff. (Video available)

Previous research has demonstrated that bluegills eat common carp eggs. Bluegills were cultured at Watha State Fish Hatchery. Coastal fisheries staff scatter-stocked 175,000 bluegills (3-5 inches) in March 2022.

Common carp biomass removal is anticipated to be conducted by permitted contractors with activity to begin October 2022. The estimated biomass for removal is 4 million pounds of common carp. This component is supported by a \$1 million grant for Invasive Species Removal at National Wildlife Refuges.

The objective is to improve submerged aquatic vegetation as critical habitat for waterfowl and the lake ecosystem by decreasing grazing and turbidity.

Study Location: Lake Mattamuskeet

Project Status: Year 3 of 7



WRC



WRC

Collaborators:

Wildlife Resources Commission (WRC); US Fish and Wildlife Service (USFWS) – Mattamuskeet National Wildlife Refuge

Principal Investigators:

Wendy Stanton, Kendall Smith, Mike Wicker (USFWS); Doug Howell, Katy Potoka, Kevin Dockendorf (WRC)

WRC Point of Contact:

Kevin Dockendorf, Fisheries Research Coordinator – Coastal Region
kevin.dockendorf@ncwildlife.org
 252-312-6122

Funding:

USFWS Large Invasive Species Grant, USFWS Coastal Funds, WRC – \$1,200,000

Comparative Population Genetics of Small Mammals in the Spruce-Fir Ecosystem of Western North Carolina

Focal study species are the rock vole, southern red-backed vole, woodland jumping mouse, red squirrel, and northern flying squirrel, emphasizing the Carolina northern flying squirrel. These mammals are associated with the spruce-fir ecosystem of western North Carolina and are state and federal priority taxa. Among these species, we will conduct comparative population genetic analyses and new field surveys, collect tissue samples and, when possible, voucher specimens, and perform detailed population genetic analyses, using both mitochondrial DNA (mtDNA) and nuclear DNA (microsatellite) markers.

Our objectives for southern Appalachian Spruce-Fir Sky Island populations of each species include:

- characterizing genetic diversity and unique genetic features,
- determining potential genetic source and sink populations,
- determining potential impacts on genetic diversity of population isolation,
- evaluating historical and contemporary gene flow between sampling locations and relating this to measures of distance and/or environmental features.
- determining if any populations represent unrecognized species, subspecies, evolutionary significant units, or management units, and
- performing a synthetic meta-analysis of our five target species and creating “heat maps” characterizing where the genetic component of biodiversity is relatively high and relatively low within the study areas.

Information from this study will be the basis for better understanding the genetic component of biodiversity in the spruce-fir ecosystem of North Carolina and can be used to help develop genetic management plans for each species.

Study Population: See map

Project Status: 1 of 4

Collaborators:

Wildlife Resources Commission (WRC);
University of North Carolina Wilmington
(UNCW)

Principal Investigators:

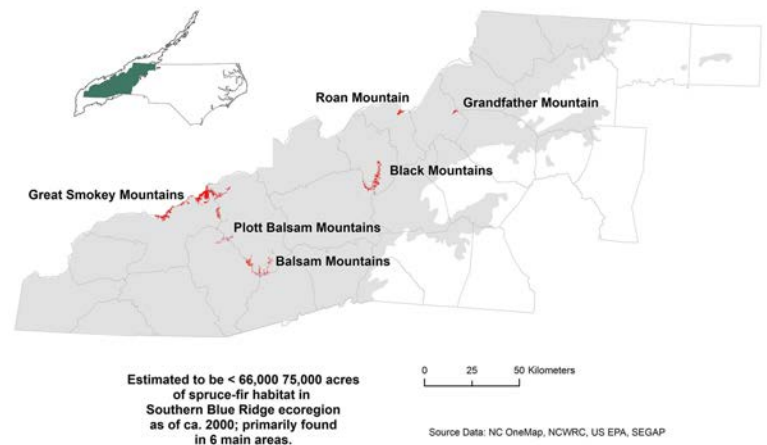
Brian S. Arbogast, Stephanie J. Kamel, UNCW;
Kendrick Weeks (WRC)

WRC Point of Contact:

Kendrick Weeks, Western Wildlife Diversity
Coordinator, kendrick.weeks@ncwildlife.org
919-609-7605

Funding:

Wildlife and Sport Fish Restoration Grant –
\$313,867



Understanding Hunter Education Graduates

Since 1991, successful completion of a Hunter Education (HE) course has been required to purchase a hunting license in North Carolina. As such, thousands of people have completed the course. However, only about 20% of HE graduates purchase a license after completing HE. Through this project, we attempted to understand those individuals who do not purchase licenses by identifying their motivations for taking the course and barriers to buying a license.

Reasons these HE graduates had not purchased a license included: living or hunting out of state, not having anywhere to hunt, not having anyone to hunt with, or not having time to hunt. Their motivations for taking the course included: wanting to learn about hunter/firearm safety, being a requirement for a license, and attending with a friend. They also identified barriers to hunting such as lack of access to privately owned land, over-crowding of public lands, no public lands near them, not having people to hunt with, and lack of knowledge on field dressing/handling harvests.

Outcomes of this project included a report with recommendations for the Wildlife Education Division and the Office of Communications, Marketing, and Digital Engagement. The next phase of this project will involve targeted marketing and follow-up classes to recent HE graduates.

Study Population: Hunter education course graduates who had not purchased a hunting license

Project Status: Year 1 of 1



WRC



WRC

Collaborators:

Wildlife Resources Commission (WRC)

Principal Investigators:

Kathryn Jewell, Cristina Watkins, Julia Whitten, Fairley Mahlum, Jamie Hall, Carrie Ruhlman, Travis Casper (WRC)

WRC Point of Contact:

Carissa Daniels, Outreach Manager
carissa.daniels@ncwildlife.org

Funding:

Wildlife and Sport Fish Restoration Grant – \$4,600

Ecological Studies and Monitoring Strategies for Eastern Spotted Skunks in North Carolina

The eastern spotted skunk, once a common furbearer, is estimated to have undergone >90% decline across its range since the 1950s. Very little is known about the status or ecology of this species. In 2015, the spotted skunk was listed as a research priority species in the NC Wildlife Action Plan due to substantial knowledge gaps. The objectives of the study are to determine spotted skunk distribution, habitat associations, and carnivore community dynamics; test and develop guidelines for long-term survey methodologies; determine fine-scale den site selection and movement ecology; and determine life history traits to generate an understanding of long-term population viability in North Carolina. A secondary objective is to cooperate with a multi-state effort to evaluate the genetic differentiation and disease ecology of eastern spotted skunks throughout North America. Results of this study will increase our understanding of basic life history traits (e.g., mortality factors, survivorship, habitat use, movements, reproduction) to determine the population status and inform the WRC on actions that can be taken to better survey, monitor, and manage this species.

Study Location: Dupont State Forest, South Mountains area

Project Status: Year 4 of 4



WRC

Collaborators:

Wildlife Resources Commission (WRC); Clemson University (Clemson); Dupont State Forest; South Mountains State Park; Foothills Conservancy; Andrew Butler, Greg Detweiler (Clemson)

Principal Investigators:

David Jachowski, Stephen Harris (Clemson); Chris DePerno, Jen Strules (NCSU), Colleen Olfenbuttel (WRC)

WRC Point of Contact:

Colleen Olfenbuttel, Black Bear and Furbearer Biologist, colleen.olfenbuttel@ncwildlife.org

Funding:

Wildlife and Sport Fish Restoration Grant – \$510,274, including \$127,575 in non-federal match from Clemson

Publications:

Detweiler, Gregory P., S. N. Harris, C. Olfenbuttel, and D. S. Jachowski. 2022. First tracking of an eastern spotted skunk litter from birth to independence. *Mammalia*. 86(3): 225-229

Harris, Stephen N., C. Olfenbuttel, and D. S. Jachowski. 2021. Canine distemper outbreak in a population of eastern spotted skunks. *Southeastern Naturalist* 20(11): 181-190.

Detweiler, Gregory P., S. N. Harris, C. Olfenbuttel, and D. S. Jachowski. 2021. Burrow excavation by an eastern spotted skunk and visitation by a long-tailed weasel. *Southeastern Naturalist* 20(11): 234-240.

Butler, Andrew R., A. J. Edelman, R.Y.Y. Eng, S.N. Harris, C. Olfenbuttel, E.D. Thorne, W.M. Ford and D.S. Jachowski. 2021. Demography of the Appalachian spotted skunk (*Spilogale putorius putorius*). *Southeastern Naturalist* 20(11): 95-109.

Beaver Management Assistance Program Evaluation

Since its inception in 1992, the Beaver Management Assistance Program (BMAP) has been providing the landowners of North Carolina affordable beaver damage assistance and mitigation. Except for an outcomes survey completed by the NC Department of Transportation in 2011, no input from any other BMAP stakeholders (landowners or county managers) has ever been solicited. As BMAP approaches its 30th year, it became apparent an evaluation of the program was necessary. This project had two phases. The first phase was an email survey of the county managers responsible for enrollment. Counties must buy into this program for landowners to utilize the services. The enrollment fee started at \$4,000 a year and has since increased to \$6,000. This first phase showed that counties have mostly positive feelings toward BMAP and the services it provides residents of that county. Phase 2 was a survey of landowners who have used BMAP services. Analysis is ongoing, with an anticipated finalized report. Outcomes of this project will inform the BMAP advisory board on future program and fee changes and provide a baseline for the creation of an evaluation tool for landowners.

Study Population: County managers, landowners who have used BMAP assistance

Project Status: Year 1 of 1



WRC



WRC

Collaborators:

Wildlife Resources Commission (WRC);
USDA-APHIS-Wildlife Services (USDA)

Principal Investigators:

Kathryn Jewell, Falyn Owens, Julia Whitten,
Cristina Watkins (WRC); Todd Menke (USDA)

WRC Point of Contact:

Falyn Owens, Extension Wildlife Biologist
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Funding:

Wildlife and Sport Fish Grant – \$5,100

Trout Health Investigations in North Carolina

In 2015, *Myxobolus cerebralis* (*Mc*; the parasite that causes whirling disease) was confirmed in rainbow trout collected from Watauga River. Subsequent testing of oligochaete hosts and wild trout stocks found the parasite in eight major river basins (Catawba River, French Broad River, Hiwassee River, Little Tennessee, New River, Savannah River, Watauga River, and Yadkin River basins). In addition, gill lice have been found on brook trout and rainbow trout populations.

Although the WRC has conducted a multi-year research project with researchers from Auburn University to explore the distribution and life history characteristics of *Mc* and gill lice in North Carolina, the WRC continues to sample trout populations across the mountains of North Carolina to aid these investigations (e.g., responding to angler reports, evaluation of potential native brook trout propagule sources for population restoration, and addressing a spatial deficiency in testing results). In 2022, research focused on the oligochaete hosts of *Mc*.

Ongoing research efforts continue to expand upon those data collected within this project.

Study Location: Statewide, with emphasis on the state's Public Mountain Trout Waters

Project Status: Ongoing

Collaborators:

Wildlife Resources Commission (WRC);
Auburn University (AU)

Principal Investigators:

Ash Bullard (AU); Jacob Rash (WRC)

WRC Point of Contact:

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Funding:

Wildlife and Sport Fish Restoration Grant –
\$15,000



WRC



WRC



WRC

Pathway to Wildlife Relevancy: Social Science Research Component

Over the last 75 years, the Wildlife Education Division (WED) has undergone numerous structural changes, but the mission to connect the public with North Carolina's wildlife and agency resources has not changed. To expand agency relevancy, a division-wide evaluation was proposed. Part of this evaluation included gathering the opinions of all the stakeholders involved with WED, from license holders to the general public.

Through a variety of data collection methods, over 6,000 stakeholders were surveyed, including 79 participants in listening sessions, 347 agency survey respondents, and over 1,000 educators. Most respondents supported WED's mission and found the programs they attended to be beneficial. However, the project highlighted the need for WED to improve its communication and outreach to the public, as many people didn't know the breadth of the agency's classes and programs. Other outcomes included gaining insights on how to target programming to various constituents by gathering preferred topics of interest and timing/format of programs. The final steps for the project are to establish individualized class evaluations, develop an operational plan for WED, and create individual program plans for each topic/skill area taught by WED staff.

Study Population: Statewide WED stakeholders including traditionally served constituents (hunters, anglers, trappers, boaters, shooters, etc.), educators (schools/camps, etc.), non-licensed constituents (bird watchers, wildlife photographers, other game land users), the North Carolina general public, partner organizations, and WRC staff

Project Status: Year 2 of 2



WRC



WRC

Collaborators:

Wildlife Resources Commission (WRC);
Wildlife Management Institute (WMI)

Principal Investigators:

Travis Casper, Kathryn Jewell, Cristina Watkins,
Julia Whitten, Carrie Ruhlman, Chris Bova
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WRC Point of Contact:

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Funding:

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Tri-colored Heron - Judy Gallagher