

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

2020-2021



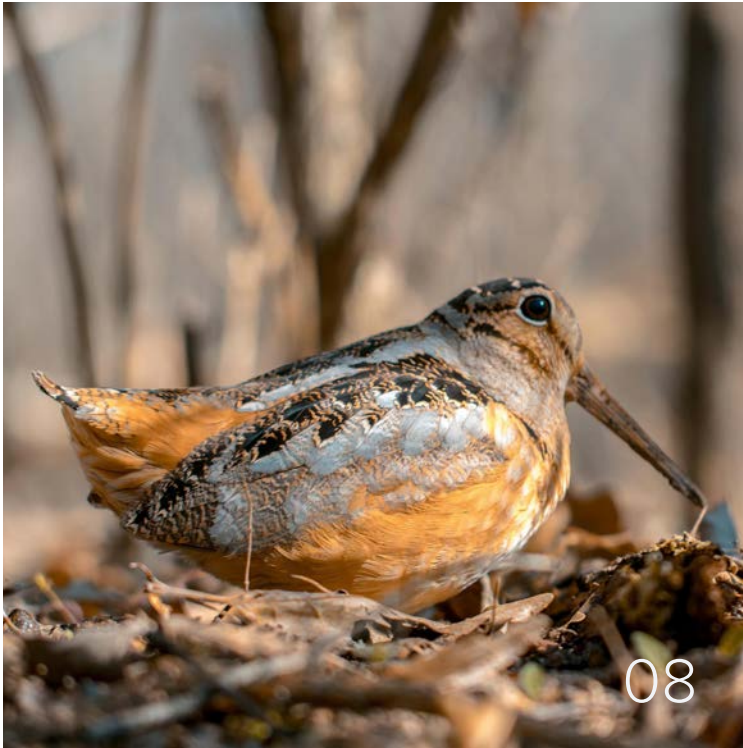
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Colleen Olfenbuttel

INTRODUCTION

Since the agency's inception in 1947, N.C. Wildlife Resources Commission staff have managed and protected the wildlife resources of our state to perpetuate our terrestrial and aquatic species and habitats and provide 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. Research is 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

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 satellite transmitters were fitted on captured woodcock, 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 3 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, and numerous NGOs

Principal Investigators (in NC):

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Doug Howell



Dale Rasmussen

Eastern Hellbender Reproductive and Larval Ecology

In this three-year study, researchers gained a comprehensive understanding of spatial and temporal variation in hellbender demography in three regional study areas across the state.

Primary objectives were to establish and evaluate the effectiveness of artificial shelter arrays of two different designs across land use gradients, compare nesting success, adult behavior, seasonal use, and environmental conditions in natural versus artificial nest shelters, and investigate habitat selection patterns of emergent larvae in the wild and in an experimental setting.

A secondary objective was to compare retention and readability of multiple tag types in larvae. Recommendations from the study will serve as a solid foundation to inform future monitoring, population status, and habitat management actions.

Study Location: Western North Carolina, with emphasis on streams in Henderson, Transylvania, and Graham counties

Project Status: Year 3 of 3; study completed in August 2020

Collaborators:

Wildlife Resources Commission (WRC)
Clemson University (CU)
United States Forest Service
Carolina Headwaters, LLC (CH)

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John Groves

Statistical Analysis of Golden Eagle Camera Trap and Telemetry Data

In this one-year study, researchers gained information on the ecology of golden eagles to better understand winter distribution, habitat use, and habitat selection of golden eagles in western North Carolina. Much of the data were collected by staff over multiple seasons, and this analysis is part of a larger southeastern analysis of data gathered from camera traps and satellite telemetered birds across the region.

Primary objectives were to determine the distribution of golden eagles in the Southeastern United States at the county and ecoregion level using recent camera trap and telemetry data and all credible records in eBird and regional ornithological journals, determine habitat use at the ecoregion level using telemetry data, estimate winter home range sizes in western North Carolina, and generate a predictive model of golden eagle habitat selection at the ecoregion level using resource selection functions,

A secondary objective was to provide at least two specific suggestions of best management practices for golden eagles in the southern Appalachians based on results.

Study Location: Western North Carolina

Project Status: Year 1 of 1; study completed in July 2021

Collaborators:

Wildlife Resources Commission (WRC)
Conservation Science Global, Inc.
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Principal Investigators:

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Trish Miller



Christine Kelly

Using Fine Scale GPS Technology to Research Sympatric Canid Population Dynamics

The goal of this study was to lay the groundwork to meet many of the research objectives identified by the WRC and US Fish and Wildlife Service to improve management of canids on the Albemarle Peninsula (AP). Specifically, the three main objectives were to understand the spatiotemporal variation in sympatric canid movement and habitat selection, evaluate performance of GPS collar and proximity sensor technologies, and understand these results in the context of canid ancestry (comparisons among coyotes, red wolves, hybrids, and backcrossed individuals) and in relation to previous work when the composition of sympatric canids may have been different.

Overall, we found very similar results to others who have studied canids on the AP; specifically, no differences in home range composition among habitat types and the importance of agricultural land cover. Home Range and Core Area sizes among residents and transients were also similar to other studies on the AP, and we found no difference between residents and transients in terms of their habitat selection at either spatial scale. We found that only 33% of our sympatric canids were residents, which differs from other published studies across the south.

Study Location: Dare, Hyde, and Tyrrell counties

Project Status: Completed June 30, 2021

Collaborators:

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

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Andrea Shipley



WRC

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 across 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 2 of 3

Collaborators:

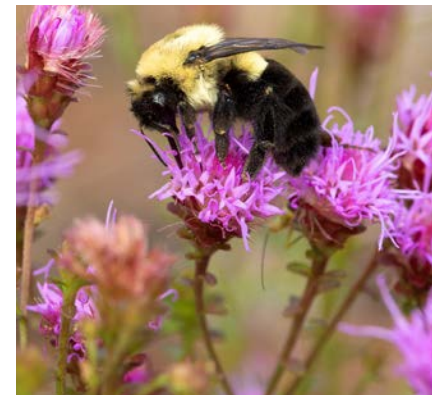
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Photos by Melissa McGaw

Whirling Disease Investigations

In 2015, *Myxobolus cerebralis* (*Mc*; the causative agent of whirling disease) was confirmed in rainbow trout collected from Watauga River the first documentation of the parasite in North Carolina.

The WRC initiated a three-year research project with scientists at Auburn University’s Southeastern Cooperative Fish Parasite and Disease Laboratory to explore the distribution and life history characteristics of *Mc* in North Carolina.

Over 3,500 trout were examined during this project. As such, this effort yielded one of the most robust examinations of *Mc* in the Southeastern United States, generated data critical to management of salmonid stocks regionally, and provided research to inform global understanding *Mc* and fish health.

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: Completed, but additional research is ongoing.

Collaborators:

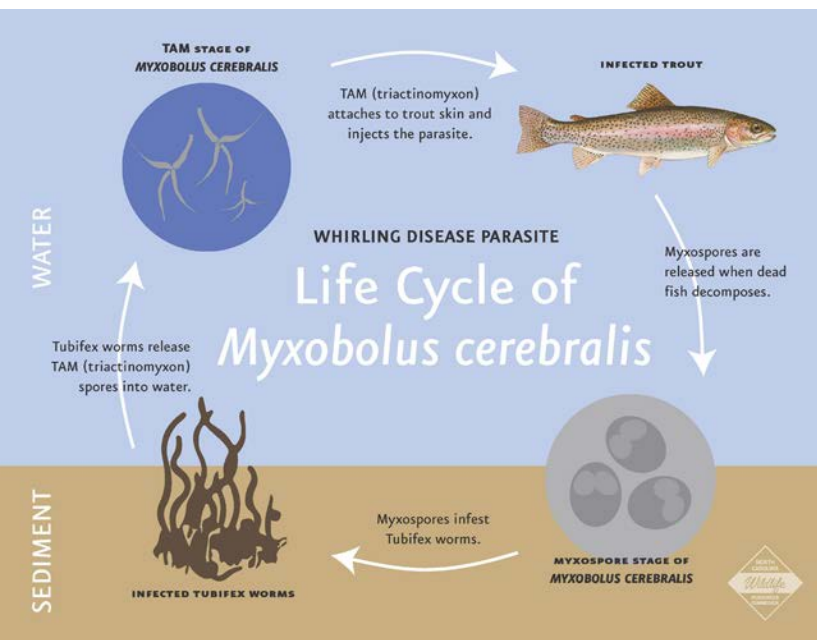
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Barry Nehring

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-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 evaluate the effectiveness of implementing the BearWise® outreach program to address human-bear interactions.

The objectives of the study are to quantify landscape attributes and fine-scale variables associated with foraging events; assess resource selection; 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 determine if BearWise® outreach causes changes in public perceptions about bears, bear management behaviors, bear-human encounters, and compliance with BearWise® practices.

Results of 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, NC

Project Status: Year 2 of 5

Collaborators:

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

Principal Investigators:

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Photos by Colleen Olfenbuttel

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

In this six-year study, we are gaining 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.

Secondary objectives are 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 Cape Fear River and research and survey efforts in coastal rivers.

Study Location: Cape Fear River and tributaries

Project Status: Year 5 of 6

Collaborators:

Wildlife Resources Commission (WRC)
University of North Carolina 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:

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Thomas Harvey



Kevin Dockendorf

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

In this two-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 statewide network of volunteers and participants by integrating NABat and the North Carolina Bat Acoustic Monitoring Program (NCBAMP).

Study Location: Statewide

Project Status: Year 2 of 3

Collaborators:

Wildlife Resources Commission (WRC)
University of North Carolina
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Principal Investigators:

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Katherine Etchison



Melissa McGaw

Ecological Studies and Monitoring Strategies for Eastern Spotted Skunks

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 [NC Wildlife Action Plan](#) listed the spotted skunk as a research priority 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: Western North Carolina, with trapping efforts in Dupont State Forest and South Mountains area

Project Status: Year 2 of 4

Collaborators:

Wildlife Resources Commission (WRC)
Clemson University (CU)

Principal Investigators:

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Colleen Olfenbittel



John MacGregor

Assessing the Status and Distribution of Fish-eating Seabirds Along the Coast of North Carolina

Double-crested cormorant (DCCO) populations have increased since halting use of DDT, an addition to the Migratory Bird Treaty Act, and increased availability of foraging habitat. Conflicts between this generalist fish-eating bird and commercial and recreational anglers have resulted in many controversial attempts at management.

In this two-year study, we are taking the first step of estimating the status and distribution of DCCO and other fish-eating birds in the sounds and nearshore areas of North Carolina via aerial surveys of sounds and roosting sites. Abundance and species identification are estimated using distance sampling techniques and photo analysis of large flocks.

Secondarily, the study provides estimates of the energy needs of these birds to provide data on the relative impact of DCCO.

Recommendations from this study will inform future proposals regarding the management of DCCO.

Study Location: Sounds and nearshore areas of North Carolina from the Virginia border to the southern end of Core Sound

Project Status: Year 2 of 2

Collaborators:

Wildlife Resources Commission (WRC)
The Center for Conservation Biology
(William & Mary) (CCB)

Principal Investigators:

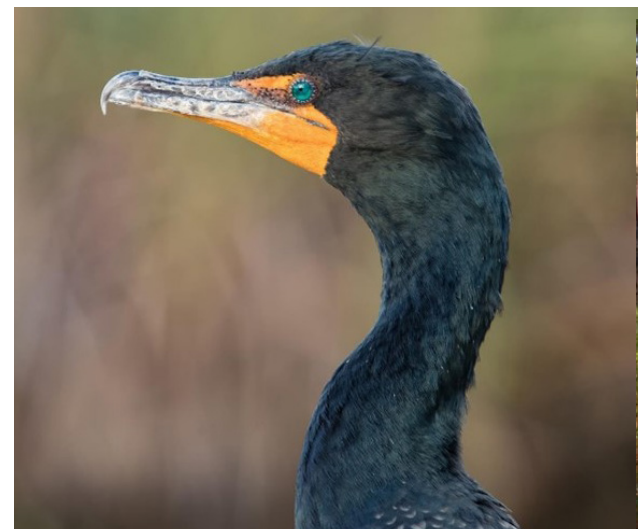
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USFWS



WRC

Development of an Optimal Strategic Forest Plan for Commission Lands

This is a four-year partnership between the WRC and NC State University with the ultimate goal of developing a sustainable and strategic forest management plan for the agency. This approach will maximize a stabilized annual cash flow, while using multiple approaches to ensure quality wildlife habitat management.

Outcomes from this project will improve operational and fiscal planning over tactical and strategic horizons. Additionally, they will allow for the comparison of multiple management alternatives and their respective impact on the wildlife resources the agency is charged with protecting and improving.

Study Location: Mountain, Piedmont, and Coastal WRC-managed game lands

Project Status: Year 2 of 4

Collaborators:

Wildlife Resources Commission (WRC)
NC State University (NCSU)
MB&G, Inc. (Natural Resource Consulting)

Principal Investigators:

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Chris Jordan



Thomas Harvey

Movement of Acoustic Tagged Largemouth Bass in Lake Mattamuskeet and Surrounding Canals

In this four-year study, we are evaluating movement patterns of largemouth bass at Lake Mattamuskeet in relation to water level changes and available habitat.

Primary objectives are to determine the spatial and temporal distribution of largemouth bass in Lake Mattamuskeet, document movements of largemouth bass within and between main lake and canal habitats, and relate those movement patterns to environmental factors, such as seasonal water levels.

Results from the study will inform district biologists, refuge staff, and anglers on habitat use of largemouth bass at Lake Mattamuskeet.

Study Location: Lake Mattamuskeet

Project Status: Year 4 of 4

Collaborators:

Wildlife Resources Commission (WRC)
US Fish and Wildlife Service – Mattamuskeet National Wildlife Refuge
NC State University

Principal Investigators:

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WRC



Thomas Harvey

Anglers' Experiences and Preferences Associated with Fisheries Management in Western North Carolina Reservoirs

In this study, we investigate angler perceptions of changing reservoir fisheries in the Mountain region and preferences for management with a focus on Lake James, Lake Hiwassee, and Fontana Lake.

Using interviews and survey methods, we broadly explore reservoir anglers' past experiences and future interests and expectations for Lake James, Fontana Lake, and Hiwassee Lake fisheries management.

To understand more specific impacts of regulatory changes to manage game fish, we capture anglers' willingness to accept minimum length limits and reduced creel limits for walleye and alternative stocked species that could replace or complement walleye.

By surveying a representative sample of Lake James, Lake Hiwassee, and Fontana Lake anglers, staff will use results to directly inform fisheries management on angling motivations, interests, and specialization and associated implications for future management of these prized reservoir fisheries.

Study Population: Lake James, Lake Hiwassee, and Fontana Lake anglers

Project Status: Year 1 of 1

Collaborators:

Wildlife Resources Commission (WRC)

Principal Investigators:

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WRC

Applying Hunter Perspectives to Help Establish Duck Hunting Zone Season Structures

Following the May 2020 Commission decision to split the state into two separate duck hunting zones (DHZ; coastal and inland), managers sought public input to help determine the season structure between these two zones.

The WRC sent surveys to all Harvest Information Program (HIP)-certified duck hunters with North Carolina hunting licenses to assess perceived impacts of DHZ establishment, preferences for season dates between zones, and attitudes toward Youth Waterfowl Days and Veterans/Military Waterfowl Days.

Analysis of the survey data concluded that inland and coastal North Carolina duck hunters share similar interests in when the duck season should be open. Inland hunters have a slightly higher preference for an October season segment, but the difference was minimal. The most salient issue for the state's duck hunters was holding the open hunting dates as late in the season as possible. Also, hunters strongly value weekend and holiday hunting dates.

Managers used survey results to craft two different season structures that sought to maximize weekend and late season hunting dates, among various other criteria.

Study Population: North Carolina HIP-certified duck hunters

Project Status: 6-months; completed February 2021

Collaborators:

Wildlife Resources Commission (WRC)

Principal Investigators:

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WRC



Tom Reichner

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

The three-year project involves a pre-implementation hydrology monitoring period to determine baseline conditions followed by a construction phase involving placement of water control structures to restore pre-drainage conditions in 6,500 acres of ditched and drained pocosin habitat. Refining water level management to ameliorate to the extent possible the water pulses associated with flood and drought events will continue several years after the implementation phase.

The primary purpose of the project and the basis for funding the project are to increase environmental resiliency to flooding regimes associated with hurricanes that negatively impact downstream human resources.

Identified secondary benefits include:

- Improving quality of pocosin and other associated wetland habitats;
- Arresting the soil subsidence associated with breakdown of dewatered organic soils;
- Mitigating potential negative impacts to the soil profile, plant communities and ambient air quality, as a result of prolonged soil combustion from wildfire events on dewatered organic soils;
- Enhancing ability to apply prescribed fire for habitat and risk management; and,
- Preserving carbon sequestration within organic soils.

While the restoration methods have been applied elsewhere in coastal North Carolina, other sites have been in the lower reaches of a watershed. The Angola Bay project is unique for its location in a headwaters section with results to serve as a model for future hydrology restoration projects in similar landscape positions.

Study Location: Angola Bay Game Land, Pender County

Project Status: Year 1 of 3

Collaborators:

Wildlife Resources Commission (WRC)
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Kris Bass Engineering, PLLC (KBE)

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Brent Wilson

Prescribed Fire

Developing a better understanding of the motivations for using prescribed fire can provide crucial information that can be included in the design of a collaborative framework to promote the benefits of prescribed fire. The WRC accessed the North Carolina Prescribed Fire Council membership (NCPFC) to explore factors that are considered during member burns.

The WRC distributed surveys to members of the NCPFC to understand general spatial and temporal trends of burns, motivations, perceptions of policy, barriers, planning considerations, and influence of habitat and species conservation on prescribed fire decision making.

Recommendations from the study will assist in creating a suitable framework for promoting the use of prescribed fire for improved habitat and species conservation, and the inclusion of coordinate conservation planning in fire prescriptions.

Study Location: NCPFC members statewide

Project Status: Year 1 of 1

Collaborators:

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Matthew Bucher

Tracking Leatherback Turtles

This five-year study is to develop insights into the behavior of leatherback sea turtles that frequent the coastal waters of North Carolina each spring.

The primary objective is to understand the migratory patterns, movements, and health status of these animals that congregate in North Carolina waters for a short period each year.

Secondary objectives include collecting samples from captured animals for genetic work, stable isotope analyses, and metabolomics. In this project, we are also testing platforms or techniques of tagging, such as suction-cup crittercams.

The aggregation of relatively large numbers of adult leatherback sea turtles in nearshore waters of North Carolina affords an excellent opportunity to capture, sample and tag this species that is otherwise difficult to work with in the marine environment. The data collected provide greater insight into the status of this species in the North Atlantic and the importance of North Carolina as seasonal habitat.

Study Location: Coastal waters off Carteret County

Project Status: Year 3 of 5

Collaborators:

Wildlife Resources Commission (WRC)
 NOAA-SE Fisheries Science Center (SEFSC)
 NOAA-NE Fisheries Science Center (NEFSC)
 NCSU-College of Veterinary Medicine (NCSU-CVM)
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Photos by Matthew Godfrey

Reproductive Behavior of Loggerhead Sea Turtles in the Northern Recovery Unit (NC, SC, and GA)

This multi-year study is to provide detailed information on reproductive behavior of loggerhead sea turtles in the northern extent of their nesting range in the West Atlantic.

The primary objectives are to derive accurate values of clutch frequency and how many individual females are reproductively active in the subpopulation.

Secondary objectives are to better understand nest site fidelity of individual turtles, to estimate rates of recruitment of adult females in the nesting population, to provide insight into rates of adult survivorship, and to uncover familial relationships among individual female turtles.

The life history parameters derived from this study are considered key for recovery assessment, according to the Federal Recovery Plan. Data from the study will also be used to derive a model for assessing population level impacts from both threats and management interventions.

Study Location: All coastal counties in North Carolina, including Currituck, Dare, Hyde, Carteret, Onslow, Pender, New Hanover, and Brunswick

Project Status: Year 12 of 15

Collaborators:

Wildlife Resources Commission (WRC)
 SC Department of Natural Resources (SCDNR)
 GA Department of Natural Resources (GADNR)
 University of Georgia (UGA)

Principal Investigators:

Brian Shamblin (UGA)
 Mark Dodd (GADNR)
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 Matthew Godfrey (NCWRC)

WRC Point of Contact:

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Sarah Finn



Matt Godfrey

Sunday Hunting in North Carolina: Public Perceptions

In 2017, the North Carolina legislature gave the WRC the authority to allow Sunday hunting on public lands. Because of the complexities of this issue, the WRC partnered with Group Solutions to better understand what the public thinks about allowing Sunday hunting on state game lands.

Using a widely distributed public survey and public meetings with game lands users around the state, the agency was able to explore the diversity of perspectives surrounding this issue.

Focus groups with game lands users helped identify barriers to support for some constituents and provided some ideas for compromise. Using these results, staff developed an optimization tool to determine which state game lands would be the most suitable for allowing Sunday hunting. Small game lands near developed areas, or with few nearby public land alternatives, were less desirable for Sunday hunting whereas rural and large parcels with less history of conflict were more suitable.

Following this study, the WRC voted to allow Sunday hunting on 51 game lands throughout the state.

Study Population: North Carolina general public and state game lands users

Project Status: Completed July 2020

Collaborators:

Wildlife Resources Commission (WRC)
Group Solutions, Inc. (GS)

Principal Investigators:

Brian McRae (WRC)
Carrie Ruhlman (WRC)
Chris Bova (WRC)
Vern Herr (GS)
Brett Boston (GS)

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Beau Leyse



Melissa McGaw

North Carolina 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 effort focuses on 937 10 sq. mi. 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 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 1 of 5



Shutterstock

Collaborators:

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

Principal Investigators:

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John Carpenter (WRC)
Kris Smith (WRC)

WRC Point of Contact:

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Population Status and Stock Identification of NC Hickory Shad Using Multiple Techniques

This multi-year research project on the anadromous hickory shad represents one of the most detailed set of investigations on this species. Project objectives focused on identifying individual spawning populations using meristics and morphometrics, body shape, otolith shape, otolith chemistry, and genetics. In this project, we developed ageing techniques for hickory shad otoliths and scales. Lastly, the project analyzed survey datasets from WRC and Division of Marine Fisheries to determine the possible overwintering locations offshore of North Carolina, spawning season timing, and potential shifts due to climate change, and demographics of the adult spawning populations in North Carolina sounds, estuaries, and four coastal watersheds (the Roanoke, Tar, Neuse, and Cape Fear rivers). In addition, new information about spawning populations from 25 watersheds in seven coastal states and the District of Columbia was included in the final report that was completed in FY21; however, the final report was accepted, and the project was completed in FY21; however, additional genetic analyses will be reported later. Results of the project will be used to develop management plans and population monitoring for hickory shad in North Carolina.

Study Location: Albemarle and Pamlico sounds, the Roanoke, Cashie, Tar-Pamlico, Neuse, and Cape Fear rivers, as well as 25 other watersheds from seven coastal states. All analysis and laboratory procedures were performed at East Carolina University in Greenville.

Project Status: Year 4 of 4

Collaborators:

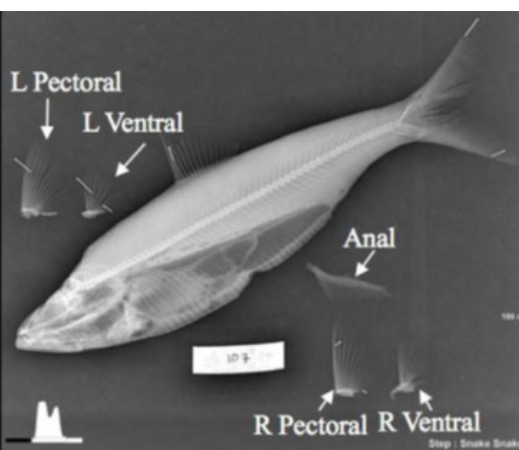
Wildlife Resources Commission
East Carolina University (ECU)
NC Division of Marine Fisheries

Principal Investigators:

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Michael Brewer (ECU)

WRC Point of Contact:

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Thomas Harvey

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 it have become impounded by beaver dams.

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

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

Recommendations from 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 1 of 2

Collaborators:

Wildlife Resources Commission (WRC)

Principal Investigators:

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Michael Fisk (WRC)

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Mike Walker



WRC

Genetic Structure and Connectivity among Populations of Diamondback Terrapins Based on Mitochondrial DNA

Our objective is to identify the scale of genetic structure and connectivity among nesting populations and foraging aggregations of diamondback terrapins in North Carolina based on mitochondrial DNA (as part of ongoing research in Georgia to collectively represent the Carolina subspecies of diamondback terrapin.)

We are revisiting the question of isolation or connectivity among known nesting populations and foraging aggregations of diamondback terrapins using maternally inherited mitochondrial DNA sequences. These baseline data are important for understanding the scale at which colonization of novel nesting sites naturally occurs. They will also inform the degree of connectivity among foraging aggregations at different spatial scales.

Study Location: All coastal counties in North Carolina, opportunistic sampling

Project Status: Year 1 of continuing research

Collaborators:

University of Georgia (UGA)
Wildlife Resources Commission (WRC)

Principal Investigators:

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Sarah Finn (WRC)

WRC Point of Contact:

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Jay Ondreika

What Do Our Data Tell Us? Examining WRC License Sales

The WRC saw a significant spike in license sales in 2020. However, most analyses examining this increase were limited to only two years (2019 – 2020). The agency has a wealth of information in its license sales database, but it appears to be underutilized.

The goal of this project is to explore the previous five years of license data and present a series of digestible figures to make these data more understandable. There is also a focus on examining trends of “new Covid customers,” which could influence Recruitment, Retention and Reactivation efforts, as well as outreach efforts.

With exploration in mind, this project does not serve to answer any outstanding questions, but rather help create and inspire new questions. After all, the license database is the largest available agency managed dataset on human subjects.

Study Population: All NCWRC license holders

Project Status: Year 1 of 1

NC Wildlife E-Newsletter Survey

The NC Wildlife E-Newsletter is one of the furthest reaching communication tools used by the WRC. However, the agency has never completed an evaluation of content preferences of the list’s subscribers.

The WRC surveyed engaged, unengaged, and uninterested subscribers to understand preferences for topics of interest included in the e-newsletter, frequency of distributions, length, and other helpful components of distribution and design. E-newsletter recipients were generally interested in fishing, hunting, rules, boating, and game lands. However, topics of interest varied between a few demographic and engagement groups.

Communications will use these data to better tailor e-newsletter strategies to particular subscriber groups. Also, findings will be used to identify gaps in the subscribership base to better represent the agency’s constituency.

Study Population: NC Wildlife E-Newsletter subscribers

Project Status: Completed June 2021

Collaborators:

Wildlife Resources Commission (WRC)

Principal Investigators (in NC):

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Collaborators:

Wildlife Resources Commission (WRC)

Principal Investigators (in NC):

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Mindy Wharton (WRC)

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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 examine the winter biology of salt-marsh (SALS) sparrow 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, and pilot testing visual and aural bird sampling protocols for both species during the nonbreeding season.

Additionally, we are using automated telemetry stations to 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 this study will assist with developing 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 3 of 4

Collaborators:

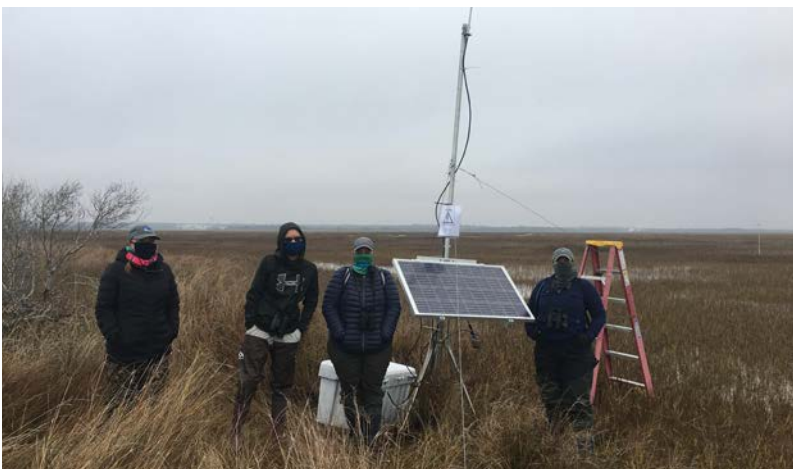
Wildlife Resources Commission (WRC)
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Principal Investigators:

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Marae Lindquist (UNCW)
Evangelyn Buckland (UNCW)
John Carpenter (WRC)

WRC Point of Contact:

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John Carpenter



Saltmarsh Sparrow - WRC



Seaside Sparrow - 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 gobble 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 2 of 4

Collaborators:

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

Principal Investigators:

Chris Moorman (NCSSU)
David Moscicki (NCSSU)
Bret Collier (LSU)
Chris Kreh (WRC)

WRC Point of Contact:

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Assistant Chief
Game and Furbearer Program
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Photos courtesy of NC State University

2020 Public Mountain Trout Water Angler Survey: Exploring Characteristics of Recreational Trout Anglers and Attitudes Towards Reduction of Regulatory Stream Classifications

In this study, we asked Public Mountain Trout Waters (PMTW) anglers a variety of questions related to where they fish, how they fish, their trust in WRC's mountain trout fisheries management, their attitudes toward two potential regulation changes, and their demographics.

Approximately 36,000 surveys were sent to a random sample of customers within the WRC's license database who held trout privileges. Of the 36,000 distributed surveys, 3,609 license holders responded, 1,745 of whom fished in PMTW in 2019.

When asked about how acceptable it would be to combine the two classifications (Catch and Release/Artificial Flies Only Trout Waters and Catch and Release/Artificial Lures Only Trout Waters) into a single Catch and Release/Artificial Flies and Lures Only Trout Waters, 83.5% of respondents replied it was neutral–perfectly acceptable compared to 16.5% of respondents opposed to the change. In August 2021, the two classifications were combined into one in WRC rules.

Future studies will further highlight the heterogeneity of attitudes and motivations of this diverse stakeholder group to help the WRC guide its management of North Carolina's trout resources.

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

Project Status: Completed

Collaborators:

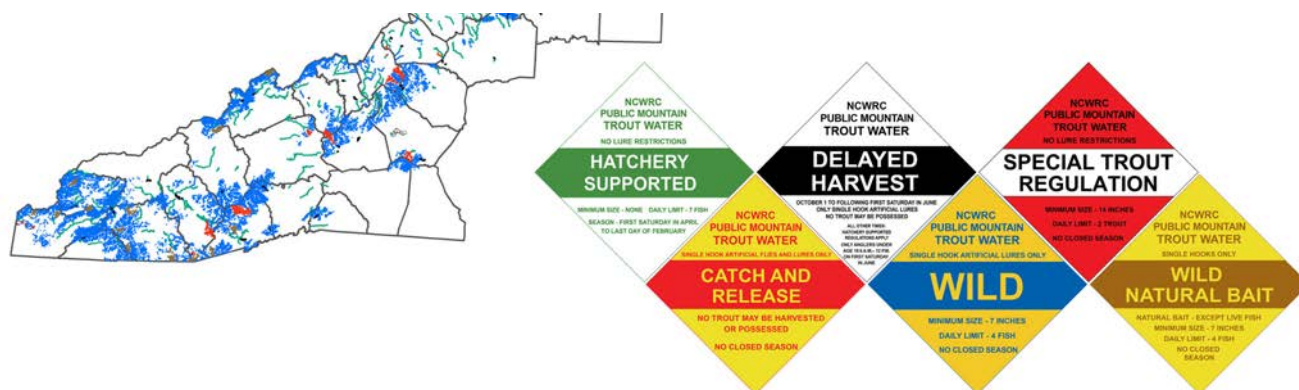
Wildlife Resources Commission (WRC)
Numerous anglers

Principal Investigators:

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Jacob Rash (WRC)

WRC Point of Contact:

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Macroinvertebrate Assemblage Assessments as a Measure of Site Quality for Federally Listed Freshwater Mussel Species

This is a year-long study and potential start to a long-term monitoring program focused on assessing the macroinvertebrate assemblages found at mussel survey sites ranging in quality from poor to excellent. The site selection for year one is focused on Tar River spiny mussel records.

The primary objective of this study is to determine if a threshold index value or taxonomic representation could provide a useful indication of adequate water quality for the presence of this species.

Secondary objectives include investigating any potential associations between aquatic insect taxa and freshwater mussels, as well as to acquire water quality and biodiversity data for use in developing mussel occupancy models.

Findings from this study will aid in prioritization of survey locations for mussel populations and help to determine if continued macroinvertebrate assessments could be useful at additional survey locations for state and federally listed mussel species.

Study Location: Ten initial sites in the Neuse and Tar-Pamlico river basins, including sites on Fishing and Little Fishing creeks, Swift Creek of the Tar, and the Little River of the Neuse

Project Status: Year 1 of 1

Collaborators:

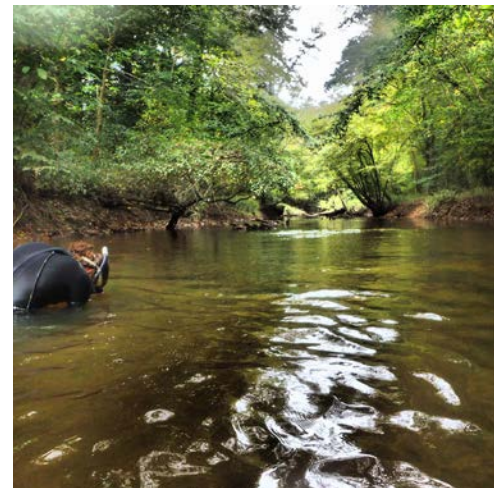
Wildlife Resources Commission
(WRC)

Principal Investigators:

Sierra Benfield (WRC)
Michael Fisk (WRC)
Michael Walter (WRC)
Andrew Glen (WRC)

WRC Point of Contact:

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Photos Sierra Benfield

Pathway to Wildlife Relevancy: A Wildlife Education Division Case Study

The WRC Wildlife Education Division (WED) has experienced many changes over the past two decades, leaving staff unsure of the division's direction. In response to this uncertainty and with a desire to expand and improve agency relevancy, WED is completing a thorough review of its programming.

Through surveys and focus groups with constituents, stakeholders, and the public, WED hopes to better understand, and therefore reflect, the needs of the public in the division's programs. Data collected during this extensive study will inform WED staff on the desire for the future of the programs and help formulate appropriate goals for evaluation.

Study Population: Statewide WED stakeholders; traditionally served constituents (hunters, anglers, trappers, boaters, shooters etc.), education programs (schools/camps etc.), funders, non-traditionally served constituents (bird watchers, wildlife photographers, other game land users), and WRC WED Staff

Project Status: Year 1 of 2

Collaborators:

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

Principal Investigators:

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Chris Bova (WRC)
Matt Dunfee (WMI)

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Photos WRC

White Bass Spawning Migration Study

White bass are a popular sportfish, particularly during spring spawning migrations. They are also used as broodfish to produce hybrid striped bass, or Bodie bass, which are stocked in lakes across the state. Their variable spawning behavior and apparent declining populations have made both angling and broodfish collections difficult in recent years.

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

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 2 of 3

Collaborators:

Wildlife Resources Commission (WRC)

Principal Investigators:

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Seth Mycko (WRC)

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Illustration: Duane Raver

Population Abundance and Growth of Elk

This five-year study will provide 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 will be addressed:

1. Does the elk herd within the boundaries of the Great Smoky Mountains National Park (GMSNP) 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 GMSNP, survival, and recruitment sufficient to enable a sustainable hunt outside GMSNP boundaries in NC?
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 NC?

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

Project Status: Year 3 of 5

Collaborators:

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

Principal Investigators:

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Jessica Braunstein (UT)
Justin McVey (WRC)

WRC Point of Contact:

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WRC



Warren Price

Nesting Behavior and Movements of Diamondback Terrapins in the Masonboro Island Reserve

Data obtained from the Terrapin Tally head-count surveys have allowed us to identify specific areas within the Masonboro Island Reserve for targeted studies of seasonal patterns of habitat utilization and nesting ecology.

We are conducting a radio tracking study of terrapins at nesting sites to better characterize nesting behavior and protect nests laid within the Masonboro Island Reserve.

The Cellular Tracking Technologies radio telemetry system provides a means of tracking terrapins within a designated study area. Location data will provide information on nesting sites and also could provide insight on overwintering sites and detailed information about use of aquatic and terrestrial habitats. Identification and protection of breeding and nesting habitats is a critical aspect of managing terrapin populations.

Study Location: Estuary adjacent to Masonboro Island

Project Status: Year 1 of 2

Collaborators:

University of North Carolina Wilmington (UNCW)
 NC Coastal Reserve Estuarine Research Reserve (NCCR-NERR)
 Wildlife Resources Commission (WRC)

Principal Investigators:

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 Hope Sutton (NCCR-NERR)
 Elizabeth Colhoun (NCCR-NERR)
 Sarah Finn (WRC)

WRC Point of Contact:

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 Coastal Wildlife Diversity Biologist
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 910-742-7729



Sarah Finn



Andrew Gosse

Assessing Geographic Patterns of Genetic Variation and Gene Flow Populations of the Gopher Frog

The gopher frog is a state endangered species in North Carolina. It typically inhabits stump cavities in high quality longleaf pine forests and congregates to breed in ephemeral ponds usually from February-April. Although once more widespread across the state, gopher frogs now occur at only a handful of disjunct sites in the Coastal Plain and Sandhills regions. As such, the long-term persistence of these NC populations is a concern, as is a loss of genetic variation over time.

The primary goal of this study was to fill in important gaps in our knowledge on the geographic structure of genetic variation and levels of genetic variability in NC gopher frogs. Approaches included obtaining multilocus genetic data (mtDNA sequence data and microsatellite data) from as many gopher frogs from as many sites in NC as possible, and to use these data to provide a more complete picture of the population genetics of this species in the state. Whereas the mtDNA sequence data provide information on relatively large geographic and temporal scales, the microsatellite genotype data can be used to evaluate levels of recent and ongoing gene flow at relatively fine geographic and temporal scales and to examine kinship structure, providing important insights into levels of relatedness among individuals found at the same site or pond. Together, analyses of these two types of data are being used to develop an initial genetic framework that can help inform conservation and management decisions.

We addressed the following genetic questions: 1) are there unique mtDNA haplotypes that only occur in NC, and if so, where do they occur geographically; 2) are there sites or ponds that stand out as having relatively high or low levels of genetic variation or inbreeding, and therefore may be good candidates to serve as sources or recipients of translocations; and 3) do genetic data provide any novel insights into the kinship structure of gopher frog populations at the various sites that might prove useful in conservation and management?

Study Location: Coastal Plain, Sandhills populations of gopher frogs

Project Status: Year 3 of 3

Collaborators:

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

Principal Investigators:

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Stephanie Kamel (UNC-W)
Nathaniel Akers (UNC-W)
Jeff Hall (WRC)

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Jeff Hall

Assessing the Distribution and Population Status of the Neuse River Waterdog

In this five-year study, we are building on surveys completed by WRC staff from 2010-2015. Results of those surveys indicate a decline in this salamander's range compared to similar surveys completed over 30 years earlier. The primary goals of this project are to further understand the current range and status of the Neuse River waterdog and determine landscape factors that limit the species' distribution and abundance.

Since this project began, the waterdog was petitioned for Federal listing under the Endangered Species Act. A listing of Federally Threatened by the US Fish and Wildlife Service (USFWS) went into effect during summer 2021. Our overall objective of this project is to provide practical steps that can be taken to reverse the declines of this endemic species in North Carolina.

Study Location: Neuse and Tar-Pamlico drainages in North Carolina

Project Status: Year 3 of 3 (with USFWS funding taking over for an additional 2 years)

Collaborators:

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

Principal Investigators:

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Krishna Pacifica (NCSU)
Jeff Humphries (WRC)

WRC Point of Contact:

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Photos by Jeff Humphries

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 using a combined approach that incorporates active tracking via boat-mounted receivers and passive tracking using fixed location receivers. To date, we have recorded over 700,000 depth or temperature readings.

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 2 of 3

Collaborators:

Wildlife Resources Commission (WRC)
Duke Energy (DE)

Principal Investigators:

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Corey Oakley (WRC)
Scott Fletcher (DE)

WRC Point of Contact:

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WRC



Illustration: Duane Raver

Demography and Recruitment Dynamics of Atlantic Sturgeon Populations

In this study, we will sample Atlantic sturgeon in the Cape Fear River basin and the Albemarle Sound region, including the Chowan and Roanoke rivers, to confirm the existence of spawning populations, identify unique aspects of spawning behavior and population demographics within each river, estimate passage success rates of adults at the Lock and Dam #1 fishway located on the Cape Fear River, and quantify juvenile (age-1) recruitment to establish methods for an index of abundance. Adult sturgeon will be tagged with acoustic telemetry transmitters, and their movement will be tracked throughout the state and Atlantic coast using a large network of receivers. The research will directly address specific actions necessary for recovery of the federally endangered Carolina Distinct Population Segment of Atlantic Sturgeon. Additionally, the project will acquire and archive 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 1 of 3

Collaborators:

University of North Carolina Wilmington (UNCW)
Virginia Commonwealth University (VCU)
NC Division of Marine Fisheries
National Marine Fisheries Service

Principal Investigators:

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Greg Garman (VCU)
Matt Balazik (VCU)

WRC Point of Contact:

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Fred Scharf



Georgia DNR

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 strengthen relevancy.

Study Population: Nationwide wildlife watchers

Project Status: Year 1 of 1

Collaborators:

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

Principal Investigators:

Ashley Dayer (VT)

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919-707-0011



Kim Kuperkova

Population Analysis of Self-sustaining Trout in Streams

The WRC has monitored self-sustaining brook trout, brown trout, and rainbow trout populations over multiple decades. Through collaboration with researchers at CU and CSU, the WRC was able to further examine these data to increase understanding of trout population dynamics.

Through this effort we were able to quantify species composition and population density of self-sustaining trout in western North Carolina over the last 30+ years, which was an initial attempt at synthesizing this large data set. As a result, spatial and temporal variability of trout populations were characterized, modifications to sampling effort and design were recommended, and a regional-specific, length-weight relationship for brook trout was developed.

Although this portion of the effort is completed, monitoring of self-sustaining populations continues, and data are being integrated into regional, collaborative-research efforts to examine population dynamics across greater spatial scales.

Study Location: Western North Carolina

Project Status: Completed, but additional research is ongoing.

Collaborators:

Wildlife Resources Commission (WRC)
Clemson University (CU)
Colorado State University (CSU)

Principal Investigators:

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Jacob Rash (WRC)

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Photos Thomas Harvey

Timber Rattlesnake Populations: Genetic Connectivity and Diversity

The timber rattlesnake is a rattlesnake of 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 threat to the species in North Carolina is the loss and fragmentation of remaining habitats because of anthropocentric encroachment. Direct correlates of this threat 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 2 of long-term project with undetermined duration

Collaborators:

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

Principal Investigators:

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Photos Jeff Hall

Stationary GPS Collar Performance under Varying Habitat Conditions on the Albemarle Peninsula

The goal of this project was to test GPS collar fix rates in varying habitat conditions.

A high level of collar performance in this study using Vortex Plus-1 Iridium collars could indicate that newer generation collars are less subject to vegetative impacts on successful 3D fixes due to collar advancements compared to earlier studies in similar terrain. Previous studies found various collar performance factors compounded in areas where satellite geometry and terrain obstructions and various vegetative covariates were in tandem. Very high fix rate quality in the Albemarle Peninsula (AP) study supports a hypothesis for heightened GPS collar efficacy with current generation Iridium collars in geographic areas of low to moderate topographic relief. Collars in the AP canid study had a higher fix failure rate than this stationary GPS project, probably due to collars moving about the AP rather than remaining stationary, where the latter would tend to have a more consistent satellite signal. This could indicate in our study area, animal behavior plays a more central role in collar efficacy than landscape or vegetative features alone.

Study Location: Dare, Hyde, and Tyrrell counties

Project Status: Completed as of June 30, 2021

Collaborators:

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

Principal Investigators:

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Andrea Shipley

Population Structure Analysis of White-tailed Deer

In this study, we are identifying the number and boundaries of distinct genetic deer populations within North Carolina. Genetic populations will be compared against the current 5 Biological Deer Management Unit delineations, which have been based on peak conception dates. Genetic populations will also be compared to historical stocking records to analyze how stocking efforts may have influenced current deer populations.

This study uses microsatellite markers developed by Erin Meredith from the California Department of Fish and Wildlife.

Study Location: Statewide coverage. Samples used in this study came from previously collected tissue samples now stored at either WRC headquarters or the North Carolina Museum of Natural Sciences. A minimum of 30 samples per district will be used for analysis.

Project Status: Year 1 of 1

Collaborators:

California Department of Fish and Wildlife
(CDFW)

NC Museum of Natural Sciences

Principal Investigators:

Erin Meredith (CDFW)

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James Pierce

Nesting Ecology of American Black Ducks in Coastal North Carolina

In this two-year study, we examined the nesting ecology of American black ducks, a species of greatest conservation need, within coastal marshes of eastern North Carolina — the southern extent of the species breeding range.

Limited knowledge of black duck breeding behavior in North Carolina may lead to habitat management decisions, such as the timing of prescribed burning, that are detrimental to breeding black ducks. The goals of this research were to better understand breeding season limiting factors and include quantification of nesting micro- and macro-habitat selection, nest initiation and peak nesting dates, and nest success and causes of failure, including identification of nest predators.

Results of the study suggest management for breeding black ducks in coastal North Carolina should focus on promoting selected nesting habitat and reducing nest predators. Prescribed burns used to set back succession on spoil islands and in brackish marshes should be conducted in the winter or in the early growing season not to exceed the twenty-fifth quantile date of black duck nest initiation (April 2).

Study Location: Hyde and Dare counties

Project Status: Completed; one peer-reviewed manuscript was published in *Journal of Wildlife Management* in May 2021.

Collaborators:

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

Principal Investigators:

Chris Williams (UDel)
Daniel Lawson (UDel)
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WRC



Doug Howell



Jeffrey Weymier

Characterization of the Population Genetics and Phylogeography of Brook Trout

The WRC led an ambitious effort to identify and genetically type 473 wild brook trout populations within North Carolina. In partnership with the King Conservation Genetics Laboratory at the USGS, we used microsatellite markers to generate a suite of genetic baseline data critical to our management of wild, native brook trout populations.

The project spanned six years, but it tied together decades of work by numerous staff (i.e., tissue collections began in 2000) and culminated in innovative data to inform management decisions by the WRC and its partners.

Although the initial portion of this research has been completed, we continue to expand our genetic baseline through annual collections and examinations.

Study Location: Western North Carolina

Project Status: Completed, but additional research is ongoing

Collaborators:

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

Principal Investigators:

Tim King (USGS)
Dave Kazyak (USGS)
Jacob Rash (WRC)

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Thomas Harvey

Tar River Spiny mussel Microbiome Health Analysis

Tar River spiny mussel (TRSM) are a federally listed endangered species. All known wild specimens (including brood mussels) currently reside at the Marion hatchery. Recently, these mussels have become sick, with several mortality cases and no obvious causal event.

In this study, we compare the microbiome of healthy propagated and wild TRSM to unhealthy propagated and wild TRSM. Mussels were swabbed at three sites: foot, mantle, and visceral mass. Mussels will be amplified for bacteria using the 16S gene and for fungi and parasites using the 18S gene. Genetic analysis will be conducted to compare the two groups and to identify any statistically significant differences between healthy and unhealthy groups.

Materials and reagents for this study are funded through the US Fish and Wildlife Service.

Study Location: Samples were collected at the Marion hatchery and transported by hand to the North Carolina Museum of Natural Sciences for genetic analysis.

Project Status: Year 1 of 1

Collaborators:

US Fish and Wildlife Service
Wildlife Resources Commission (WRC)

Principal Investigators:

Heather Evans (WRC)
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Photos by Rachael Hoch

Utility of eDNA Analysis for Detection of American Shad and Atlantic Sturgeon after Flood Pulses

In this study, we will test the utility of eDNA monitoring for the presence of Atlantic sturgeon and American shad. These species are blocked from historic spawning grounds on the Cape Fear River by three dams. The US Army Corps will conduct controlled flood pulses to temporarily submerge the dam during spawning season. Fish will be monitored through acoustic telemetry, and water samples will be taken above and below the dams.

eDNA analysis will then be compared against and combined with telemetry data to 1) determine if American shad and Atlantic sturgeon can pass over the dams during flood pulses and 2) evaluate the efficacy of eDNA monitoring compared to telemetry.

Study Location: Cape Fear River

Project Status: Year 1 of 2

Collaborators:

The Nature Conservancy, US Army Corps of Engineers, University of North Carolina Wilmington (UNCW), Clemson University (CU), University of Maryland (UMD)

Principal Investigators:

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Ashley Hatchell (USACE)
Fred Scharf (UNCW)
Troy Farmer (CU)
Louis Plough (UMD)
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American shad (left) and Atlantic sturgeon illustrations by Duane Rover

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 strain largemouth bass 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.

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

In October 2020, we stocked 2,000 sub-adult largemouth bass followed by a stocking in 2021 of 40,000 fingerlings. Evaluations of these stockings will be conducted via electrofishing surveys and the collection of genetic material from fish captured during these surveys. It will take several years for these fish to reach harvestable size and for conclusions to be made regarding the effects of stocking these fish in Lake Norman.

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

Project Status: Year 1 of 5

Collaborators:

Wildlife Resources Commission (WRC)
Lake Norman Legends angling group

Principal Investigators:

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Casey Joubert



WRC

Conservation Status and Management of Henslow's Sparrow on the Voice of America Game Land

In this two-year study, we will examine Henslow's sparrow (HESP) ecology at the Voice of America Game Land.

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

Additionally, 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 serve as a solid foundation to 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; some sampling will also take place at Voice of America Site B, Pitt County.

Project Status: Year 1 of 2

Collaborators:

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

Principal Investigators:

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John Carpenter



Steve Maslowski/USFWS



John Carpenter

Lake Gaston Creel Survey 2019-2020

Lake Gaston is a 20,300-acre hydropower reservoir on the Virginia/ North Carolina border, owned and operated by Dominion Energy. This year-long creel survey provided current estimates of angling effort, catch, and harvest as well as data on angler demographics, expenditures, and opinions. The survey also provided data about non-angling recreational use patterns. These data will be compared to the results, where possible, from previous creel surveys, to quantify changes in the Lake Gaston fishery. Results will be used by biologists to refine and prioritize management objectives.

A total of 563 interviews were conducted during the year-long survey period with an estimated 218,000 angler-hours of effort. Largemouth bass and spotted bass were the most targeted and caught species, whereas crappie was the most harvested species. Anglers spent an estimated \$1 million during the creel survey, with gas accounting for the greatest expense category. Approximately 80% of anglers rated their fishing experience as good or excellent.

The creel survey was funded through Federal Aid in Sport Fish Restoration and Dominion Energy.

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

Project Status: Completed

Collaborators:

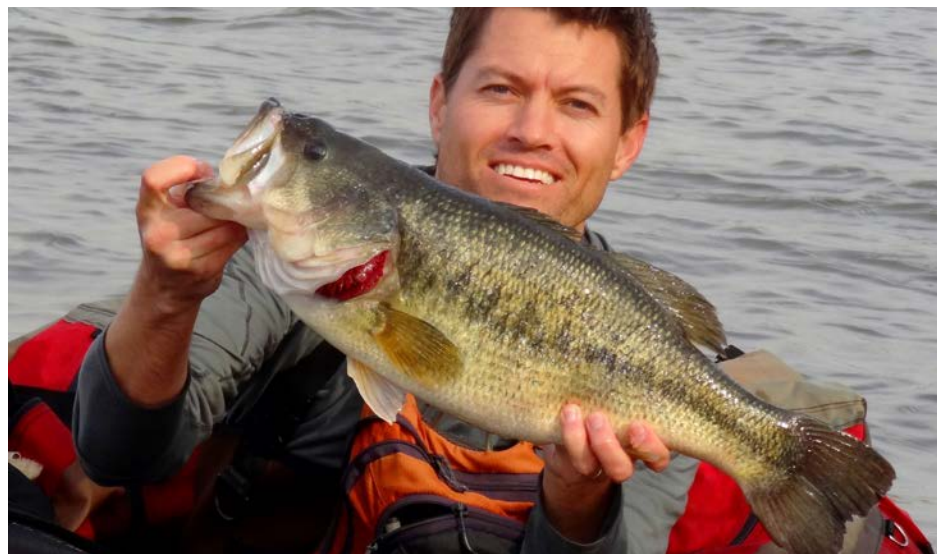
Wildlife Resources Commission (WRC)
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Matt Jepson

DNA Marker Development and Genetic Diversity Analysis for Priority Mussel Species

In this study, we are developing and screening a suite of novel and informative genetic markers for eight NC priority mussel species (dwarf wedgemussel, Appalachian elktoe, brook floater, yellow lance, Atlantic pigtoe, James spiny mussel, Tar River spiny mussel, and Tennessee clubshell) and assessing the genetic diversity of wild and captive breeding populations.

The primary objective of this study is to use next-generation sequencing technology to identify single nucleotide polymorphisms (SNPs) for use in assessing genetic diversity.

The second objective is to develop a high-throughput and low-cost genotyping protocol for each species utilizing the screened SNPs identified in the primary objective that can be used to inform management and conservation decisions.

Preliminary results produced 2,594 to 11,460 informative SNPs (species dependent), and genetic analyses suggest that the populations are structuring at the whole stream and watershed levels. The genetic information produced from this project will be used in the development and implementation of a comprehensive monitoring program for these priority mussel species.

Study Location: Statewide

Project Status: Year 4 of 4

Collaborators:

Wildlife Resources Commission (WRC)
Georgia Southern University (GSU)
Florida International University (FIU)
US Fish and Wildlife Service,
NC Museum of Natural Sciences

Principal Investigators:

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Rachael Hoch

Hybridization and Population Genetic Structure of American Black Ducks in Coastal North Carolina

Mallards are present on the breeding grounds of the American black duck, and hybridization occurs between these species. In this two-year study, we assessed the genetic integrity, hybridization rates, and population structure of this local breeding population.

Strong population structure and high co-ancestry across genetic markers due to interrelatedness among sampled nests in NC suggest black ducks have been locally breeding in this area for a prolonged period of time. Despite high inter-relatedness among samples, nucleotide diversity is similar to the continental black duck population, suggesting little effect of genetic drift, including inbreeding. Molecular diversity of black ducks in NC is maintained at reference levels through influx of genetic material from unrelated, migrating male black ducks. Hybridization levels were 47.5%, covering three filial generations. Of identified hybrids, 54.7% and 53% were the direct result of interbreeding between black ducks and captive-reared or wild mallards, respectively.

Because of high rates of interspecific hybridization and successive backcrossing events, introgression from wild and feral mallards is occurring into this population of breeding black ducks and requires careful consideration in future management efforts.

Study Location: Hyde and Dare counties

Project Status: Completed; one peer-reviewed manuscript was published in *Journal of Wildlife Management* in July, 2021.

Collaborators:

Wildlife Resources Commission (WRC)
University of Delaware (UDel)
University of Texas El Paso (UTEP)

Principal Investigators:

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WRC



Agami Photo Agency

Microsatellite Marker Development for Use in Alewife Parentage- based Tagging

In this study, we are creating a microsatellite marker panel that can be used for parentage-based tagging (PBT) of alewife. The panel can then be used to track stocking efforts through calculations of hatchery contribution to stocked rivers, identification of optimal stocking sites, calculations of effective population size, and analysis of population structure.

Previously identified markers from the sister taxa, blueback herring, are being used for marker development in alewife. Virginia and North Carolina samples will be used for marker testing. This project is funded through Virginia Commonwealth University (VCU).

Study Location: Samples collected from VCU and from vouchered specimens at the North Carolina Museum of Natural Sciences

Project Status: Year 1 of 2

Collaborators:

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October 28, 2021

Chris Turner

