

# 2019 WILDLIFE DIVERSITY PROGRAM ANNUAL REPORT



N.C. Wildlife Resources Commission  
Wildlife Diversity Program  
919-707-0050  
[ncwildlife.org/WDP](http://ncwildlife.org/WDP)

The North Carolina Wildlife Resources Commission's (NCWRC) Wildlife Diversity (WD) Program is housed within the agency's Wildlife Management and Inland Fisheries divisions. Program responsibilities principally include surveys, research and other projects for nongame and endangered wildlife species. Nongame species are animals without an open hunting, fishing or trapping season. This report represents an overview of many of the recurring program activities and ongoing research within the WD Program for 2019. Information included herein does not represent the full report on these individual activities.

## Wildlife Diversity Program Staff



**Dr. Sara Schweitzer**, Wildlife Diversity Program Coordinator  
Ph.D., 1994, Oklahoma State University

Years with the NCWRC: 10

- Association of Fish & Wildlife Agencies Feral-Free-Ranging Cat Working Group-Chair
- Association of Fish & Wildlife Agencies Partners in Flight/Shorebird/Waterbird Working Group-Chair
- Partners in Flight Steering Committee-Chair



**Todd Ewing**, Aquatic Wildlife Diversity Program Manager  
M.S., 2002, Appalachian State University

Years with the NCWRC: 24

- Southeast Aquatic Resource Partnership (SARP) Steering Committee-Member
- Southeastern Association of Fish and Wildlife Agencies, Wildlife Diversity Committee, Past Chair
- Wildlife Diversity Program Managers, Member



**Scott Anderson**, Bird Conservation Biologist  
M.S., 2004, Oregon State University

Years with the NCWRC: 16

- Partners in Flight Eastern Working Group - Exe. Committee Member
- Association of Fish & Wildlife Agencies Bird- and Fish-Related Conflict Working Group-Vice Co-Chair
- North American Bird Conservation Initiative, Communications Committee, Chair



**David H. Allen**, Eastern Wildlife Diversity Supervisor  
M.S., 1988, Clemson University  
Years with the NCWRC: 30



**John P. Carpenter**, Eastern Landbird Biologist  
M.S., 2007, Alabama A&M University  
Years with the NCWRC: 10



**Alicia Davis**, Alligator Biologist  
B.S., 2015, North Carolina State University  
Years with the NCWRC: 4.5



**Katharine DeVilbiss**, Central Region Aquatic Wildlife Diversity  
Biologist  
M.S., 2013, State University of New York College of Environmental  
Science and Forestry  
Years with the NCWRC: 1



**Katherine Etchison**, Mammalogist  
M.S., 2015, Ball State University  
Years with the NCWRC: 5

- Southeastern Bat Diversity Network



**Dr. Luke Etchison**, Western Region Aquatic Wildlife Diversity Coordinator  
Ph.D. 2018, Ball State University  
Years with the NCWRC: 3

- Southeastern Lake Sturgeon Work Group-Member
- Tennessee River Basin Partnership-Member
- Little Tennessee Native Fish Conservation Partnership-Steering Committee Member and Co-chair of Conservation Workgroup



**Michael Fisk**, Eastern Region Aquatic Wildlife Diversity Coordinator  
MS, 2010, North Carolina State University  
Years with the NCWRC: 6



**Sara Finn**, Coastal Wildlife Diversity Biologist  
M.E.M., 2011, Duke University  
Years with the NCWRC: 8

- Diamondback Terrapin Working Group
- 8th Symposium on the Ecology, Status, and Conservation of the Diamondback Terrapin-Co-coordinator

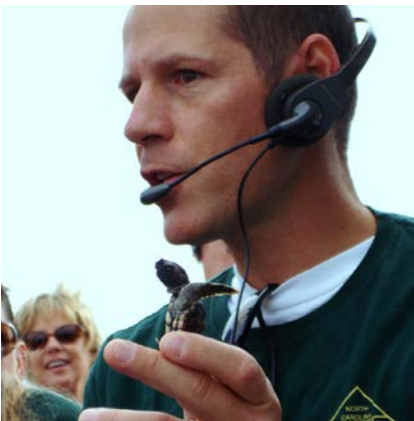


**Andrew Glen**, Eastern Region Aquatic Wildlife Diversity Biologist  
M.S., 2017, University of Texas at Tyler  
Years with the NCWRC: 1



**Gabrielle Graeter**, Conservation Biologist/Herpetologist  
M.S., 2005, University of Georgia  
Years with NCWRC: 13

- The Box Turtle Connection-Co-Chair



**Dr. Matthew Godfrey**, Sea Turtle Biologist  
PhD, 1997, University of Toronto  
Years with the NCWRC: 18

- Endangered Species Research-Editorial Board
- Marine Turtle Newsletter-Editorial Board
- Florida Atlantic University-Affiliate Scientist
- NC State University College of Veterinary Medicine-Adjunct Professor
- Duke University-Nicholas School of Environment-Adjunct Professor



**Jeff Hall**, Partners in Amphibian and Reptile Conservation (PARC) Biologist  
M.S., 2006, East Carolina University  
Years with the NCWRC: 13

- NC Herpetological Society-Exe. Council Member
- National Partners in Amphibian and Reptile Conservation-Advisor



**Dr. Jeff Humphries**, Eastern Amphibian and Reptile Biologist

Ph.D., 2005, Clemson University

Years with the NCWRC: 13

- SE Partners in Amphibian & Reptil Conservation Gopher Frog Working Group-Chair
- The Box Turtle Connection-Chair
- Hellbender Conservation Symposium-Founder
- NC State University-Adjunct Professor



**Carmen Johnson**, Waterbird Biologist

M.S., 2015, UNC Wilmington

Years with the NCWRC: 1



**Brena Jones**, Central Region Aquatic Wildlife Diversity Coordinator

M.S., 2005, Tennessee Tech University

Years with the NCWRC: 15

- Robust Redhorse Conservation Committee-Executive Committee
- NC Chapter of the American Fisheries Society-Past President



**Chris Kelly**, Western Bird and Carolina Northern Flying Squirrel Biologist

M.S., 2000, North Carolina State University

Years with the NCWRC: 15

**Allison Medford**, Piedmont Eco-Region Wildlife Diversity Biologist  
M.S., 2014, North Carolina State University  
Years with the NCWRC: 4

No Image Available



**Dylan Owensby**, Western Region Aquatic Wildlife Diversity Biologist  
M.S., 2015, North Carolina State University  
Years with the NCWRC: 1.5

- Tennessee Endangered Mollusk Committee-Member



**Michael Perkins**, Foothills Region Aquatic Wildlife Diversity Biologist  
M.S., 2014, Appalachian State University  
Years with the NCWRC: 5

- National Brook Floater Working Group



**T.R. Russ**, Foothills Region Aquatic Wildlife Diversity Coordinator  
M.S., 2006, Tennessee Tech University  
Years with the NCWRC: 14

- National Brook Floater Working Group



**Andrea Shipley**, Mammalogist (shared staff with Surveys & Research)  
M.S., 2012, Eastern Kentucky University  
Years with the NCWRC: 2



**Kendrick Weeks**, Western Wildlife Diversity Supervisor  
M.S., 2001, North Carolina State University  
Years with the NCWRC: 12



**Lori Williams**, Western Amphibian Biologist  
M.S., 2004, Virginia Tech  
Years with the NCWRC: 15

- NC Giant Salamander Network-Co-Chair
- Western Carolina University-Adjunct Faculty

*Cover photos (clockwise from top): Measuring a robust redhorse (NCWRC); Mark and recapture of American alligators (Thomas Harvey); Little brown bats (Katherine Etchison); Southern hognose snake (Dr. Jeff Humphries) and Banding a loggerhead shrike (Melissa McGaw)*



## Table of Contents

### FIRST QUARTER-COASTAL REGION

Loggerhead Shrike Monitoring Continues in Southeastern North Carolina .....	12
"Tern Turret" Provides Least Terns with Alternative Option .....	13
Beach Renourishment Projects Can Impact Sea Turtle Nesting .....	14
Field Surveys for Upland Snakes and Amphibians Continue .....	15
Tiger Salamander Populations Benefit from Wetland Restoration and Creation .....	16
Carolina Pygmy Sunfish Monitoring Continues in Southeastern Counties .....	17

### FIRST QUARTER-PIEDMONT REGION

Crayfish Surveys Conducted in the Sandhills and Upper Coastal Plain .....	18
Robust Redhorse Population Augmentation and Captive Propagation Continue .....	19
Staff Build and Install Nest Boxes for Barn Owls in Piedmont .....	19

### FIRST QUARTER-MOUNTAIN REGION

Surveys for Four-Toed Salamanders Document Six New Populations .....	20
Staff Launch Project to Test for Mercury in Carolina Northern Flying Squirrels .....	21
Inactive Gold Mines Hold a Different Treasure — Tri-colored Bats .....	22

### FIRST QUARTER-STATEWIDE

NCPARC Joint Annual Meeting was a Huge Success .....	24
Venomous Reptile Training Conducted for Agency Staff .....	24

### SECOND QUARTER-COASTAL REGION

Wilson’s Plover, American Oystercatcher Breeding Season Surveys Conducted .....	25
Thirteen Adult Leatherback Sea Turtles Captured So Far this Season .....	26
Staff Conduct Spring Mark-Recapture Surveys of Alligators at Lake Waccamaw .....	27
Loggerhead Shrike Nest Monitoring Continues .....	28
Cape Fear and Lumber Basin Crayfish Surveys Update .....	29
Annual Southeastern Diversity Network Bat Blitz Yields 225 Bats .....	30

### SECOND QUARTER-PIEDMONT REGION

Annual Monitoring of Robust Redhorse in the Pee Dee Continues .....	31
Staff Conduct Surveys of Species of Greatest Conservation Need Mussels .....	32
Staff Continue to Monitor Restored Wetlands on Sandhills Game Land .....	33
Biologists Discover New Species of Crayfish .....	33

### SECOND QUARTER-MOUNTAIN REGION

Pond Mountain Game Land Update .....	34
Staff Conduct Rainy Night Surveys for Long-tailed Salamanders .....	35
Golden-Winged Warbler Field (and Forest) Trips Update .....	36

Searching for Northern Pine Snakes in the Mountains ..... 38

Appalachian Cottontail Distribution Project Continues ..... 40

Biologists Begin Mussel Reintroductions in French Broad and Little Tennessee Watersheds ..... 42

**SECOND QUARTER-STATEWIDE**

Workshops Conducted for Natural Resource Professionals ..... 43

Staff Conduct Surveys on Private Lands for Habitat Suitability for Reptiles & Amphibians ..... 44

**THIRD QUARTER-COASTAL REGION**

Research on Coastal Sparrow Species Begins this Winter ..... 45

Despite Dorian, Sea Turtle Nesting Sets Record for 2019 ..... 46

Oregon Inlet Island Cleanup Nets 1,200 Pounds of Trash ..... 47

Lake Waccamaw Surveys Show Increase in Mean Density of Mussels ..... 48

Late Summer Mark-Recapture Surveys of Alligators in Lake Waccamaw ..... 49

Cape Fear Crayfish Surveys Continue ..... 50

**THIRD QUARTER-PIEDMONT REGION**

Staff Collect Eight Carolina Madtom Broodstock for Propagation ..... 50

Gopher Frogs Using Newly Created Habitat on Sandhills Game Land ..... 51

Tar River Spiny mussel Propagation and Augmentation Continue ..... 52

Mussel Population Monitoring in the Pee Dee River Continues ..... 53

Weymouth Woods Wetlands Workshop Focuses on At-Risk Species ..... 54

Timber Rattlesnake Gestational Sites Visited ..... 54

Priority Mussel Surveys Conducted in the Cape Fear and Pee Dee River Basins ..... 55

**THIRD QUARTER-MOUNTAIN REGION**

Biologists Locate New population of Federally Endangered Appalachian Elktoe ..... 55

More Spruce Pine Restoration Projects Underway ..... 56

Peregrine Falcon Eyerie Checks Completed with Partner Assistance ..... 57

Progress and Challenges in Conservation of Bog Turtles ..... 58

Biologists Find Fewer Hellbenders during 2019 Breeding Season Surveys ..... 60

Record Number of At-risk Little Brown Bats Caught in Avery County ..... 62

**THIRD QUARTER-STATEWIDE**

Training Conducted for New Law Enforcement Officers ..... 63

First Statewide Meeting Conducted on Gopher Frog Head-Starting Efforts ..... 63

**FOURTH QUARTER-COASTAL REGION**

191 Cold-Stunned Sea Turtles Found So Far This Season ..... 64

Carolina Pygmy Sunfish Monitoring Continues in Southeastern Counties ..... 65

Marking and Data Collection of North Carolina Alligators Since 2017 ..... 66

Coastwide Waterbird Survey Updates Presented at Waterbird Society Meeting ..... 68

Staff Conduct Surveys for Broadtail Madtoms; Deploy "Motels" for Tiny Catfish ..... 69

**FOURTH QUARTER-PIEDMONT REGION**

Mark-Recapture Surveys Conducted on Focal Snake Species in Sandhills ..... 70  
Pine Snake Nest Excavated During Snake Surveys ..... 71  
Staff Collect No Carolina Madtoms During Recent Survey ..... 72  
5,075 Robust Redhorse Fingerlings Stocked into Pee Pee River in November ..... 72

**FOURTH QUARTER-MOUNTAIN REGION**

Head Start on Winter Bat Surveys Pays Off ..... 73  
North Carolina's Newest Endemic Salamander Species is Official ..... 74  
Golden-winged Warbler Habitat along the Cherohala Skyway Restored ..... 75  
Saving a Streambank to Save a Bog Community ..... 76

**FOURTH QUARTER-STATEWIDE**

The North Carolina Birding Trail Launches New Website ..... 77  
NCPARC News ..... 78  
Many Species of Greatest Conservation Need Found During Annual Christmas Bird Count ..... 79



*Bog turtle (Photo: Jeff Hall)*



*Eastern hellbender (Photo: Lori Williams)*



*Tar River Spiny mussels  
(Photo: Loretta Luttakcas)*



*Peregrine Falcon (Photo: Christine Kelly)*

## First Quarter 2019

### Coastal Region

## Loggerhead Shrike Monitoring Continues in Southeastern North Carolina

Wildlife Diversity Program (WDP) staff ramped up their monitoring and banding efforts for loggerhead shrikes in early 2019. This species has experienced one of the highest reported regional population losses in the Atlantic Coast from 1970-2014. In response, WDP personnel have joined forces with the Loggerhead Shrike Working Group to develop coordinated research and conservation activities across the species' range.

Given the shrike's predatory instincts, the most successful method of capture is a modified potter trap baited with a live mouse, which is itself protected inside a smaller cage.

In March 2019, staff banded 21 shrikes (12 male, seven fe-

male, and two of unknown gender) across five southeast North Carolina counties. They have also located and are actively monitoring 13 active nests.

This on-going project will allow biologists to model the shrikes' full annual life cycle by providing in-

formation about connections between breeding and wintering populations, genetics, juvenile dispersal, nesting success, and annual survivorship. This effort will help them identify factors that contribute to shrike population declines and their recovery.



*Color banding adult loggerhead shrike near Wilmington. (Photo: Melissa McGaw)*



## “Tern Turret” Provides Least Terns with Alternative Nesting Option

In 2017, the North Carolina Aquarium at Pine Knoll Shores discovered a colony of least terns nesting on the gravel rooftop of the aquarium. Wanting the terns to successfully fledge chicks, aquarium staff reached out to the Wildlife Diversity Program’s (WDP) Waterbirds Investigations and Management Project for advice on how to make their roof tern friendly. Since that time, the (NCWRC) and aquarium staff have worked together to promote nesting by least terns on the rooftop, which has been dubbed the “tern turret.”

In March, staff from both NCWRC and the aquarium began preparing the tern turret for the upcoming nesting season. They placed least tern decoys on the rooftop to attract nesting birds to the protected breeding grounds of the aquarium roof. They also added 30 concrete blocks to provide cover once the chicks hatched.



Least tern eggs in the sand  
(Photo: Annika Anderssen)

During the summer, temperatures on rooftops can be high, and an ordinary roof provides little to no shade. The shadows cast by the blocks give chicks a place to escape the blazing heat. In 2017 the tern turret had 18 nests, which grew to 24 nests in 2018. This year, staff from the aquarium and the WDP will monitor the colony’s success via eight cameras that have been strategically placed around the roof.



Least tern (Photo: Annika Anderssen)



Wildlife Diversity Program technician, Nick Jennings places least tern decoys on the roof of the North Carolina Aquarium at Pine Knoll Shores. (Photo: NCWRC)

## Beach Renourishment Projects Can Impact Sea Turtle Nesting

Sandy oceanfront beaches of North Carolina are used as nesting habitat by four sea turtle species: loggerhead, green, Kemp's ridley and leatherback. Turtles generally lay their eggs in the flat open sand between the high tide line and the base of the primary dune. The width of this area is affected by various environmental forces, including storms, tidal cycles and beach inlet dynamics.

In response to excessive erosion, beach towns undertake beach nourishment projects, where sand is pumped up from the nearby ocean floor and placed below the dunes, to widen the beach strand. Normally, the sand pumped up for nourishment projects is "beach quality" and matches the native sand in color, grain size, etc., and is suitable nesting habitat for sea turtles.

Staff with the Wildlife Diversity Program (WDP) and Habitation Conservation Division

work closely with partner resource agency personnel from U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, and the N.C. Division of Coastal Management to inspect nourishment projects to ensure that the pumped sand is of sufficient quality to foster successful sea turtle egg laying and egg incubation. If these inspections reveal issues with the pumped sand, further cooperation is needed to develop plans to mediate those issues. For example, in 2018, a nourishment project on Ocean Isle Beach resulted in heavy concentrations of rocks placed on a section of the eastern end of the island's beach, which was identified by a WDP Biologist during an inspection visit. The presence of the rocks

on this area of beach would impede the ability of reproductive sea turtles to successfully excavate nest cavities in the sand. Subsequent coordination with the various regulatory agencies and the town resulted in two rock removal efforts to help ensure that this area of the beach could be used by nesting sea turtles. Increased erosion of coastal beaches is anticipated to occur in the future, and in response, more nourishment projects also are likely to occur. WDP staff will continue to inspect beach nourishment projects to ensure that suitable sea turtle nesting habitat is maintained on the state's coast.



*Concentration of rock placed on Ocean Isle Beach in 2018 during a beach nourishment project.*

*(Photo: NCWRC)*

## Field Surveys for Upland Snakes and Amphibians Continue

This quarter was an especially busy field time for Wildlife Diversity Program staff who worked with species identified as Species of Greatest Conservation Need in the [N.C. Wildlife Action Plan](#). Staff set up trail cameras and surveyed for upland snakes, especially eastern diamondback rattlesnakes, as well as surveys on several amphibian species such as the gopher frog, ornate chorus frog and Mabee's salamander. Field sites included Croatan National Forest, Camp Lejeune, Holly Shelter Game Land, Military Ocean Terminal at Sunny Point (MOTSU) and several others. Gopher frogs were head-started from three coastal locations including Croatan, Holly Shelter and MOTSU.



(All photos: Jeff Hall)



## Tiger Salamander Populations Benefit from Wetland Restoration and Creation

In the first quarter 2019, NCWRC biologists continued to survey for amphibians and reptiles throughout the eastern part of North Carolina. One priority for the past decade has been to document focal amphibian species on the Sandhills Game Land, located in Richmond and Scotland counties, with a specific focus on eastern tiger salamanders.

In 2007, tiger salamanders were known only from four wetlands on the game land. Through wetland restoration and creation efforts that started in 2010, NCWRC biologists hoped to improve habitat for these salamanders and other associated amphibians and reptiles.

As of 2019, they have now documented tiger salamanders breeding in 12 wetlands on the game land,

mainly at sites that have undergone restoration by NCWRC staff. Five of the newly occupied sites are the result of wetland restoration; one occupied site is a newly created wetland; and the other two sites are ponds that were only recently discovered. Many of these newly occupied wetlands appear to have very robust populations of tiger salamanders, based on egg mass counts, demonstrating the effectiveness of restoration efforts.

This effort also brings up questions about how these salamanders are able to find and repatriate sites where they have been absent for many decades. Staff plan to continue monitoring these sites and to continue restoration efforts to increase populations and meta-populations of tiger salamanders and other imperiled species.



*Tiger salamander* (Photo: Kevin Stohlgren)



## Help Us Keep North Carolina Wild

*Three ways YOU can help.*

- Donating to the North Carolina Tax Check-off for Nongame and Endangered Wildlife Fund, found on line 30 of your North Carolina income tax form each year.
- Purchasing a Wildlife Conservation License plate. This new plate, unveiled in 2019, costs \$30 with \$20 going to the agency's Nongame and Endangered Wildlife Fund.
- Donating to the Wildlife Diversity Endowment Fund, a special fund where the accrued interest – not the principal – will be spent on programs that benefit species that are not hunted or fished.



Nongame projects are primarily funded through these donations and purchases. Every dollar in donations given to the fund is matched with federal and other grants, so donated dollars actually count twice. All donations are tax deductible!

Learn more: [ncwildlife.org/donate](http://ncwildlife.org/donate)



## Carolina Pygmy Sunfish Monitoring Continues

Staff continued annual monitoring surveys for the Carolina Pygmy Sunfish, a state listed threatened species endemic to Columbus and Brunswick counties in North Carolina and small portions of the coastal plain in South Carolina. Of the 10 localities sampled in November, staff collected Carolina pygmy sunfish at three, including a tributary population outside of the core range of Juniper Creek, newly discovered in early 2018. Hurricane Florence brought

catastrophic flooding to the Coastal Plain in fall 2018 and much of the cover vegetation preferred by this species was killed by prolonged inundation or stripped away. This would have altered the local distributions, contributing to the reduced detection during these surveys. Access to some sites also was restricted due to poor road conditions.

Carolina Pygmy Sunfish are still present and catch per unit effort ranged from 0.5 to 5 individuals per person hour. Surveys this year will provide more information re-

garding the ability to recolonize these areas when vegetation has returned.

Staff collected additional fishes identified as Species of Greatest Conservation Need in the [N.C. Wildlife Action Plan](#), including the Everglades pygmy sunfish (at four localities) and the banded sunfish (at six localities). Overall fish abundance was observed to be markedly reduced as compared to previous years, likely due to hurricane effects.



*Carolina pygmy sunfish*  
(Photo: Brena Jones)

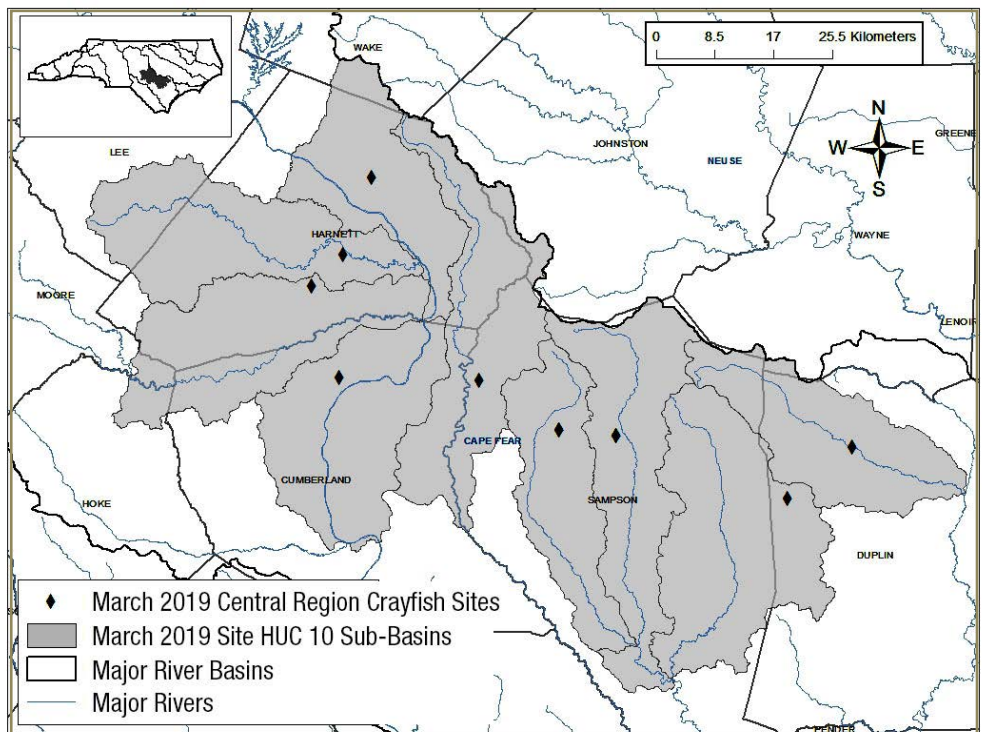
## First Quarter 2019

### Piedmont Region

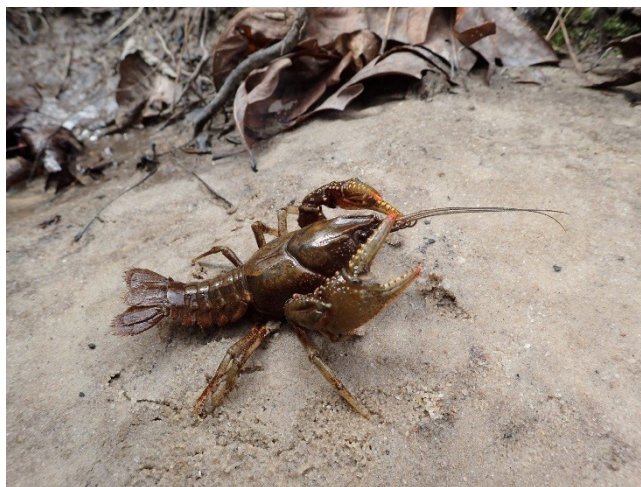
## Crayfish Surveys Conducted in the Sandhills and Upper Coastal Plain

Wildlife Diversity Program staff conducted crayfish surveys in the Sandhills and upper Coastal Plain of the Cape Fear River drainage in March 2019 as part of a bigger project to update distribution records for both native and exotic invasive species. Staff surveyed nine sites, each in a unique 10-digit HUC, at locations where crayfish data were not previously recorded or had dated records (>15 years old). Staff collected no species identified as Species of Greatest Conservation Need in the [N.C. Wildlife Action Plan](#).

They found variable crayfish (at four sites and in one new HUC — Great Coharie Creek, located in Sampson County.) While the survey included sites within the historical range of the Sandhills crayfish, endemic to the Carolinas, staff did not locate any. However, they did find the exotic red swamp crayfish at two localities, representing newly documented occurrences in the Upper South River and Little Coharie Creek sub-basins in Sampson County. Surveys will continue through 2019.



Map of crayfish surveys conducted by staff in March



Variable crayfish (Photo: Katharine DeVilbiss)

## Robust Redhorse Population Augmentation and Captive Propagation Continue

In November 2018, 2,024 Phase I (6 months old) robust redhorse fingerlings raised at the SC Department of Natural Resources' Dennis Center were stocked into the Pee Dee River, half at Cheraw, SC and half at Jones Creek Shoal, NC. These fish were the products of adults collected in the Pee Dee River spawning shoals in North

Carolina. Another 2,000 were held back at Dennis Center to grow out to Phase II (18 months old), which will be stocked in the winter 2019, along with individuals from the same year-class reared at NCWRC's McKinney Lake Hatchery. Phase III fish, held back from the 2015 year-class in ponds at both hatcheries, were also weighed, measured, and fin-clipped in November and De-

cember 2018. Forty-four individuals remain at McKinney Lake Hatchery, averaging 18.62 inches in total length and 3.4 pounds in weight. The Dennis Center held 34 individuals, averaging 18.8 inches and 3.3 pounds. Results of fin clip genetic analysis will allow biologists to determine whether these animals may be used as future broodstock.

## Staff Build and Install Nest Boxes for Barn Owls in Piedmont

The Piedmont Barn Owl Project is moving forward with four boxes deployed on private land in Anson and Randolph counties. Biologists built the boxes based on plans from the Barn Owl Trust ([www.barnowl-trust.org.uk](http://www.barnowl-trust.org.uk)) and installed them during this quarter. The boxes

have not been checked yet, but biologists are hopeful the boxes are occupied with nesting owls.

In 2012, the New Hope chapter of the Audubon Society started installing barn owl nest boxes in areas with appropriate habitat, but none of the 27 boxes have been occupied. The chapter has been helpful with the continuing expansion of the project through word-of-mouth with landowners and equipment loans of nest cameras and nest boxes. The chapter also has been publicizing the project on its website.



*Technical Assistance Biologist, John Isenhour, builds a nest box.*  
(Photo: Allison Medford)



*Barn owl box* (Photo: Allison Medford)

**Wildlife Diversity Program biologists are seeking barn owl information. Contact Allison Medford to report any known or potential nest sites:**

[allison.medford@ncwildlife.org](mailto:allison.medford@ncwildlife.org)

**910-975-9393**

## First Quarter 2019

### Mountain Region

## Surveys for Four-Toed Salamanders Document Six New Populations

In the first quarter 2019 Wildlife Diversity Program staff, collaborators and volunteers began a project to survey potential sites for four-toed salamander, a state-listed species of Special Concern, federally listed species of concern and a species identified in the [N.C. Wildlife Action Plan](#) as a Species of Greatest Conservation Need. The primary purpose was to find new sites in the greater French Broad River valley and collect tissue samples to see if more populations exist for the unique, highly divergent species group known currently only as “Clade E” (based on

previous research by Tim Herman, an expert on the species).

Over a span of three weeks, the team surveyed 24 wetland habitats to look for nesting females. They succeeded in documenting six new populations of four-toed salamanders in Buncombe, Henderson, and Transylvania counties, where they previously only knew of three sites. Further, staff updated records at a historical site in Henderson County where the species had not been seen since 1976.

Pending lab analysis of samples collected will help determine the distribution of the rare “Clade E” four-toed salamander in the area.



*A female four-toed salamander*  
(Photo: Lori Williams)



*A female four-toed salamander with eggs on nest* (Photo: Jim Petranka)



*Four-toed salamander nesting habitat* (Photo: Jim Petranka)



*Project collaborator, Tim Herman, finds a four-toed salamander nest.* (Photo: Lori Williams)

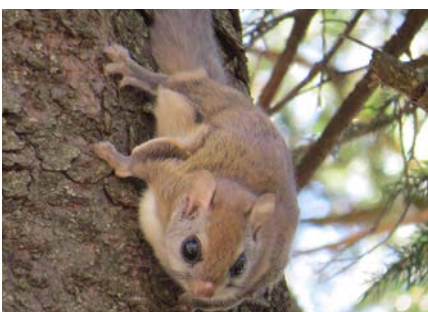
## Staff Launch Project to Test for Mercury in Carolina Northern Flying Squirrels

This winter Wildlife Diversity Program (WDP) staff launched a pilot project to test for mercury accumulation in Endangered Carolina northern flying squirrels. The 1990 U.S. Fish and Wildlife Service Recovery Plan for Appalachian Northern Flying Squirrels recommends research on heavy metal accumulation in fungi and lichens eaten by northern flying squirrels and bioaccumulation of metals in the flying squirrels themselves.

Dr. Joe Poston and a student at Catawba College will be testing mercury levels in flying squirrel hair samples. WDP staff developed field protocols and snipped hair samples from 18 northern flying squirrels captured in the Black Mountains, Great Balsams and Unicois for mercury testing. The results will help better determine the current threat level of heavy metal pollution to Carolina northern flying squirrels after a decade or more of improved air quality in western North Carolina.



*A biologist snips hair from the side of a northern flying squirrel's tail  
(Photo: Clifton Avery)*



*Carolina northern flying squirrel  
(Photo: Clifton Avery)*



*Wildlife Diversity technician Kristi Confortin holds bags of flying squirrels to keep them warm as they await processing on a cold day (Photo: Christine Kelly)*



*Pisgah National Forest silviculturist, Rachael Dickson, helped check flying squirrel boxes (Photo: Christine Kelly)*

## Inactive Gold Mines Hold a Different Treasure — Tri-colored Bats

The tri-colored bat is a hibernating species with a statewide distribution in North Carolina. This species has experienced extensive population declines in western North Carolina, where White-nose Syndrome (WNS) and the caves that harbor it are widespread. Few caves exist east of the Southern Appalachian Mountains in North Carolina to accommodate bat hibernation, but recent efforts by NCWRC biologists have uncovered a link between the nation's first Gold Rush and hibernating tri-colored bats. The first documented discovery of gold in the United States occurred in Cabarrus County in 1799 and kicked off 50 years of gold mining in the

state, drawing miners from across the globe. The N.C. Gold Rush was eclipsed by the more familiar California Gold Rush in 1848, but gold mining continued to a lesser degree in the Tar Heel state for another century. Though not as productive as its California counterpart, the

N.C. Gold Rush left hundreds of underground portals throughout the Piedmont Region, providing critical hibernation habitat for the tri-colored bat in a region where caves are scarce.

*continued on next page*



*A hibernating tri-colored bat in an inactive gold mine (Photo: Katherine Etchison)*

**Wildlife Diversity Biologist, Katherine Etchison, swabs tri-colored bats to test for the causative fungus of White-nose Syndrome.**

*(Photo: Olivia Munzer)*



## Inactive Gold Mines Hold a Different Treasure — Tri-colored Bats

Nine of these mines were surveyed in winter 2019 yielding 86 tri-colored bats, 30 of which hibernated in a single site. This count is slightly greater than the highest counts in Mountain hibernacula, some of which formerly held thousands of tri-colored bats before the arrival of WNS. Fungal swabs were collected from each Piedmont site to test for the causative pathogen of WNS and results are pending; however, sites that tested positive for this pathogen in the past continue to show stable counts and visibly healthy bats. This could be an indication that WNS is unable to grab a foothold in the Piedmont Region, perhaps due to the warmer, shorter winters that provide small amounts of insect activity for bats to re-build their fat reserves. The explanation for continued health among these tri-colored bats remains unclear, but one thing is for sure, NCWRC biologists are finding inactive gold mines now hold a different kind of treasure.



*The entrance to an inactive gold mine in which 18 hibernating tri-colored bats were counted (Photo: Katherine Etchison)*



*Wildlife Diversity Biologist, Allison Medford, measures the entrance to an inactive gold mine. (Photo: Katherine Etchison)*

## First Quarter 2019

Statewide

### NCPARC Joint Annual Meeting was a Huge Success

In February, N.C. Partners in Amphibian and Reptile Conservation (NCPARC) met jointly with Southeast PARC (SEPARC). The meeting was held at the Blue Ridge Assembly in Black Mountain, marking the second time the regional meeting was held in North Carolina. It also marked the 10-year anniversary of the first time the groups met jointly in North Carolina. The meeting was extremely successful, attracting the largest

number of attendees ever at a SEPARC or NCPARC meeting with more than 340 registrants.

Participants were treated to an excellent keynote speaker, Joe Pechmann from Western Carolina University, over 40 oral presentations, over 60 posters, workshops and task teams before and during the meeting. There was also a trivia contest and socials, as well as a range of field tours on the final day of the meeting. To see a full agenda of the



meeting, as well as abstracts for the presentations and posters, visit the SEPARC website ([separc.org/meetings](http://separc.org/meetings)).

### Venomous Reptile Training Conducted for Agency Staff

Wildlife Diversity Program staff assisted with three training sessions for Wildlife Management and Law Enforcement divisions on venomous reptiles. In addition, staff conducted a training for D6 and D7 Law Enforcement Officers, specifically focused on the conservation of reptiles and amphibians, and those species of particular concern from a poaching and illegal wildlife trafficking perspective. All training sessions were well attended with over 50 staff present at each event.



*Law Enforcement officers in Districts 6 and 7 learned the appropriate techniques to handling venomous snakes. (Photo: Jeff Hall)*



## Second Quarter 2019

### Coastal Region

#### Wilson's Plover, American Oystercatcher Breeding Season Surveys Conducted

Throughout May and June, Wildlife Diversity Program (WDP) staff from the Waterbirds Investigations and Management Project conducted a breeding season survey of Wilson's plovers and American oystercatchers along the North Carolina coast.

First conducted in 2004, this triennial survey was launched to investigate anecdotal observations of declines in the populations of the two species. Since that time, WDP staff have worked with federal, state and private partners, as well as numerous volunteers, to collect data representing the distribution,

abundance, and reproductive success of these species throughout the coast.

To locate the birds, biologists and technicians walk or boat along the edge of beaches and islands, watching and listening for the target species. Once found, staff observe their behavior and attempt to locate and document their nests, recording the number of eggs or chicks.

The final numbers will not be compiled until later this year, but early estimates show an increase in the number of nesting pairs for both species.



*Wilson's plover.* (Photo: [Russ on Wikimedia](#))



*An adult American oystercatcher acts as sentinel atop a shell rake.* (Photo: Carmen M. Johnson)

## Thirteen Adult Leatherback Sea Turtles Captured So Far this Season

Leatherback sea turtles infrequently nest in the summer on the sandy beaches of North Carolina. However, they regularly occur in the state's waters, mostly in the spring and early summer. Each year, there are numerous observations reported by anglers at oceanside piers and by boaters close to shore, especially around Carteret County. This past May, a collaborative project including biologists and researchers from the National Marine Fisheries Service, N.C. State University College of Veterinary Medicine, N.C. Aquariums, and NCWRC sought to capture free-swimming leatherbacks, to track their migratory behavior using satellite tags and video cameras.

Over the course of two weeks, the team captured 13 adult leatherback sea turtles using a modified hoop net in and around Cape Lookout bight. Two of the turtles bore flipper tags from nesting beaches in Grenada and Trinidad. All the captured leatherbacks departed North Carolina waters within two weeks of being tagged, with most moving north along the coast of Virginia and Maryland. Biologists anticipate the satellite tags will continue to transmit location data into 2020, showing whether these animals tend to remain in coastal waters throughout the year, or move out into waters of the open ocean where they assume the turtles spend most of their time.



*Using a hoop net to capture a free-swimming leatherback sea turtle near Cape Lookout bight in May 2019. (Photo: NCWRC)*



*Leatherback sea turtle  
(Photo: Dr. Matthew Godfrey)*

## Staff Conduct Mark-Recapture Surveys of Alligators at Lake Waccamaw

This spring, NCWRC and NC State Park staff conducted mark-recapture surveys from May 6-9 at Lake Waccamaw as part of an ongoing collaborative research project at Lake Waccamaw. Since these surveys began in late summer 2017, all alligators captured as part of this project have been marked in accordance with the statewide marking and data collection protocol. Over time, these data will be used to estimate abundance, growth rates of individuals between sexes and among size classes, and the population growth rate. During this capture session, 36 alligators were caught and released on-site following data collection; 31 individuals were previously unmarked and 5 were recaptures.

During late May 2019, other researchers from NC State University captured and marked six alligators (five previously unmarked, one recapture) at Lake Waccamaw as part of a separate ecotoxicology research project. These researchers followed the same marking and data collection protocol and submitted these data to NCWRC staff to be included in the mark-recapture study.

This project also provides a unique opportunity to provide hands-on training on the statewide marking and data collection protocol for agency staff and ex-

**In spring 2017, a new marking and data collection protocol was initiated for all alligators handled by NCWRC staff, Alligator Control Agents and researchers. This requires scanning for/the insertion of a PIT tag, collection of tissue samples (tail scutes), sex determination by cloacal examination, measuring total length (TL) and snout-vent length, and recording GPS coordinates of locations of capture and release.**

ternal handlers of wild alligators. During these spring surveys at Lake Waccamaw, 48 people (16 NCWRC law enforcement officers, 16 Land and Water Access staff, three Wildlife Management Division staff, three other NCWRC staff, three Jurisdictional Alligator Control Agents from New Hanover County Police Department/Animal Control, and seven conservation partners from Bald Head Island Conservancy, the NC Zoo, and NC State Parks) received training.



*An alligator being measured (Photo: Thomas Harvey)*



*Tail scute collected (Photo: Thomas Harvey)*

## Loggerhead Shrike Nest Monitoring Continues

Wildlife Diversity Program staff monitored reproductive activity for 34 pairs of loggerhead shrikes in southeast North Carolina in April, May and June. Apparent nesting success (at least one young fledged) was 50 percent and is slightly lower than the range-wide average of 56 percent. Biologists witnessed re-nesting attempts by five pairs whose initial nests had failed, but only one of these was successful on the second try.

Shrikes in North Carolina preferentially bred in agriculturally dominated landscapes, mostly on privately owned properties, and should be considered a “farm-friendly” bird. They did, however, exhibit some plasticity by also building nests in residential front yards, pine forest edges, city parks and heavily urbanized areas, including parking lots. Pine trees were the most frequently used nesting structure, followed by cedar and pear trees, and even one nest was found atop an old satellite dish covered in wisteria vines.

Shrikes begin breeding earlier than most other songbirds and this appears to create a dependency on non-deciduous vegetation that can better conceal a nest early in the spring. As the breeding season advanced, biologists noticed birds beginning to

select a wider diversity of nesting tree and shrub species. They are hopeful the data they are collecting will be useful to landowners who would like to manage their property for wildlife, including loggerhead shrikes. Staff will continue to monitor these sites and color band birds throughout the year to provide information about connections between breeding and wintering populations, genetics, juvenile dispersal, nesting success and annual survivorship. This effort will help them identify factors that contribute to shrike population declines and their recovery.



*Loggerhead shrike (Photo: John Carpenter)*



*Loggerhead shrike nest with nestlings, June 2019. (Photo: John Carpenter)*

## Cape Fear and Lumber Basin Crayfish Surveys Update

NCWRC staff continued surveys to update distribution records for both native and exotic crayfish species in the Cape Fear and Lumber drainages, partnering with the N.C. Museum of Natural Sciences (NCMNS). The 33 sites targeted were previously un-surveyed locations or had dated records that were more than 10 years old.

Staff collected no Species of Greatest Conservation Need, but saw variable crayfish at six sites, representing newly documented occurrences in five sub-basins. These sub-basins were Drowning Creek, Raft Swamp, Shoe Heel Creek, Upper Little Pee Dee river in the Lumber watershed and Upper Little River in the Cape Fear watershed. Staff found individuals from the *Cambarus* species *C. acuminatus* complex at three sites and sent voucher specimens to NCMNS for genetic analysis. While the survey included sites within the historical ranges of five North Carolina endemic species, none of these species were captured.

A White River crayfish exhibiting signs of porcelain disease was found in Bear Swamp in Robeson County. Aside from the recognizable bleaching of

color on the underside of animals, little is known about the disease and the effect it may have on crayfish. The exotic red swamp crayfish was found at nine localities, representing newly documented occurrences in four sub-basins of the Lumber River watershed -Red Hill Swamp, Porter Swamp, Ashpole Swamp and Leith Creek.

Staff will continue surveys through the end of 2019.



Red swamp crayfish (Photo: Jodie Owen)



White River Crayfish exhibiting porcelain disease (Photos: Katharine DeVilbiss)

## Annual Southeastern Diversity Network Bat Blitz Yields 225 Bats

Bat biologists and enthusiasts from across the Southeast gathered on the Albemarle Peninsula for the annual Southeastern Bat Diversity Network (SBDN) Bat Blitz in June. The SBDN Bat Blitz is an intensive three-night mist-netting event that occurs in a different southeastern state each year. The last time North Carolina hosted the Blitz was in 2011 in Avery County. The NCWRC helped host this year's Bat Blitz, alongside the N.C. Division of Parks and Recreation, the N.C. Museum of Natural Sciences and Alligator River National Wildlife Refuge.

The Wildlife Commission's Wildlife Education staff kicked off the first night of the Bat Blitz with an educational program for the public. The program, "Bats Working the Night Shift," covered topics on bat biology, behavior and conservation needs. The program also highlighted local bats during a night hike in which bat echolocation calls were recorded and identified. Mistnetting surveys were conducted during the following three nights and targeted 28 survey sites in eight counties, including 13 sites on nine game lands. Participants captured 225 bats of eight species. Highlights included the capture of a Federally Threatened northern long-eared bat and three Species of Greatest Conservation Need:



*An eastern red bat is compared with a Seminole bat on Alligator River Game Land (Photo: Kristi Confortin)*

southeastern bat (31), Rafinesque's big-eared bat (9) and tri-colored bat (3). Attendance included over 50 participants, which consisted of biologists from state and federal agencies, students, professors and environmental consultants. Overall the bat blitz was a great success for bats and participants alike and will be used to establish long-term monitoring on the coastal plain.



*Wildlife Diversity Technician, Kristi Confortin, and Wildlife Diversity Biologist, Katherine Etchison, band bats during the SBDN Bat Blitz (Photo: Kevin Parker)*

*A southeastern bat caught on Lower Roanoke River Wetlands Game Land (Photo: Kristi Confortin)*



## Second Quarter 2019

### Piedmont Region

## Annual Monitoring of Robust Redhorse in the Pee Dee Continues

Staff continued annual cooperative sampling and population monitoring for robust redhorse in the Pee Dee River downstream of Blewett Falls dam, alongside partners in the Yadkin-Pee Dee Technical Working Group, including Duke Energy, SC Department of Natural Resources (SCDNR), and SC Aquarium.

During targeted spring surveys, staff captured 53 robust redhorse in 95.8 hrs of electrofishing — a catch rate of 0.55 fish per hour. These captures represent:

- 45 unique individuals of which 29 were previously untagged fish

- 15 females, 30 males
- 12 recaptures from previous years, a recapture rate of 29.3%
- 4 Phase II juveniles, spawned in spring 2015, stocked in November 2016

Fish ranged in size from 19 to 29 inches (480 to 745 mm) in total length (TL), representing multiple age classes. Males that were known products of a 2014 stocking, released at 6 months of age, were reproductively mature, representing successful recruitment of captive reared fish into the wild population. Eggs from two females were crossed with four males for captive propagation this year. The resulting fry will be grown out in ponds at

Wildlife Commission's McKinney Lake Fish Hatchery and SCDNR's Dennis Center for population augmentation stocking.

Duke Energy biologists captured eight more individuals near Blewett Falls dam, including four 2015 Phase II fish. This brought the total number of robust redhorse captured in North Carolina in 2019 to 53 fish.

Staff collected fin clips from all animals in North Carolina, and genetic analysis conducted by SCDNR this summer will determine whether the new fish are products of previous augmentation efforts.



*A 5-year old, sexually mature male robust redhorse with breeding tubercles on snout and fins*

*(Photo: Brena Jones)*

## Staff Conduct Surveys of Species of Greatest Conservation Need Mussels

In May and June, staff continued status assessment surveys for the state endangered brook floater mussel at 31 sites in the Pee Dee and Cape Fear river basins. Biologists have detected 36 brook floaters from 11 sites, including Densons Creek, Little River, and West Fork Little River in the Pee Dee drainage, as well as the Deep, Rocky, and Haw rivers in the Cape Fear drainage. Genetic swabs were taken from a subset of the mussels for an ongoing population diversity study, and all brook floaters were tagged.

Focusing on the Deep River in Randolph and Moore counties, NCWRC staff and volunteers from partners including N.C.

State University, the Greensboro Science Center, private consulting firms and Appalachian State University, contributed 207 person-hours (p-h) searching for Species of Greatest Conservation Need (SGCN) mussels in six reaches of river during multiple visits. More than 12,000 individuals were collected over 15 surveys. In addition to brook floater, SGCN species detected included:

- Savannah lilliput; Federal Species of Concern, State Endangered
- Yellow lampmussel; Federal Species of Concern, State Endangered
- Triangle floater; State Threatened
- Creeper; State Threatened
- Chameleon lampmussel
- Eastern creekshell

Additional species found included Florida pondhorn, Atlantic spike, eastern elliptio and paper pondhorn. Catch per unit effort (CPUE) ranged from 3.1 (at Hwy. 1 in Moncure) to 143.3 (at Highfalls) mussels per p-h.

During these surveys, several animals were recaptured that were originally tagged as part of the Carbonton Dam removal study from 2005 to 2008. These eastern elliptios had remained in the original study site and are now well over 12 years old, as they were marked with a Dremel tool with the year of collection and were adults at the time of first capture.



Marked elliptio from 3<sup>rd</sup> year of Carbonton study (Photo: Brena Jones)



Tagged brook floaters from Densons Creek (Photo: Katharine DeVilbiss)



## Staff Continue to Monitor Restored Wetlands on Sandhills Game Land

In the second quarter, NCWRC biologists continued to monitor multiple wetlands that have undergone restoration on the Sandhills Game Land. One example is “Dismal Pond,” a site where restoration started in 2013. This approximately 23-acre isolated wetland was ditched and drained in the early 20<sup>th</sup> century, but the ditch was plugged in 1997 to attempt to restore the water table. As a result, the mature trees that had grown up in the 1900s were inundated and killed, creating swamp-like conditions instead of the natural, open and grassy state the wetland would have likely been in before ditching and a lack of fire. Agency staff began restoring the wetland by



Drone photo of “Dismal Pond” on Sandhills Game Land, January 2019 (Photo: Brady Beck)

unplugging the ditch, removing woody vegetation, restoring prescribed fire, and then re-plugging the ditch system. Uplands surrounding the wetland were also managed to create an open-canopy longleaf pine system. Staff monitored frog and toad use of the wetland during 2018-19 using an automated recorder. Analysis of the recordings revealed at least 10 species using the wetland during this time period. These included southern cricket frog, southern toad, pinewoods treefrog, gray treefrog, green treefrog, barking treefrog, spring peeper, green frog, American bullfrog and southern leopard frog. Monitoring and restoration efforts will continue for the foreseeable future to determine whether species richness increases and to assess the need for re-introducing some species that may have been lost in the past.

## Biologists Discover New Species of Crayfish

In the foothills of western North Carolina, biologists with the Wildlife Diversity Program and the NC Museum of Natural Sciences recently described a new species of crayfish, *Cambarus franklini*, from the upper South Fork Catawba River. Using morphological and genetic data, they worked together to define this new species. The South Mountain Crayfish is found only in Burke and Catawba counties and found almost exclusively in the main stem of Henry and Jacob Forks. It is distinguished from other crayfish in this area by its large chelae and blue-green and red coloration. Though this species has a limited range in the South Mountain region of North Carolina, it does have good water quality protection provided by the South Moun-

tains State Park and the Division of Water Resources stream classifications in both streams of Outstanding Resource Waters and High Quality Waters.



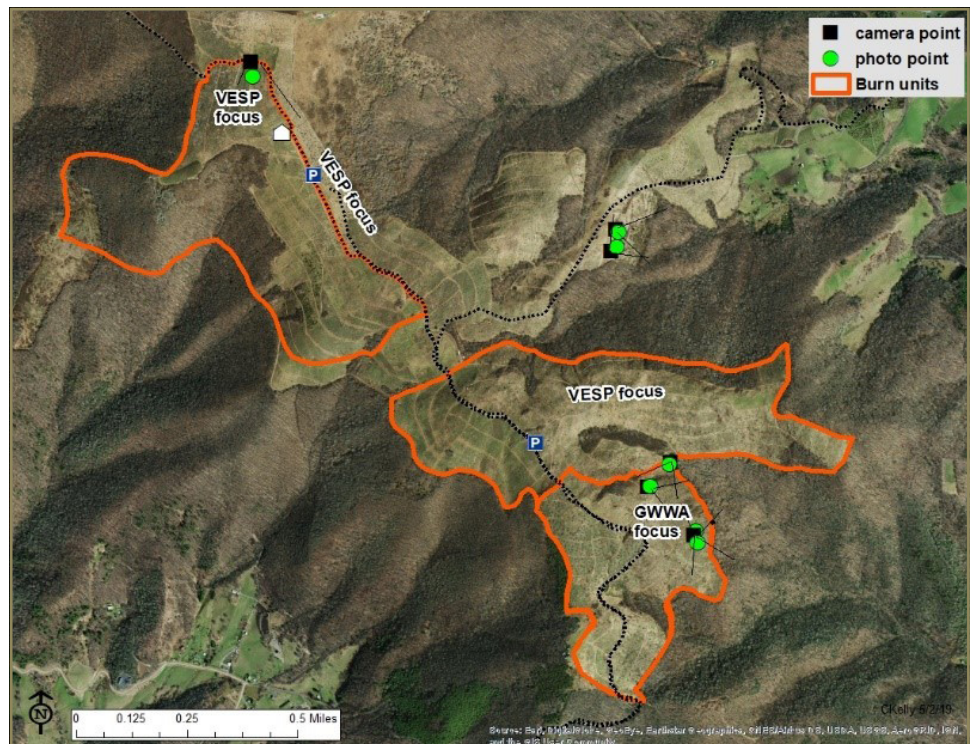
## Second Quarter 2019

### Mountain Region

## Pond Mountain Game Land Update

Pond Mountain Game Land’s extensive former Christmas tree fields present a unique opportunity for the NCWRC to manage for a desired type of early successional habitat. Wildlife Diversity Program (WDP) and Land and Water Access crews met on site in 2018 and set objectives to manage  $\frac{1}{3}$  of the open areas as grassland,  $\frac{1}{3}$  as shrub-scrub, and  $\frac{1}{3}$  as young forest. Prescribed burning, disking and mowing are tools being used to manage these seral stages.

In spring 2019, the Wilkes Crew burned over 400 acres. WDP biologists established photo points to monitor vegetation succession in response to management over the next five to 10 years within areas deemed most suitable for golden-winged warbler and vesper sparrow. During annual bird surveys, biologists documented seven black-billed cuckoos in wet, shrubby areas of Pond Mountain Game Land. Although the New River basin is one of the most reliable spots for black-billed cuckoos in western North Carolina, the species is uncommon and had not been previously documented on Pond Mountain at such high density.



*Photo monitoring points, prescribed burn units, and bird management focus on Pond Mountain Game Land (VESP = vesper sparrow; GWWA = golden-winged warbler)*



*A vesper sparrow at Pond Mountain Game Land (Photo: Christine Kelly)*



*A black-billed cuckoo (Photo: Kevin Parker)*

## Staff Conduct Rainy Night Surveys for Long-tailed Salamanders

In the second quarter, Wildlife Diversity Program staff and volunteers conducted rainy night surveys for surface-active salamanders, with a particular target in mind—the rare, hard-to-find, and poorly studied, long-tailed salamander, a state Special Concern species and Species of Greatest Conservation Need.

Despite targeted surveys, staff have not been able to find the species at any known site in

North Carolina in the past 10 years. The state’s best population appears to be in the Watauga River corridor, but several of those records are quite dated. However, in June during road cruising surveys, staff located a long-tailed salamander close to historical sites where the species was reported over 30 years ago and not since that time.

Further, of immediate conservation concern, is a well-known long-tailed salamander population along Hwy. 105 in Watauga Coun-

ty whose rocky slope habitat is slated for construction of a new roadway. In coordination with local private landowners, staff and volunteers began visiting the site on rainy nights in the spring and have continued those efforts this summer to find individuals for relocation in similar, nearby habitat as well as to further biologists' knowledge of relative abundance and habitat use for this understudied species.



*Searching for long-tailed salamanders in the dark for translocation (left). A long-tailed salamander translocated away from an upcoming road construction site in Watauga County (Photos: Kat Diersen)*

## Golden-Winged Warbler Field (and Forest) Trips Update

In April, the NCWRC, Southern Appalachian Highlands Conservancy and the Appalachian Trail Conservancy co-hosted the spring Southeast Golden-winged Warblers partners meeting. Partners toured old-field habitat in Roaring Creek Valley in Avery County to see sites recently managed for golden-winged warblers. Then, with the [Best Management Practices for Golden-winged Warblers](#) in hand, they put their heads together to develop tentative prescriptions for areas needing habitat management and for the broader landscape.

May 2019 marked the 10<sup>th</sup> year of monitoring timber harvest units on the Nantahala

National Forest. Because a primary objective of the U.S. Forest Service is to regenerate forest, this habitat is inherently ephemeral, eventually “aging out” around 12 to 14 years after harvest beyond what these birds will use. Therefore, short of dedicating early successional forest patches managed over the long term for golden-winged warblers, biologists believe the birds’ best prospect for finding their next home on national forest land is the shifting mosaic of new harvest units. In turn, monitoring points shift to new locations as old units age out. The Hazanet units, where monitoring began in 2010, are now 13 years old and were unoccupied this year. Nearby in the Cheoah Mountains, two 3-year old, harvest

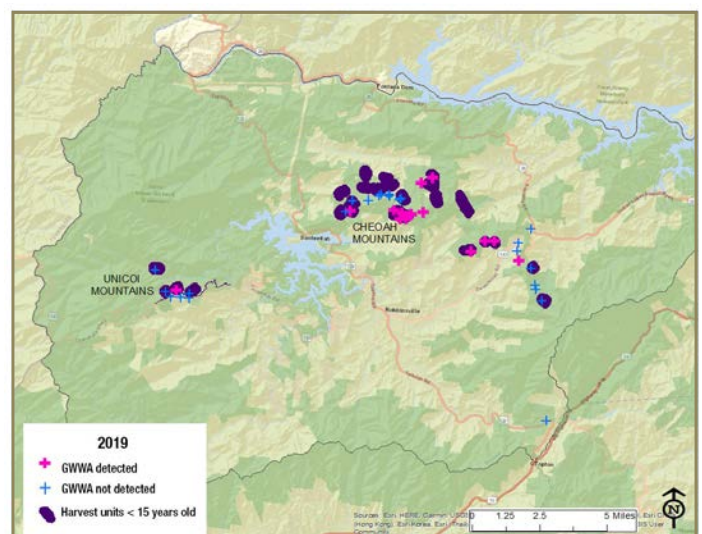
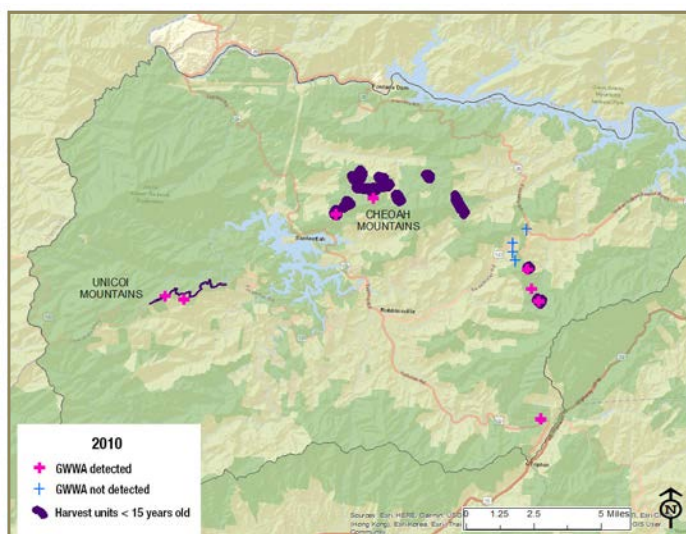


Golden-winged warbler  
(Photo: Christine Kelly)

units at Ollie’s Creek harbored an impressive six males each. The three smaller 3-year old harvest units at Green Gap were all occupied.

Two of the males banded in 2018 were back on territory

(continued on next page)



Potential golden-winged warbler habitat within U.S. Forest Service timber harvest project areas on the Cheoah Ranger District in 2010 (left) and 2019 (right).

## Golden-Winged Warbler Field (and Forest) Trips Update

after another round-trip migration to northern South America for the winter. A golden-winged warbler had claimed one of the new (2-year old) harvest units in the Santeetlah project area in the Unicoi Mountains, but logging is still underway. Meanwhile, succession has claimed formerly occupied roadside habitat along the adjacent Cherohala Skyway.

In June, partners from the Forest Service, National Wild Turkey Federation, and Audubon NC joined NCWRC staff for their final bird survey in the Cheoah Mountains. For some of the silviculturists in attendance, it was their first time seeing and hearing a golden-winged warbler!

While watching the birds sing from tall residual oak trees and skulk through low thickets of pokeweed and goldenrod, partners and staff developed novel modifications to traditional silviculture prescriptions, intended to maximize habitat features such as song perches, food and nest sites for golden-winged warblers.



*Wildlife Diversity technician, Clifton Avery, surveys birds in a 3-year old harvest unit on the Cheoah Ranger District. (Photo: Christine Kelly)*



*A golden-winged warbler color-banded in May was sighted again on territory in mid-June by U.S. Forest Service biologist Johnny Wills. (Photo: Johnny Wills)*



*Wildlife Diversity Program biologists found a golden-winged warbler on territory in this 2-year-old harvest unit on the Cheoah Ranger District. (Photo: Christine Kelly)*

[Check out this slow-motion video of a golden-winged warbler being released!](#)

## Searching for Northern Pine Snakes in the Mountains

One of North Carolina's many Species of Greatest Conservation Need is the northern pinesnake. This large, nonvenomous snake is also a federal and state species of Special Concern. While it is most commonly encountered in the Sandhills and southern Coastal Plain of North Carolina, there are a handful of records, mostly historic, from the southwestern mountains. Pinesnakes have been reported in Cherokee and Swain counties, and many range maps show their distribution extending from Cherokee to

Rutherford counties.

The NCWRC began new work this year with the goal of better understanding these pinesnake populations in the mountains. The first step toward learning more about these populations is to locate some of these elusive animals. Pinesnakes spend the majority of their time burrowing underground, so it can be difficult to encounter them.

Following the recommendation of biologists in Georgia and South Carolina, the NCWRC is trying to locate these snakes using drift fences with camera traps. A drift fence is a

common method of capturing reptiles and amphibians. The drift fence acts as a barrier on the landscape to impede the movement of animals and usually has some type of trap attached to it to capture the animal as it tries to go around the fence. In this case the trap is a camera. This camera trap consists of a modified trail camera suspended in a bucket placed at each end of the fence to photograph animals moving along the fence.

To focus the pictures at such close range, staff modified the cameras by gluing reading glass lenses over the cameras' lenses. Staff partnered with private landowners to place the drift fences in locations where the habitat seemed suitable, including the location where a pinesnake was found most recently in the mountains.

Pinesnakes prefer open areas near pine-oak forest, and the open areas usually contain some type of recent disturbance (e.g., agriculture or development). Cherokee County is the focus currently because that is where a pinesnake was most recently encountered in the North Carolina mountains, and because there are many recent records immediately southward in Georgia.

*(continued on next page)*



*Northern pinesnake (Photo: Lori Williams)*

## Searching for Northern Pine Snakes in the Mountains

Staff installed two drift fences this spring, and hope to install a third later this year. The fences will be left in the field for at least two years, and the cameras will operate during the pinesnake active season (April through October) each year.

Thus far, staff have not photographed any pinesnakes, but they have captured a variety of other wildlife on camera, including squirrel, rabbit, mouse, rat, eastern fence lizard, common five-lined skink, copperhead and several arthropods.



*A camera trap drift fence placed in Cherokee County for detecting northern pinesnakes. Modified trail cameras are suspended in the buckets at the ends of the fence. NCWRC Conservation Technician, David Woody, finishes securing one of the camera trap buckets to the fence. (Photo: NCWRC)*



*A juvenile five-lined skink (left) and eastern fence lizard (right) documented in a camera trap*

## Appalachian Cottontail Distribution Project Continues

Populations of the Appalachian cottontail are assumed to be declining in many parts of their range. However, the population status and trends in most of the range of this species, including North Carolina, are unknown.

In 2018, the Wildlife Diversity Program (WDP) initiated a two-year Appalachian cottontail project in the western region of the state to better understand distribution, habitat preferences, and landscape genetics of the species. WDP staff have been working with partners at the Center for Proactive Conservation, Virginia Tech, and Warren Wilson College to perform scat surveys and trapping to gather genetic and spatial information. So far, 13 sites have been trapped over two field seasons, including locations at Roan Mountain Highlands, Great Smoky Mountains National Park, Black Balsam Knob, Blue Ridge Parkway and Cradle of Forestry, for a total of 1,704 trap nights.

*(continued on next page)*



*A grassy bald on Roan Mountain, October 2018  
(Photo: Andrea J. Shipley)*

*An Appalachian cottontail resting after being processed post-capture, Roan Mountain, October 2018.*

*(Photo: Andrea J. Shipley)*





## Appalachian Cottontail Distribution Project Continues

During this effort, the presence of Appalachian cottontail was genetically confirmed for the first time at Cradle of Forestry. Both Appalachian cottontail and eastern cottontail were captured, in addition to potentially hybrid individuals. Of 16 captured Appalachian cottontail, six were fitted with radio collars and tracked to gather habitat selection information. Two seasons of scat and vegetation sampling along transects have been performed at 14 sites, for a total of 156 transects. Sampling along transects was performed along an elevational gradient to attempt to ascertain the degree of elevational distribution overlap between eastern cottontail and Appalachian cottontail. As habitat fragmentation increases and new areas become disturbed, new pathways for eastern cottontail to inhabit traditionally Appalachian cottontail habitat could potentially increase. It is important for staff to gain an understanding of how these two species overlap in their distribution and habitat preferences to inform future management considerations for Appalachian cottontail population conservation. An additional trapping and tracking field season is planned for the August 2019 through February 2020 timeframe to expand survey sites to include Mt. Mitchell, Panthertown and the Unicoi Mountains.

This project is slated to wrap up in the first half of 2020, with results to include habitat modeling for the two cottontail species based on telemetry and scat survey data.



*Field crew from Virginia Tech checking a trap line on Roan Mountain, October 2018 (Photo: Andrea J. Shipley)*



*The Virginia Tech field crew sets up a processing station to process a captured cottontail rabbit, Roan Mountain, October 2018. (Photo: Andrea J. Shipley)*

## Biologists Begin Mussel Reintroductions in French Broad and Little Tennessee Watersheds

This spring, three mussel species have returned to waterways where they haven't been seen in over 100 years. In an effort to restore mussel species diversity in western North Carolina, NCWRC biologists have begun reintroductions of spike, wavy-rayed lampmussel and creeper mussels in partnership with Eastern Band of Cherokee Indians, U.S. Fish and Wildlife Service, Mars Hill University, UNC Asheville, and Western Carolina University. Wavy-rayed lampmussel has been reintro-

duced into the French Broad River in Rosman, NC, Ivy River in Mars Hill, N.C. and Oconaluftee River in Cherokee, NC. Hatchery-propagated wavy-rayed lampmussels were affixed with uniquely identifiable Passive Integrated Transponder (PIT) tags prior to being stocked and will be monitored by partners to assess growth and survival at these three reintroduction sites. More stocking efforts are planned at these sites and other areas of the French Broad and Little Tennessee drainages.

Western region biologists also have recently reintroduced spike

and creeper mussels through translocations. In May, 50 adult creeper were relocated from the Little River, a tributary of the French Broad River, to the Ivy River. In June, 75 adult spike were relocated from the Little Tennessee River to the Oconaluftee River above Ela Dam.

These stockings also will be regularly monitored for survival. Biologists are hopeful that these reintroductions will eventually lead to the return of self-sustaining populations for these native mussel species.

Creeper



Processing creepers before translocation



Spike



Wavy-rayed lampmussel



## Second Quarter 2019

Statewide

### Workshops Conducted for Natural Resource Professionals

Wildlife Diversity Program staff assisted with two workshops focused on reptiles and amphibians. The first occurred at Carolina Beach State Park and was targeted toward natural resource managers. Numerous reptile and amphibian species were observed during the training including both hognose species, eastern and southern. Turtle traps were particularly effective with three traps yielding 26 turtles representing four different species. The second workshop, also primarily for natural resource staff, focused on snakes and was held at Dismal Swamp State Park. Several snakes were seen on a walk around the property including a timber rattlesnake and three eastern kingsnakes.



*Eastern hognose snake (Photo: Jeff Hall)*



*Eastern chicken turtle (Photo: Jeff Hall)*



*Southern hognose snake (Photo: Jeff Hall)*

## Staff Conduct Surveys on Private Lands to Determine Habitat Suitability for Several Reptile and Amphibian Species

Wildlife Diversity Program staff worked with numerous private landowners during this quarter. A Johnston County landowner was considering management actions for isolated wetlands on the property and to review which Species of Greatest Conservation Need (SGCN) amphibians might be present. Staff visited a private property in Sampson County to assess potential for gopher frog use and other SGCN amphibians. Future management efforts will be made at both properties to increase value of the sites for amphibians.

Staff also visited a third property in Mecklenburg County to consider suitability for timber rattlesnakes. Although they saw no timbers on this visit, they observed other reptiles and amphibians, noting the potential for rattlesnakes to exist on the property is very high. Staff also visited several private lands focusing on surveys for the bog turtle. Bog turtles were found at many of these sites and of varying age classes — everything from hatchling to old adult.



*Pair of southern toads in amplexus in a wetland in Sampson County  
(Photo: Jeff Hall)*



*Adult bog turtle (top) and bog turtle hatchling  
(Photos: Jeff Hall)*

## Third Quarter 2019

### Coastal Region

#### Research on Coastal Sparrow Species Begins this Winter

The NCWRC recently entered into a cooperative agreement with UNC-Wilmington to conduct research on winter survivorship and population density and abundance of saltmarsh and seaside sparrows in southeastern North Carolina. Staff also will attempt to determine migratory status and timing of local breeding seaside sparrows. Both these coastal-dwelling sparrows are listed as Species of Greatest Conservation Need (SGCN) in the [N.C. Wildlife Action Plan](#), and saltmarsh sparrows are currently being considered for federal listing under the Endangered Species Act. Throughout their life cycles, these birds rely on tidal marshes that are being lost or degraded at accelerating rates.

From January through April 2019, 168 sparrows were banded in the marshes of Masonboro Island. Radio transmitters were attached to 20 birds (15

on seaside sparrows; five on saltmarsh sparrows) to quantify winter home range size and habitat use. Preliminary results support the prediction that the sparrows' movements track with the tide. At high tide, the birds cluster in patches of black rush, also known as needlerush, while at low tide, they move into lower elevations to forage among cordgrass. Both sparrow species have high site fidelity throughout the winter. In particular, the sparrows remained in the same general areas for the life span of their radio tags.

Currently, biologists are acquiring the necessary permits to begin construction and deployment of Motus towers, which will allow them to remotely track digitally coded VHF radio tags attached to breeding seaside sparrows from June to January. This will allow biologists to describe each tagged bird's movements during the migratory season.



*Saltmarsh sparrow* (Photo: Dr. Ray Danner)



*Seaside sparrow* (Photo: Wikimedia)

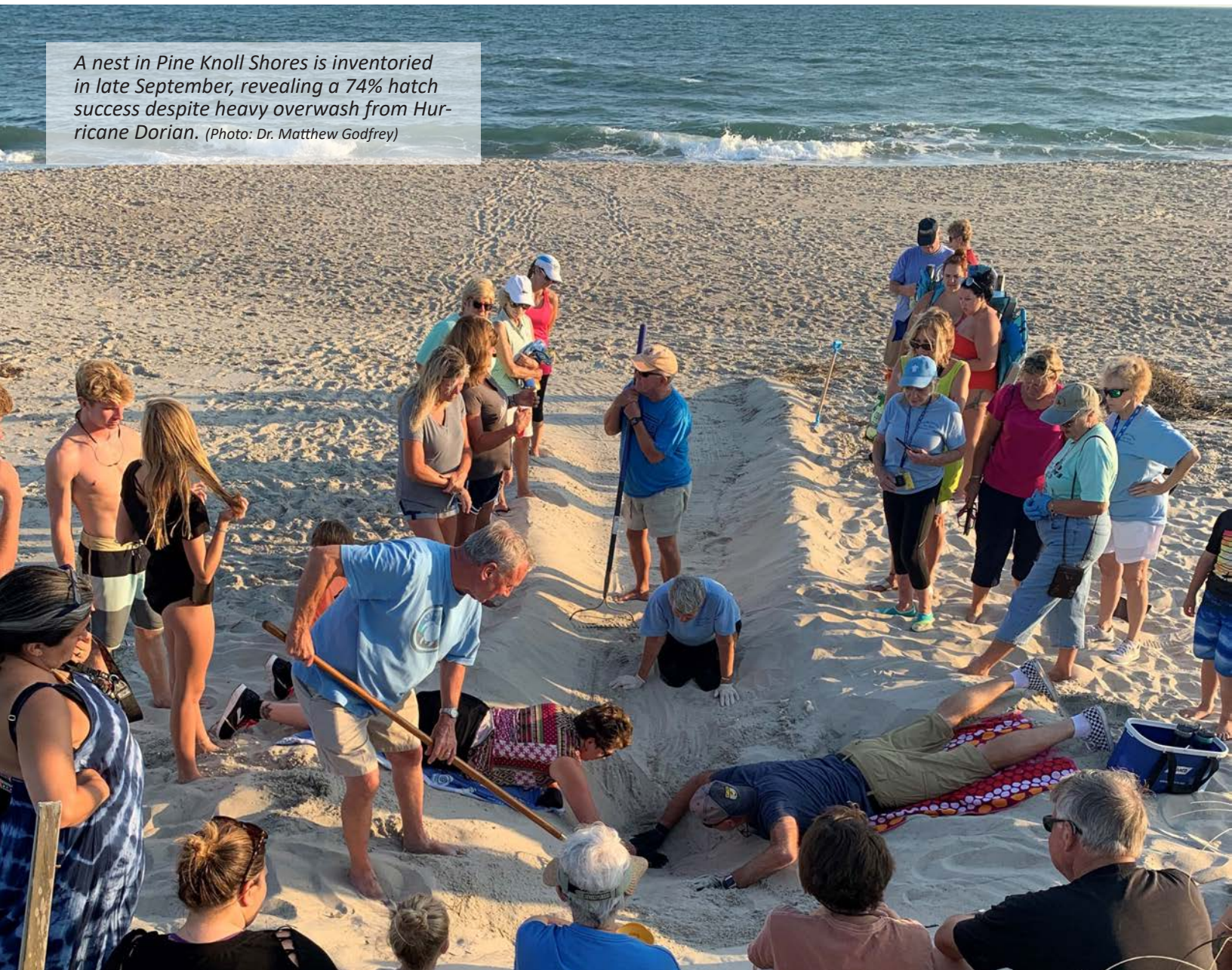
## Despite Dorian, Sea Turtle Nesting Sets Record for 2019

The 2019 sea turtle nesting season was record-breaking with over 2,300 nests laid on North Carolina beaches between May and September. The previous record was in 2016 with 1,650 nests. Nests laid late in the season are at risk of loss from impacts due to tropical storms and hurricanes, which

bring the potential for heavy overwash events and erosion. Hurricane Dorian visited the North Carolina coast Sept. 5-6, bringing storm surge that caused flooding and beach erosion in some areas. Other areas reported sand accretion. Prior to Dorian's arrival in North Carolina, 1,358 of the 2,357 known nests had already emerged (57.6%). Fewer

than 100 nests were reported as completely washed away due to Dorian (most were along Cape Lookout and the Outer Banks). Inventories were performed on nests that emerged after the storm and revealed that many nests still managed to produce some hatchlings, despite being washed over by Dorian.

*A nest in Pine Knoll Shores is inventoried in late September, revealing a 74% hatch success despite heavy overwash from Hurricane Dorian. (Photo: Dr. Matthew Godfrey)*



## Oregon Inlet Island Cleanup Nets 1,200 Pounds of Trash

This year, Wildlife Diversity Program staff held their third annual Oregon Inlet Island Cleanup. This two-day event, conducted in partnership with the Wildlife Education Division's Citizen Science Program, removed an estimated 1,200 pounds of trash from seven state-owned islands near Oregon Inlet. The islands provide nesting, foraging and roosting habitat for more than 40 species of waterbirds. During summer, brown pelicans, terns, American oystercatchers, black skimmers, herons and egrets build nests on these islands and raise their young. The islands also provide needed stopover habitat for migrating shorebirds in spring and fall. Marine debris, particularly plastics, can be directly or indirectly ingested by birds that mistake the trash for prey items. Birds can also be harmed by consuming fish and other marine organisms that have eaten plastic. Fishing line, nets and balloon ribbons also pose the risk of entanglement.

Removing trash has become an annual part of managing the islands, along with posting closure signs ahead of the nesting season and working with the U.S. Army Corps of Engineers to minimize disturbance to the birds and achieve beneficial placement of dredge material.

Since cleanups began in 2017, volunteers and staff have cleared 102 bags of trash, plus larger items from the islands. Each piece of trash is recorded, and the information is shared with The Ocean Conservancy's Trash Information and Data for Education and Solutions (TIDES) Project. This year small pieces of plastic and plastic bottles were the most common types of trash found, while the most interesting items were a frame from a bee hive and a message in a bottle. A dead sandwich tern was also found entangled in fishing line on one of the islands. By continuing to remove trash from the islands staff hope to reduce these mortalities and maintain trash free islands that benefit both nongame and game species.



*Citizen Science Coordinator Marissa Liverman and volunteer, Debbie Spillman, remove plastic trash from an island near Oregon Inlet. (Photo: NCWRC)*

## Lake Waccamaw Surveys Show Increase in Mean Density of Mussels

NCWRC staff, in partnership with N.C. State Parks, have conducted annual standardized surveys since 2009 for three fish Species of Greatest Conservation Need (SGCN) at multiple sites in Lake Waccamaw, including the endemic, federally threatened Waccamaw silverside. The mean number of Waccamaw silversides collected per minute of seining (catch rate) at all sites combined has been highly variable over nine sampling years and was 2.1 fish/minute (fpm) of seining in 2019. This value has ranged from 1.82 fpm in 2017 to 23.5 fpm in 2009. Variability is expected due to the fish's schooling behavior, preference for open waters of the lake, and varied sampling conditions, such as very warm water (exceeding 33° C), which causes fish to move out into deeper habitats where they cannot be seined. The highest catch rate at a single site in 2019 was 4.7 fpm. Waccamaw killifish and Waccamaw darters were also collected with minimal effort,

suggesting that healthy populations persist within Lake Waccamaw.

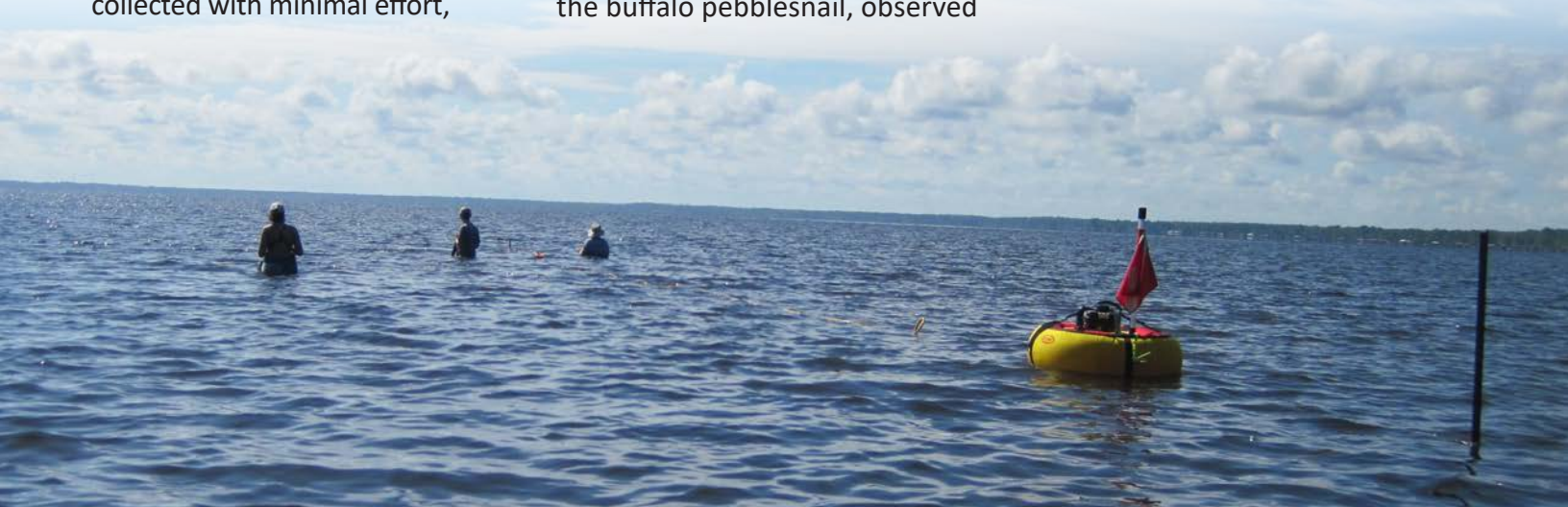
Staff also conducted quantitative mussel surveys in Lake Waccamaw, which have been completed biennially since 2009. The mean density of mussels across all three sites increased to 41/m<sup>2</sup> in 2019 (previous range 23-28/m<sup>2</sup>). Local density remained stable at both the southern site by the state park (13/m<sup>2</sup>) and the northern site (48/m<sup>2</sup>), but doubled at the northwestern site (64/m<sup>2</sup>, up from 29/m<sup>2</sup> in 2017) in the area treated for the invasive exotic weed hydrilla.

The Waccamaw spike and tide-water mucket remain the most abundant mollusk species, composing 92-96% of the individuals at each study site. Two species of micro-snail endemic to the lake, the Waccamaw siltsnail and the Waccamaw snail, sampled using a petite ponar substrate grab, showed a similar combined mean density across sampling sites of 336/m<sup>2</sup> in 2019 (315/m<sup>2</sup> in 2017). Densities of some larger snail species, such as the buffalo pebblesnail, observed

during visual surveys have declined, nearing the lower limit of detection. However, higher densities of these same snails were detected in the ponar samples in 2017 and 2019. Reasons for these differences remain unclear.



*Presence of juvenile mussels shows evidence of successful reproduction; Below: Mussel surveying at Lake Waccamaw (Photos by Brenna Jones)*





## Late Summer Mark-Recapture Surveys of Alligators at Lake Waccamaw

NCWRC and NC State Park staff conducted mark-recapture surveys from Sept. 9-12 at Lake Waccamaw as part of an ongoing collaborative research project at Lake Waccamaw. Since these surveys began in late summer 2017, all alligators captured as part of this project have been marked in accordance with the mandatory marking and data collection protocol (see p. 27 for more information). Over time, these data will be used to estimate abundance, growth rates of individuals between sexes and among size classes, and the population growth rate. During this capture session, 17 alligators were caught and released

on-site following data collection; 13 individuals were previously unmarked and four were recaptures.

This project also provides a unique opportunity to provide hands-on training on the mandatory marking and data collection protocol for agency staff and external handlers of wild alligators. During these late summer surveys at Lake Waccamaw, 16 people (one NCWRC law enforcement officer, one Wildlife Management Division staff, two other NCWRC staff, one Private Alligator Control Agent, three conservation partners from the NC Wildlife Federation and NC State Parks, and eight Jurisdictional Alligator Control Agents from Cherry Point MCAS, the NC Aquar-

ium, Camp Lejeune, and New Hanover County Animal Control) received training.

They captured and marked 49 previously unmarked alligators at Lake Waccamaw during 2019, which brings the total number of alligators marked at Lake Waccamaw to 131. To date, 144 people (42 NCWRC law enforcement officers, 19 Wildlife Management Division staff, 16 Land and Water Access staff, 17 other NCWRC staff, 28 Jurisdictional Alligator Control Agents, nine Private Alligator Control Agents, and 13 conservation partners) have been trained at Lake Waccamaw during these surveys.



Scanning for PIT- tag  
(photo: Thomas Harvey)



Collecting a scute from an alligator's tail for marking purposes (Photo: Thomas Harvey)

## Cape Fear Crayfish Surveys Continue

As part of ongoing efforts to update distribution records for both native and exotic invasive crayfish species, Wildlife Diversity Program staff visited four sites in the Coastal Plain region of the middle Cape Fear basin

in late July 2019. Individuals of the native *Cambarus* species *C acuminatus* complex were observed at two localities, and voucher specimens were provided to partners at the N.C. Museum of Natural Sciences, where morphologic and

genetic work toward taxonomic clarification is taking place. No Species of Greatest Conservation Need or exotic crayfish species were collected.

## Third Quarter 2019

### Piedmont Region

## Staff Collect Eight Carolina Madtom Broodstock for Propagation

The Carolina madtom is endemic to the Tar and Neuse drainages in North Carolina, and staff have documented significant declines throughout its range due to urbanization and invasive species.

The species is currently a candidate to be federally listed as endangered this year. Wildlife Diversity Program staff have partnered with Conservation Fisheries Inc. (CFI), located in Knoxville, Tenn., to propagate and ultimately attempt to restore populations of Carolina madtoms into suitable habitats. Survey efforts continued this summer throughout the Carolina madtom's historic range to collect broodstock to transfer to CFI.

Eight individuals from the Tar Basin were transferred to CFI while no Carolina madtoms were collected within the Neuse Basin. As a result of several years of collections, CFI is currently holding around 50 individuals to be used for propagation efforts. Populations in the Tar drainage appear to be persisting although there is great concern over populations within the Neuse drainage. A considerable amount of effort has been allocated throughout the drainage resulting in no individuals, and these populations may be extirpated.

Sampling for additional broodstock will continue next summer in attempts to collect more individuals and increase the genetic diversity of broodstock.



*Carolina madtom collected in Fishing Creek, in the Tar River Basin*  
(Photo: Michael Fisk)

## Gopher Frogs Using Newly Created Habitat on Sandhills Game Land

In third quarter 2019, NCWRC staff documented gopher frogs using new summer habitat near the few breeding ponds remaining on the Sandhills Game Land in Scotland County. Gopher frogs are one of the rarest amphibians in North Carolina, now only existing at about seven sites in the state. They use fishless, isolated wetlands to breed in the fall and winter, then move to upland longleaf pine habitat in the spring and summer. During the summer, they mainly use holes in old pine stumps to escape predators and periodic fires until returning to their breeding pond each year.

These frogs travel at least 2 miles from their breeding pond to a stump where they stay for the summer, based on telemetry work conducted by

NCWRC biologists. This year, biologists conducted surveys to search for gopher frogs in an area near their breeding pond that was part of a timber thinning in 2008. Timber operations around gopher frog ponds are often thought to be detrimental to frog populations. However, they found four gopher frogs this year using stump holes created from trees that were cut during the timber thinning. This indicates that a one-time harvesting of trees to enhance habitat, though it may have short-term negative effects on some wildlife populations, can create refuges for species such as gopher frogs within 10 years.

Staff will continue to do surveys for this elusive and rare species to try to preserve more habitat in hopes that gopher frogs will persist in North Carolina.



*Gopher frog found next to a stump created by a timber thinning operation. Photo is from 2019; the area was thinned by a timber harvest in 2008. (Photo: NCWRC)*

## Tar River Spiny mussel Propagation and Augmentation Continue

This summer, Wildlife Diversity Program staff continued Tar River spiny mussel augmentation efforts within the Tar River basin. The Tar River spiny mussel occupies a fraction of its historical range, and it is thought that remnant populations are at levels too low to be self-sustaining. This project's goal is to reestablish populations by releasing hatchery-reared individuals to bolster Tar River spiny mussel populations. Broodstock from the Tar

drainage has been collected to be used to propagate hatchery-reared individuals. Each mussel is tagged to help track when the recaptured individuals were stocked. To date, over 35,000 mussels have been released at 12 reaches within Fishing, Little Fishing and Swift creeks, as well as the mainstem Tar River.

Post-stocking monitoring is conducted to document survivorship, growth, and ultimately recruitment within each reach where releases have occurred. Staff recaptured 648 individuals from 10 sites this

summer from multiple cohorts dating back to 2015. Within augmented reaches, recaptured individuals exhibited adequate growth, and gravidity (reproductive activity) has been observed. While released populations appear to be persisting, the true indicator of success is to document recruitment within these reaches. At sites where gravidity has been documented, future surveys will integrate sampling techniques to assist in detecting recruitment.



*Recaptured Tar River spiny mussels with Hallprint, Laser and Black Dot tagging techniques to differentiate between cohorts (Photo: Michael Fisk)*



*Laser tagged Tar River spiny mussels ready to be released*

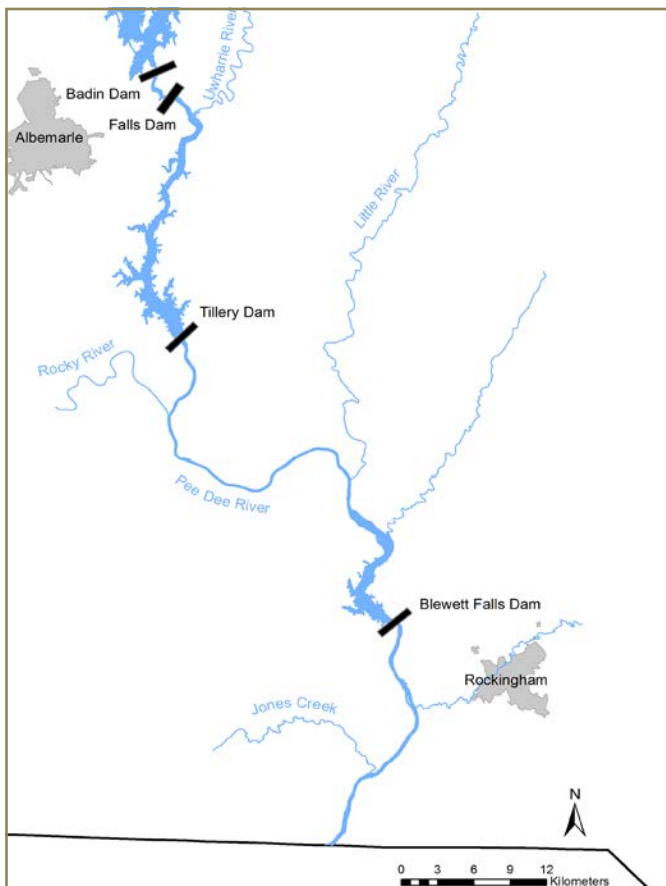
*(Photo: Loretta Luttackas)*

## Mussel Population Monitoring in the Pee Dee River Continues

Beginning in 2009, three long-term mussel population monitoring sites were established in the lower Pee Dee River, near the state border in south-central North Carolina. In 2019, with help from partners including Duke Energy/Progress, NCWRC staff conducted the sixth biennial survey for priority mussel species downstream of Blewett Falls and Tillery dams. Monitoring at the third site, below Falls Dam, has been turned over to Cube Hydro as part of its Federal Energy Regulatory Commission (FERC) license requirements. These data provide an opportunity to document the potential changes in mussel diversity and abundance due to the improved dissolved oxygen levels and minimum flows downstream of these dams implemented under new FERC licenses for Duke En-

ergy/Progress. In addition, this long-term dataset may provide insights into population responses to other events such as extreme floods from large hurricanes.

The mean density across years (2009-2019) of all mussels remains the highest below Blewett Falls Dam ( $26/m^2$ ), the furthest downstream dam in the Pee Dee River, while the Tillery site has a mean density of  $11/m^2$ . There were 10 species found at both sites in 2019. This year saw a decrease in density at the Tillery site, down to  $6/m^2$ . Density at the Blewett Falls site remained relatively stable at  $29/m^2$  in 2019, as compared to  $31/m^2$  in 2017. A possible hypothesis for this effect is that the Tillery site may have seen more impacts from the record-breaking flooding from Hurricane Florence in fall 2018, as this site is in the main channel and there is a higher proportion of bedrock substrate, which could reduce the ability of mussels to burrow for shelter. The Blewett Falls site, near Jones Creek, is located in a side channel and offers more gravel and softer substrates as potential refugia. Staff collected several species of mussels listed as Species of Greatest Conservation Need, including the yellow lampmussel, eastern lampmussel, Carolina creekshell and eastern creekshell.



Mussel Monitoring Area Map – Pee Dee River



Female yellow lampmussel (Photo: Brena Jones)

## Weymouth Woods Wetlands Workshop Focuses on At-Risk Species

In September, staff organized a regional workshop on management of isolated wetlands with a focus on at-risk species, especially amphibians. Forty-nine participants came from four states, and included numerous federal and state agencies, as well as NGOs. The three-day workshop included

presentations on the value of wetlands at Weymouth Woods State Nature Preserve, field tours to sites undergoing different levels of management, and suggestions for how to be successful with wetland restoration efforts. Field tours included sites on the NCWRC-managed Sandhills Game Land, as well as two proper-



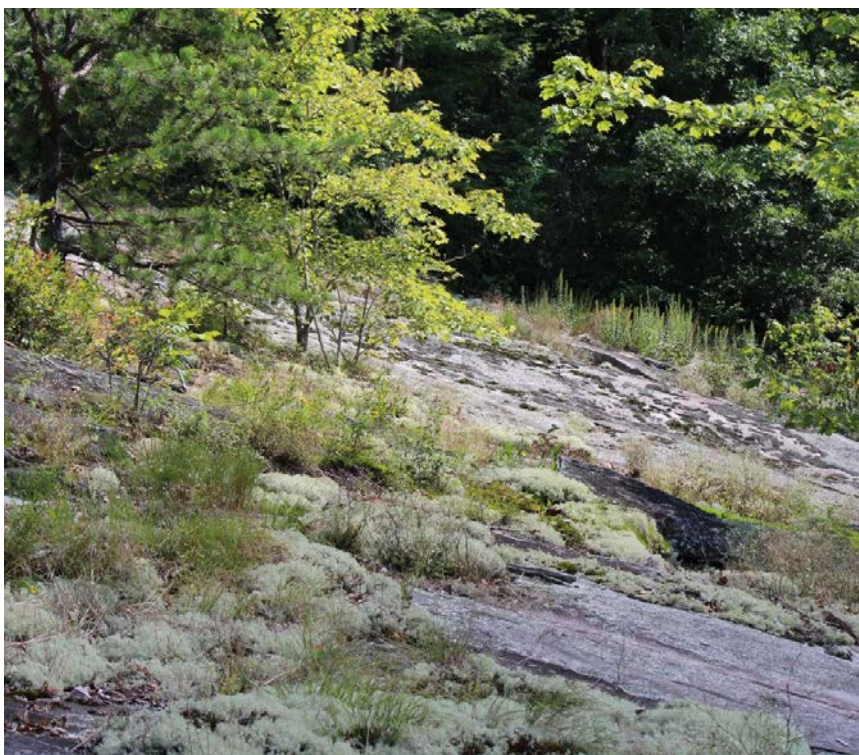
ties owned by N.C. Department of Agriculture.

## Timber Rattlesnake Gestational Sites Visited

Wildlife Diversity Program staff visited several timber rattlesnake gestational sites to assess issues with human intrusion. They saw several timber rattle-

snakes at each site along with evidence of disturbance from human visitors, such as broken rocks and campfire rings. Staff will continue to work with partners to try to mini-

mize disturbance of these sites, as they are extremely important for female rattlesnakes needing birthing sites.



*Timber rattlesnake gestational site (left); timber rattlesnake (top)  
(Photos: Jeff Hall)*

## Priority Mussel Surveys Conducted in the Cape Fear and Pee Dee River Basins

Wildlife Diversity Program staff continued survey efforts for the State Endangered brook floater and Atlantic pigtoe mussels at 26 sites in the Pee Dee and Cape Fear river basins in Union, Anson, Stanley, Moore and Randolph counties. Although neither target species was detected, native mussels were found at 16 of the sites, including the following species designated as Species of Greatest Conservation Need:

- Yellow lampmussel (Federal Species of Concern, State Endangered)
- Notched rainbow (State Threatened)
- Creeper (State Threatened)

Additional species found included eastern creek-shell, Florida pondhorn, eastern elliptio, and variable spike. Furthermore, five individuals of an unknown species from the Little River of the Pee Dee drainage

were collected and sent to the N.C. Conservation Aquaculture Center for further study. The NCWRC will continue working with partners, including the U.S. Fish and Wildlife Service to research additional details of their taxonomy, life history and distribution.



*One of the Little River mussels at the N.C. Conservation Aquaculture Center in Marion (Photo: Brena Jones)*

## Third Quarter 2019

### Mountain Region

## Biologists Locate New population of Federally Endangered Appalachian Elktoe

A tip from biologists Lori Williams and Morgan Harris, who spotted a mussel while searching for hell-benders, led to the discovery of a previously unknown population of federally endangered Appalachian elktoe. Late this summer, Wildlife Diversity Program biologists completed a short survey in Burningtown Creek, a small tributary to the Little Tennessee River,

and located 19 Appalachian elktoe ranging in size from juveniles to large adults. The size range and overall healthy appearance of the mussels indicated that this is a thriving, self-sustaining population. This find is especially significant because it represents the only known healthy population of the species in the main-stem Little Tennessee River Basin.

This species was once abundant in the Little Tennessee River between Franklin and Fontana Lake, but that population has been nearly wiped out over the last 15 years. Biologists first noted the decline in this population following the torrential floods that occurred during 2004. Staff will continue to monitor the distribution, abundance and overall health of the Burningtown Creek population in the coming months.



*Appalachian elktoe (Photo: Dylan Owensby)*

## More Spruce Pine Restoration Projects Underway

After last fall's workshop, partners of the Southern Appalachian Spruce Restoration Initiative (SASRI) embarked on their own spruce forest restoration adventures in other massifs. Appalachian Trail Conservancy (ATC) proposed a restoration project at Roan Mountain that will thin a spruce plantation and develop additional age classes by plant-

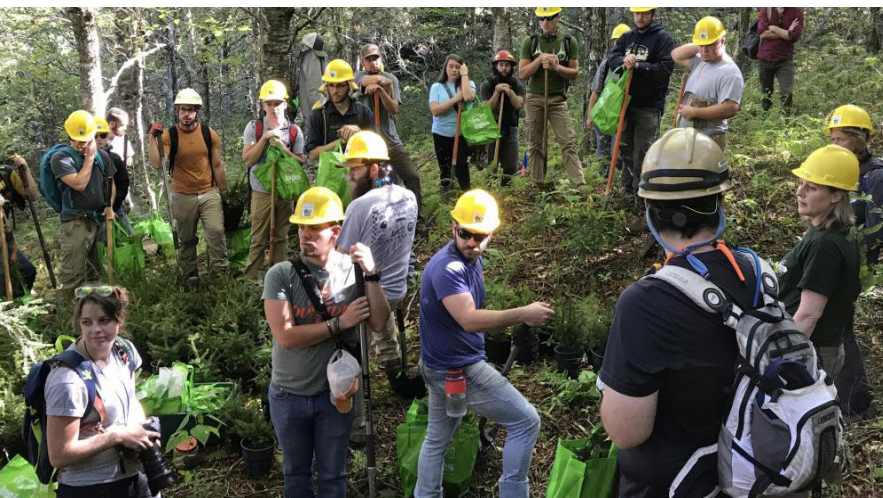
ing seedlings and preparing the site for seed germination in anticipation of the next big cone crop.

NCWRC biologists helped Southern Appalachian Highlands Conservancy (SAHC) prepare a proposal for The Cornell Land Trust Small Grants Program to restore conifer forest for birds. SAHC was awarded the grant, and the NCWRC is collaborating with them, ATC and Virginia Tech on a second spruce

restoration project at Roan Mountain. Meanwhile, the next phase of the Flat Laurel Collaborative Spruce project was implemented in September in the Great Balsams. Hiking clubs and horses hauled 300 seedlings down the trail, and silviculture students from Haywood Community College planted them in one afternoon.



*SASRI partners met at Roan Mountain to discuss a spruce restoration project. (Photo: Chris Kelly)*



*Silviculture students prepare to underplant red spruce seedlings in a hardwood forest in the Great Balsams (Photo: Alex Storm)*



*Red spruce seedling (Photo: Chris Kelly)*



## Peregrine Falcon Eyerie Checks Completed with Partner Assistance

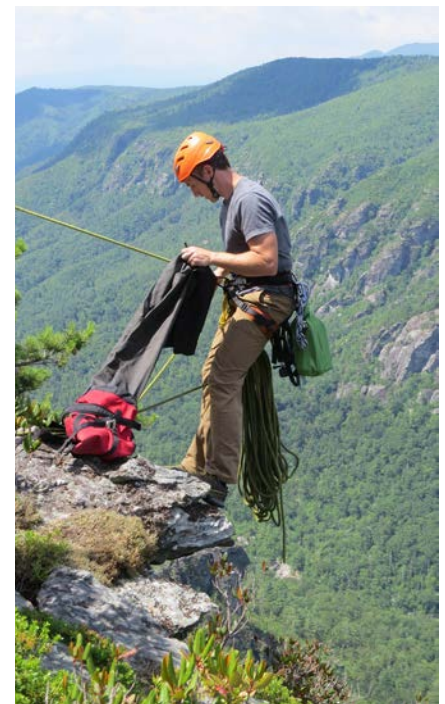
Rock climbers from the Carolina Climbers Coalition (CCC) assisted Wildlife Diversity Program staff with two peregrine falcon eyrie checks after the breeding season. In July, the CCC's Executive Director Mike Reardon and Northern Piedmont Representative Bryan Payst rappelled in to a ledge in Linville Gorge to look for nesting evidence. In August, Tom and Mary Caldwell, checked a new nest ledge discovered by climbers this year at the CCC-owned Laurel Knob in Jackson County. The Laurel Knob falcons reared one fledgling on a former raven stick nest.



*An old raven stick nest used by a pair of peregrine falcons in 2019 on Laurel Knob (Photo: Tom Caldwell)*



*Peregrine falcon (Photo: Chris Kelly)*



*Mike Reardon rappels to a peregrine ledge in Linville Gorge (Photo: Chris Kelly)*

## Progress and Challenges in Conservation of Bog Turtles

Conservation of bog turtles is a complicated undertaking. Bog turtles are federally threatened (Similarity of Appearance) and state listed as threatened in North Carolina. Unfortunately, the threats this species and their habitat — bogs — face are numerous. At one bog in the Piedmont (photo below), the threats have loomed large — development impacts, changes in hydrology, invasive species issues, encroachment from woody vegetation, effects of busy roads

and habitat fragmentation, problems with mesopredators, and more. Efforts to “save” this bog and the resident bog turtles have been numerous over the years. A recent visit in late September gave the NCWRC and partners, including Catawba Lands Conservancy and Project Bog Turtle, some new hope for this particular bog turtle population. Work done in fall 2015 to address problems with hydrology has improved the habitat quality. Despite the drought in late summer and early fall 2019 in the Piedmont, the wetland had satu-

rated soils with groundwater at the surface, a condition that was rarely seen before the restoration project in 2015. Before the restoration project, the bog had been drying up in late summer most years, and telemetry showed that the bog turtles would cope by leaving their bog habitat and move into the streambanks, even overwintering in the streams. During the restoration work, a deep and continually worsening head-cut was stabilized and a vertical liner was placed at the lower

*(continued on next page)*



Piedmont Bog (Photo: NCWRC)

## Progress and Challenges in Conservation of Bog Turtles

end of the bog to help hold and raise the groundwater level in the bog. In the recent visit, even the lower end of the bog had groundwater near the surface in some areas.

Although it was encouraging to see that the wetland hydrology was improved, the best part of the day was finding two healthy 3-year old bog turtles. Bog turtles had not been found at this site since 2014, despite several surveys. It was especially hopeful to find two young turtles, because this proves there are adult turtles present and that there has been recent reproductive success. These young turtles hatched in late summer 2016, after the hydrologic restoration efforts, and have survived since then in the bog. Usually hatchlings and young turtles stay fairly close to their nest in the bog the first few years. Therefore, it is likely the bog has provided suitable habitat for them since they hatched, giving further proof that the restoration project improved the hydrology.

The other piece of hope in this story is that Catawba Lands Conservancy recently protected the headwaters of the bog. They used crowd-funding to raise funds to purchase 18 acres of land immediately adjacent to the bog. This land directly drains into the bog habitat, so protecting it was a major step in the right direction. This land provides a forested buffer that reduces the impacts of threats from development on this bog turtle population.

Despite these recent successes and a bit more optimism among the involved partners, there is still much to be done to help give this population a chance at recovering from the steep decline it has experienced in the last 20 years. Protecting the turtles from getting hit on the busy road, reducing predation on nests and turtles, finding



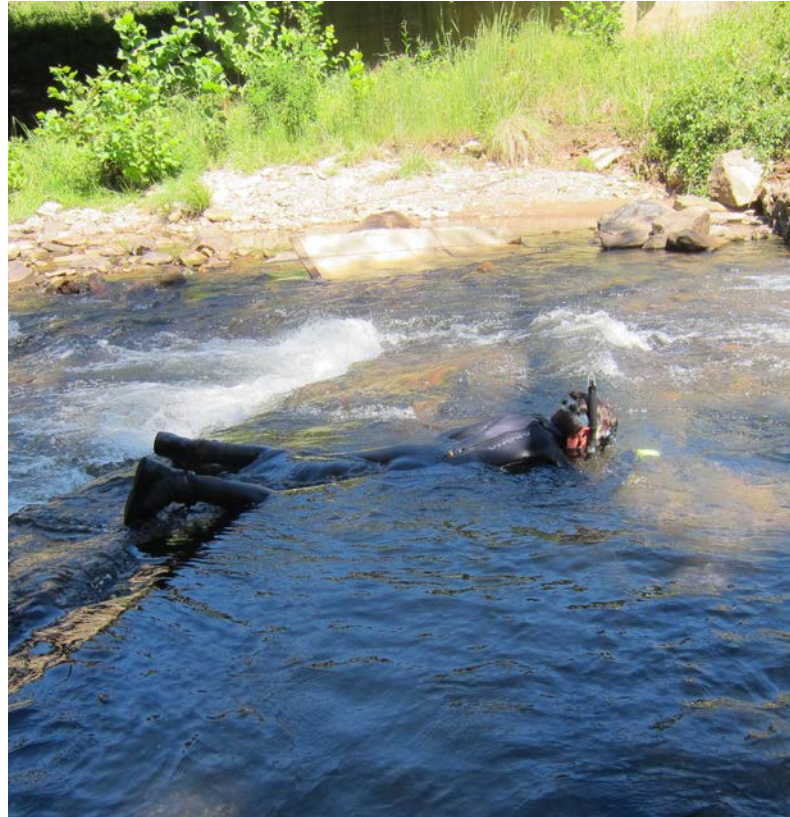
*Catawba Lands Conservancy Land Stewardship Director Sharon Wilson is elated that two healthy juvenile bog turtles were found at this site. (Photos: NCWRC)*

ways to increase survivorship, and continuing to improve habitat quality are all high priorities. This will require staff to put all the conservation tools on the table. They will need help from many partners and finding sufficient funding and resources may be challenging, but by working closely with partners, prioritizing efforts, and taking effective on-the-ground action, there is still hope for this bog turtle population and others.

## Biologists Find Fewer Hellbenders during 2019 Breeding Season Surveys

Over 14 consecutive days in late August through early September 2019, Wildlife Diversity Program staff conducted breeding season surveys for eastern hellbender, a state special concern species and a Species of Greatest Conservation Need as listed in the [N.C. Wildlife Action Plan](#). Staff completed 39 passive snorkel surveys, and partners contributed three additional surveys. Passive snorkel methods entail biologists looking for animals engaging in breeding behaviors but not disturbing them or their habitats. Biologists sampled 25 streams across 10 western counties and documented 116 animals; they occasionally found eggs dislodged from nest shelters. This total is less than 2018's surveys from just 10 streams. While biologists often saw males, called "denmasters," in defensive posture at the entrance of nest rocks and sometimes individuals active on the stream bottom, they rarely saw multiple animals congregating and fighting as is typical during the breeding season. They found loose eggs, approximately 1-2

*(continued on next page)*



*Kevin Parker, Wildlife Diversity technician, conducting breeding season passive snorkel survey for Eastern Hellbender (Photo: Lori Williams)*

*"Denmaster" male eastern hellbender defending nest rock. (Photo: Lori Williams)*



## Biologists Find Fewer Hellbenders during 2019 Breeding Season Surveys

days old, as early as Aug. 30, which indicated some populations may have bred several days earlier than expected, perhaps due to the late-summer drought and low water levels in western North Carolina. The early onset of breeding activities meant that

counts of animals were lower than expected at several sites because fewer were visible compared to previous years. Still, staff gained valuable knowledge and experience searching for denmaster males that were often tucked far underneath large boulders. They also learned

more about the variety of nest shelters males may choose including bedrock ledges and clay/cobble aggregates, and that openings for these shelters often face upstream or laterally rather than downstream, as published literature indicates.



*Adult eastern hellbender on stream substrate during breeding season (Photo: Lori Williams)*

## Record Number of At-risk Little Brown Bats Caught in Avery County

In the years since White-nose Syndrome (WNS) appeared in western North Carolina, bat species that were once common have undergone severe population declines. One such species, the little brown bat, has declined by 93%. Declines are uniformly steep among states where WNS is established leading the U.S. Fish and Wildlife Service to review this at-risk species for potential listing. This species has all but disappeared from the NCWRC's long-term survey results save

for one anomaly in Avery County. A mistnet survey in this county recently resulted in little brown bat capture for the fourth consecutive year at the site. Eight little brown bats were captured during the 2019 survey, which is a record high for the years following WNS arrival. Of these eight, one bat was a juvenile and another was a female with signs of recent lactation. These indications of recent reproduction offer a beacon of hope since reproduction is often reduced or bypassed during WNS recovery. Plans are being made to conduct

radio-telemetry efforts on this survivor population in 2020 to better understand the colony.



*Little brown bat caught in Avery County (Photo: Katherine Etchison)*



*Little brown bats caught in Avery County (Photo: Katherine Etchison)*



*Wildlife Diversity Program Intern, Trevor Walker, and N.C. State Parks Inventory Biologist, Ed Corey, measure a little brown bat (Photo: Katherine Etchison)*

## Third Quarter 2019

Statewide

### Training Conducted for New Law Enforcement Officers

Wildlife Diversity Program staff assisted with several meetings and workshops focused on conservation, management, and identification of reptiles and amphibians during this quarter. In July, staff participated in a law enforcement training session for in-coming new officers at the North Carolina Justice Academy in Salemburg. Eighteen participants were instructed in the laws and regulations regarding reptiles and amphibians, heard case studies involving these

species, and experienced first-hand training on handling snakes. These trainings have been incredibly well-received by officers.



*Officer training at the North Carolina Justice Academy (Photo: Jeff Hall)*

### First Statewide Meeting Conducted on Gopher Frog Head-Starting Efforts

In August, staff held the first statewide meeting on head-starting work with gopher frogs. Participants came from North and South Carolina and included staff from NCWRC, N.C. Aquariums, N.C. Zoo, N.C. Natural Heritage Program, N.C. Museum of Natural Sciences, S.C. DNR, U.S. Fish and Wildlife Service and U.S. Forest Service. The meeting was held to share results of recent head-starting efforts, to collaborate on future head-starting, and to offer suggestions from each of the different locations to help with future successes. Due to the success of this first meeting, participants suggested this become an annual meeting of partners.



*Gopher frog headstarting tanks (Photo: Carol Price)*

## Fourth Quarter 2019

### Coastal Region

## 191 Cold-Stunned Sea Turtles Found So Far This Season

The North Carolina Sea Turtle Stranding and Salvage Network, coordinated by NCWRC biologists, monitors sea turtle strandings along North Carolina's coast throughout the year. During winter months, when inshore water temperatures drop below 50°F, sea turtles strand due to hypothermia or cold-stunning.

The 2019-20 winter has so far produced 191 cold-stunned sea turtles since mid-November (182 green

turtles, 7 Kemp's ridleys, and 2 loggerheads). The majority (>90%) of these cold stuns occurred in a mass stranding event from Dec. 19-23, 2019 when 170 cold-stunned turtles were found between Carteret County (n=59) and Dare County (n=111). To date, 179 live, cold-stunned turtles have been recovered and admitted to rehabilitation facilities — 23 of those turtles have already been released offshore and several more will be cleared for release soon.

*A subset of the live sea turtles recovered from Cape Lookout Bight during the mass stranding event in December 2019. These turtles received health assessments and initial care at NCSU's CMAST before being transferred to rehabilitation partners (NC Aquariums and Karen Beasley Center). (Photo: Dr. Matthew Godfrey)*





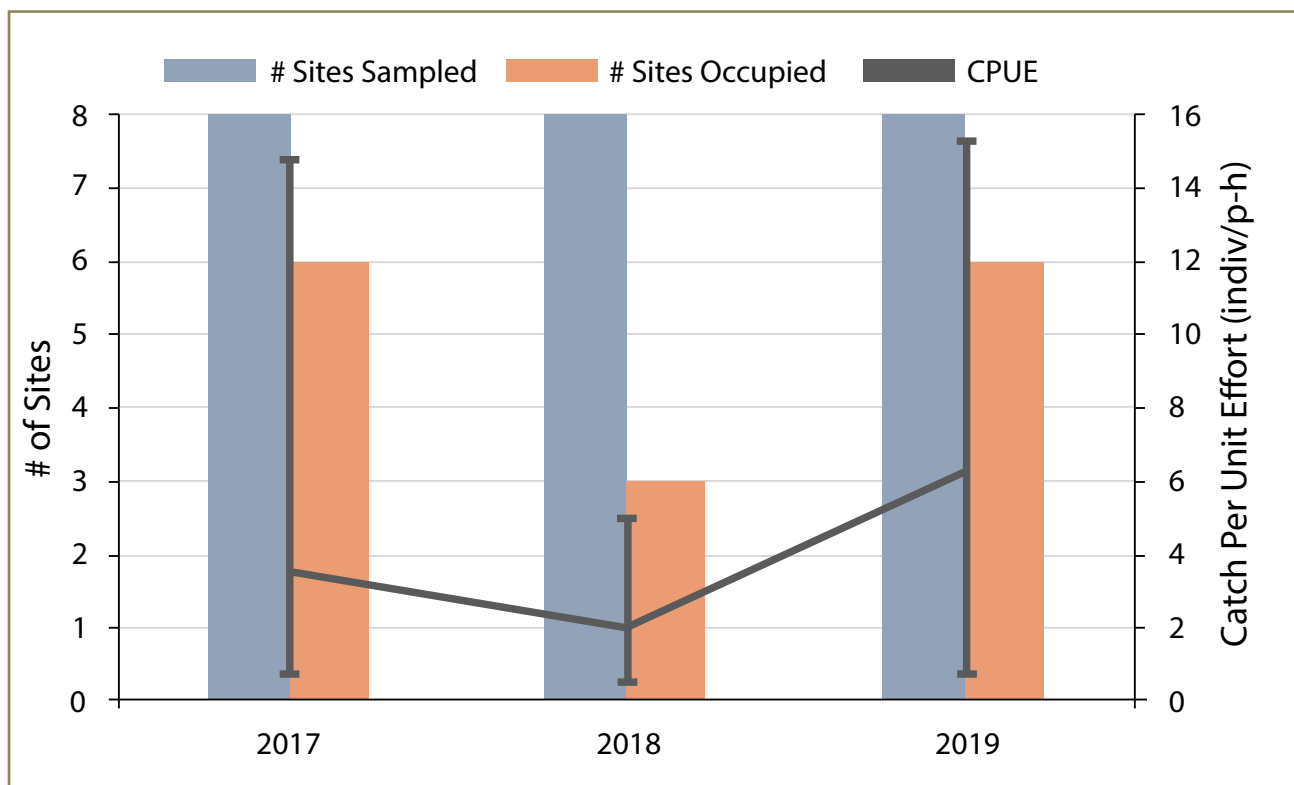
## Carolina Pygmy Sunfish Monitoring Continues in Southeastern Counties

Wildlife Diversity Program staff continued annual monitoring surveys for the Carolina pygmy sunfish, a State Threatened species endemic to Columbus and Brunswick counties in North Carolina and small portions of the coastal plain in South Carolina. Of eight previously occupied localities sampled in October, staff collected Carolina pygmy sunfish at six, including a tributary population outside of the core range of Juniper Creek, which was newly discovered in early 2018. Carolina pygmy sunfish are still present and catch per unit effort (CPUE) ranged from 0.7 to 15 individuals per person hour. It does appear that the species has returned to areas where cover vegetation has recovered following the catastrophic flooding that



*Carolina pygmy sunfish* (Photo: Tim Aldridge/NANFA)

occurred in fall 2018. Staff collected additional species classified as Species of Greatest Conservation Need, including the Everglades pygmy sunfish (four localities), banded sunfish (six localities) and snail bullhead (one locality).



*Carolina pygmy sunfish monitoring results by year. Gray line indicates average CPUE values, with vertical gray bars indicating maximum and minimum CPUE for each year. 2018 sampling was conducted two months after Hurricane Florence.*

## Marking and Data Collection of North Carolina Alligators Since 2017

In spring 2017, a new marking and data collection protocol was initiated for all alligators handled by NCWRC staff, Alligator Control Agents and researchers. This requires scanning for/the insertion of a PIT tag, collection of tissue samples (tail scutes), sex determination by cloacal examination, measuring total length (TL) and snout-vent length, and recording GPS coordinates of locations of capture and release. To date, 345 individuals have been marked in

North Carolina (see Table 1). Data were collected from 184 alligators in 2019, 23 of which were recaptured individuals that had previously been marked in 2017 and/or 2018. Forty-nine previously unmarked alligators were captured and marked at Lake Waccamaw during 2019 mark-recapture surveys (see pages 27 and 49 for more information), which brings the total number of alligators marked at Lake Waccamaw to 131. The mark-recapture surveys at Lake Waccamaw provide a unique opportunity to provide

hands-on training on the mandatory marking and data collection protocol for agency staff and external handlers of wild alligators. To date, 144 people (42 NCWRC law enforcement officers, 19 Wildlife Management Division staff, 16 Land and Water Access staff, 17 other NCWRC staff, 28 Jurisdictional Alligator Control Agents, 9 Private Alligator Control Agents, and 13 conservation partners) have been trained at Lake Waccamaw during these surveys.

**Table 1. Alligators Handled in North Carolina by Year (2017-2019)**

2017		2018		2019		Total Records	Individuals Marked
New	Recapture	New	Recapture	New	Recapture		
71	5	113	17	161	23	390	345



*NCWRC Law Enforcement Officers receive hands-on training on the mandatory marking and data collection. (Photo: Alicia Davis)*



*Juvenile alligator found during surveys. (Photo: Alicia Davis)*

## Spatial Ecology of Alligators in North Carolina

Since November 2018, agency staff have been deploying GPS transmitters on alligators for two separate spatial ecology projects. To date, nine GPS transmitters have been deployed on four males and five females ranging from 6.4 to 10.6 ft in length in Columbus, Hyde, Brunswick, Pender, Craven and Onslow counties.

### *Relocated Alligators*

In effort to learn more about the fate of relocated alligators and examine fine-scale movements post-relocation, NCWRC staff initiated a telemetry project in fall 2018. To date, staff have deployed five GPS transmitters on alligators as part

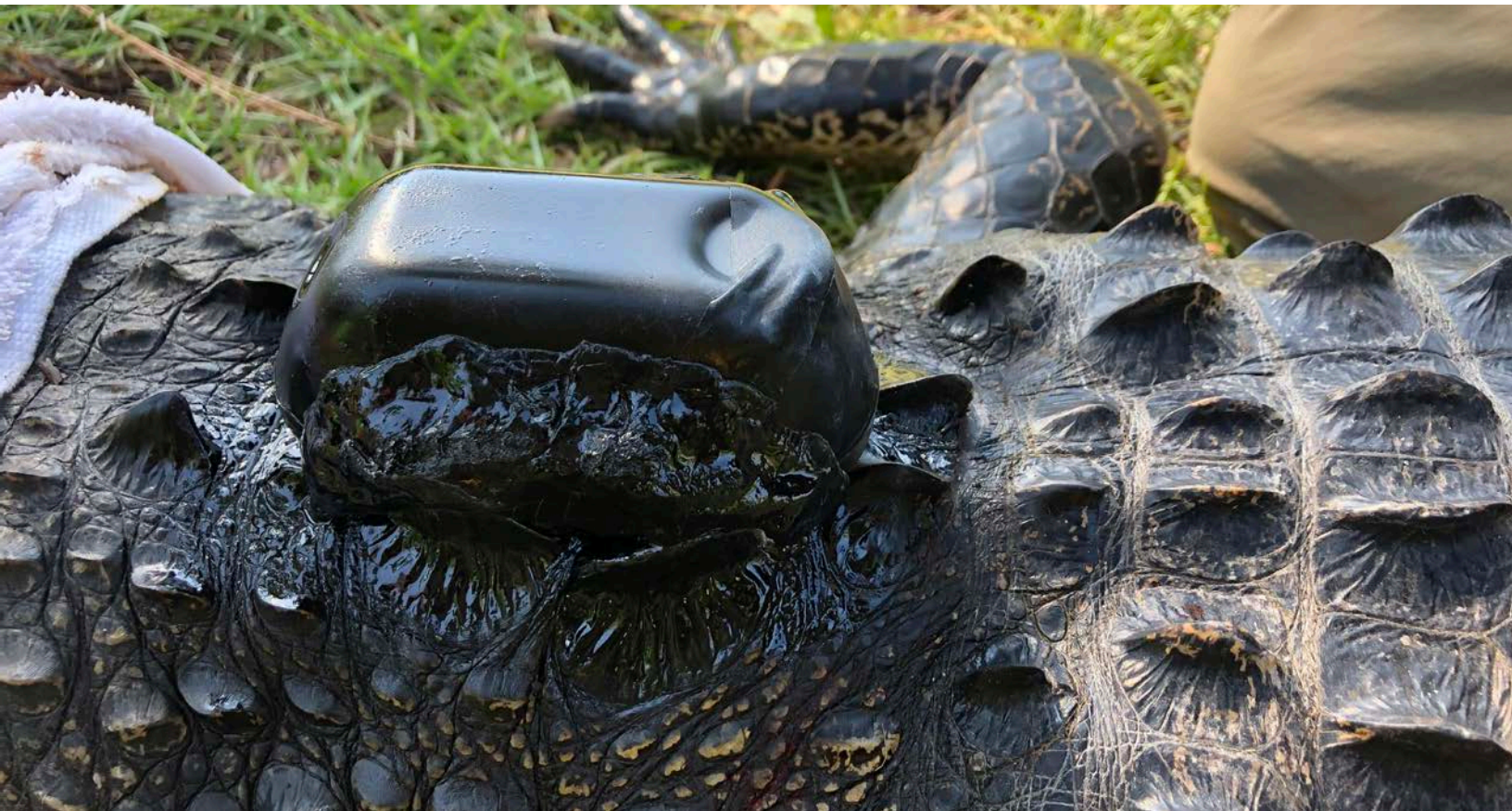
of this project, two of which were deployed on adult males in May and August 2019.

### *Reproductive-Aged Females on NCWRC Game Lands*

In May 2019, NCWRC commenced deployment of GPS transmitters on reproductive-aged females to learn more about alligator nesting habits in North Carolina. Staff are focusing their attempts to locate adult females for this project in areas of predicted nesting habitat on game lands to aid ground-truthing efforts and inform decisions regarding potential designation of these areas as alligator sanctuaries. To date, staff have deployed four transmitters on adult females ranging from 7.4 to 8.2 ft in length.

During efforts to locate adult females for this project, staff attempted to capture any alligators encountered for marking and data collection in accordance with the mandatory protocol (see pages XX and XX for more information). Out of 48 alligators captured on game lands between late May and early August of 2019, only five were reproductive-aged females. One adult female alligator was marked in accordance with the protocol but not affixed with a GPS transmitter due to total blindness resulting from facial gunshot wounds.

*Alligator with GPS transmitter*  
(Photo: Thomas Harvey)

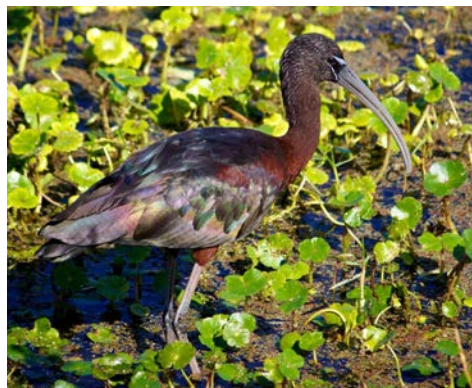


## Coastwide Waterbird Survey Updates Presented at Waterbird Society Meeting

In November, Wildlife Diversity Program (WDP) staff attended the Waterbird Society Meeting in Salisbury, Md., giving presentations on brown pelicans and great egrets. As part of the Pelicans of the World Symposium, WDP Coordinator Dr. Sara Schweitzer spoke about collaborative work between the Wildlife Commission, Audubon North Carolina, and graduate students and faculty in the Department of Mathematics at UNC-Wilmington to quantitatively and spatially analyze increases in the distribution and abundance of nesting brown pelicans over time in North Carolina. Through coastwide surveys dating back to the 1970s, North Carolina has a long-term data set that can be used to monitor changes in colonial waterbird populations. As the number of islands managed for habitat characteristics needed by nesting pelicans increased, and sites were protected from disturbance, the number of pairs increased in the state. During the most recent colonial waterbird survey, 5,455 nesting pairs at 13 colonies were documented. Results from this



*Great egret* (Photo: Annika Andersson)



*Glossy ibis* (Photo: Keenan Adams/USFWS)

study will aid future management of dredged-material islands for brown pelicans and other colonial nesting waterbirds.

WDP Biologist Carmen Johnson presented work by Annika Andersson, Johnson and Schweitzer on surveys carried out over a 4-year period to better understand the ecology and roosting dynamics of great egrets in North Carolina. These surveys elucidated the habitat features selected by, and abun-



*Little blue heron* (Photo: Mark Buckler)

dance trends of great egrets at, evening roost sites, and composition of additional species using these roosts, including four state-listed species of special concern (snowy egret, little blue heron, tricolored heron and glossy ibis). Results from this study are being used by WDP staff to inform public land management decisions, landowner assistance programs and local development planning programs.

## Staff Conduct Surveys for Broadtail Madtoms; Deploy "Motels" for Tiny Catfish

Aquatic Wildlife Diversity Program staff conducted surveys for the broadtail madtom (State Special Concern), a rare, undescribed native catfish, to provide data to inform management decisions and aid species descriptions. Endemic to a handful of coastal plain basins in the Carolinas, less than a dozen of these hard-to-collect fish have been captured in surveys between 2008 and 2016. In October and November

2019, staff visited 55 sites totaling 78 person-hours in Lake Waccamaw, the Lumber River and tributary creeks of the Lumber basin, and the South and Black rivers of the Cape Fear basin.

Staff collected nine individual broadtail madtoms at four sites, from the Lumber River and its tributary, Shoe Heel Creek. Sampling effort averaged 32 kick-seines per site, with an average catch per unit effort of 0.11 broadtail madtoms per person hour. No broadtail madtoms were collected from Lake

Waccamaw or the Cape Fear basin during these targeted surveys. Staff deployed 20 small, artificial cover structures, informally named "madtom motels," at three occupied sites. Staff will periodically check the structures for occupancy and deploy additional units across multiple localities during 2020. Additional SGCN fish species collected during the survey include the Pinewoods darter, thinlip chub and Waccamaw darter.



*Aquatic Wildlife Diversity staff deployed 20 madtom motels at three sites occupied by broadtail madtoms. (Photo: Katharine DeVilbiss)*



*Broadtail madtoms (Photo: Katharine DeVilbiss)*

## Fourth Quarter 2019

### Piedmont Region

#### Mark-Recapture Surveys Conducted on Focal Snake Species in Sandhills

In fourth quarter 2019, Wildlife Commission staff spent considerable effort on mark-recapture surveys for a suite of snake species in the North Carolina Sandhills. Specifically, southern hognose snakes were targeted, as they are classified as a Species of Greatest Conservation Need and are state-listed as a Threatened species. They have an activity peak during October. Staff detected very few southern hognose snakes this year compared to previous years, but the reasons for low encounter rates are unknown. Among the reasons could be possibly drought, but also possibly a true decline in the species.

Of note, one adult that was first found and marked on Oct. 8, 2018 was again encountered Oct. 5, 2019, and encountered again Oct. 10, 2019. Recaptures of cryptic species like Southern hognose snakes are uncommon, but the long-term mark-recapture study is beginning to offer insights into abundance and movements of focal snake species on the Sandhills Game Land.

Monitoring of snake populations will allow NCWRC staff to determine population trends of multiple species, including the southern hognose snake.



*Southern hognose snake* (Photo: Dr. Jeff Humphries)

## Pine Snake Nest Excavated During Snake Surveys

Wildlife Diversity Program staff surveyed for upland snakes during October—a particularly important month for detections of the southern hognose snake, eastern hognose snake, eastern coachwhip, northern pine snake and many other species. Overall, 2019 was a poor year for detections of southern hognose snakes with some of the lowest detection numbers in recent years, but at least a few adults were found. However, the story

proved slightly brighter for the northern pine snake. Through telemetry work conducted by Jeff Beane, supported by both the N.C. Museum of Natural Sciences and Project Simus, NCWRC staff assisted with an assessment of a pine snake nest. Only nine nests have been found and excavated in North Carolina, including the one from this fall. That nest contained seven eggs, and all hatched out. Typically difficult to find, this nest was only revealed through



radio tracking of an adult female that Beane believed had laid eggs. This was not confirmed, however, until the nest was unearthed, and the hatched eggs revealed successful reproduction.



*Northern pine snake nest being excavated by NCWRC staff, N.C. Museum of Natural Sciences staff, and Project Simus staff (Photo: Jeff Hall)*



*Northern pine snake eggs excavated from nest chamber. (Photo: Jeff Hall)*

**Northern pine snakes lay the largest eggs of any snake in North America.**

## Staff Collect No Carolina Madtoms During Recent Survey

In October, Wildlife Diversity Program staff continued Carolina madtom surveys in the Neuse Basin to collect brood stock in collaboration with Conservation Fisheries Inc. Surveys were concentrated in the Little River (Johnston County) and in Contentnea Creek (Wilson County). The Carolina madtom is a small, rare catfish endemic to the Tar and Neuse River basins. It is state listed as a threatened species. Surveys consisted of snorkeling and low frequency electrofishing. Staff collected no Carolina madtom but efforts will continue next summer to collect brood stock for propagation purposes.



While staff collected no Carolina madtoms during recent surveys, they did observe this Neuse River waterdog, a state-listed species of Special Concern. (Photo: NCWRC)

## 5,075 Robust Redhorse Fingerlings Stocked into Pee Pee River in November

In November 2019, 5,075 Phase I (6 months old) robust redhorse fingerlings raised at the SC Department of Natural Resources' Dennis Center and Wildlife Commission's McKinney Lake Fish Hatchery in Hoffman

were stocked into the Pee Dee River in North Carolina. These fish were the products of adults collected in the Pee Dee River spawning shoals in North Carolina in spring 2019. Another 700 were held back at McKinney Lake Hatchery to grow out to

Phase II (18 months old), which will be stocked in the winter of 2020. An additional 126 Phase II fish from the 2018 year-class were PIT-tagged and released at the same time.



Katharine DeVilbiss releases Phase II robust redhorse into the Pee Dee River. (Photo: Joseph McIver)



Juvenile robust redhorse (Photo: Todd Pusser)



## Fourth Quarter 2019

### Mountain Region

#### Head Start on Winter Bat Surveys Pays Off

Wildlife Diversity Program (WDP) biologists kicked off the winter bat survey season during the last quarter of 2019. These surveys typically occur in January and February each year, but with continued questions about bat hibernacula locations and the spread of white-nose syndrome (WNS), the winter survey season needed an early start. The goal for early surveys at Piedmont mines was to deploy monitoring equipment at mine entrances and interiors to track temperatures and bat activity throughout winter. These data will indicate how suitable the mines are for *Pseudogymnoascus destructans* (the fungus that causes WNS) growth and how vulnerable bats may be to the disease.

During one of these early surveys, WDP staff counted 32 tricolored bats -- a record high -- in a Nash County mine. The entrance to this mine was re-

cently rehabilitated by Engineering, Habitat Conservation, and Wildlife Diversity Program staff to ensure continued winter habitat for bats. Documenting the highest bat count at the site is encouraging evidence that changes to the entrance did not deter returning bats.

Another highlight occurred during the survey of the maternity cave used by Virginia big-eared bats in the summer months. A Virginia big-eared bat was found hibernating in the cave for the first time. Other caves used by hibernating Virginia big-eared bats will be surveyed in January as part of ongoing monitoring efforts for this endangered species and hibernacula surveys will continue across the state throughout the winter.



*A hibernating tri-colored bat in a Nash County mine (Photo: Olivia Munzer)*



*A hibernating Virginia big-eared bat (Photo: Katherine Etchison)*

## North Carolina's Newest Endemic Salamander Species is Official

Since 2008, Wildlife Diversity Program staff and volunteers have been collecting tail tissue samples from state threatened green salamanders (*Aneides aeneus*) to bank for future genetic research. By 2013, staff helped form a collaborative partnership with several additional researchers including conservation geneticists. Through this collaboration, the research

team pursued a long-standing question, dating back at least to the 1990s, of whether the disjunct population of green salamanders in the Hickory Nut Gorge (Buncombe, Henderson, Rutherford, Polk counties) warranted a separate species status. In recent years, and at long last, the question was answered. The culmination of this work was realized in December 2019 with a published peer-reviewed, jour-

nal article officially describing North Carolina's newest endemic species, the Hickory Nut Gorge Green Salamander (*Aneides carayaensis*), based on genetic analysis and significant differences in physical traits.

Like other green salamander populations throughout the Appalachians, this species needs mature forests with rock outcrops or cliffs that are shaded, humid, moist but not saturated, and with clean rock crevices wide enough and deep enough for salamanders to use in their various life stages and seasonal habitat needs. The Hickory Nut Gorge is a small geographic area, and relatively few sites and few individuals have been documented for the species, yet the threats to the species and its habitat continue to grow. The main threats include loss of forests especially near rock habitat, increased landscape fragmentation from road building and other development, disease, climate change, possibly overcollection, and in more recent years, wide-scale, intense wildfires and landslides. Staff and partners plan to continue looking for new sites, monitoring existing ones, conserving habitat, and researching this unique, rare species and newest member of the state's salamander community.



The rare Hickory Nut Gorge green salamander (*Aneides carayaensis*), North Carolina's newest endemic salamander species (Photo: Lori Williams/NCWRC)



Hickory Nut Gorge green salamander (Photo: Dr. JJ Apodaca)



Hickory Nut Gorge green salamander (Photo: Dr. JJ Apodaca)

## Golden-winged Warbler Habitat along the Cherohala Skyway Restored

A small cluster of golden-winged warblers in the Unicoi Mountains of Graham County was given room to grow. Biologists anticipated the cluster on the Cherohala Skyway serving as a source for colonizing new timber harvest units in the U.S. Forest Service's nearby Santeetlah project area. Indeed, at least one of the harvest units was occupied in May. However, just as new habitat associated with the Santeetlah project became available, habitat along the Skyway became unsuitable or "aged out" beyond what golden-wings will use. The section of Skyway between mileposts 14 and 15 has supported golden-winged warblers for many years, but Sue Cameron of the U.S. Fish and Wildlife Service found none during her annual surveys in 2019. Fortunately, the Wildlife Commission and partners had identified habitat improvement along the Skyway as a priority to maintain and grow this cluster. The Wildlife Commission and the U.S. Forest Service developed a project to set back succession along this part of the Skyway.

They used Google Earth leaf-off satellite imagery from 1993 and 2013 to compare the extent of canopy closure for each time period and then delineated potential treatment areas.

In November, a team of six staff from the Wildlife Diversity Program and the Cherokee and Nantahala National Forests treated approximately seven acres by felling small trees in open areas where a young forest canopy was closing.

In December, a team of five staff from the Wildlife Commission's Land and Water Access, Wildlife Diversity Program, and Nantahala National Forest cut stump sprouts below Shute Cove overlook. Completion of remaining work at the Obadiah overlook will restore 10+ acres of habitat. Staff anticipate a much better outcome in the spring 2020 bird survey.



*Golden-winged warbler (Photo: USFWS)*



*Pre-treatment conditions along the Cherohala Skyway (Photo: Christine Kelly)*



*Post-treatment conditions along the Cherohala Skyway (Photo: Christine Kelly)*

## Saving a Streambank to Save a Bog Community

As the frequency of intense storms increases due to climate change, biologists are seeing more severe stream erosion on the landscape, storm events that yield higher daily rainfall amounts, greater volumes of run-off, and thus more erosive flows in streams and rivers. They have also observed the impact these intense storms can have on the Southern Appalachian bog natural community that is often located adjacent to a stream. In several cases, they have observed severe streambank erosion that threatens the hydrology of an adjacent bog. At a bog in Ashe County, the stream had eroded and migrated over so far that it resulted in a new hydrological connection between the bog and the stream. Not only did water begin to flow out of the bog and into the stream, decreasing the degree of saturation in part of the bog, but the streambank also threatened to eventually erode and drain the bog. With an emergency on their hands, staff took action to temporarily stabilize the streambank and prevent further detriment to the bog community until a full stream restoration can be initiated.

Southern Appalachian bogs are a unique and rare habitat type and have a diverse plant and animal community, including populations of bog turtles.

Bog turtles are listed as federally Threatened (S/A) and state listed as Threatened in North Carolina. Unfortunately, the threats this species and their habitat face are numerous. Fortunately, through funding from the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program and collaboration with the private landowner and many partners, NCWRC staff were able to complete the stream stabilization effort in fall 2019. Before the project began, the stream bank was eroding and moving closer to the bog's edge with each storm event (Figure 1). The stream bank was stabilized with large boulders and erosion control matting, the area where they were connected hydrologically was secured to minimize water flow out of the bog, and all areas where the soil was disturbed were seeded and covered with straw immediately to minimize erosion (Figure 2).

This project was successful because it was installed before any bog habitat was lost and has held back erosion during subsequent large storm and flooding events. The true success will be when staff can fully restore this stream segment and bring it even greater stability for the bog and stream in order to conserve bog turtles and native brook trout. The NCWRC will need help from many partners and finding sufficient funding and resources may be challenging, but by working closely with partners,

prioritizing efforts, and taking effective on-the-ground action, there is still hope for this bog and bog turtle population and others facing similar threats.



*Figure 1. In this photo from May 2019, prior to the project, the streambank was eroding at a rapid pace and getting closer to the bog habitat with every large storm event. The shrubby area just beyond the sloughing streambank marks the edge of the bog habitat.*

*(Photo: Gabrielle Graeter/NCWRC)*



*Figure 2. Large boulders and matting were used to stabilize the formerly eroding stream bank. The bog edge is immediately behind the pink flagging. Large gravel was laid down adjacent to the boulders to ensure the farmer could access his hayfield again.*

*(Photo: Gabrielle Graeter/NCWRC)*

## Fourth Quarter 2019

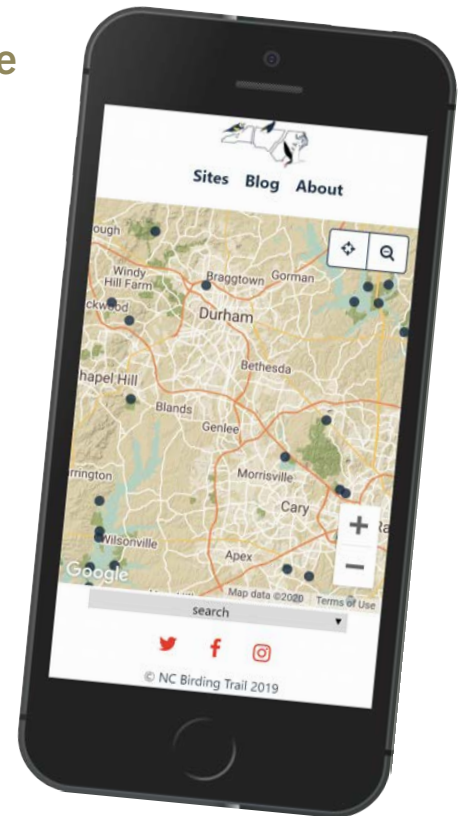
### Statewide

### The North Carolina Birding Trail Launches New Website

Each year, over 1.9 million people participate in bird watching at their homes or on trips, bringing hundreds of millions of dollars to the state's economy. The North Carolina Birding Trail ([ncbirdingtrail.org](http://ncbirdingtrail.org), [Facebook](#), [Twitter](#)) has served as a roadmap to the state's incredible birding and wildlife heritage, spurring ecotourism and strengthening people's connection with nature for 15 years.

The goal of the NCBT has always been to encourage use

of the outdoors by providing easily accessible information. This year, the NCBT has increased its reach by completely re-designing its website with a mobile-friendly design, allowing users to access it from any Internet-connected device. The website lists descriptions, habitats, recent notable bird sightings, and navigation links for each site on the Trail. It will also be used as a platform for engaging, bird-related information like the recent "[What is Birding?](#)" series of essays. Check it out!



*New NC Birding Trail website is mobile-friendly*



[Cedar Point Tideland Nature Trail](#)

*(Photo: Scott Anderson)*



[Patsy Pond Nature Trail Nature Trail](#)

*(Photo: Scott Anderson)*

## Other NCPARC News

In early November, NCWRC staff from both Wildlife Diversity Program (WDP) and Law Enforcement attended a regional meeting on turtle conservation. Lt. Mark Cagle and Jeff Hall were invited to co-present about ongoing efforts in North Carolina regarding reptile trafficking and to highlight cooperation between Wildlife Management and Law Enforcement divisions. Cagle and Hall presented the details of some of the major reptile cases in the state and also emphasized the importance of training. Cooperation between management biologists and law enforcement officers has been key to the success of these cases and important in decision-making about final disposition of confiscated animals.

In November and December, staff assisted with a N.C. State University (NCSU) project surveying for the Neuse River waterdog. Through financial assistance from NCWRC, a graduate student is assessing detectability and occupancy for this interesting salamander. The Neuse River waterdog was recently proposed for federal listing under the Endangered Species Act as Threatened, and this NCSU study will help reveal management actions

that can be taken to assist recovery of the species.

WDP staff visited many coastal wetlands to assess potential for amphibian Species of Greatest Conservation Need (SGCN). SGCN species surveyed for included southern chorus frog, ornate chorus frog, gopher frog, Mabee's salamander, eastern tiger salamander and four-toed



salamander. Work will continue surveying for these species through early spring.



*Neuse River waterdogs in a minnow trap during field surveys (Photo: Jeff Hall)*



*Field surveys for the Neuse River Waterdog with NCSU grad student, volunteers and NCWRC staff (Photo: Jeff Hall)*

## Many Species of Greatest Conservation Need Found During Annual Christmas Bird Count

The National Audubon Society's annual Christmas Bird Count is the oldest, active citizen science bird project in the nation. Beginning on Christmas Day 1900, this tradition was initiated to encourage outdoorsmen to count birds during the holidays. Every year since, from mid-December through early January, tens of thousands of volunteers brave the often cold and wet weather to take part in this effort. This past holiday season, 518 surveys were conducted and over 6 million birds counted throughout the Americas. The NCWRC assists with numerous counts throughout the state – approximately 50 are performed in North Carolina each year.

On Dec. 15, 2019, many species of greatest conservation need, including Henslow's sparrows and red-cockaded woodpeckers, were found within the Holly Shelter & Lea-Hutaff Island count, which is centered within a coastal fringe forest containing a diverse mix of habitats. Audubon NC and other organizations use data collected in this long-running census to assess the relative health of bird populations; however, these surveys are limited by a lack of standardized methodology. The NCWRC is attempting to ameliorate this by initiating a state-wide winter bird atlas that will allow staff to more accurately track bird distribution and abundance during the winter months.



*Henslow's sparrow* (Photo: John Carpenter)

## THE WILDLIFE DIVERSITY PROGRAM



The Wildlife Diversity Program was established in North Carolina in 1983 to prevent nongame species from becoming endangered by maintaining viable, self-sustaining populations of all native wildlife, with an emphasis on species in decline.

More than 700 nongame animals call North Carolina home. Many nongame species, including mammals, birds, amphibians and reptiles, freshwater mussels and fish, are common and can be seen or heard in your own backyard. Other nongame animals, such as bald eagles and peregrine falcons, were, at one time, considered endangered, but now soar high in the sky, thanks to the work conducted by wildlife diversity biologists.

The men and women who work for the Wildlife Diversity Program are dedicated to conserving and promoting nongame wildlife and their habitats through a variety of survey and monitoring programs, species management, and habitat conservation or restoration projects. These programs and projects target nongame animals and their habitats, but game species — such as deer, turkey, mountain trout, and black bass — also benefit because they share many of these same habitats.

You can learn more about the many projects and programs conducted by wildlife diversity personnel on behalf of nongame and endangered wildlife by visiting [www.ncwildlife.org/wdp](http://www.ncwildlife.org/wdp).

## *Stay Informed* on wildlife activities in North Carolina

Subscribe to **NC Wildlife Update** - news including season dates, bag limits, legislative updates and more -- delivered to your inbox from the N.C. Wildlife Resources Commission.

Sign up at: [ncwildlife.org/News/WildlifeEmailUpdate](http://ncwildlife.org/News/WildlifeEmailUpdate)



Stay Connected with the N.C. Wildlife Resources Commission  
[ncwildlife.org](http://ncwildlife.org)