



NORTH CAROLINA WILDLIFE RESOURCES COMMISSION

# WILDLIFE DIVERSITY PROGRAM QUARTERLY REPORT

JULY-SEPTEMBER 2021





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.

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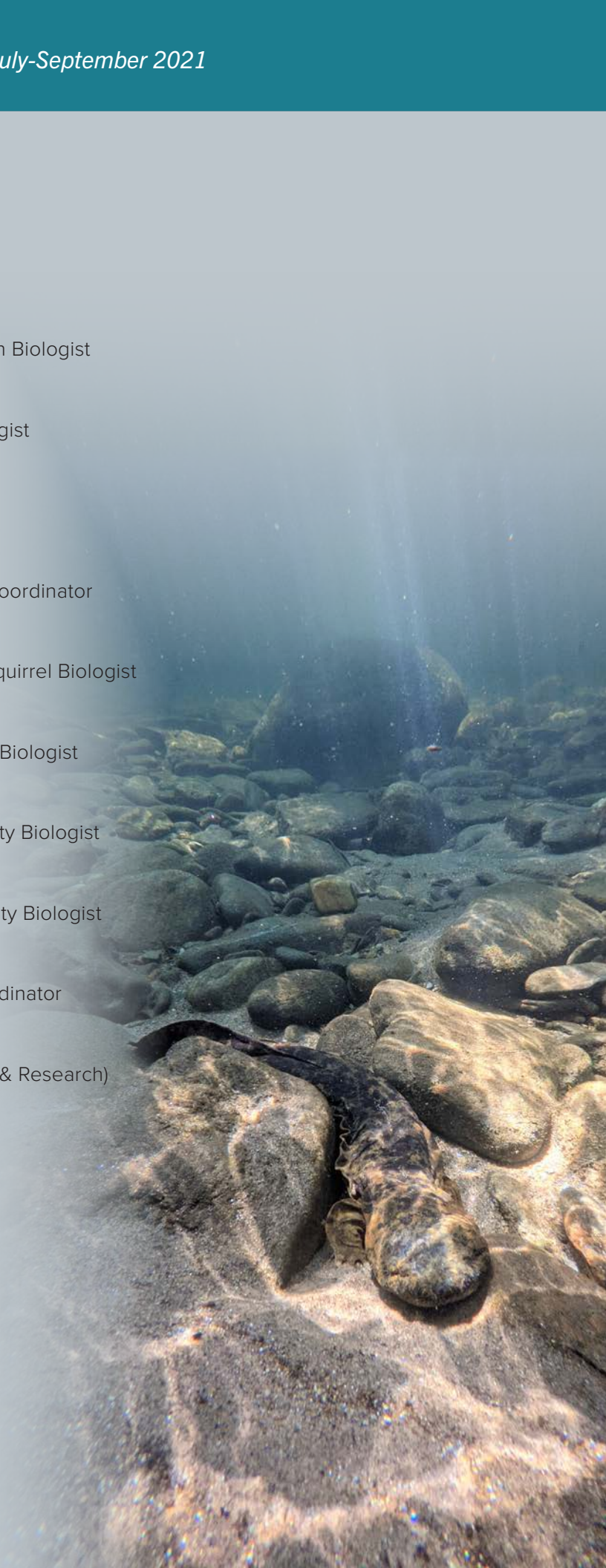
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*Cover photos from top left clockwise: Madtom habitat bag (Brena Jones; Wildlife Diversity Biologist, Releasing juvenile Gopher Frogs to a restored wetland in the North Carolina Sandhills (Michael Martin); NCWRC Conservation Biologist Gabrielle Graeter is elated to discover a 5-year-old male bog turtle at the focal population (NCWRC); Piping Plover, (Carmen Johnson); and Wildlife Diversity technician, Ben Dalton, posing with an adult Eastern Hellbender active on the stream bottom during breeding season snorkel surveys.*



## Juvenile Gopher Frogs Released at Newly Restored Wetland in Sandhills

by Dr. Jeff Humphries, Eastern Amphibian and Reptile Biologist

In collaboration with the North Carolina Zoo, biologists with the N.C. Wildlife Resources Commission (NCWRC) continued to raise Gopher Frogs as part of a “headstarting” program. Gopher Frogs have become so rare on the landscape that headstarting — raising frogs from eggs to juveniles in captivity and releasing them into the wild — has become an important conservation tool. This year in the Sandhills in North Carolina, biologists raised and released 459 juvenile frogs.

They collected small portions of egg masses from a relatively stable population and released the frogs at a newly restored wetland for the second year in a row. If successful, this effort would be the first time a new population of Gopher Frogs has been created or restored in North Carolina. Increasing the number of populations or meta-populations is important for increasing the chances that this species remains part of the state’s fauna. Staff are monitoring the introduc-

tion using automated recorders to listen for breeding adults and searching for egg masses during the breeding season. Since Gopher Frogs don’t reach sexual maturity until 2–3 years old, this winter and spring will be the first chance staff will have to determine if the introduction efforts are successful. If those efforts are successful, biologists plan to re-introduce frogs to other restored wetlands to improve populations and population resiliency across the frog’s range.



Releasing juvenile Gopher Frogs to a restored wetland in the North Carolina Sandhills (left); A headstarted juvenile Gopher Frog ready for release at a restored wetland (Photos: Michael Martin)



## Piping Plover Nesting Season Ends with Below Average Results

by Carmen Johnson, Waterbird Biologist

Nesting season recently ended, and with that came the wrap-up of the annual Piping Plover Breeding Season Survey. Each season, NCWRC staff and partners survey all suitable nesting habitat, recording observations of pairs and individuals. Piping Plovers are ground nesters, making a shallow scrape in the sand that may be lined with fragments of shells. Because of this nesting habit, Piping Plovers face challenges from human disturbance, overwash and predators (including pets). In 2021, 40 pairs were detected in the state, and 17 chicks fledged (productivity of 0.43 fledglings/pair). This is below the average of 45.61 pairs and 24.4 fledglings since monitoring began in 1989, demonstrating the need for continued conservation efforts. The Atlantic population of Piping Plovers is federally listed as Threatened under the U.S. Endangered Species Act. NCWRC staff will continue to work with partners in North Carolina and throughout the Piping Plover's range to recover the species.



Adult male Piping Plover (top photo); Piping Plover nest with two eggs (Carmen Johnson)



## Monitoring Sea Turtle Nesting Using DNA Eggshell Samples

by Dr. Matthew Godfrey, Sea Turtle Biologist

Since 2010, an eggshell sample has been collected from nearly every loggerhead sea turtle nest laid in Georgia, South Carolina and North Carolina, which is considered the range of the Northern Recovery Unit loggerhead population. The DNA fingerprints generated by the eggshell samples reveal the unique identities of all female turtles that lay their clutches in this region. Based on its eggshell sample, the loggerhead turtle nest laid on North Core Banks on June 27, 2021 was the first nesting activity documented by female loggerhead CC014164. However, the DNA sample provided a match in a different data-

base from a long-term, in-water monitoring project conducted along the southeastern United States. The turtle had been captured for research in 2003 near St. Augustine, Florida. The turtle's straight carapace length at that time was 27½" (70 cm). Incorporating average growth rates and minimum size at sexual maturity, biologists determined this turtle would be expected to start reproduction within 10 years. However, she was not observed nesting for nearly 20 years. It is possible that she experienced slower-than-average growth, or perhaps experienced delayed reproduction. Another possibility is that she started

nesting outside of the Northern Recovery Unit, but only recently moved to beaches within the area. Historical flipper-tagging data revealed that some adult female loggerheads can switch between nesting beaches as far apart as Cape Lookout National Seashore in North Carolina and Cape Canaveral National Seashore in Florida. It is thought that the Northern Recovery Unit loggerhead population split away from the Florida loggerhead population <20,000 yrs. ago, but there is increasing evidence that low level genetic exchanges across the two regional populations continue to occur.



*An adult female loggerhead, on Cape Lookout National Seashore, found after she finished nesting but before she successfully found her way back to the ocean in the early morning (NPS - Cape Lookout National Seashore)*



## Ambiguity Between Warbler Species Cleared Thanks to Cooperative Project

by John Carpenter, Eastern Landbird Biologist

Wayne's Black-throated Green Warblers were historically associated with the once vast Atlantic White Cedar forests that blanketed the Atlantic Coastal Plain from Virginia through the Carolinas. Wayne's Warbler, as it is colloquially referred to, is now a Species of Greatest Conservation Need in the North Carolina, South Carolina and Virginia Wildlife Action Plans. Surprisingly, the status of the Wayne's Black-throated Green Warbler as a true subspecies (*Steophaga virens waynei*)

depends largely on the taxonomic source one references. The Birds of the World series — a revered resource from the Cornell Lab of Ornithology — considers it subsumed by the nominate species, *S. virens*, which is commonly found throughout much of the Appalachian Mountains and into Boreal Canada. Avibase, on the other hand, list *waynei* as a subspecies, likely due to differing habitat preferences and apparently smaller bill. This ambiguity has recently been cleared up through a cooperative project involving the

N.C. Wildlife Resources Commission, Catawba College, Arkansas State University, and Penn State University. Using Whole Genome Resequencing (WGS), biologists have determined that Wayne's Black-throated Green Warblers are genetically distinct from birds that breed outside the Atlantic Coastal Plain.

They hope this will help garner Wayne's Warbler, as well as the non-riverine swamp, bay, and pocosin habitats they use, more attention and conservation.



Black-throated Green Warbler (Jack R. Perry Photography)



Wayne's Black-throated Green Warbler in Croatan National Forest (J.P. Carpenter)





## Staff Conduct Fish Surveys, Deploy Habitat Bags at Lake Waccamaw

by Brena Jones, Central Region Aquatic Wildlife Diversity Coordinator

NCWRC staff, in partnership with NC State Parks, have conducted annual standardized surveys since 2009 for three fish Species of Greatest Conservation Need 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 3.2 fish/minute (fpm) of seining in 2021. 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. Waccamaw Killifish and Waccamaw Darters were also collected, suggesting that populations persist within Lake Waccamaw; however, numbers of Waccamaw Killifish were very low for the second year in a row.

Staff also deployed some artificial habitat bags, providing native mussel shells for cover, in an attempt to document Broadtail Madtom, a State Special Concern species, in the lake. This small native catfish, which has a genetically unique population in Lake Waccamaw, was rediscovered in the lake in 2019, not having been previously seen since 2002.

They can be difficult to detect due to their diminutive size (rarely exceeding 65 mm or 2.6 in), so these bags will be checked periodically to determine if fish are using them or if modifications are needed.



Madtom habitat bag (Brena Jones)

## Crayfish Surveys Targeting Special Concern Crayfish Yield Zero Results

Staff biologists visited four sites in July 2021 as part of ongoing efforts to update distributional records of native crayfish species. The sites were in Guil-

ford County, specifically targeting the known geographic range of the Greensboro Burrowing Crayfish, which is state listed as a species of Special Concern.

Although the target species was not found, individuals of the native *Cambarus* species *C. acuminatus* complex were found in burrows at two of the sites.



## Staff Conduct Broadtail Madtom Surveys in Lumber River and Tributaries

Staff conducted site visits in the Lumber River and two tributaries, Shoe Heel Creek and Joes Creek, for the state listed Special Concern Broadtail Madtom, a rare, undescribed native catfish. They checked 40 small, artificial cover structures, informally named “madtom motels”, which were previously deployed at four localities, for occupancy

on two occasions. They found one Broadtail Madtom in a motel — the first since deploying the cover structures in 2019.

They also found several juvenile native catfish species utilizing the motels: Margined Madtom, Yellow Bullhead; and the non-native Channel Catfish. The number of occupied structures per site ranged from 0 to 6

out of 10 motels, with an average of 2.8 occupied motels. For comparison, during the previous site visit in May 2021, no fish were found occupying any of the cover structures.

Staff will continue to check motel occupancy on an ongoing basis and are planning additional future deployments and surveys.



Broadtail Madtoms (Katherine DeVilbiss); An assembled “madtom motel” (Photo NCWRC)



## Biologists Search for Undescribed Freshwater Mussel Species in Little River

by Katharine DeVilbiss, Central Region Aquatic Wildlife Diversity Biologist

NCWRC staff performed mussel surveys for an unknown, potentially new-to-science species in the Little River and tributary waters of the Pee Dee river drainage to gain valuable geographic range, habitat preference and behavioral information. Since their first discovery in a reach of the Little River in May 2019, individuals of this species were known exclusively from that one locality and one other locality 1.8 km upstream, found in June 2021. In the Little River, 23 surveys were performed, and another 26 in tributary waters including West Fork Little River, Densons Creek, Barnes Creek, Hannahs Creek, and Betty McGees Creek, in Randolph and Montgomery counties. Biologists detected 19 individuals of the unknown species over nine sites, increasing their known range to approximately 6.5 km of the Little River. None were detected during the surveys in other waterways. Search effort totaled 198 person-hours (p-h), for an average catch per unit effort of 0.09 individuals per p-h. Staff swabbed a subset of the found undescribed species for genetic material and took two individuals to the NCWRC Conservation Aquaculture Center in Marion, NC for ongoing life history studies.



Undescribed mussel species from Little River, Pee Dee basin (Katherine DeVilbiss)

In addition to the undescribed species, SGCN species detected included Brook Floater, a State Endangered species; Carolina Creekshell, a State Endangered species; Notched Rainbow, a State Threatened species; and, Savannah Lilliput, a Federal Species of Concern and State Endangered species. Staff biologists plan to continue surveys and studies in 2022 to further their understanding of this undescribed freshwater mussel species.

## Surveys in Little River Reveal Significant Increase in Mussel Abundance

by Michael Fisk, Eastern Region Aquatic Wildlife Diversity Coordinator

Wildlife Diversity Program staff conducted snorkel surveys in the Roanoke River bypass channel this summer to determine the long-term impacts of providing consistent water releases within the bypass channel on the mussel commu-

nity. Roanoke Rapids Dam is in Halifax County and is operated by Dominion Power. It was constructed in 1955 and created a new channel for releases to flow through, bypassing the original river channel. This rendered the bypass channel, which is

approximately .62 mile (1 km) long, largely dewatered, except for dam spillage during high water events, test releases and local precipitation. As part of the hydropower relicensing agreement in 2005, Dominion Power began releasing water back into

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the bypass reach and was charged with conducting mussel surveys every seven years beginning in 2007. The NCWRC has completed these surveys each year.

In July 2021, eight surveyors spent 62.5 person hours over two days snorkeling through the bypass reach. They documented 10 species and found over 2,000 mussels (Figure 1). This was a significant increase in mussel abundance compared to past surveys documenting <100 mussels in 2007, and <200 mussels in 2014 (Figure 1).

The significant increase in mussel abundance was attributed to the Northern Lance, Eastern Elliptio and Eastern Lampmussel. These species comprised 97% of all mussels found. Live Roanoke slabshell and Triangle floater were documented in 2021, whereas, in previous surveys, only shells had been collected. Other notable species documented were the Alewife Floater, Tidewater Mucket and Eastern Pondmussel — all listed as state threatened in North Carolina.



Northern Lance encountered during 2021 survey in the Roanoke bypass channel (Rob Adams)

This increase in abundance shows that mussels will repopulate an area when suitable conditions are provided although this is not a “quick fix.” Mussel repopulation unlike other taxa (e.g., fish) can take several decades to detect significant changes, and this time frame must be considered when evaluating restoration efforts. Staff will continue to survey the Roanoke bypass channel and evaluate its recovery.

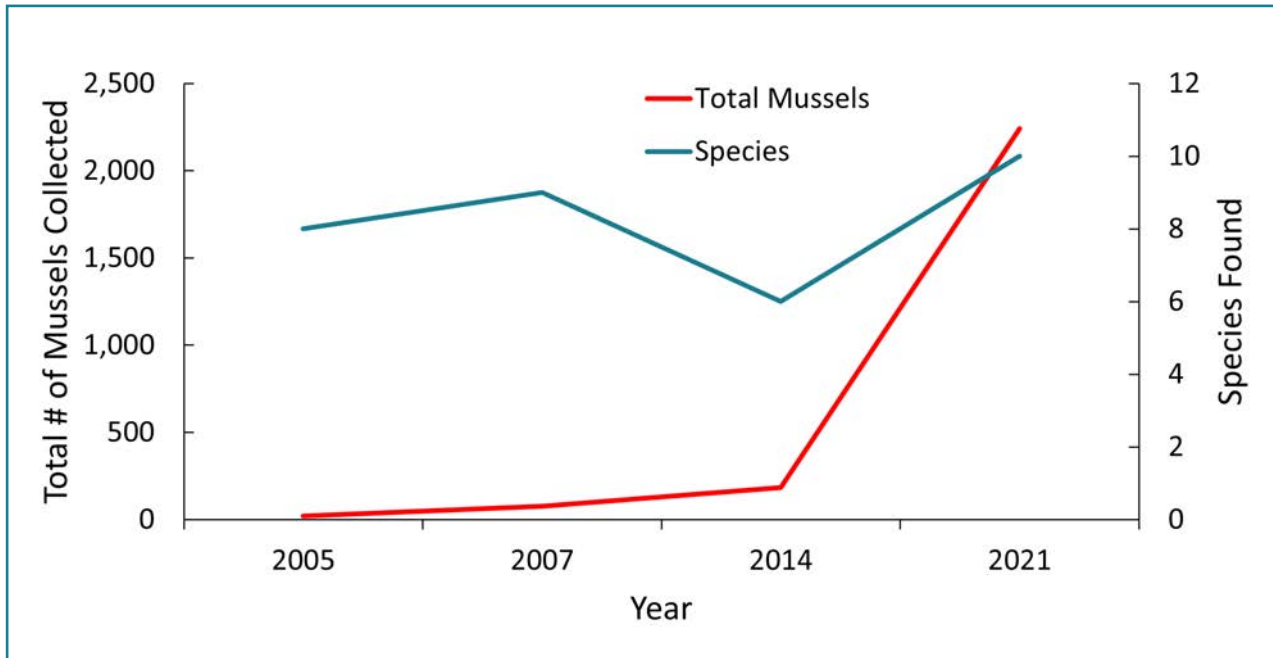


Figure 1: Mussels collected and species documented from 2005–2021 during surveys within the Roanoke bypass channel.



## Barn Owl Project Update

*by Allison Medford, Piedmont Eco-Region Wildlife Diversity Biologist*

The Barn Owl Project progressed this quarter, and fall nest monitoring began late in the quarter. Cameras have been posted on two sites — one on an active spring nest and one on a perching site near one of the nest boxes. Biologists hope to get a sense of the owls' fall activity using these cameras.

They have invested in temperature and relative light data loggers to give them a better sense of the temperature and light preferences of Barn Owl nests. They will use this information to tweak their nest box design to best mimic the “natural” nest sites (though, of course, these sites are in man-made structures or even other nest boxes; none of the known Barn Owl nests are in trees, rock shelves, rock outcroppings or other truly natural places).

In the upcoming quarter, they hope to document any fall nests and install more nest boxes.



*Barn Owl (Trevor Partridge)*

## Northern Saw-whet Owl Conservation Plan Begun

*by Allison Medford, Piedmont Eco-Region Wildlife Diversity Biologist*



*Northern Saw-whet Owl (Shutterstock)*

The new cohort of Species Conservation Plans (SCP) was assigned, including the Northern Saw-whet Owl (NSWO) Plan. The Piedmont Eco-Region Wildlife Diversity Biologist is learning about these owls in depth and, using Western Bird and Carolina Northern Flying Squirrel Biologist Chris Kelly as a well-spring of information, has started piecing together the SCP for North Carolina.

Researchers at UNC-Wilmington have expressed interest in expanding monitoring for NSWOs in the mountains, so the promise of new information about these elusive critters is on the horizon.



## Biologists Assess Golden-winged Warbler Habitat in Cheoah Mountains

by: Christine Kelly/ Western Bird and Carolina Northern Flying Squirrel Biologist

In August, biologists returned to Graham County to measure habitat data around several Golden-winged Warbler nests. This work was done to see how habitat at the nine Golden-winged Warbler nests found in the Cheoah Mountains measured up with respect to typical and recommended habitat

characteristics outlined in the revised Golden-winged Warbler Conservation Plan. These nests were associated with two-age timber harvests ranging from five to 15 years post-harvest. One was located on the edge of a logging deck that had been converted to a wildlife opening, one on the side of a closed

permanent woods road, and seven along closed temporary roads. Vegetation data in nested 1m, 5m, and 11.2 m plots were collected using protocols from the Conservation Effects Assessment Protocols (CEAP). The map shows 11.3 m vegetation plots (Figure 1).

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Figure 1. Four of the Golden-winged Warbler nests, vegetation sampling plots at nests, and additional birds detected in the Cheoah Mountains (Graham County), 2021



In silviculturally derived management sites such as these, the Conservation Plan notes that most nest sites contain >50% forbs, and the Cheoah nests averaged 46.4% (Table 1). Woody cover is an important determinant of nest site selection, with typical Golden-winged Warbler nest sites containing some wood component, but the level never exceeding 70%. Woody cover at the nine Cheoah nests aver-

aged 21.9%. Golden-wings tend to select against sites with lots of grass cover, and the Cheoah nests had little grass (mean 8%).

Another feature of nest sites is approximately 13% open ground. At the Cheoah nests, open ground consisted of bare ground (0.5%) and leaf litter (10.3%).

Finally, blackberry can be an indicator of high-quality nest sites, but should occur in small amounts, not exceeding 40%.

Blackberry cover at the Cheoah nests averaged 6.1%. Overall, the nine nests fell within the range of desired habitat components known to be important to nesting Golden-winged Warblers, though caution should be used in interpreting these results as plots were restricted to the nests and not the surrounding management sites.

Table 1. Recommended habitat management targets for GWWA nests and results from nine nests in the Cheoah Mountains, NC in 2021, showing means and standard errors.

Habitat component	Desired habitat component <sup>a</sup>	9 nests in Cheoah Mtns, NC
Woody cover	5-50%. <70%	21.9% (5.9)
Forb cover	45-100%	46.4% (8.8)
Rubus cover	5-40%	6.1% (1.8)
Grass/sedge cover	5-25%, <45%	8.0% (2.4)
Open ground	13%	0.5% (0.5) bare ground 10.3% (2.8) litter
# Tall shrubs/5 m <sup>b</sup>	<5	0.88 (0.61)
Distance to forest edge <sup>b</sup>	39-230 m	24.2 m (6.4)

<sup>a</sup>From the GWWA Conservation Plan. <sup>b</sup>From high quality nests in the CEAP project.



Left photo: In August, NCWRC biologists measured vegetation around the nest of this male Golden-winged Warbler "Dark Blue-silver Yellow" that was banded on May 6, 2021.

Right photo: Dark Blue-silver Yellow was spotted later helping his mate deliver food to their nestlings. The nest was along the side of a temporary road adjacent to a five year old harvest unit.

(Photos: Christine Kelly)





## Mistnetting Efforts Result in High Numbers of Bats at Several Sites

by Katherine Etchison, Mammalogist

This quarter represents the first sustained mistnetting efforts by the NCWRC since the onset of the COVID-19 pandemic. After the pause in mist netting during summer 2020, the NCWRC bat team and partners successfully completed all planned long-term monitoring sites. Partners from the U.S. Fish and Wildlife Service, the U.S. Forest Service, and NC State Parks collaborated to make sure the season went successfully. In addition, they successfully navigated new protocols around personal protective equipment used while working hands on with bats.

This netting season helped to fill in gaps in information as a result of the absent netting season of 2020. Notably, biologists captured high numbers of bats at several sites including one in Nantahala National Forest where 48 big brown bats were captured, the highest number recorded there. Additionally, one site at which 27 endangered Gray Bats were captured in 2018 again provided an opportunity to catch a relatively large number (10) in one night, one of which was originally banded in a neighboring state by the Tennessee Wildlife Resources Agency. Unfortunately, there were no captures of a few spe-

cies such as the Tri-colored Bat and Northern Long-eared Bat, both of which have experienced steep population declines due to white-nose syndrome (WNS). However, capture efforts at one site in Avery County again yielded Little Brown Bat captures this year, indicating that the species continues to be present at this site even though it too experienced steep population declines due to WNS.

### “The Fat Bat Project”

In addition to long term mistnetting, the bat conservation team continued its collaboration on the Gray Bat project with Indiana State University

and began collaboration with Bat Conservation International on a national project dubbed “The Fat Bat Project.” As autumn approached, the NCWRC helped select and set up sites for a pilot study where UV lights are being set up to attract insect prey for bats to feed on before going into hibernation. Recent research has indicated that bats with higher fat stores going into winter are more likely to survive WNS, if infected. As a result, this project was developed with the goal of creating a scalable conservation solution, which could be rolled out across North America to help recover bat populations that have been decimated by WNS.



*Little Brown Bat captured in Avery County (Kyle Shute)*





## Good News and Bad News for Hellbender Populations in the Aftermath of Tropical Storm Fred's Catastrophic Floods

by Lori Williams, Western Amphibian Biologist

In late summer, the remnants of Tropical Storm Fred dumped record amounts of rainfall and caused unprecedented flooding in western North Carolina that cost lives, destroyed homes and property, and resulted in untold damage to river ecosystems. Among the many questions of “what survived?” in the hardest-hit rivers in Haywood and Transylvania counties was the unknown effects on a sensitive, state-listed species, the Eastern Hellbender,

especially since the floods came just before its breeding season.

When the flood waters receded and rivers were safe to enter, Wildlife Diversity staff, partners and volunteers began the task of assessing habitat damage and monitoring the hellbender population as they have done for many years. They saw severe, and possibly lasting, damage to rivers with deep scouring of the river bottom, displacement and destruction of the large, flat boulders

hellbenders require, significant streambank erosion and loss of riparian vegetation and altering of stream channels. The number of fish and aquatic wildlife, including hellbenders, that perished in the floods is unknown. However, biologists do know that at least 11 live hellbenders were rescued in two river systems, with at least seven confirmed mortalities, although actual mortality numbers were likely much higher.

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*Wildlife Diversity technician, Ben Dalton, poses with an adult Eastern Hellbender active on the stream bottom during breeding season snorkel surveys.*





In good news, though, they did find adult hellbenders in comparable numbers to previous years, although actual breeding and nesting appeared to be down. Overall, for the breeding season snorkel surveys, staff completed 49 surveys with only 13 failing to document hellbenders. They covered eight

counties and counted 278 animals (the most ever!), at least 70 of which were from one of the worst-hit rivers in the French Broad drainage, demonstrating the resilience of adult hellbenders. The impact on juvenile and larval hellbenders is unknown but may be revealed in the coming years with more monitoring efforts.



*Clockwise from top left: The historic flood in August 2021 ravaged streambanks and deposited deep beds of dry cobble, altering stream flow (Lori Williams); During breeding season snorkel surveys in the best Eastern Hellbender populations, it is common to see two or more adults active on the stream bottom; An adult Eastern Hellbender found during breeding season snorkel surveys; Although nesting and breeding activity may have been down from previous years, Wildlife Diversity staff still observed a number of “denmaster” male Eastern Hellbenders guarding their nest rocks. (Photos: Ben Dalton)*



## Recent Discoveries in a Bog Turtle Population Give Biologists Renewed Hope

by Gabrielle Graeter, Conservation Biologist/Herpetologist

Unfortunately, many remaining bog turtle populations in North Carolina are small and in decline. The threats they and their habitat face are numerous. Threats include development, changes in wetland hydrology, invasive and woody plants, busy roads and habitat fragmentation, predation, and more. NCWRC staff and partners are working hard to improve habitat conditions and improve the status of bog turtle populations at many of these sites.

At one population in western North Carolina, mark-recapture data analysis indicates the population is in decline, with population abundance estimated to be eight turtles in 2015. Since then, two adults are known to have died. With extensive survey effort over the past few years, staff estimate that there are as few as four or five adult turtles remaining in this population. A scientific journal article by Shoemaker et al. (2013) concluded that for a bog turtle population to be viable over the long term, it must have at least 15 adult females, or approximately 30 adults. This focal population is far from meeting that minimum number. It is especially worrisome that only one adult male has been detected over the last decade. With such a small population size, this

population is prone to extirpation without immediate intervention.

Due to past land-use and current threats to this species, it can take a lot of effort to stabilize or increase a population. At this focal population, NCWRC staff and partners have made many efforts to protect the land, manage the habitat, and improve the status of the bog turtle population over the years. For example, the NCWRC purchased the land to help protect the habitat from fur-

ther degradation, and staff have removed non-native invasive plants and woody vegetation to maintain the bog as open canopy. They have also used radio-telemetry to better understand the turtles' habitat use. In January 2018, a large-scale restoration project to address erosion problems, improve hydrology, and expand the size of the wetland was completed, thereby improving the amount and quality of the habitat at this site.

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The 9-month old bog turtle that was discovered during surveys at the focal population in summer 2021 (NCWRC)



In summer 2021, staff were elated to discover two previously undetected bog turtles at this bog, giving them new hope for this population. One was a juvenile turtle that had hatched the previous fall. With all the hard work staff have been doing to improve the habitat for the species, it was very exciting to know there has been recent nest success! They also captured a large 5-year-old male bog turtle that they had never seen before, which is fantastic given the shortage of breeding males. Biologists hope in the next couple of years he will be reproductively active and ready to contribute even more to the population! Despite these recent successes, there is still much to be done to help stabilize this population. By working closely with partners, prioritizing efforts, and taking effective on-the-ground action, biologists believe there is still hope for this bog turtle population and others.



NCWRC Conservation Biologist Gabrielle Graeter is elated to discover a 5-year-old male bog turtle at the focal population. (Gabrielle Graeter)

## How YOU Can Support Wildlife Conservation in North Carolina

Whether you hunt, fish, watch, or just appreciate wildlife, you can help conserve North Carolina's wildlife and their habitats and keep North Carolina wild for future generations to enjoy.

How? It's as easy as 1, 2, 3.

- 1 Donate to the Nongame and Endangered Wildlife Fund by checking Line No. 30 on your N.C. State Tax Form.
- 2 Purchase a Wildlife Conservation Plate, which features an illustration of a Pine Barrens Treefrog, for \$30, with \$20 going to the agency's Nongame and Endangered Wildlife Fund.
- 3 Donate to the Wildlife Diversity Endowment Fund, a special fund where the accrued interest — not the principal — is spent on programs that benefit species not hunted or fished. [ncwildlife.org/donate](http://ncwildlife.org/donate)





## Tropical Storm Fred Assessments on Mussel Populations in Western NC

by: Dr. Luke Etchison, Western Region Aquatic Wildlife Diversity Coordinator

Historic and tragic flooding came to parts of western North Carolina on Aug. 17, 2021 as the remnants of tropical storm Fred drenched much of the region. The heaviest rainfall came to the high elevation ridges bordering Transylvania and Jackson counties, with some gauges reportedly receiving over 20 inches of rain in just 72 hours. The worst impacts were felt in Haywood County, where the dangerous flooding

in the East Fork Pigeon River claimed the lives of six people. This type of flooding has the power to roll over the substrate that lies on the stream bed, and potentially displace or kill benthic aquatic organisms. These animals are also likely to face exposure to pollutants from human waste, petroleum products, and many other toxic substances that might wash into streams during high flow events.

Of particular concern to biologists are the area's mussel populations, which already have very limited distributions. Western Aquatic Wildlife Diversity biologists started post-flooding surveys as soon as water levels receded, focusing most of their time on sites that were known to be occupied by the Federally Endangered Appalachian Elktoe. Since most of the flooding was limited to the Nolichucky, French Broad, and Pigeon watersheds, snorkel surveys included the South Toe, Cane, French Broad, Little, Mills, and Pigeon (East Fork, West Fork, and mainstem) rivers.

From the limited number of sites that were searched, biologists were encouraged by what they saw. Although most of the rivers showed signs of bank erosion, riparian damage, and sediment scouring, the majority of sites still had populations of healthy mussels. These populations were typically located in refugia areas, which seemed to be less impacted by the high flows. The major exception was the East Fork Pigeon River, where a previously known small population of mussels could not be accounted for. The long-term impacts of this major flooding event are unknown, but biologists are hopeful that these aquatic ecosystems will quickly rebound.



*A healthy Appalachian Elktoe found during post-flooding surveys in the West Fork Pigeon River in Haywood County (Dr. Luke Etchison)*



*Flooding damage on the East Fork Pigeon River in Haywood County (Dr. Luke Etchison)*



## N.C. Partners in Amphibian and Reptile Conservation News

by Jeff Hall, Partners in Amphibian and Reptile Conservation Biologist

Virtual meetings continued to be an important component of NCPARC working group functionality. Two working groups met virtually during this quarter: Education and Outreach (EO), and Policy, Trade, and Regulation (PRT). The EO working group continues to find avenues for education about the conservation of reptiles and amphibians even through constraints of the pandemic, such as small neighborhood outreach events and virtual programs and workshops. The

PRT working group has been reviewing various regulatory proposals involving venomous reptiles, snapping turtles, and listed species.

Upland snake surveys during this quarter were especially successful including many SGCNs such as Carolina Pigmy Rattlesnake, Timber Rattlesnake, Southern Hognose Snake, Northern Pine Snake, and Eastern Coachwhip. Staff conducted these surveys and some moni-



toring of known sites across the state. Records of these species continue to be extremely important to help direct conservation and restoration efforts on the lands that they call home.



Timber Rattlesnakes in a gestation site with numerous adults and recently born babies (Jeff Hall)



Top photo: Southern hognose snake; Northern pine snake (Photos: Jeff Hall)