



*North Carolina
Wildlife Resources Commission*



Wildlife Diversity Program Quarterly Update

Third Quarter 2017



Volunteer with banded brown pelican

In This Issue:

- Page 2 - [Bio-Blitz at State Park Nets Amazing Wildlife Diversity](#)
- Page 3 - [Restored Wetland Shows Dramatic Increase in Amphibian Diversity](#)
- Page 4 - [Storm Events Impact Sea Turtle Nesting Success in 2017](#)
- Page 5 - [Cormorant, Pelican and Tern Banding Continues along Coast](#)
- Page 6 - [Red Spruce Planted to Create Better Habitat for Wildlife](#)
- Page 7 - [Partnerships Protect Bogs](#)
- Pages 8/9 - [Research on Agrochemical Impacts on Hellbender Habitat](#)
- Page 10 - [Yellow Lance Surveys Conducted in Tar River; Brook Floater Surveys Conducted](#)
- Page 11 - [Mussel Surveys Conducted in Pee Dee River](#)
- Page 12 - [Lake Waccamaw and Rocky River Fish and Mussel Surveys Update](#)

Bio-Blitz at State Park Nets Amazing Wildlife Diversity

Wildlife Diversity Program staff assisted the N.C. Division of Parks and Recreation with its 10th Bio-Blitz at Carolina Beach State Park in New Hanover County in September. A Bio-Blitz is a coordinated event that focuses on finding and identifying as many species as possible in a specific area over a short period of time.

Scientists, families, students, teachers and other community members work together to count the various plants, animals, fun-

gi and other organisms that live in a place. Carolina Beach State Park boasts unique ecosystems, such as limesink ponds and coastal variants of longleaf pine forests, which provide the backdrop for the amazing diversity found there.

The goals of this blitz were:

- to increase staff knowledge and understanding of flora and fauna at the park;
- to update existing species records, and
- to continue to refine the model for future bio-blitzes.



State biologists demonstrate bird banding to local citizens at Carolina Beach State Park's 10th BioBlitz.



This migrating black-throated blue warbler was captured, banded and released unharmed.



Restored Wetland Shows Dramatic Increase in Amphibian Diversity

During the 3rd quarter, Wildlife Commission biologists analyzed frog call recording data from a recently restored isolated wetland to document colonization and habitat use of the wetland pre- and post-use after restoration efforts. This wetland (Block-O Wetland) had not experienced prescribed fire for decades and had reverted to a mostly forested wetland instead of a fire-maintained, open-canopied wetland, which would likely be its most natural state. This wetland was monitored with a digital froglogger (automated sound recorder) for three years before restoration took place (2014-2016), and is now being monitored using the same protocol post restoration for at least three years. This wetland has been monitored for frog calls from January through July for four years to date. For the first three years of monitoring (when the wetland was completed forested and drained via a large ditch), only three species were detected — spring peeper, southern cricket frog, and eastern narrowmouth, although dipnet surveys indicated that no successful breeding of any of those species took place.

This wetland was logged as part of a larger forestry operation in late 2016 and the drainage ditch was filled in, allowing the wetland to return to a more natural state. Wildlife



Old ditch that was plugged by game land managers to restore the hydrology of this isolated wetland.

Aerial photo of Block O Wetland in the process of restoration. (Photo by Brady Beck)



Cope's gray treefrog (Photo: Jeff Hall)



Squirrel treefrog (Photo: Jeff Hall)



Barking treefrog (Photo: Jeff Hall)

Commission management staff removed all larger trees from the wetland, and agency biologists monitored the pond for amphibian colonization this year. In the first year after restoration, **amphibian diversity increased dramatically, from three species to 12 species.** In 2017, staff documented the calls of 12 species of frogs using the pond. These species were southern cricket frogs, eastern narrowmouth, spring peepers, southern leopard frogs, green frogs, Cope's gray treefrogs, pinewoods treefrogs, barking treefrogs, southern toads, oak toads and squirrel treefrogs. Eastern spadefoots were also detected emerging along the pond margin, but the calls of this species were not detected on digital recordings. Frog-call monitoring, along with repeat photography of this pond, will continue so that biologists can document the effectiveness of restoration efforts. Staff also will continue dipnet surveys to document breeding success of species following restoration of this wetland.

Storm Events Impact Sea Turtle Nesting Success in 2017

Sea turtles are iteroparous, meaning they lay multiple clutches of ~120 eggs during a single nesting season. Commonly, an individual adult female will reproduce during >5 nesting seasons, allowing her to lay at least a few thousand eggs on sandy nesting beaches during her lifetime. It is thought that this strategy of laying many eggs at different times of year and in different years helps spread out the impact of potential threats to the incubating eggs. Under ideal conditions, the hatching success of a sea turtle clutch will be 85% or better. However, hatching success can be lowered by various biotic and abiotic factors, including predation by crabs, foxes, coyotes, etc., as well as nest inundation from extreme tidal overwash. The latter often occurs in late summer and early fall, when tropical storms and hurricanes affect the coast of North Carolina. In September 2017, the coast of North

Carolina was impacted by Hurricanes Jose and Maria, causing nearly all incubating sea turtle nests to be overwashed and inundated at least a few times. Some nests were covered by water for hours or even days at a time (left photo), which often leads to embryonic death from interrupted gas exchange. Other nests were lost because the wave action resulted in sand erosion, and the eggs were washed out to sea. Many other nests experienced overwash and inundation from the hurricanes, but nevertheless produced hatchlings (right photo).

At the time of writing this report, 1,226 sea turtle nests were laid on North Carolina beaches in the 2017 nesting season, and of these, 164 nests had a less than 10% hatching success, caused by excessive washover and inundation associated with storm events. This number may increase when volunteers and cooperators check on hatching success at the end of expected incubation, but there have been reports of many nests still producing hatchlings after the stormy conditions beaches experienced in September.



An incubating sea turtle nest with standing water on top it, on Holden Beach, NC in September 2017. This nest had 0% hatching success.



A sea turtle nest on Shackleford Banks that was overwashed several times in September 2017, and had extra sand deposited on top of the nest. The original top of the nest was exposed with a shovel after emergence of the hatchlings. This nest had 90% hatching success.

Banding Terns, Cormorants and Pelicans Continues along Coast

During July and early August, the Wildlife Commission’s Waterbirds Investigations and Management Project staff banded tern and pelican chicks on islands in North Carolina’s coastal region.

Royal terns, sandwich terns and brown pelicans have been banded annually with partner, John Weske,

since the late 1970s when populations of these species were beginning to rebound from poor reproductive rates affected by pollutants such as DDT, and from habitat losses. With halted disposal of most chemicals into North Carolina’s waters and wetlands in the mid-1970s, as well as a focused waterbird management plan by the Wildlife Commission and partners in the early 1980s, pelican and tern populations rebounded significantly.

The continued banding of pelican and tern chicks provides data on their dispersal and migration, behavior

and social structure, life-span and survival rates, reproductive success, and population growth. In 2017, Wildlife Commission staff, partners and volunteers banded 3,804 brown pelican, 7,893 royal tern, 1,851 sandwich tern, three Caspian tern and 32 double-crested cormorant chicks.

A key partner, Audubon NC, manages several islands within the Lower Cape Fear River, and a group of small islands near Ocracoke Inlet and in Core Sound. Many of the pelicans and terns banded were on these islands.



Wildlife Diversity Biologist Dr. Sara Schweitzer bands a brown pelican while a volunteer secures the bird.



Volunteer with banded brown pelican



Banding royal and sandwich tern chicks with volunteers on Big Foot Island.

More than 900 Red Spruce Planted to Create Better Habitat for Rare Wildlife Species

Since the inception of the Southern Appalachian Spruce Restoration Initiative (SASRI), Wildlife Diversity Program biologists have been eyeing a degraded section of high elevation forest in Haywood County for SASRI's first red spruce restoration project. The forest, situated south of the Flat Laurel Branch Trail, was impacted by logging and two severe wildfires in the early 1900s. Hardwood trees recovered faster than red spruce in burned areas, leaving today's hardwood-dominated stands. Boosting the conifer component will improve habitat for Carolina northern flying squirrels, red crossbills and other species that use mixed spruce-fir and northern hardwood forest.

Wildlife Diversity staff and partners, such as the United States Forest Service and U.S. Fish and

Wildlife Service, formed the Flat Laurel Spruce Collaborative and used SASRI's Spruce Restoration Plan, a map of current spruce overstory density, and understory vegetation data collected by former Warren Wilson College student Bo Dossett, to develop a prescription. Where advanced regeneration of spruce was scarce, seedlings grown by the Southern Highlands Reserve would be planted; where they were not scarce, existing seedlings and saplings would be released by girdling or cutting overtopping hardwoods. Although this project area was a top candidate for restoration, the project faced some challenges to make sure the project complied with the Nantahala Pisgah Forest Land and Resources Management Plan, National Environmental Policy Act and

National Historic Preservation Act. In addition, its location approximately 1 mile from the nearest road presented a logistic challenge and, simultaneously, an opportunity for engagement with forest visitors.

Over 40 volunteers from 10 organizations spent 1½ days hiking seedlings into the project site. Given the high visibility of the project, volunteers talked with hikers about spruce and squirrels at an information booth set up in the Black Balsam parking lot. Forestry and wildlife students from Haywood Community College and Warren Wilson College then planted more than 900 seedlings over the course of five days. The schools are establishing long-term monitoring plots to track seedling growth and survival.



Jeremy Peyton and Brandy Benz of the U.S. Forest Service use a bamboo pole to hoist bags of spruce seedlings. (Photo Chris Kelly)



Warren Wilson College student Robert Townsend plants a red spruce seedling. (Photo by Chris Kelly)

Partnerships Are Key to Protection of Mountain Bogs

Multiple conservation entities have been collaborating to protect rare mountain bogs in western North Carolina. Recently, the Wildlife Commission has been working closely with the U.S. Fish and Wildlife Service - Asheville Field Office (USFWS), The Nature Conservancy (TNC), Blue Ridge Conservancy (BRC), Blue Ridge Parkway (BRP) and Project Bog Turtle (PBT) on formulating a strategy to protect a handful of sites in Ashe, Alleghany and Henderson counties. These conservation groups share the common goal of protecting as many mountain bogs as possible due to their rare and unique natural communities, which provide essential habitat for threatened bog turtles. The sites targeted for protection are all within the Conservation Partnership Areas (CPAs) identified by the USFWS for the [Mountain Bogs National Wildlife Refuge](http://fws.gov/refuge/MountainBogs) ([fws.gov/refuge/Mountain Bogs](http://fws.gov/refuge/MountainBogs))

Wildlife Commission staff played a key role in identifying the best plan of action and each site was evaluated separately to determine the best course of action. For some sites, it was important for various reasons—such as imminent sale or habitat degradation—to move quickly towards purchase of the property and with others, staff may have more time. Staff have found funding for a

few sites and for the others, they are still working to identify and apply for grants to help fund protection efforts.

A key component of successfully protecting these sites is building relationships over many years with the private landowners. Through building trust and sometimes greater interest in their wetlands, staff have influenced outcomes in a positive way. For example, many landowners initially refuse to even discuss selling their land or setting up a conservation easement, but many years later, they change their minds and are willing to consider options to conserve these important habitats.

Patience and good communication have paid off for protection of a bog in Ashe County that has a bog turtle population. All three of the owners whose land contains the majority of this wetland complex are elderly and did not originally have a plan for their land. The Wildlife Commission has built a strong

relationship with the landowners going back to 2002 when staff first discovered bog turtles there, and this has made a difference. The landowners have warmed to the idea of selling the portion of their land that contains the wetland. To move quickly and not miss this opportunity, the Wildlife Commission brought TNC to the table. Thus, the Wildlife Commission has played a very important role in the negotiations and communications with the landowners due to the trust they have in agency staff. TNC is an important partner because it shares the agency's goal of protecting these rare mountain bog communities and it has the ability to raise funds and purchase property relatively quickly. TNC is moving forward on this purchase and everyone involved is excited that they may be able to protect this mountain bog and the associated bog turtle population in perpetuity.



The Wildlife Commission and TNC have partnered to help protect this privately owned mountain bog in Ashe County.

Biologists Complete Research on Agrochemicals Impacts on Hellbender Habitat

In the third quarter, Wildlife Diversity Program staff and partners completed collaborative research examining the bioavailability and potential impacts of widely used agrochemicals (e.g., atrazine and glyphosate) and heavy metals (e.g., cadmium, mercury, and lead) in river habitats of eastern hellbender, a Species of Greatest Conservation Need and a state Special Concern species.

The joint project between the Wildlife Commission and Tennessee State University was designed to use water quality assessments to examine correlations between these toxins and hellbender populations. Biologists are interested in how the accumulation of chemical pollutants may have historically impacted, or continues to impact, hellbender populations. They need to increase their understanding of land use effects on water quality and aquatic wildlife, particularly hellbender populations. Field methods included collecting water and soil samples at 15 sites each in North Carolina and Tennessee that represented a gradient of agricultural land use (high to low) as well as a gradient of hellbender population health (stable to declining or presumed extirpated).

Staff used a hand-held meter to record water quality parameters during each sampling event, such as



Eastern hellbender on river substrate; in summer 2017, hellbender habitat was the subject of a water toxicology study between Tennessee State University and the Wildlife Commission. (Photo Lori Williams)

temperature, dissolved oxygen, turbidity, conductivity, pH, salinity, and total dissolved solids. Staff collected sediment samples once at the end of the summer. Biologists deployed water sampling devices three times over the summer for 48 hours each. The device itself was a novel design that consisted of two lengths of semi-permeable dialysis tubing filled with deionized water and placed in a protective, mesh sleeve. The sleeve was secured and weighted down on the ends and tied off to a stake from the river bank. Devices were nestled down within river sediment at or under suitable hellbender shelter rocks (large, flat boulders). The theory was that the dialysis tubing itself mim-

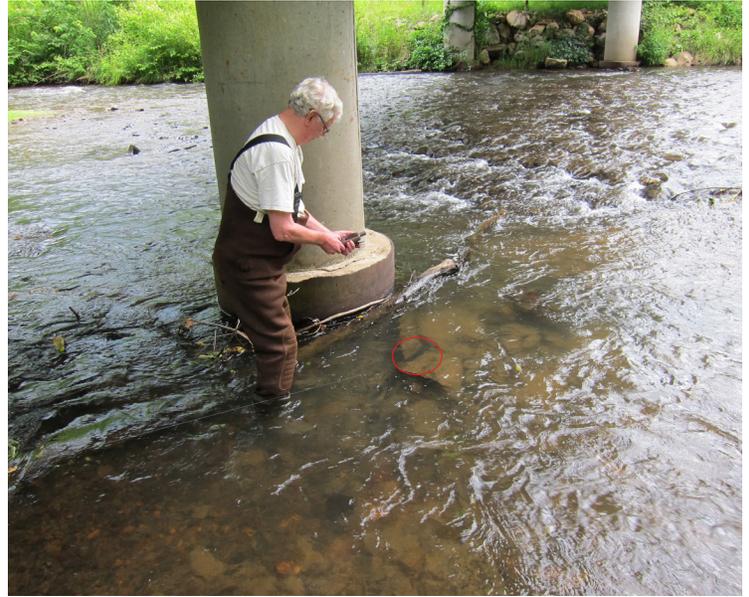
ics the semi-permeable skin of a hellbender and thus could serve as a proxy for the animal in the same microhabitat. Samples were collected over the course of the summer growing season when herbicides or other agrochemicals are broadly applied on the landscape and which may then run off into waterways as aquatic contaminants.

Samples are currently in lab analysis. Information gained from this work will help biologists understand factors that may contribute to hellbender declines and whether relationships exist between agricultural land use, bioavailability of chemical pollutants, and hellbender population status.

Biologists Complete Research on Agrochemicals Impacts on Hellbender Habitat (continued)



Wildlife Diversity staff inserts dialysis tubing filled with deionized water into a protective sleeve to be installed at eastern hellbender habitats to determine agrochemical and heavy metal presence in rivers; the membrane of the dialysis tubing mimics a hellbender's semi-permeable skin. (Photo John Groves)



Project collaborator, John Groves (Curator Emeritus, NC Zoo) records a GPS point after installing a water sampling device, circled in red. (Photo Lori Williams)



A water quality meter in use at a study site, measuring parameters such as temperature, pH, conductivity, dissolved oxygen, turbidity, salinity, and total dissolved solids. (Photo Lori Williams)



Wildlife Diversity staff collects a river sediment sample for heavy metal testing. (Photo Lori Williams)

Staff Conduct Yellow Lance Surveys in Tar and Neuse Rivers

During this quarter, Aquatic Wildlife Diversity staff continued status assessment surveys for yellow lance in the Tar and Neuse rivers. They found yellow lances at three of the 20 sites surveyed. They found one very small individual (18 mm) at a new locality in the Tar River, indicating recent recruitment. Another survey location in Shocco Creek represents the first yellow lance observation in 12 years. In

addition, during a survey in Fishing Creek, staff discovered seven individuals, which were retained and transported to the Wildlife Commission's Marion Conservation Aquaculture Center for future captive propagation efforts. Staff plan to complete the yellow lance surveys in the Tar and Neuse River basins in 2018, as well as identify locations for future augmentation efforts.



Aquatic Wildlife Diversity staff conduct status assessment surveys for yellow lance in the Tar and Neuse Rivers. (Photo NCWRC)



Yellow lance (Photo NCWRC)

Staff Conduct Brook Floater Surveys in Cape Fear and Yadkin-Pee Dee River Basins

Status assessment surveys continued for the brook floater in the upper Cape Fear and mid/lower Yadkin-Pee Dee river basins in central North Carolina. These mussels have been detected at eight of 44 sites in 33 streams sampled during this period and samples of genetic material from each individual were added to the population diversity analysis. This species has been found at very low densities in the study area, comprising less than 0.1% of the total abundance of mussels at any one site.

Additional Species of Greatest Conservation Need collected include the Triangle floater, chameleon lampmussel, Savannah lilliput, notched rainbow, Eastern creekshell, and Carolina Creekshell. Surveys will continue in 2018.



Swabbing a brook floater for genetic analysis. (Photo NCWRC)

Staff Conduct Mussel Surveys in Pee Dee River

The Pee Dee River, in south-central North Carolina, supports abundant and diverse mussel populations. In 2017, with help from partners including Duke Energy/Progress and NC State Parks, Wildlife Commission staff continued their biennial surveys for priority mussel species in downstream of Blewett Falls, Tillery, and Falls dams.

These data are providing biologists with a unique opportunity to document the potential changes in mussel diversity and abundance due to the improved water quality (higher dissolved oxygen) and minimum flows downstream of these dams that are part of the Federal Energy Regulatory Commission (FERC) license for Duke Energy/Progress and Cube Hydro.

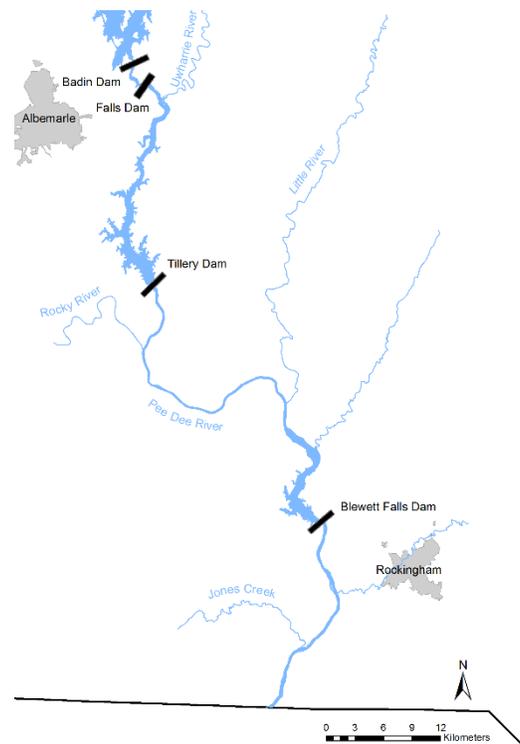
The mean density (2009-2017) of all mussel species combined was the highest below Blewett Falls Dam (25.6/

m²), the furthest downstream dam in the Pee Dee River, where species diversity was also highest (13 species) and the density was 11.7/m² below Tillery Dam. The study site downstream of Falls Dam had the least diversity (7 species) and lowest density of mussels (4.1/m²). Since 2009, the density of mussels has remained stable at the Tillery study site, but declined at the Falls site in 2017. Mussel density at the Blewett Falls site, after increasing from 19.3/m² in 2009 to 30.9/m² in 2013, decreased in 2015, but had rebounded to 31.4/m² in 2017. Species diversity has remained similar at all three sites across recent survey cycles.

Staff collected several Species of Greatest Conservation Need including the yellow lampmussel, Eastern lampmussel, Carolina creekshell and Eastern ccreekshell.



Gravid female yellow lampmussel with display lure. (Photo Brena Jones)



Mussel Monitoring Area Map – Pee Dee River

Lake Waccamaw Fish and Mussel Monitoring Surveys Update

Since 2009, Wildlife Commission staff have conducted annual standardized surveys for rare fishes at several sites in Lake Waccamaw, including the endemic, federally Threatened Waccamaw silverside. Project partners include N.C. State Parks, U.S. Fish and Wildlife Service, and N.C. State University.

The overall mean number of Waccamaw silversides collected per minute of seining (catch rate) has been highly variable over the eight sampling years and was 1.8 fish/minute of seining in 2017. The mean catch rate was the highest in 2009 at 23.5 fish/minute and in 2017, the highest catch rate at a single site was 6.9 fish/minute. This variability in catch rate is expected due to the fish's schooling behavior, preference for open waters of the lake, and variable sampling

conditions. 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 are completed biennially since 2009. Mussel populations persist at a relatively stable overall mean density ranging from 23 to 28 individuals/m², although local densities for some species are lower than those in historical surveys.

The Waccamaw spike has shown increased population densities compared to previous surveys and several species that did not occur in historical surveys have been collected during these monitoring efforts, including the yellow lampmussel, the rayed pink fatmucket, and a species



Waccamaw killifish. (Photo Brena Jones)

of lanceolate *Elliptio*. The Waccamaw spike and Tidewater mucket were the most abundant mollusk species found in study sites. Densities of some snail species have declined, nearing the lower limit of detection during visual surveys, although the cause remains unknown. Two species of micro-snails endemic to the lake, the Waccamaw siltsnail and the Waccamaw snail, which are sampled using a petit ponar substrate grab, have increased in combined mean density across sampling sites, from 121/m² in 2013 to 316/m² in 2017.

Rocky River Mussel Surveys Update

Staff continued surveys for native mussel species in the tailrace of Hoosier Dam in the Rocky River in Chatham County. Dewatering of the impoundment was completed in August of 2017 and dam removal is planned for 2018. Staff conducted four surveys in the previously impounded area during the controlled dewatering process. Seven Savannah lilliput (State Endangered) were collected from dewatered areas, PIT tagged, and

relocated. Staff also trained employees of the project management firm, Unique Places, to relocate other, more common mussel species in the impoundment to appropriate habitat as water levels receded. Of 22 previously tagged Savannah lilliput, 16 have been detected at least once during monitoring efforts since relocation and all were alive except one. Staff will continue surveys and monitoring through 2018.



Dewatered impoundment behind Hoosier Dam in fall 2017. Treeline indicates former water level. Exposed banks have been seeded for stability. (Photo NCWRC)