

2019 SURVEYS & RESEARCH PROGRAM SUMMARY REPORT



N.C. Wildlife Resources Commission
Wildlife Management Division
919-707-0050
ncwildlife.org

The North Carolina Wildlife Resources Commission's Surveys & Research (S&R) Program is housed within the agency's Wildlife Management Division. Program responsibilities principally include surveys, research and regulations for game and furbearer species. This report represents an overview of many of the recurring survey activities and current research within the S&R Program for fiscal year 2018-19. Information included herein does not represent the full report on these individual activities. For most activities, more thorough and detailed reports are available and can be found on our website (ncwildlife.org) or by request.

Many of the activities highlighted in this report could not be accomplished without the commitment and effort of numerous employees throughout all divisions of the agency. We especially want to acknowledge staff of the Private Lands Program in the Wildlife Management Division and staff of the Land & Water Access Division for their year-round commitment to many of these projects.

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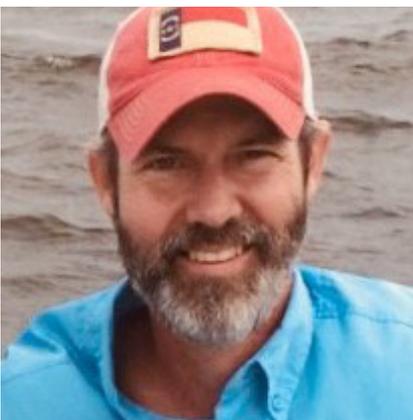


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Cover photos (l to r, clockwise): Chris Kreh, Upland Game Bird Biologist monitors an acoustic recorder, Wood duck in a trap; Coastal Region Private Lands Supervisor Evin Stanford (right) collects biological data from a harvested deer

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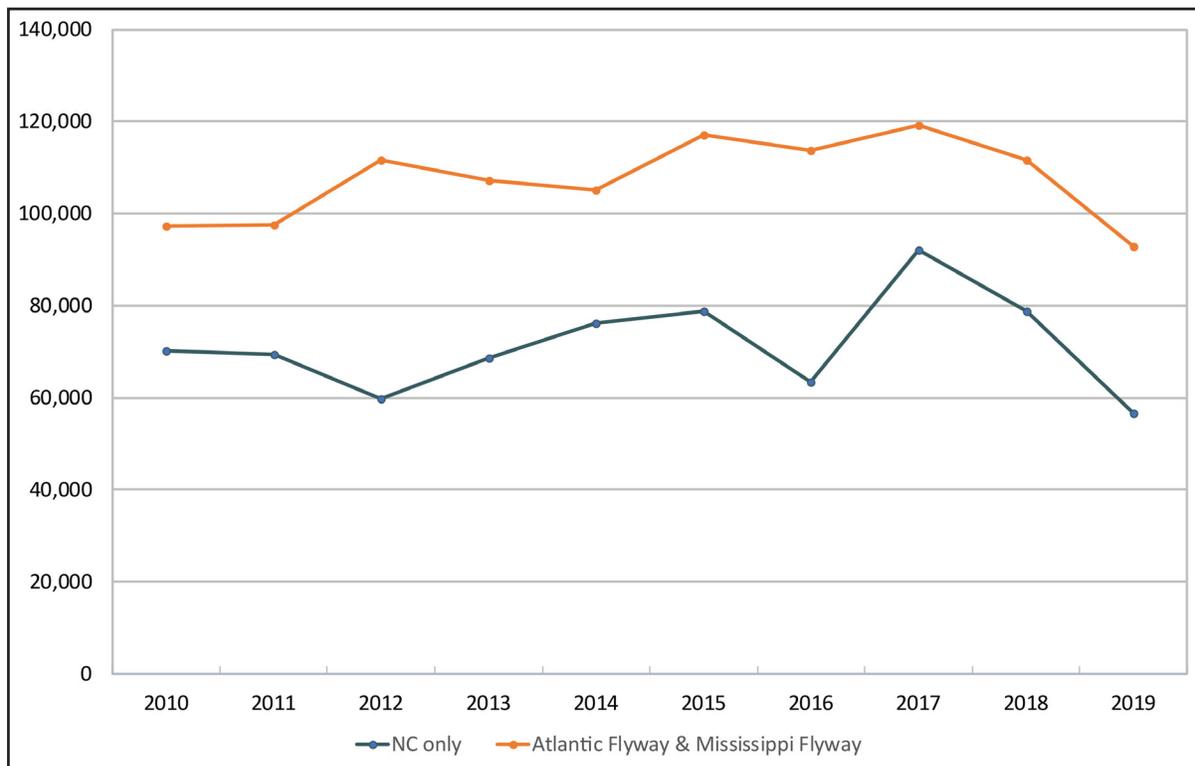
Migratory Game Birds

Aerial Waterfowl Surveys

The mid-winter waterfowl survey, conducted annually in cooperation with the U.S. Fish & Wildlife Service (USFWS), is a coastal aerial survey that focuses on estimating numbers of tundra swans and Atlantic brant. Permit allocation among tundra swan hunt states is based on the combined Atlantic and Mississippi Flyway mid-winter surveys. Observed numbers of brant in the Atlantic Flyway inform the annual USFWS brant harvest decision. Agency staff also continue to count Canada geese in the Northeast Hunt Zone during the survey to monitor trends in migrant numbers of this species in northeast North Carolina.

For the 2019 survey, due to a federal government shutdown, the USFWS was not able to provide aircraft assistance. Without the ability to utilize the services of the USFWS float plane, staff were not able to survey some sections of the southern Outer Banks (Hatteras/Ocracoke) and the Pamlico County/Cedar Island area. Typically, these areas hold very few tundra swans and Canada geese; however, the area not surveyed in 2019 typically contains North Carolina's wintering brant population. During the January 2019 survey, staff observed 56,681 tun-

dra swans and 10,806 Canada geese. They observed no brant. The number of tundra swans observed was 28% lower than 2018 and 22% lower than the previous nine-year average. In addition, the three-year running average for the combined Atlantic Flyway and Mississippi Flyway tundra swan count fell below 110,000 birds. In accordance with the Tundra Swan Management Plan, this will necessitate a reduction in available permits for the 2020-21 hunting season. Numbers of Canada geese in the Northeast Hunt Zone were 40% lower than the 2018 estimate and 32% lower than the previous 9-year average.



Numbers of tundra swans observed in North Carolina's mid-winter waterfowl survey and the combined survey total for the Atlantic & Mississippi Flyways.

Aerial Waterfowl Surveys (continued)

2019 marked the 6th year of a helicopter-based survey for breeding black ducks in North Carolina’s coastal marshes. The survey, occurring in mid-April each year, includes all significant coastal marsh habitat from

Cedar Island north to the Virginia state line. In the first three years, staff made a number of changes to survey procedures, but have maintained a consistent sampling design since 2016. In spring 2019,

they estimated 1,478 pairs of breeding black ducks and 3,302 total black ducks. The 2019 estimates are the highest since they began the survey in 2014 and suggest excellent production and survival the previous year.

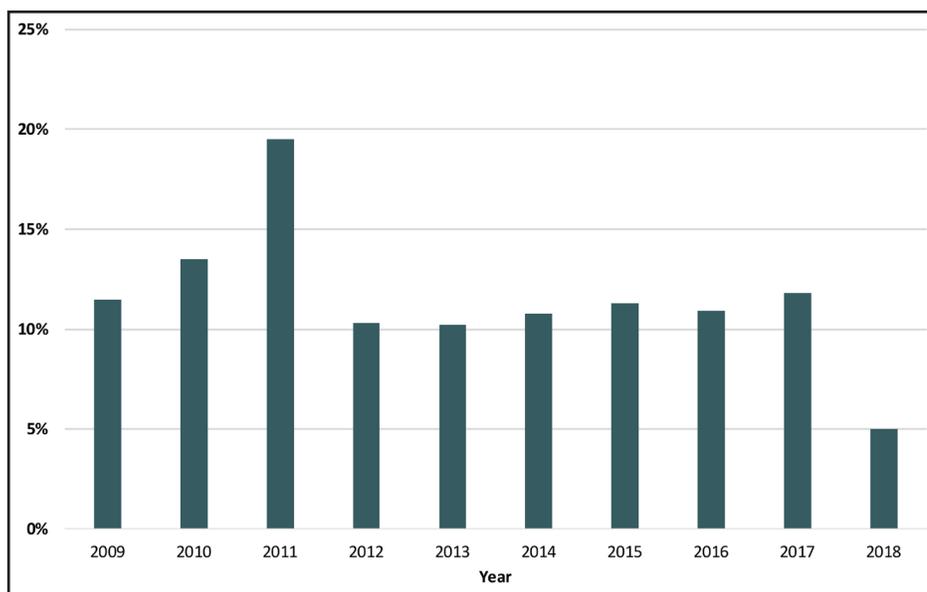
Tundra Swan Productivity Survey

Since the late 1970s, NCWRC staff, biologists with the U.S. Fish & Wildlife Service and wildlife agency staff in other Atlantic Flyway states annually conduct a productivity survey of eastern population tundra swans. In North Carolina, the survey is conducted in December, prior to any substantial harvest occurring. Observers determine the number of adult (white plumage) and juvenile (gray plumage) swans in wintering flocks across the Coastal plain. Juvenile swans lose their gray plumage in late winter, so the ratio of immature to adult swans at this time

can be used as an indicator of annual production. The combined survey across all Atlantic Flyway states that have wintering tundra swans serves as a long-term index to assess this important population parameter.

In 2008, Atlantic Flyway partners modified survey methodology to provide a more representative and consistent sampling and reporting protocol. Total numbers of swans observed in the flyway for this survey average approximately 20-25,000 swans with North Carolina

normally accounting for 70% of the total surveyed swans. The fall 2018 survey in the Atlantic Flyway estimated that 5% of surveyed swans consisted of juvenile swans. This is the lowest percentage recorded in the last 10 years and the lowest since 1992. Recent declines in productivity have also been observed in other arctic nesting waterfowl including Atlantic brant and Atlantic Population Canada geese due to poor nesting conditions, (i.e., snow and ice cover) upon their arrival on their breeding grounds.



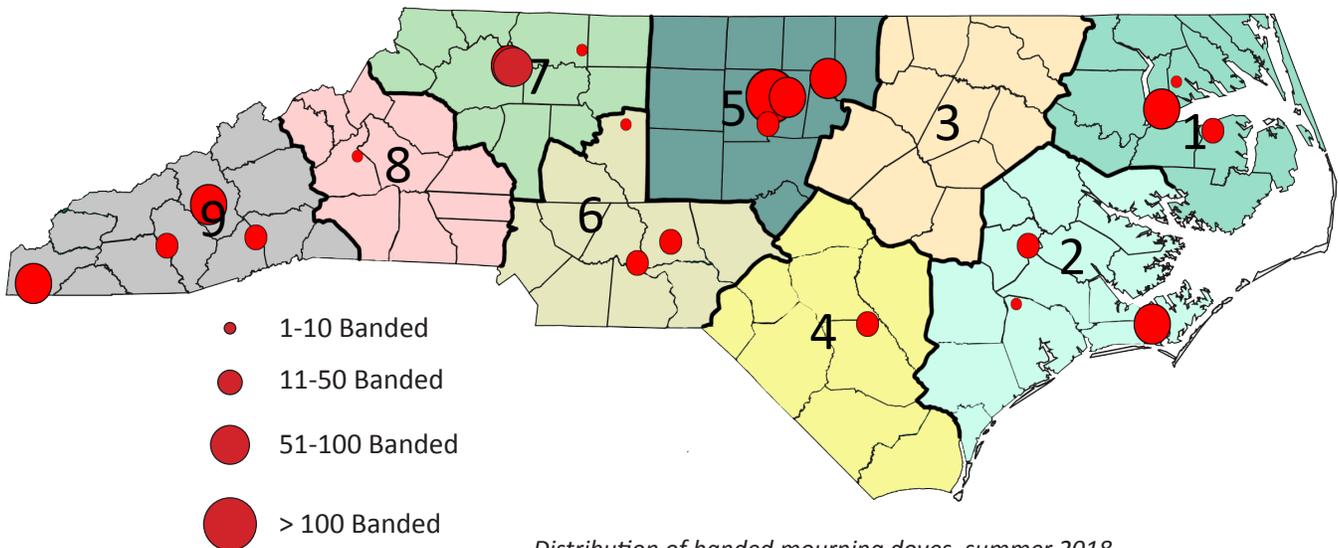
Percent of juvenile tundra swans in the Atlantic Flyway as determined by winter productivity surveys.

Dove Banding

As part of a nationwide program since 2003, agency staff each summer (July-August) capture and band mourning doves in order to better understand harvest and survival rates. Data obtained from these efforts directly

inform a harvest strategy used to guide hunting seasons in the Eastern Dove Management Unit, an administrative boundary that includes all dove hunting states east of the Mississippi river. In summer

2018, staff banded 1,048 mourning doves. This represents a slight increase of 4% from the previous year's total and is 22% below the annual banding goal of 1,345 doves. Most doves (74%) were banded in districts 1, 5 and 9.



Distribution of banded mourning doves, summer 2018.

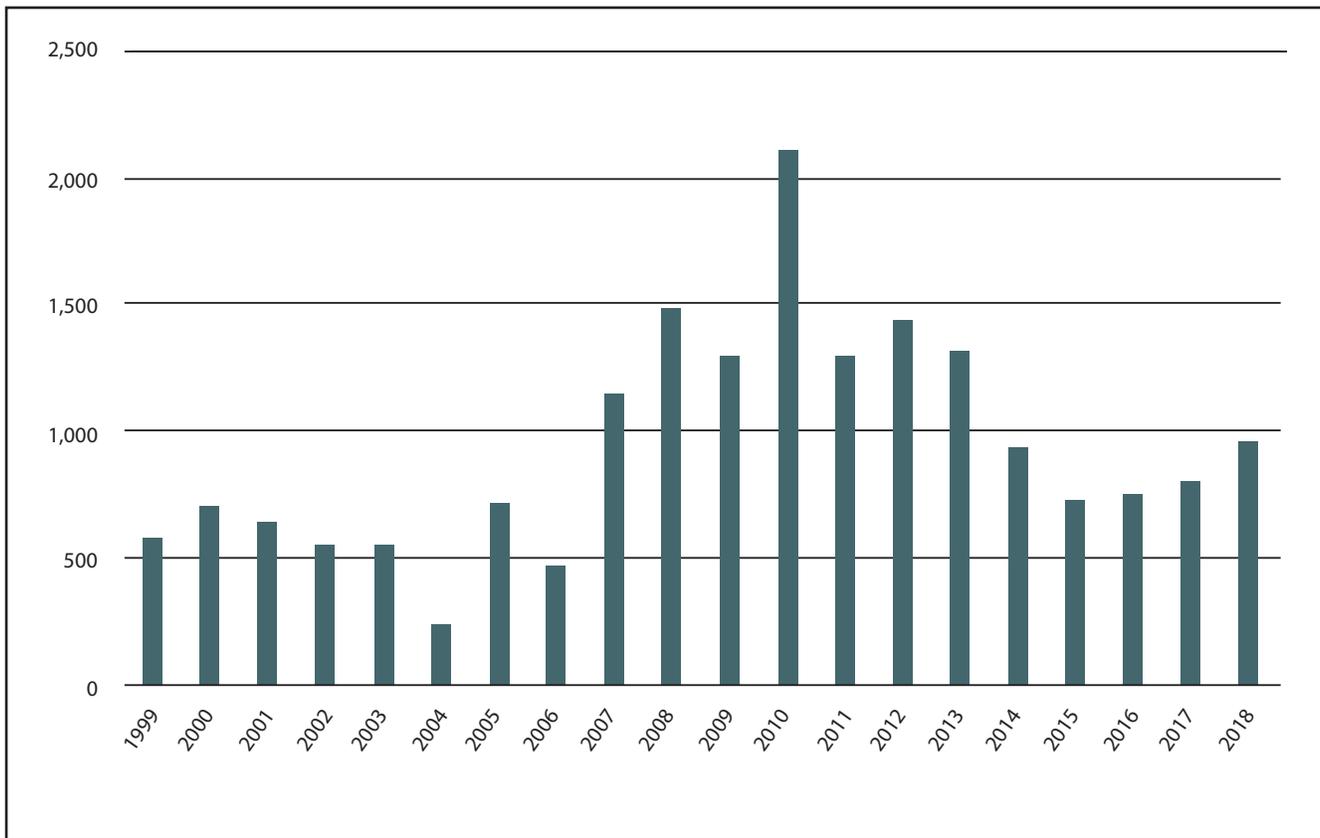
Wood Duck Banding & Wood Duck Nest Box Monitoring

As part of their long-term and ongoing monitoring efforts, agency staff continue to capture and band wood ducks each summer during July-September. When combined with similar efforts by other state wildlife agencies and the U.S. Fish and Wildlife Service, the data obtained from hunter band recoveries provide critical information (harvest and survival rates) that is needed to appropriately monitor and manage the harvest of wood duck populations. During the 2018 banding

period, staff captured and banded 962 wood ducks statewide, representing a 20% increase from the previous year but a 21% decrease from the previous 10-year average. Despite the recent decline in banding totals, the NCWRC is routinely among the leaders in numbers of wood ducks banded in the Atlantic Flyway each year.

Staff continue to maintain and monitor over 500 wood duck nest boxes located in public wa-

ters in District 1 (northeastern North Carolina). These wood duck boxes originated from an agency program called "Operation Wood Duck" that began in the late 1980s. For the 2018 nesting season, staff estimated a nest success rate of 67% from 427 nesting attempts. This compares to a long-term nest success rate of 67%. Nearly 3,000 ducklings were produced, and since the inception of the program, staff estimate nearly 70,000 ducklings produced.



Numbers of wood ducks banded by the NCWRC, 1999-2018.

Migratory Game Bird Harvest and Hunter Activity

Harvest and hunter participation estimates for most migratory game birds in North Carolina are generated by the U.S. Fish & Wildlife Service through the Harvest Information Program (HIP) and through NCWRC annual hunter harvest surveys. Estimates of harvest and hunter participation for tundra swans, Canada geese in the Northeast Hunt Zone and light geese (snow and Ross’s geese) during the Light Goose Conservation Order Season as

determined by NCWRC surveys are as follows: In accordance with the approved Tundra Swan Management Plan, 6,250 permits were allocated to North Carolina for the 2018-19 season. During the 2018-19 hunting season, an estimated 5,265 swan hunters hunted 12,149 hunter days. Estimated numbers of swan hunters remain unchanged from the previous year, but swan hunter days increased 6% from 2017-18. An

estimated 2,869 tundra swans were killed during the 2018-19 season representing a 12% decrease from the previous season. Staff estimated 1,493 hunters killed 500 Canada geese (includes unretrieved birds) during the 14-day Canada goose season in the Northeast Hunt Zone; a 25% decrease from the previous season. Additionally, 101 hunters reported harvesting 409 light geese during the spring 2019 Light Goose Conservation Order Season.

Woodcock Migration Ecology Project

The American woodcock is a migratory forest bird that has experienced population declines of 0.8% per year for the past five decades. Relatively little is known about woodcock migration compared to other life phases, but recent advances in tracking technology have facilitated the ability to follow movements of individual woodcock during migration at a level not previously possible. In 2018, NCWRC entered into a collaboration with the University of Maine, 10 states, and two Canadian provinces that represent the woodcock breed-

ing, stopover, and wintering range in eastern North America.

The objectives of the Eastern Woodcock Migration Ecology Project are to describe the migration ecology of American woodcock over five years using Global Positioning System (GPS) transmitters. Woodcock are captured at night using handheld spotlights and nets, then fitted with a GPS transmitter before being released. So far, 3,296 locations from 112 transmitters have been collected, including locations from breed-

ing, migration and wintering areas. In North Carolina, NCWRC biologists and staff captured and fitted six woodcock with transmitters during February 2019 at Butner Falls of Neuse Game Land. Four wintering woodcock captured in North Carolina migrated to New York (1), and Quebec (2) and New Brunswick (1) in Canada. During the next three years, NCWRC biologists and staff will expand their efforts and will deploy 15 transmitters each year that will also include woodcock capture sites in the Coastal plain and mountains.



American woodcock (Photo: NCWRC)



Left to right – Chris Baranski (Northern Piedmont Land & Water Access Management Biologist) and Land & Water Access Butner Crew members Brandon Hyde & Caleb Lippard hold a captured woodcock as part of the Woodcock Migration Ecology Project. (Photo: NCWRC)

Black Bears

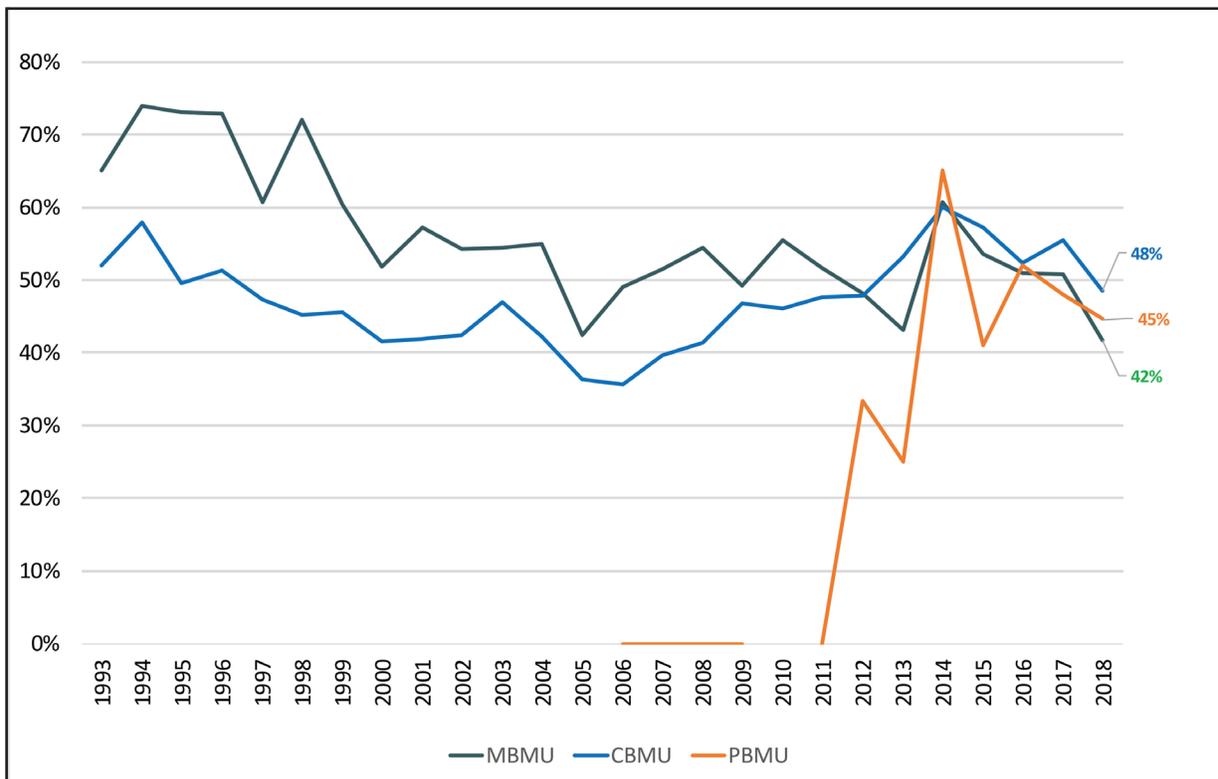
For more information on black bears, including the Black Bear Annual Report in North Carolina, visit: ncwildlife.org/bear and click “Surveys and Reports” tab.

Black Bear Cooperator Program

Mortality information from harvested bears, including the collection of premolar teeth and weights, began in 1969 under the voluntary Black Bear Cooperator Program. Age and sex information gathered from biological samples are used for analyzing the age structure of the harvested population and for population reconstruction modeling. During the 2018-19 bear hunting season, the NCWRC collected 1,609 upper pre-molars from cooperating hunters

(977 Coastal Bear Management Unit (CBMU), 611 Mountain Bear Management Unit (MBMU), 21 Piedmont Bear Management Unit (PBMU). The number of bear teeth submitted by hunters statewide has declined since the 1990s from 57-64% to 46% in 2018, despite intensive efforts expended by staff during the bear hunting seasons. To increase submission rates, the NCWRC, in 2014, started mailing bear coop-

erator envelopes to all holders of the Bear E-stamp prior to and during the regulated bear hunting season. Tooth submission rates in all three management units declined. Submission rates were 48% in the CBMU, 42% in the MBMU and 45% in the PBMU. Bear houndsmen participation in the Bear Cooperator Program has been substantially higher than participation by still hunters; in 2018, 51% of houndsmen and 36% of still hunters who harvested a bear also submitted biological information.



Bear tooth submission rates, 1993-2018, for the MBMU (Mountain Bear Management Unit, CBMU (Coastal Bear Management Unit and PBMU (Piedmont Bear Management Unit).

Mast Surveys

Mountain hard mast (acorns, hickory nuts, etc.) surveys were conducted along 12 routes in fall 2018 with nearly 1,400 trees sampled. The hard mast crop was rated as poor with an overall index of 1.58. This represented a decrease from the previous year's "fair" mast crop (index of 3.44). Since 1983, North Carolina has experienced 12 years out of 36 years in which the hard mast index was rated as poor. White oaks, hickories and beech all

rated as poor and below the long-term average. Red oaks rated as fair, but also below the long-term average.

The fall soft mast (fruits, berries, etc.) survey was conducted in conjunction with the hard mast survey. Overall, soft mast production was below the production observed in 2017; grape was slightly above the long-term average while pokeberry, cherry

and blackgum were below long-term averages. Pokeberry, cherry and black gum rated as poor, while grape produced fair crops. Although the impetus for the hard mast survey was related to a desire to better understand annual hard mast production and its impacts on black bear populations, hard mast is an important food source for many species of wildlife and is important to monitor for its multi-species impacts.

Bear E-Stamp Surveys

Using the bear e-stamp holder database for the 2018 bear hunting season, staff mailed 83,183 bear hunter surveys in late January 2019. Staff received 30,188 responses (37% response rate) and similar to the 2017 season, 61% of respondents had not hunted black bears prior to the 2018 bear hunting season. Similar to the results from previous years, 29% of respondents reported they had no intentions to hunt bear (got the bear e-stamp because it was free or didn't know they had a bear e-stamp). Thirty-four percent responded they usually hunt bears and planned on doing so during the 2018 bear hunting season while 27% percent of respondents consider themselves a bear hunter. When asked to describe their bear hunting efforts during the 2018 bear hunting season, 14% of respondents specifi-

cally hunted for bear, 51% hunted for other game species but may have taken a bear, and 35% did not hunt for bears. These descriptions of bear hunting efforts have remained very consistent since the inception of the survey. Of the hunters who described they hunted specifically for bear during the 2018 season, 58% reported hound hunting and 42% reported still/

stand hunting—similar to the previous year. Six percent of respondents who hunted during the 2018 season were successful at harvesting a bear. Fifty percent of successful respondents used dogs to harvest their bear, while 50% reported harvesting their bear by still hunting. Fifty-seven percent of successful respondents reported using the aid of unprocessed food to harvest their bear.



Female black bear at Cades Cove
(Photo: Zach N-Wikimedia)

BearWise Program

In 2018, the Southeastern Association of Fish & Wildlife Agencies' (SEAFWA) Large Carnivore Working Group, comprising the state bear biologist from each SEAFWA member state, developed BearWise (bearwise.org), a regional program to help people live responsibly with black bears. To achieve this, BearWise shares ways to prevent conflicts, provides credible resources to resolve problems, and encourages community initiatives to keep bears wild.

During the year, the agency's BearWise Committee developed a certification process and a brochure (ncwildlife.org/bearwise-certification) for neighborhoods, towns, businesses, campgrounds, parks, colleges, or other type of land-based organizations to become BearWise-Certified. BearWise-certified communities commit to co-existing responsibly

with bears, securing all potential food sources, and knowing when and how to report bear activity. One of the most effective ways to reduce human-bear interactions is to secure trash. But most waste service providers do not offer bear-resistant trash cans. In response, the agency's BearWise Committee, in collaboration with Asheville Sanitation, the Western North Carolina Nature Center, and Uno the Bear, tested various trash cans that had been retro-fitted to try to make them bear-resistant. A brochure also was created that provides a list of certified bear-resistant trash cans and where to purchase (ncwildlife.org/bear). Click the tab "Have a Problem?" to download this brochure). To



promote BearWise, seven BearWise Technical Guidance boxes were developed for Commission staff, outreach materials were created for Commission staff and partners to distribute, BearWise was promoted on the Commission's Facebook page, and the BearWise Committee conducted approximately 59 BearWise outreach events with an estimated 9,500 people in attendance. In addition, BearWise was a featured theme at the 2018 Mountain State Fair.



Left to right, Colleen Olfenbuttel (Black Bear/Furbearer Biologist) and Chris Turner (District 1 Wildlife Biologist) promote the BearWise Program at Plymouth's Black Bear Festival. (Photo: NCWRC)

Movements & Survival of Rehabilitated Bear Cubs

As part of the agency's bear cub rehabilitation program, staff, in collaboration with the University of North Carolina Wilmington, have monitored the movements and survival of released, rehabilitated black bears. The objective is to determine if any of the rehabilitated bears establish a home range or continue to be a transient, quantify the average distance moved from the release lo-

cation and average rate of movement per day, and determine if the release location affects the first-year survival and movement patterns. Rehabilitated bears are released when they are about 1.5 years old, which is a period of time of natural family break-up and when early summer foods are emerging. Since 2015, 34 bears have been fitted with

Vectronic GPS collars upon release from the Commission's rehab facility. In summer 2018, nine bears (three males, six females) were released in the mountains and Coastal Plain regions. The GPS collars record the bears' locations every 2 hours until the collar is either manually removed after legal harvest, slips off, or is remotely blown off after approximately 12 months.



Casey Dukes (Wildlife Conservation Biologist I) fits a bear with a GPS collar as part of the agency's review of the bear cub rehabilitation program. (Photo: NCWRC)

Furbearers

For more information, including reports, on furbearers and trapping in North Carolina, see also:

ncwildlife.org/trapping

Raccoon Field Trial Survey

Data were collected on raccoon field trials conducted from May 1987 through February 2019. Data collected included total time hunted by each cast (individual timed event), the number of dogs in each cast, and the number of raccoons observed. Since 1987, raccoon hunting clubs have reported 23,786 field trial casts with

42,794 raccoons observed. The statewide hunting success (0.99 coons/hour) was lower than the last survey year (1.02 raccoons/hour), but slightly above the 30-year average (0.93 raccoons/hour). Data indicate that the Piedmont (1.17 raccoons/hour) and Mountain (0.84 raccoons/

hour) regions saw a decrease in the number of raccoons seen per hour, while the Coastal Plain (0.96 raccoons/hour) region saw a very minor increase in the number of raccoons seen per hour. Despite low participation (25%) in the survey, the number of surveys returned has remained stable over time.

Eastern Spotted Skunk Population Camera Survey

Since January 2015, North Carolina, in coordination with Clemson University, has conducted a winter camera survey to document presence of Eastern Spotted Skunks. Unlike striped skunks that are distributed nearly statewide, spotted skunks in North Carolina are found only in the western part of the state at mid- to upper elevations. If there are enough detections, staff hope to use the data to identify individuals, determine habitat

preference, and track trends in the population. Until winter 2017, detections were low due to the camera brand being used. In winter 2017, staff established 51 camera sites using Bushnell HD Aggressor cameras and detected nine Eastern Spotted skunks, a 300% increase in detections compared to 2016. For the winter 2018 and 2019 surveys, they set-up cameras at the same sites as in 2016.

They established cameras at the same sites to determine how much camera brand influenced non-detectability of spotted skunks in 2015 and 2016. In 2018, staff detected 45 spotted skunks and in 2019, they detected 94 spotted skunks. Staff are currently reviewing the 2018 and 2019 photos to determine how many detections were individual skunks. Since surveys started, staff have detected spotted skunks at 26 different sites in North Carolina.



Eastern spotted skunk
(Photo: John MacGregor)

Pilot Camera Survey of Weasels

Weasels are rarely observed in the southeastern United States and it is unknown if this is because they are rare and declining or because they are secretive and difficult to survey. For example, only 72 museum records for North Carolina exist, and only three of these records have occurred since 2000. Non-baited camera traps are likely not effective at detecting weasels, with only four weasel detections recorded by the ~4,000 cameras in the NC Candid Critter and eMammal database. The typical camera trap set parallel to the ground and without bait might not

be ideal for detecting small mammals, such as weasels.

A N.C. State University student, in collaboration with the NCWRC and the N.C. Museum of Natural Sciences tested the effectiveness of a baited-tube camera trap survey that has been successful in detecting weasels in Montana and West Virginia. The student placed up to 20 cameras with baited tubes on six game lands (Jordan, South Mountains, Sandhills, Croatan, Pisgah and Shocco Creek) in North Carolina. These cameras were deployed for two weeks at

each game land. One long-tailed weasel was detected on South Mountain Game Land and one on Pisgah Game Land. Other species detected regularly include Virginia opossum, white-footed mice and Northern raccoon.

Staff plan to deploy cameras and baited tubes for a longer period of time during the next survey period. The results of this study will evaluate the effectiveness of baited-tube camera traps to detect weasels in the region and contribute to biologists' understanding about the distribution and abundance of weasels in North Carolina.



Trail Camera photo of a long-tailed weasel. (Photo: Jessie Matthews/NC State University)

Bobcat & River Otter Sex and Age Ratio

Starting with the 2013-14 season, North Carolina began collecting bobcat skulls or lower jaw bones from licensed trappers. The information will be used to determine the sex and age ratio of the harvest. Biologists' sampling objective is 10-15% of the trapper harvest for five consecutive years. Due to low pelt prices and the voluntary nature of the program, staff have not yet achieved collecting 10% of the harvest. Since the 2013-

14 season, they have collected 183 skulls; during the 2018-19 season, they collected 47 skulls. The majority of the harvest is of 1-year old bobcats (32%), followed by 2-year old bobcats (25%). The sex ratio of the harvest is slightly biased toward male bobcats (55%).

River otter skulls are also collected to gather data on the age structure and sex ratio of har-

vested otters. The annual sampling period is from November through February, which is concurrent with the regulated furbearer trapping season. Since the 2010-11 season, staff have collected and aged 1,128 skulls; during the 2018-19 season they collected 174 skulls. The majority of the harvest is of 1-year old otters (41%), followed by 2-year old otters (18%). The sex ratio of the harvest is biased towards male otters (65%).

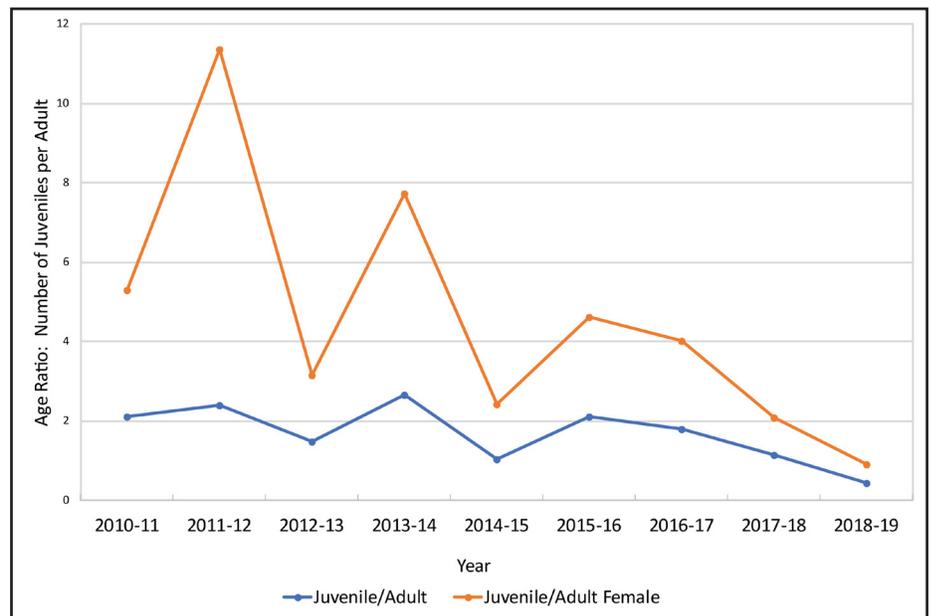
Muskrat Sex and Age Ratio

Due to concerns about regional muskrat populations, several southeastern, northeastern and Canadian furbearer biologists have started monitoring muskrat populations in cooperation with licensed trappers. Efforts involve monitoring the age and sex ratio of harvested muskrats, as this may indicate population declines. For example, a high proportion of adults could indicate poor reproduction. Starting in 2011, North Carolina joined regional efforts by attending fur sales and working with North Carolina fur dealers. During the 2018-19 season, NCWRC staff sampled 540 muskrats, a decline from the 2017-18 season, likely due to a decline in the harvest of muskrats due to low pelt prices. The ratio of juveniles to adults, and juveniles to adult females was the lowest since the survey was initiated. While this could reflect poor reproduction, it may also reflect that 45% of pelts from sampled muskrats were too prime

to determine age. Biologists will continue to monitor the age and sex ratio of the harvest and identify whether additional research is needed to monitor the status of muskrat populations.



Muskrat (Photo: Tom Koerner/USFWS)

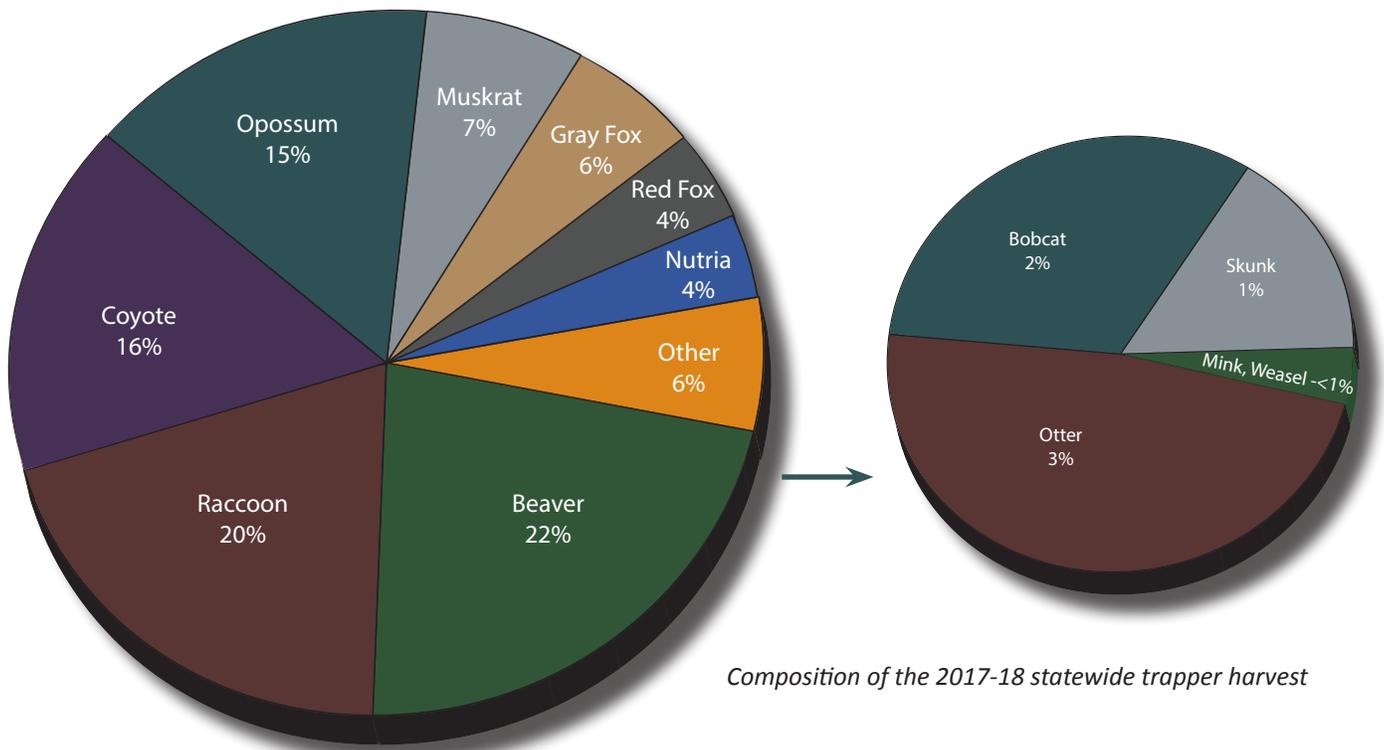


Age ratios of harvested muskrats as determined by pelt characteristics.

Trapper Harvest Survey

Since the 2002-2003 trapping season, an annual voluntary trapper mail harvest survey has been sent to all licensed trappers to track reported statewide furbearer harvest by species. Results for the 2018-2019 survey are not complete, as surveys were still being received in July and August 2019. For the 2017-

18 trapping season, there was a 18% increase (58,283 estimated harvest) in the overall furbearer harvest compared to 2016-17 (49,351 estimated harvest). For the 2017-18 trapping season, staff estimated 1,533 active, licensed trappers—a decrease of 5% from the previous year.



Composition of the 2017-18 statewide trapper harvest

Pelt Prices

Licensed fur dealers and the North American Fur Auction were contacted to solicit average pelt prices paid to North Carolina fur harvesters during the 2018-19 trapping season. Fur prices increased by 17%, with red fox (84%), coyote (48%), raccoon (28%), muskrat (26%), gray fox

(18%), otter (17%) and opossum (14%) experiencing increases and striped skunk (-40%), bobcat (-7%) and beaver (-3%) experiencing declines in pelt prices. There were 10 licensed fur dealers during the 2018-2019 furbearer harvest season, an increase from nine the prior season.

White-Tailed Deer

For information on white-tailed deer in North Carolina, see also: ncwildlife.org/deer

Biological Data Collection

The NCWRC annually collects and monitors deer data from four primary sources: 1. mandatory big-game reported harvest system, 2. hunter harvest survey, 3. deer hunter wildlife observation survey, and 4. biological harvest data collected by staff and cooperators.

The NCWRC relies on these databases to provide technical guidance to landowners, assess the current condition of the herd, and evaluate proposed deer rules relative to statewide biological objectives. Agency personnel obtained biological data (e.g., age, sex, weight, antler measurements, fetal/reproductive infor-

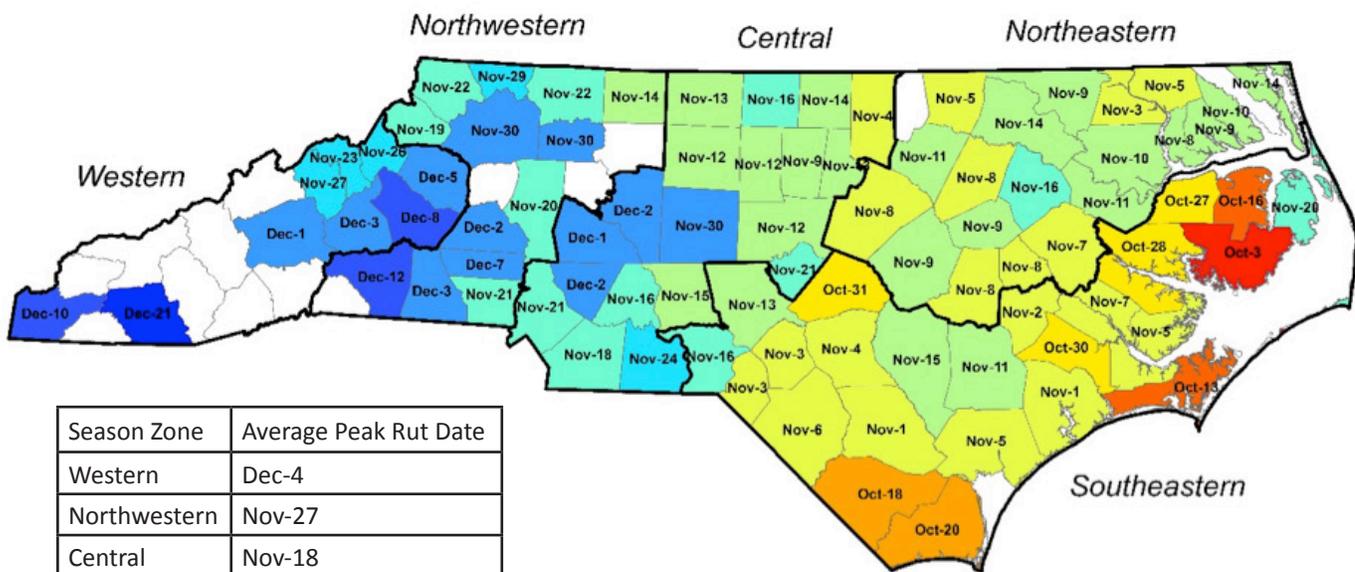
mation) from 5,597 deer from a variety of sources, including the Deer Management Assistance Program (DMAP), voluntary hunt clubs, agency-staffed check stations, meat processors, taxidermists, herd health evaluations, depredation permit kills, vehicle kills, disease evaluations, and a hunter jawbone return program. This information continues to be used to evaluate the status of herds in relation to habitat, population parameters, and current harvest season frameworks. Additionally, these data are used to increase understanding of

breeding chronology across the state and continue to evaluate timing of harvest relative to breeding seasons.



Estimates of peak rutting dates can be calculated by the measurement of deer fetuses from road-killed or harvested deer. Because fetuses develop at a pre-determined, consistent rate, length of fetus allows biologist to estimate conception date. Average conception dates thereby infer peak rutting activity. (Photo: NCWRC)

Updated 2019



Season Zone	Average Peak Rut Date
Western	Dec-4
Northwestern	Nov-27
Central	Nov-18
Northeastern	Nov-9
Southeastern	Nov-1

Estimated peak rut dates based on reproductive data collected through the agency's annual deer biological data collection program. Counties shaded in white cannot be estimated due to low samples sizes. Note: Estimated peak rut dates may change slightly over time as sample sizes for individual counties increase.

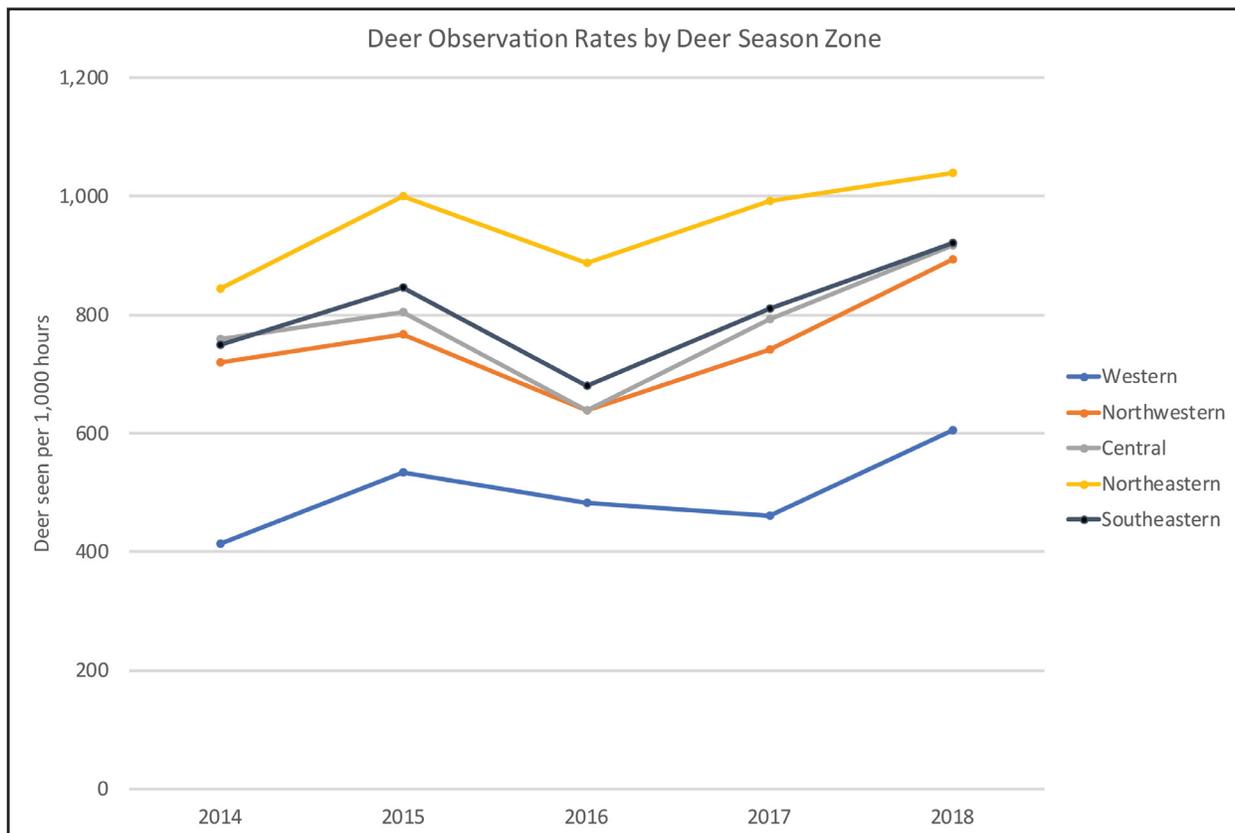
Deer Hunter Observation Survey

To provide an economical and statistically robust means of monitoring the relative observation rates of several game species (including white-tailed deer), NCWRC staff have conducted an annual North Carolina Deer Hunter Observation Survey since 2014. These observation data provide valuable insight into geographical and temporal variation in deer herd parameters, otherwise not captured in the reported harvest trends. Harvest estimates can be highly influenced by hunter selectivity, and harvest trends do not always accurately reflect current herd trends. In comparison, observation estimates could represent more realistic measures of overall current deer abundance.

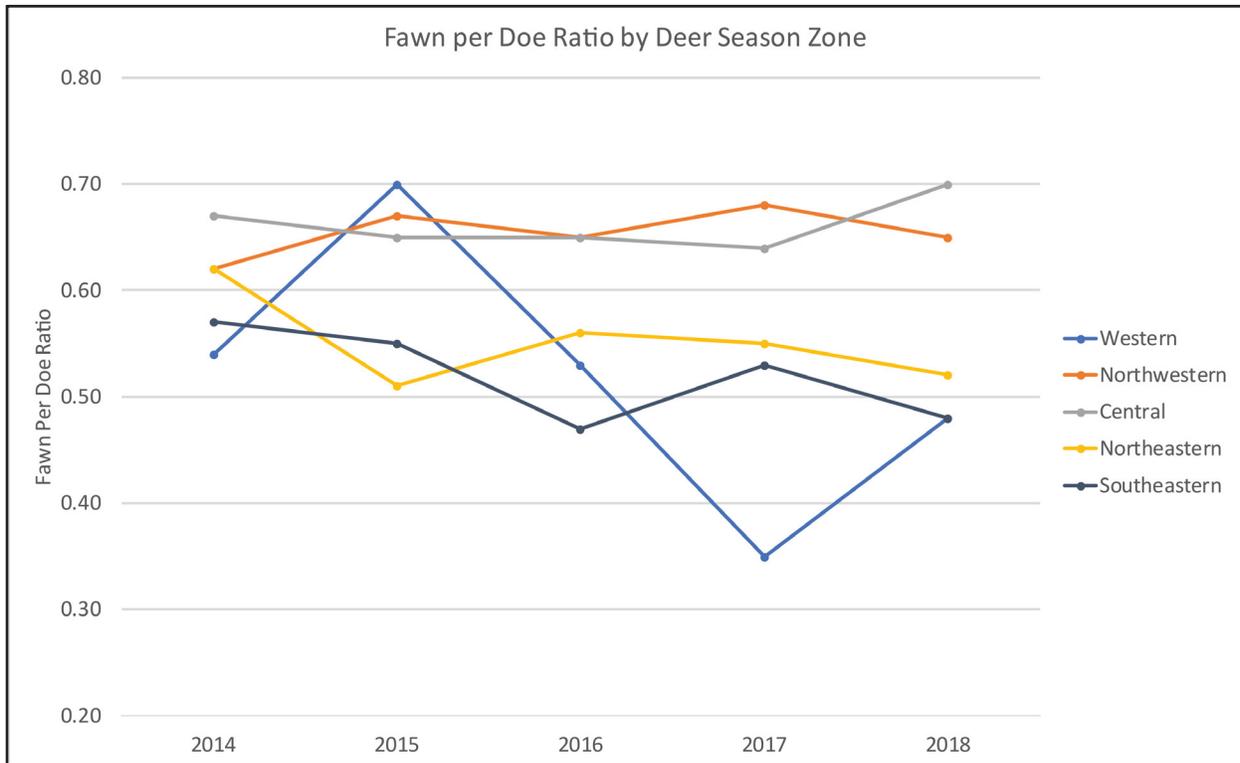
During the 2018-19 hunting season, 1,451 deer hunters participated in the survey and reported over 73,000 deer observed. In 2018, hunters observed on average 0.89 deer/hr., 2.3 does/buck, and 0.55 fawns/doe. The overall observation rate generally increased in all management zones compared to 2017. Observed fawn/doe ratios are typically higher in Central and Northwestern Deer Zones and lower in the Southeastern and Northeastern Zones. Western Zone fawn/doe ratios vary annually, which may be due to fluctuations in mast production.



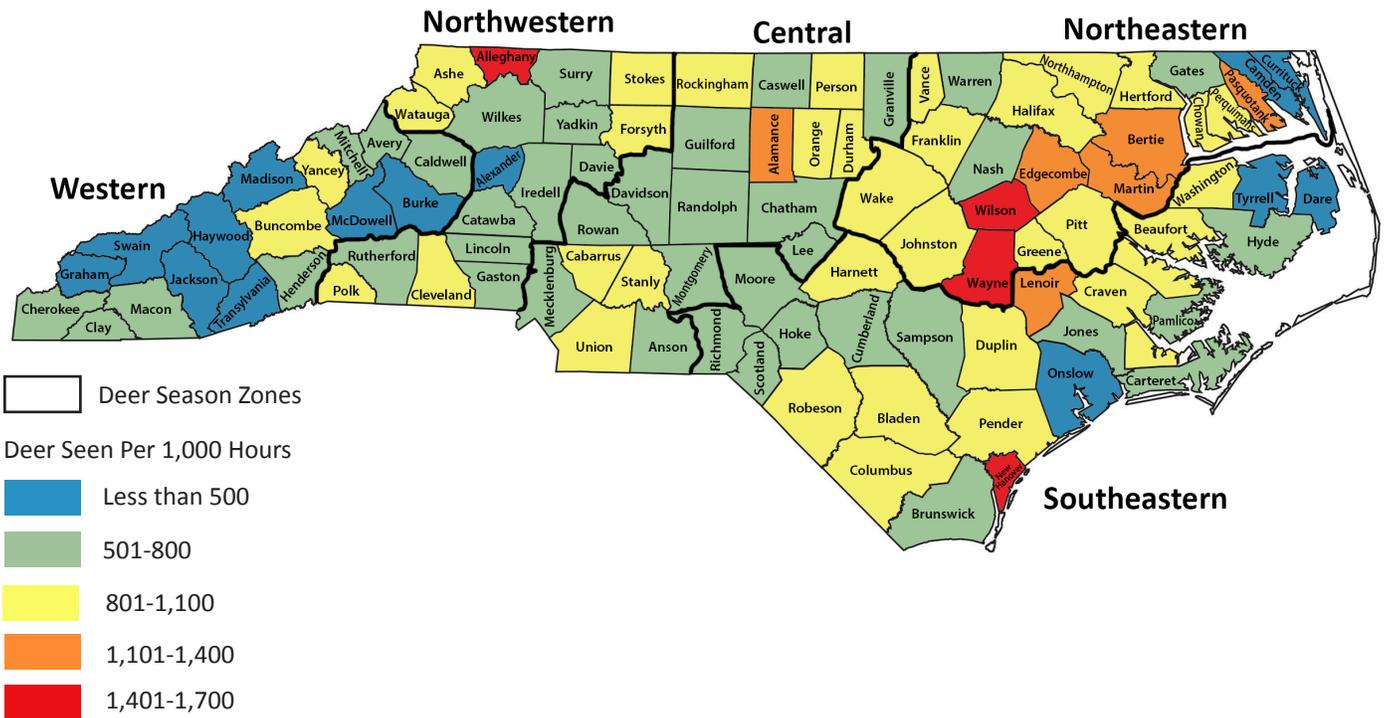
Photo: NCWRC



Regional observation rates of white-tailed deer as determined from the annual deer hunter observation survey.



Regional fawn/doe ratios as determined from the annual deer hunter observation survey.



Deer observation rates by county (number of deer seen per 1,000 hours), North Carolina Deer Hunter Observation Survey, 2014-2018.

Chronic Wasting Disease Surveillance

2018-19 marked the first year of a revised Chronic Wasting Disease (CWD) surveillance plan. Previously, the NCWRC had focused on intensive, statewide sampling once every five years. The new plan calls for annual sampling based on five-year sampling goals. During the 2018-19 sampling year, the NCWRC processed 3,240

samples (including clinical samples) with testing by the Wisconsin Veterinarian Diagnostic Lab. To date, CWD has not been detected in North Carolina. As part of the Cervid Health Cooperator Program, 281 of the 3,240 samples were collected by 21 participating taxidermists. Staff are continuing

To date, CWD has not been detected in North Carolina.

to recruit and train taxidermists for CWD surveillance. So far, staff have certified 65 Cervid Health Cooperators.



Left to right – Colleen Lippert (Wildlife Health Temporary), Kimberly McCargo (Conservation Biologist I), Joe Fuller (S&R Program Supervisor) and Dr. Jon Shaw (Deer Biologist) sort, label and package Chronic Wasting Disease samples to be shipped to the Wisconsin Veterinarian Diagnostic Lab. (Photo: NCWRC)

Upland Game Birds & Small Game Mammals

Wild Turkey Observation Survey

Each summer (July-August), the NCWRC coordinates an observation survey to gain insight into wild turkey productivity and carryover of gobblers from the previous spring turkey season. In 2018, 1,379 individuals helped with the survey, including a mix of NCWRC employees, National Wild Turkey Federation members, and others who had participated in the survey previously.

Productivity statewide was estimated to be 1.8 poults/hen (unchanged from the previous year). Productivity was slightly higher in the coastal region (1.9 poults/hen) than in the

Piedmont and mountain regions (both 1.7 poults/hen). These estimates of turkey reproduction in 2018 were relatively low in comparison to the last decade, but generally comparable to the last three years. During the last 10 years, productivity estimates have been as high as 2.7 poults per hen. It could be that some of this general decline in productivity is due to turkey populations increasing and expanding into marginal habitats where nesting and brood rearing are more difficult. The turkey population has increased

in recent years and is relatively large (estimated at 265,000 turkeys statewide in 2015), so it is capable of producing (i.e. hatching and rearing) large numbers of turkey annually, even though the reproductive indices (i.e. average measures per hen) have declined somewhat.

Also, while it is important to note that productivity alone does not predict potential changes in the turkey population, the relatively low turkey reproduction observed in 2016, 2017 and 2018 may lead to lower population and harvest levels in the next few years.

Grouse Drumming Survey

Since 2002, NCWRC staff have conducted an annual drumming survey to monitor ruffed grouse populations. Each spring (late March/early April), staff listen for drumming grouse on U.S. Forest Service property in western North Carolina. Since 2018, staff have included survey routes on state-owned game lands in western North Carolina.

In 2019, ruffed grouse were monitored by counting drumming males at 378 listening stations distributed across 24 routes on the Nantahala - Pisgah National Forests. These national forests are distributed throughout the southern mountains and represent a great deal of potential grouse habitat and hunting opportunity. Additionally, staff surveyed routes on Cold Mountain (24 stations), Needmore (12 stations), Sandy Mush (10 stations)

and Silver (18 stations) game lands, which are state-owned game lands. All survey routes were driven two times and data analysis is ongoing; however, low abundance of grouse suggests that populations remain near all-time low levels.

Staff also walked a 10.8-mile grouse survey route on Pond Mountain Game Land in the northern mountains. Assuming that drumming grouse can be heard from $\frac{1}{8}$ of a mile, this walking survey gives the opportunity to hear grouse on approximately 1,700 acres. Over the course of three mornings (April 2, 4 and 11), they slowly walked the entire route twice and found drumming grouse at six separate locations. Staff plan

to continue this survey, with the same methodology, for one more year at which time they will evaluate whether this technique offers worthwhile insight to the grouse population on Pond Mountain Game Land. If results are encouraging, they may establish similar walking routes on other areas.



Ruffed grouse (Photo: USFWS)

Grouse/West Nile Virus Surveillance

West Nile virus (WNV) is a mosquito-borne disease that has had a devastating effect on numerous North American bird species since it was introduced in 1999. Research conducted by Pennsylvania suggests that ruffed grouse are routinely exposed to WNV, which appears to cause declines in the population — particularly in young grouse and grouse chicks. However, little is known about local effects of WNV in the North Carolina ruffed grouse population.

To better understand the effects WNV has on ruffed grouse populations, NCWRC is participating in a multi-state, multi-year WNV surveil-

lance project. During the 2018-19 hunting season, avid grouse hunters provided feathers and blood samples from 68 ruffed grouse (63 birds from North Carolina and five from Tennessee). The 63 ruffed grouse from North Carolina were harvested in 13 counties, the majority of which came from Haywood, Macon and Madison counties. These samples were used to determine sex, age and previous exposure to West Nile virus (WNV) for these birds. Based on the feather characteristics, the sample included 15 adult females,

21 adult males, 16 immature females and 14 immature males.

All feathers and blood samples were submitted to Southeastern Cooperative Wildlife Disease Study in Athens, Georgia. Four of the 58 (6.9%) blood samples taken from North Carolina-harvested ruffed grouse showed evidence of exposure to the Flavivirus, a family of viruses that includes WNV. After the three-year study, biologists hope to have a better understanding of how exposure rates vary across the range of participating states and the relationship of exposure rates and population impacts.



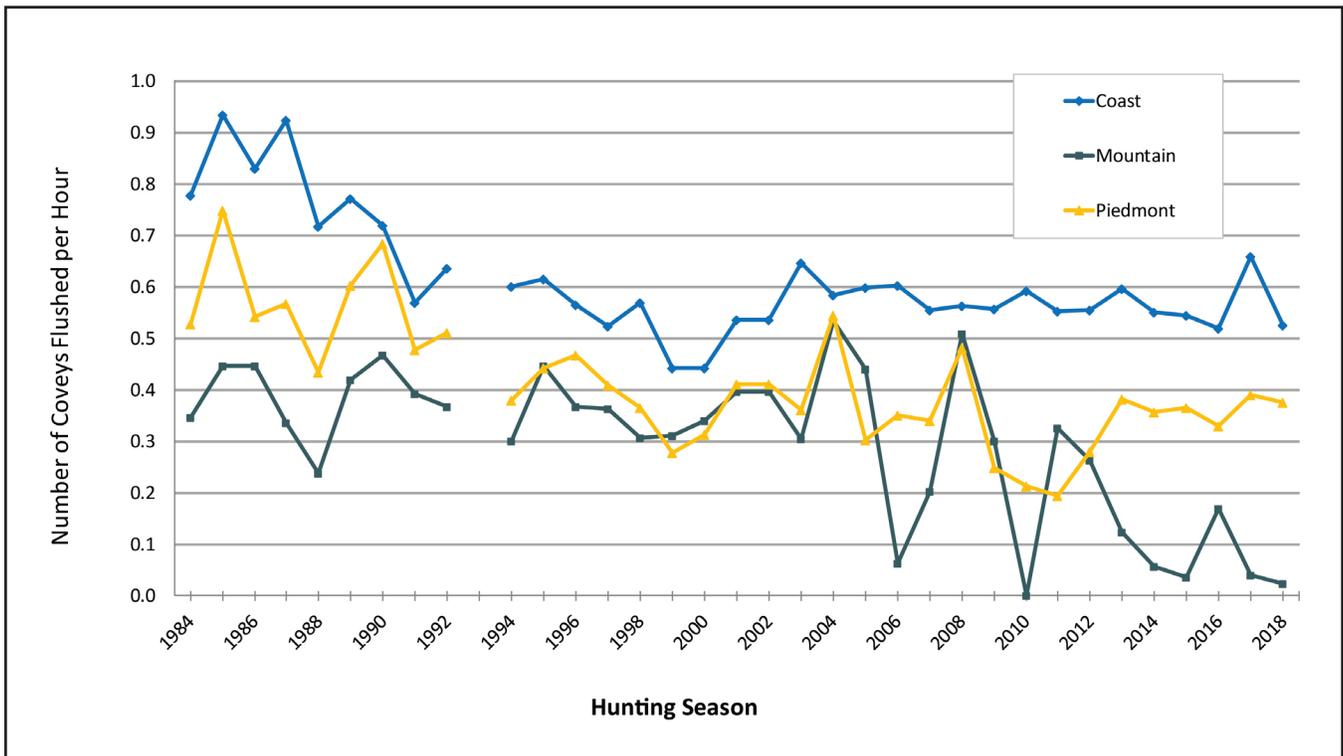
Left to right – Merrill Cook (Wildlife Health Biologist), Joe Fuller (S&R Program Supervisor) and Chris Kreh (Upland Game Bird Biologist) record sex and age of harvested ruffed grouse as part of the ruffed grouse West Nile Virus Surveillance Project. (Photo: NCWRC)

Avid Quail and Grouse Hunter Surveys

Staff continue to work with avid hunters to monitor bobwhite quail and ruffed grouse hunting activity. Forty-six avid quail hunters provided hunting data during the 2018-19 hunting season on 695 quail hunting trips. On an average hunt day, 1.6 coveys were flushed and 1.5 quail were bagged per hunt party. Quail hunting success varied within the state depending on the region and landowner type. By region, flush rates were 0.58 coveys per hour in the Coastal Plain and 0.38 coveys per hour in the Piedmont. Flush rates in the mountain region were nearly zero suggesting

that quail are likely extirpated (locally extinct) in much of the mountain region. By landowner type, statewide flush rates were 0.64 coveys/hour on private land versus 0.19 coveys/hour on game lands. On 47% of the reported hunting trips, hunters found no coveys. Hunting success has been fairly stable in the Piedmont and Coastal Plain since the mid-1990s (i.e., coveys flushed, harvest), although the data indicate a slight increase in the percentage of hunting trips in which no birds are flushed. However, hunting

success is not a direct indicator of quail abundance because hunters selectively change their hunting locations to areas with higher quail abundances. The number of hunters participating in the avid hunter survey continues to decline despite efforts to recruit more participants. The 46 participants this past year compare to over 200 participants during the 1994 hunting season. The average age of avid hunters has been steadily increasing — from the mid-40s when the survey began (1984-85 season) to 60 this past year.



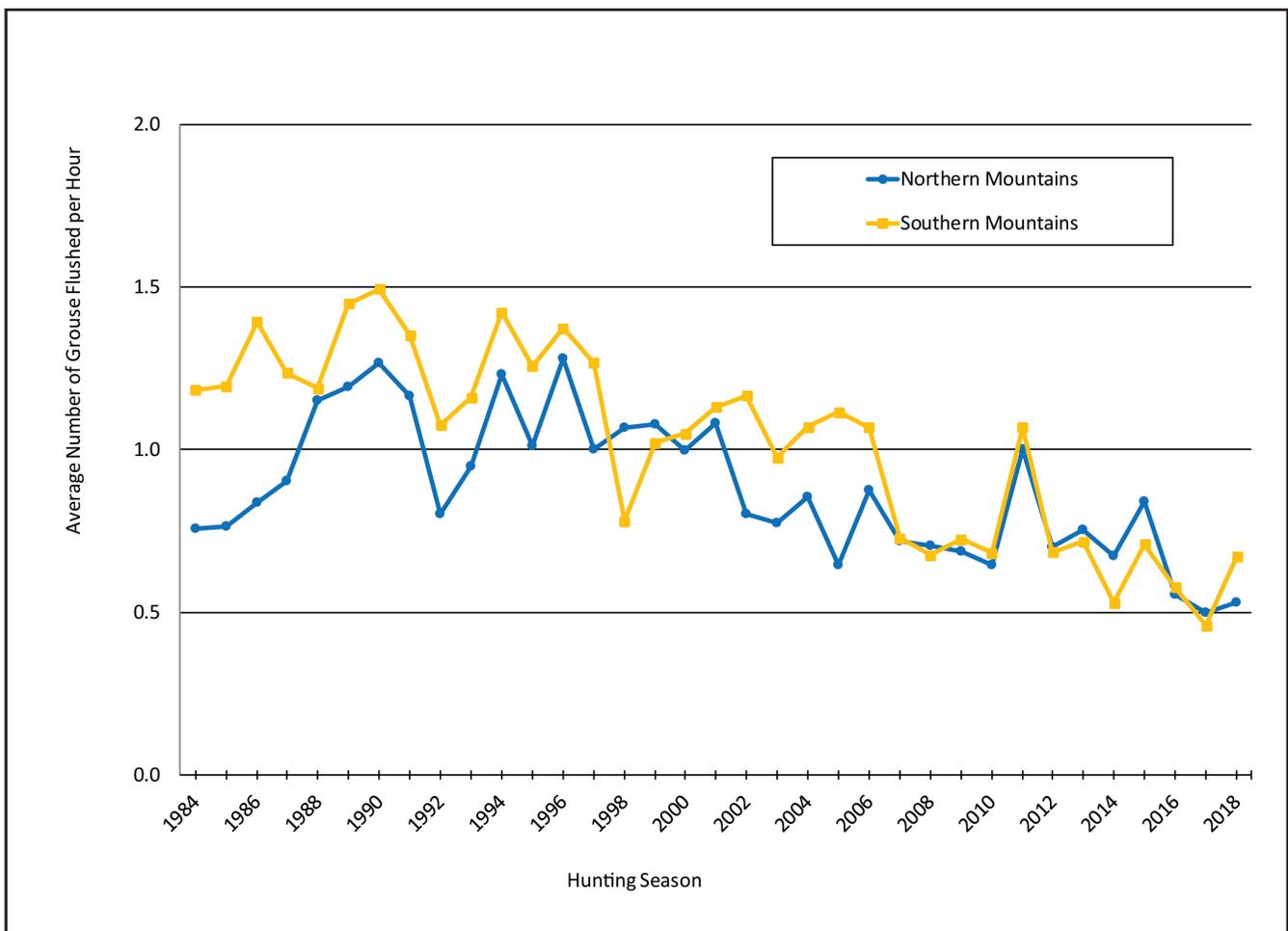
Average number of bobwhite quail coveys flushed per hour, as determined from the North Carolina Avid Quail Hunter Survey.

Avid Quail and Grouse Hunter Surveys (continued)

Fifty-four avid grouse hunters submitted hunt data during the 2018-19 hunting season, providing statistics for 507 hunting trips. Average number of grouse trips/hunter has declined over time and the 9.4 trips/hunter recorded in 2018-19 is the lowest since the inception of the survey. In most years, Ashe and Madison counties have recorded the most hunts by participants. However,

during the 2018-19 season, Macon, Haywood and Clay counties were most often reported with over 60 hunts each. Since 1984, grouse flush rates have generally declined over time from a high of 1.4 flushed per hour (recorded in 1990) and a high of 6.3 flushed per trip (recorded in 1989 and 1990). In 2018-19, participants flushed, on

average, 0.7 grouse per hour and 2.3 grouse per hunting trip and—both slight increases from the previous year. On 33% of the hunting trips, no grouse were found. While flush rates have certainly declined over time, flush rates are not a direct indicator of grouse abundance because hunters will change their hunting locations over time to focus on areas with more grouse.



Average number of grouse flushed per hour, as determined from the annual North Carolina Avid Grouse Hunter Survey.

Acoustic Recorder Surveys

Turkey

Staff continued to use acoustic recorders during spring 2019 to determine the timing of wild turkey gobbling across the state. The programmable units are used to record an audio file in the field each day, which is later processed by computer software that tallies the number of turkey gobbles. This is the fourth year this equipment has been used and staff expect results to help ensure

that wild turkey hunting seasons maximize both turkey reproduction and hunter satisfaction.

Staff deployed 51 acoustic recorders statewide during spring 2019 with each NCWRC district having five or six recorders. Recorders were deployed on large properties with little to no turkey hunting pressure. Each unit was programmed to record

2.5 hours/day, beginning 30 minutes before sunrise, from Feb. 24 through June 3, 2019. Approximately 12,500 hours of total time were recorded. Two full-time, temporary employees have completed data processing, using RavenPro software. Staff will thoroughly analyze all data collected from 2016 through 2019.

Quail

Coveys call very predictably, with a unique whistle, just before sunrise on clear cool mornings in October and November. Staff deployed 39 acoustic units during the fall 2018 to record this unique call on areas managed for bobwhite quail. Preliminary work with this equipment in the fall of 2016 suggested that this would be an efficient way to confirm presence/absence of quail at numerous locations where manpower is not available to conduct traditional surveys. These data may also be useful in determining peak calling dates and

times, thereby allowing staff to refine methods used in traditional fall surveys.

Each recording unit was programmed to record 1 hour per day, beginning 45 minutes before sunrise each morning. In the southeastern part of the state, staff deployed six units on the Corporate CURE property and six units on Suggs Mill Pond Game Land. In the northern Coastal Plain, they deployed two units on Embro Game Land, three units on Tillery Game Land and one unit

on Shocco Creek Game Land. In the northern Piedmont, they deployed 14 units on the CURE area on Caswell Game Land. And in the western region, six units were placed on Sandy Mush Game Land and one unit on a private property in Yadkin County.

Preliminary analysis of the 2018 data confirms coveys of quail present at many locations and can help evaluate agency habitat management on these areas. A full analysis of the data will be completed in 2019, after which staff will determine how to best proceed with this effort.

Grouse

At several locations in the western region, acoustic recorders set for wild turkey gobbling also recorded drumming of ruffed grouse. Staff recently analyzed these audio files

to determine dates and daily timing of peak drumming rates. Results suggest that peak drumming occurs the first two weeks of April and daily drumming

drops substantially approximately 2 hours after sunrise. Results will help guide changes to the agency's grouse drumming survey protocols.

Avid Rabbit Hunter Survey

Thirty-two respondents reported harvesting 1,596 rabbits during 416 hunting trips throughout 56 counties in North Carolina. Marsh rabbits were harvested in 20 of the 56 counties and accounted for 11% of the reported harvest. There were 42 reported hunts in November, 62 in December,

171 in January and 141 in February. Seventy-seven percent of the rabbit harvest occurred in December and January. Hunters jumped approximately 1.3 rabbits per hour and harvested approximately 58% of those rabbits, which is a lower success rate than the 2017-

2018 season where hunters harvested 61% of rabbits that were jumped. On an average hunt, 6.6 rabbits were jumped, and 3.8 rabbits were harvested. Hunters jumped at least one rabbit on 99.8% of the reported hunts and successfully harvested one or more rabbits on 84.6% of the hunts.



Photo: Melissa McGaw

Multi-Species Surveys & Research

Big Game Harvest Reporting

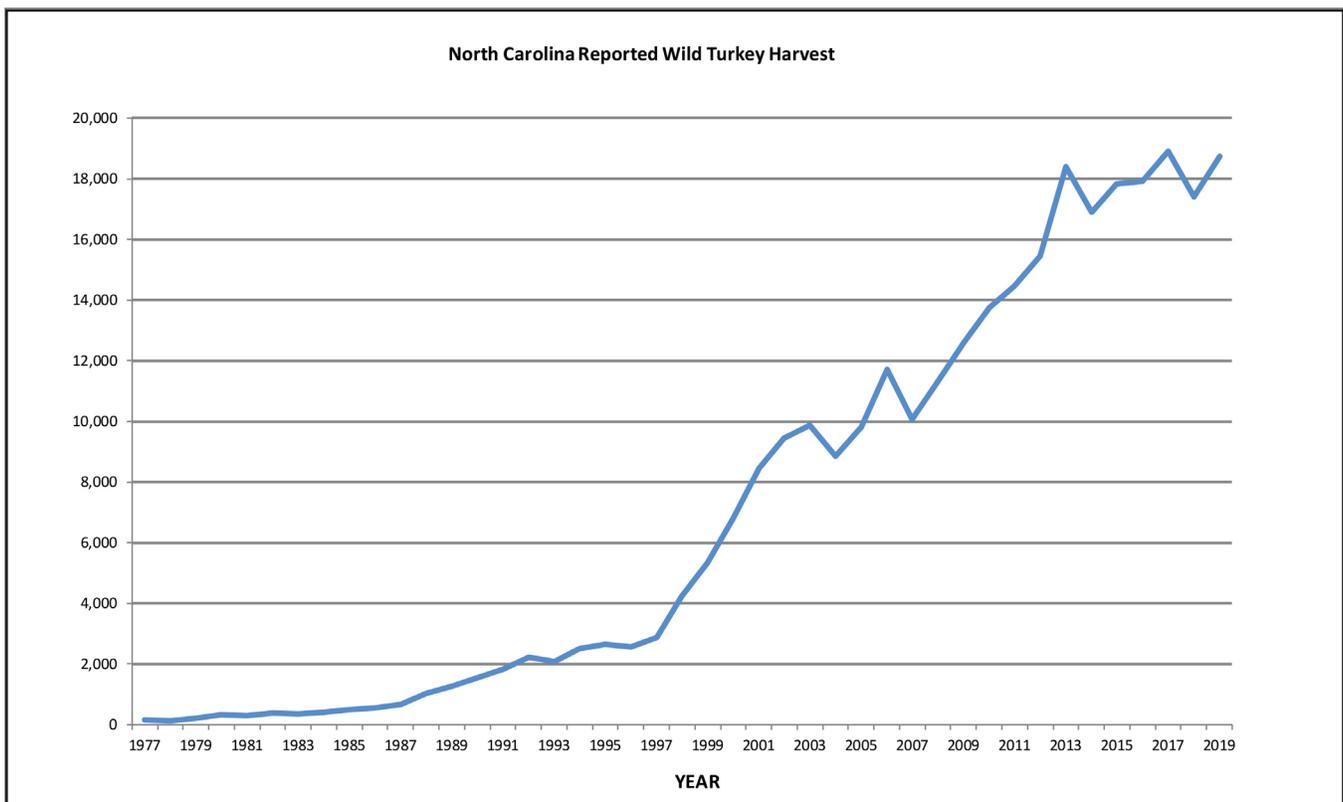
Mandatory reporting of big-game (deer, bear, turkey) harvest is required by General Statute and provides a long-term dataset of reported harvests for these species. Currently, reporting is allowed by either automated telephone or Internet. In coordination with the IT Department, S&R Program personnel provide oversight of some technical aspects of both reporting systems.

Wild Turkey Harvest

The 2019 spring wild turkey season in North Carolina ran from April 13-May 11 statewide. The dates for the Youth Season were April 6-12. Game lands were open during the youth season, but some game lands required a permit. Male or bearded turkeys were legal with a daily limit of one bird and a season limit of two birds. Youth could harvest only one

bird during the Youth Season. Reporting of wild turkey harvests is mandatory via the agency's telephone or online reporting systems. Including 1,478 birds harvested during the Youth Season, the 2019 reported spring turkey harvest was 18,730 birds. This year's total statewide harvest was up nearly 8% from 2018.

This year's total statewide harvest of 18,730 birds was up nearly 8% from the 2018 total harvest of 17,408 birds.



North Carolina reported wild turkey harvest.

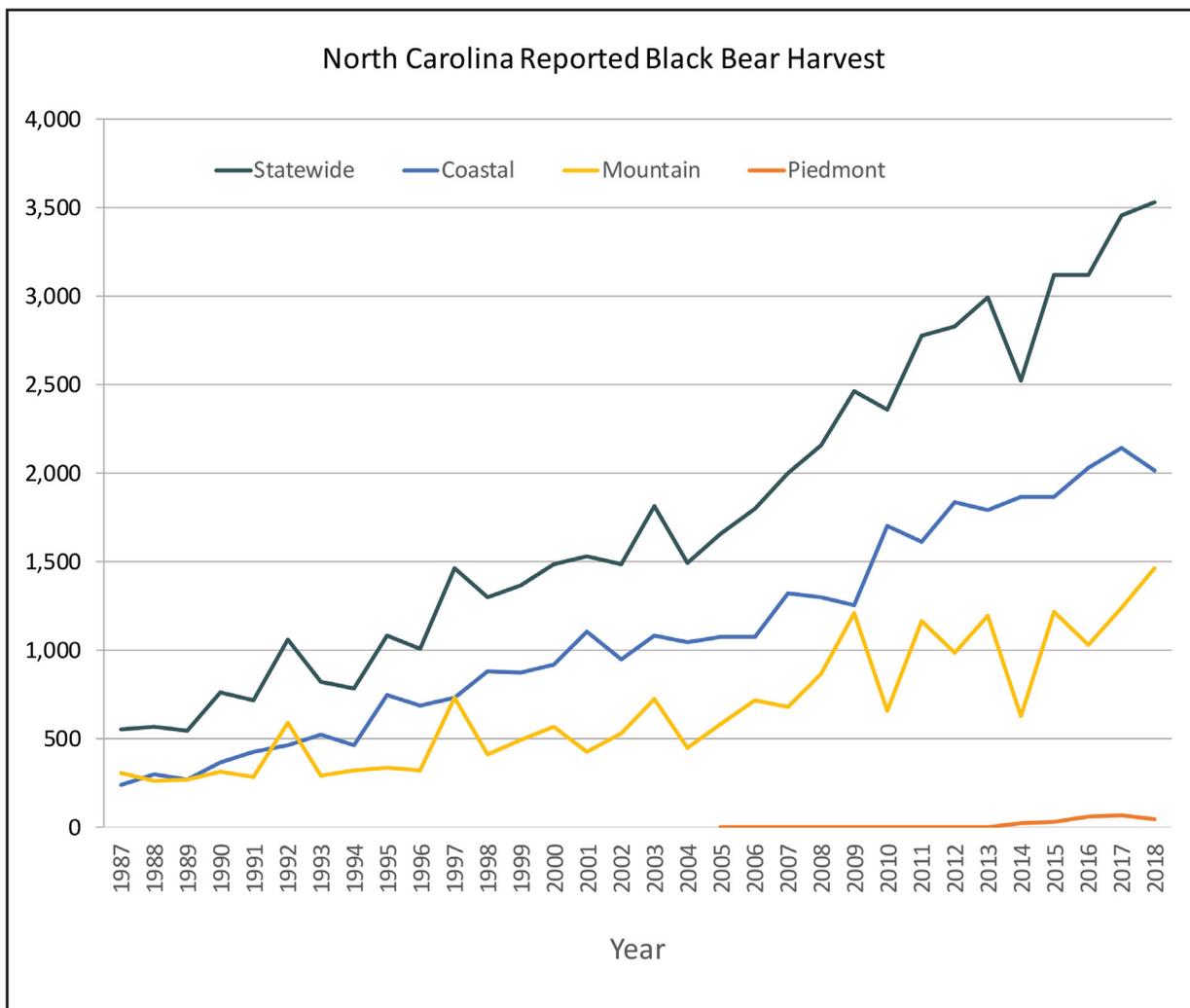
Bear Harvest and Mortality

Statewide in 2018, reported black bear harvest was 3,530, consisting of 2,069 male (59%) and 1,461 (41%) female bears. Total statewide harvest was up 2% from the 2017 season, largely driven by a 16% increase in the Mountain Bear Management Unit (BMU). The Coastal BMU harvest declined 6%, likely due to inaccessibility in several counties because of high water caused by Hurri-

cane Florence. Total known 2018 black bear mortality was 3,893 bears, including the statewide harvest plus additional non-harvest mortality as follows:

- Auto=336 bears
- Depredation=10 bears
- Illegal=6 bears
- Other=6 bears
- Unknown=5 bears

The 2018 statewide harvest of 3,530 black bears was up 2% from the 2017 total harvest of 3,454 black bears.



North Carolina reported black bear harvest.

White-tailed Deer Harvest

In 2017, agency staff concluded a multi-year deer season frameworks evaluation that resulted in management changes in 2018-2019. Changes were implemented to reduce harvest intentionally with the goal of stabilizing deer numbers and improving the sex ratio and age-structure of the herd. A statewide antlered bag limit of two and antlerless bag limit of four were established, and antlerless harvest opportunity was shifted toward the opening of the season in the Western Zone. These rule changes, along with weather events, such as Hurricane Florence, likely impacted hunter effort, harvest selectivity and reporting compliance.

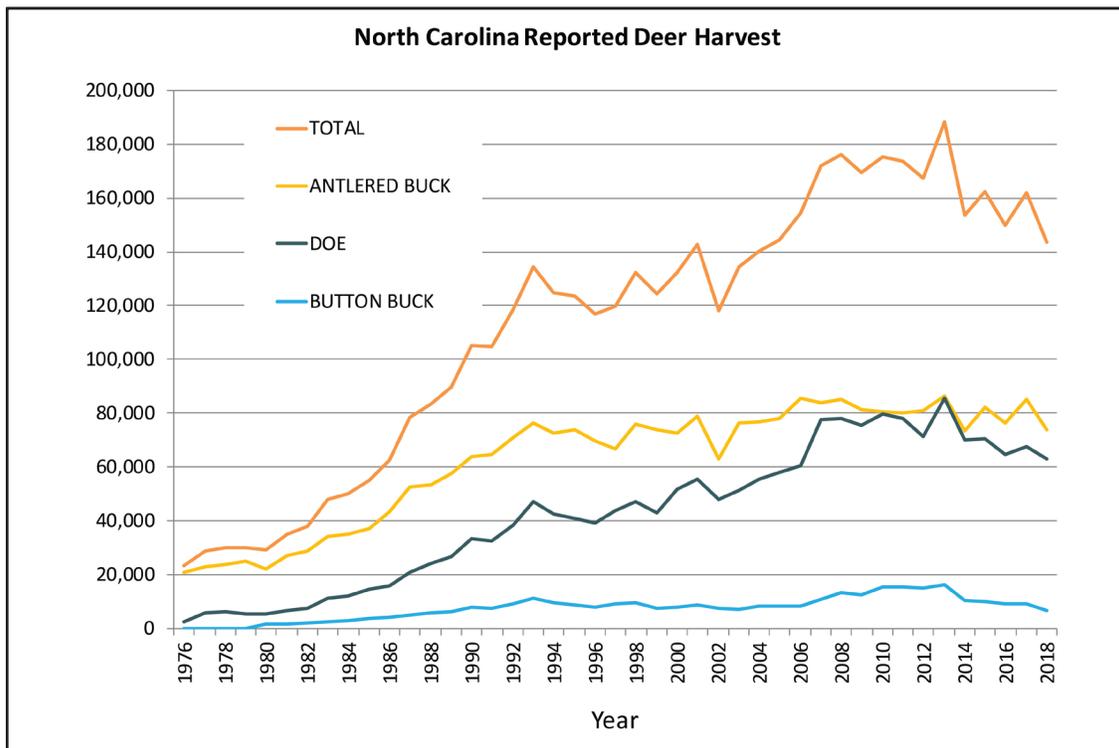
North Carolina hunters reported harvesting 143,529 deer during the 2018-2019 hunting season, consisting

of 51.5% antlered bucks, 4.6% button bucks and 43.9% does. Total statewide harvest was down 9.2% from the previous three-year average. Reported harvest changed little in the Central (-1.2%) and Northwestern (+0.6%) zones; increased in the Western Zone (7.3%); and declined in the Southeastern (-19.2%) and Northeastern (-20.4%) zones. Antlered buck harvest declined at 2X the rate of doe harvest in the former four-antlered-buck bag limit area, and button buck harvest declined at more than 4X the rate of doe harvest statewide. The proportion of yearling bucks in the antlered buck harvest declined about 3% statewide. The proportion of does in the harvest

prior to peak breeding increased 10% in the Western Zone.

Changes in the structure and condition of the herd can take years, but these early harvest metrics indicate population demographics are trending in the direction of meeting most biological objectives, with the exception of substantial buck harvest continuing to occur before peak rut.

The 2018 statewide harvest of 143,529 white-tailed deer was down 9.2% from the previous three-year average.



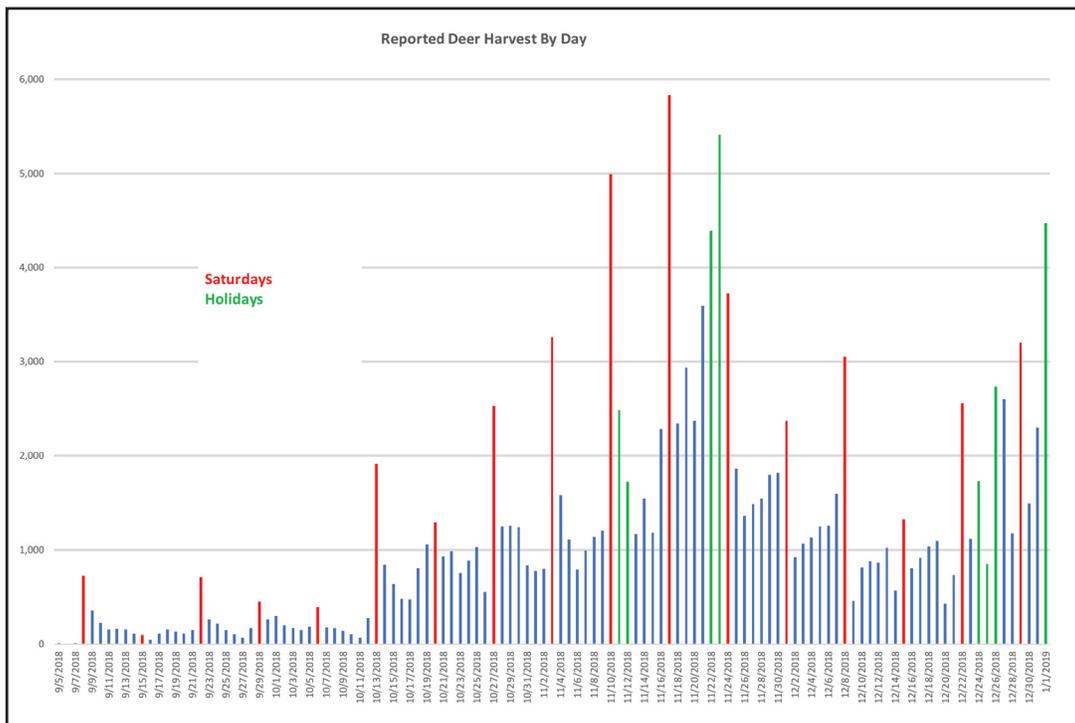
North Carolina reported deer harvest.

White-tailed Deer Harvest (continued)

As some might expect, deer hunting participation and harvest ebb and flow during an extended-length hunting season where archery season opens statewide in early September. Harvest totals for most species are positively related to effort and deer harvest is no exception. Predictably, higher harvests

generally occur on Saturdays and around holidays. In 2018, the highest daily harvest for deer occurred on Saturday, Nov. 17. The next two highest harvest days for deer occurred on Nov. 23 (Friday after Thanksgiving) and Saturday, Nov. 10. All electronic reporting for

big-game harvests can now be monitored in real-time at ncwildlife.org/Hunting/Big-Game-Harvest-Reporting. This gives those interested the opportunity to monitor deer harvest as the season progresses and also gives hunters the ability to view past harvest registrations.



Total daily deer harvest for the 2018 statewide deer hunting seasons.


North Carolina Wildlife Resources Commission

Big Game Home Page Log out

Big Game - View My Past Harvests

Report a Harvest

Listed below are your reported big game harvests since the fall of 2001.

The yellow highlight shows the portion of the authorization number that should be recorded on your Big Game Report Card. Age values are currently only available for Bear and Deer.

Auth Number	Harvest ID #	Report Date	County	Animal	Type	Weapon	Game Land/Municipality	Dogs	Age	CWD Test Results	Certificate
2876370	166833911	11/17/2018	Perquimans	Deer	ANTLERED BUCK	Gun		No			Print
2876348	166833910	11/17/2018	Perquimans	Deer	ANTLERED BUCK	Gun		No			Print
2671554	166833914	10/30/2017	Perquimans	Deer	DOE	Gun		No			Print
2478989	166833912	10/20/2016	Perquimans	Deer	DOE	Gun		No			Print
132239396323		11/22/2008	Bertie	Deer	DOE	Gun	Bertie County	No			Print
142239369073		12/22/2007	Bertie	Deer	ANTLERED BUCK		Yes				Print
122139210952		10/21/2006	Bertie	Deer	ANTLERED BUCK						Print
140137092330		12/1/2003	Washington	Deer	DOE		Yes				Print

Age values are assigned by wildlife biologists for hunters who participant in the [Bear](#) and [Deer](#) Cooperator Programs. *Chronic Wasting Disease (CWD) Test Results are available to hunters who submit biological samples for disease testing.

Screenshot of a hunter's past registered harvests available on the agency's website.

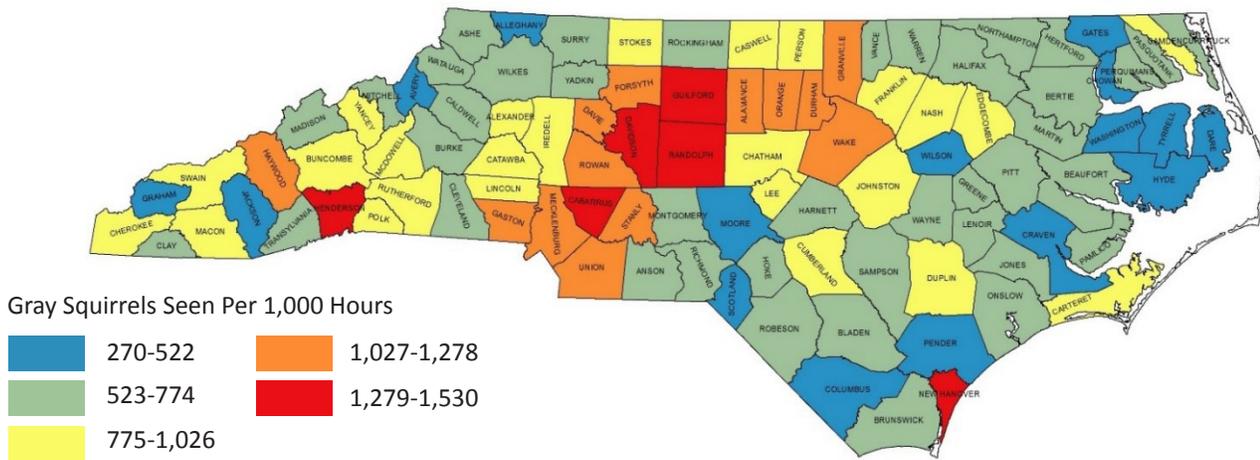
Deer Hunter Observation Survey

As mentioned on page 21, a deer hunter observation survey has been conducted each year since 2014. During the five deer hunting seasons from 2014-2018, volunteer deer hunters recorded wildlife observations on 132,247 hunting trips encompassing 452,429 observation hours.

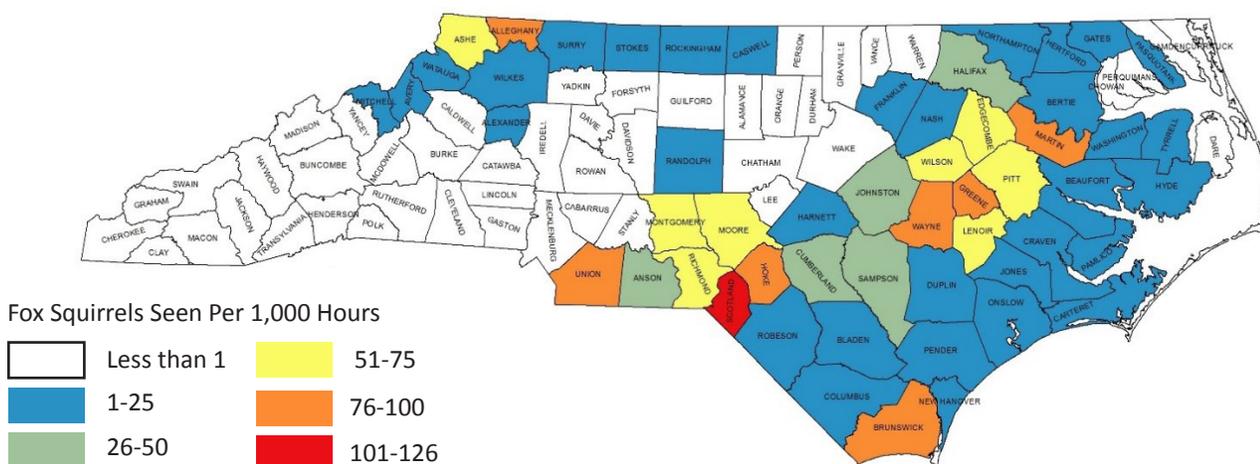
While the survey provides insight into deer herd parameters, it may also have long-term utility in monitoring many additional game

species that are normally difficult to monitor. Not only are participants asked to record observations of deer but they are also asked to record observations of all other game species observed. Staff believe that over time this survey will provide insight into changes in species abundance that may occur from both a spatial and temporal perspective. In this report staff highlight the

distribution of gray squirrels and fox squirrels from the Deer Hunter Observation Survey. Gray squirrels are a common species found statewide; however, highest concentrations are observed in the central Piedmont. Conversely, fox squirrels have a more limited distribution and are observed in highest concentrations in the upper Coastal Plain, Sandhills and far northwestern counties.



Number of gray squirrels seen per 1,000 hours of observation as determined from the annual North Carolina Deer Hunter Observation Survey.



Number of fox squirrels seen per 1,000 hours of observation as determined from the annual North Carolina Deer Hunter Observation Survey.

Annual Hunter Harvest Survey

Each year, the NCWRC conducts a survey of randomly selected hunting license holders for the purpose of estimating hunter participation and harvest of multiple species. While reported harvests of big game spe-

cies can be tallied through our mandatory reporting systems, this survey provides a separate independent reference for harvest estimates and reporting compliance. Below is hunter participa-

tion and harvest estimates for many North Carolina small game species for the 2018-19 hunting seasons.

Note that bobcat, coyote, fox and raccoon may also be harvested by trappers. Trapper harvest estimates for these species are separate and included on page 19.

Species	Total Hunters	% change from previous 3-year average	Total Harvest	% change from previous 3-year average
Mourning Dove	60,822	-15%	750,314	-17%
Gray Squirrel	50,525	-6%	402,255	-4%
Rabbit	32,362	-14%	214,906	-1%
Coyote	24,784	-28%	31,617	-30%
Crow*	8,442	-14%	52,551	-47%
Raccoon	8,186	-22%	59,883	-9%
Bobwhite Quail	5,436	-46%	22,845	-50%
Fox Squirrel	3,518	-14%	2,931	-50%
Ruffed Grouse	3,390	-14%	2,878	-42%
Fox (Gray & Red)	2,175	-34%	1,977	-50%
Woodcock	1,983	-10%	5,564	-22%
Bobcat	1,517	-60%	988	-66%

* % change in crow estimates are compared to the previous year only as crow hunter/harvest estimates are not derived each year.

General Disease Surveillance

Staff investigated 119 disease reports and submitted several cases to laboratories for disease surveillance efforts. Disease reports included 16 different species including 98 deer, 10 Canada geese, 10 gray squirrels, seven Brazilian free-tailed bats and six black bears. One noteworthy diagnosis included three deer likely succumbing to Pulmonary pythiosis (one confirmed and two suspected). Pulmonary pythiosis, also known as swamp cancer, is caused by the fungus-like organism, *Pythium insid-*

iosum, and can eventually cause severe pneumonia like conditions. Pythosis is rarely reported in wildlife, including deer, but animals can be exposed to the opportunistic pathogen when standing in or drinking stagnant, zoospore-containing water. Diagnosis of pythiosis appears to be increasing in southeastern states. Additionally, one black bear was diagnosed with rabies. While all mammals are susceptible to infection by rabies virus, black bears historically

have not been a frequent wildlife host of the virus.

One deer herd health check was performed during the 2018-19 period, and seven animals were euthanized and necropsied. Samples from all relevant tissues were sent to the Southeastern Cooperative Wildlife Disease Study for diagnostics. The results indicated that zero of six Pilot Mountain State Park deer had antibodies against EHD and Bluetongue viruses, suggesting the herd is at risk for an HD outbreak.

North Carolina Wildlife Resources Commission Mission Statement

To conserve North Carolina's wildlife resources and their habitats and provide programs and opportunities that allow hunters, anglers, boaters and other outdoor enthusiasts to enjoy wildlife-associated recreation.

Surveys & Research Program Mission Statement

The mission of the Surveys and Research Program is to 1) ensure the long term viability and sustained harvest of game and furbearer populations by providing the best possible scientific information on the status and management of each species and its habitats so that regulations and management are based on objective data; and 2) participate in planning and coordination of management directives based on sound science.



ncwildlife.org