

2020 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 (NCWRC) 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 2019-20. 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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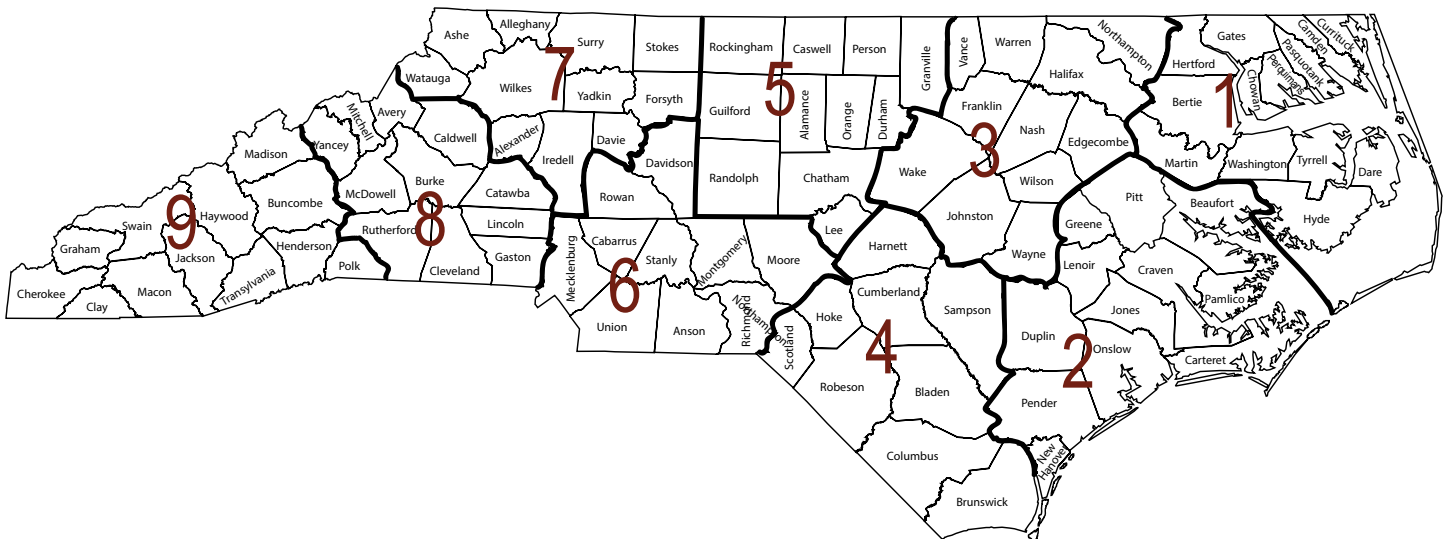
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N.C. Wildlife Resources Commission District Map



Cover photos (l to r, clockwise): Jason Allen, District 5 Wildlife Biologist, bands a wood duck (NCWRC); Doug Howell, NCWRC Migratory Game Bird Coordinator and Sara Yates, USFWS Pilot Biologist, prepare a Cessna 182 float plane for the 2020 Mid-winter Waterfowl Survey (NCWRC); A mix of NCWRC Land and Water Access staff and Haywood Community College Students collect biological information at a deer check station in Cleveland County (NCWRC); Upland Game Bird Biologist Chris Kreh (right) and North Carolina State University PhD student David Moscicki (left) prepare a transmittered wild turkey for release (David Gladkowski).

Table of Contents

Black Bears	7
Bear Harvest and Mortality	7
Black Bear Cooperator Program	8
Bear E-Stamp Survey	9
Mast Surveys	9
Sardine Bait Station Surveys	10
Wildlife Underpass Camera Survey	11
Movements & Survival of Rehabilitated Bear Cubs	12
Human-Bear Interactions	13
BearWise Program	13
Furbearers	14
Raccoon Field Trial Survey	14
Eastern Spotted Skunk Population Camera Survey	15
Eastern Spotted Skunk Detection Dog Pilot Study	15
Pilot Camera Survey of Weasels	16
Bobcat & River Otter Sex and Age Ratio	17
Muskrat Sex and Age Ratio	18
Trapper Harvest Survey	19
Pelt Prices	19
Depredation Take	20
Rabies and Canine Distempers in Furbearers	21
White-tailed Deer	22
Biological Data Collection	22
Deer Harvest and Hunter Numbers	23
Deer Hunter Observation Survey	25
Chronic Wasting Disease Surveillance	27
Upland Game Birds & Small Game Mammals	28
Wild Turkey Harvest	28
Wild Turkey Summer Observation Survey	29
Wild Turkey Research	30
Wild Turkey Gobbling Chronology Project	31
Grouse/West Nile Virus Surveillance	33
Avid Quail and Grouse Hunter Surveys	34
Avid Rabbit Hunter Surveys	35
Appalachian Cottontail Research	36

Migratory Game Birds	37
<u>Waterfowl Surveys</u>	37
<u>Mid-Winter Waterfowl Survey</u>	37
<u>Northeast Hunt Zone Resident Goose Survey</u>	38
<u>Tundra Swan & Canada Goose Harvest Surveys</u>	38
<u>Tundra Swan Productivity Survey</u>	39
<u>Waterfowl and Webless Species Monitoring</u>	40
<u>Wood Duck Banding</u>	40
<u>Mourning Dove Banding</u>	41
<u>Waterfowl and Webless Species Research</u>	41
<u>American Black Duck Nesting Ecology</u>	41
<u>American Woodcock Migration Ecology</u>	42
Multi-Species Surveys & Research	43
<u>Deer Hunter Observation Survey</u>	43
<u>Annual Hunter Harvest Survey</u>	45
<u>General Disease Surveillance</u>	47



Black Bears

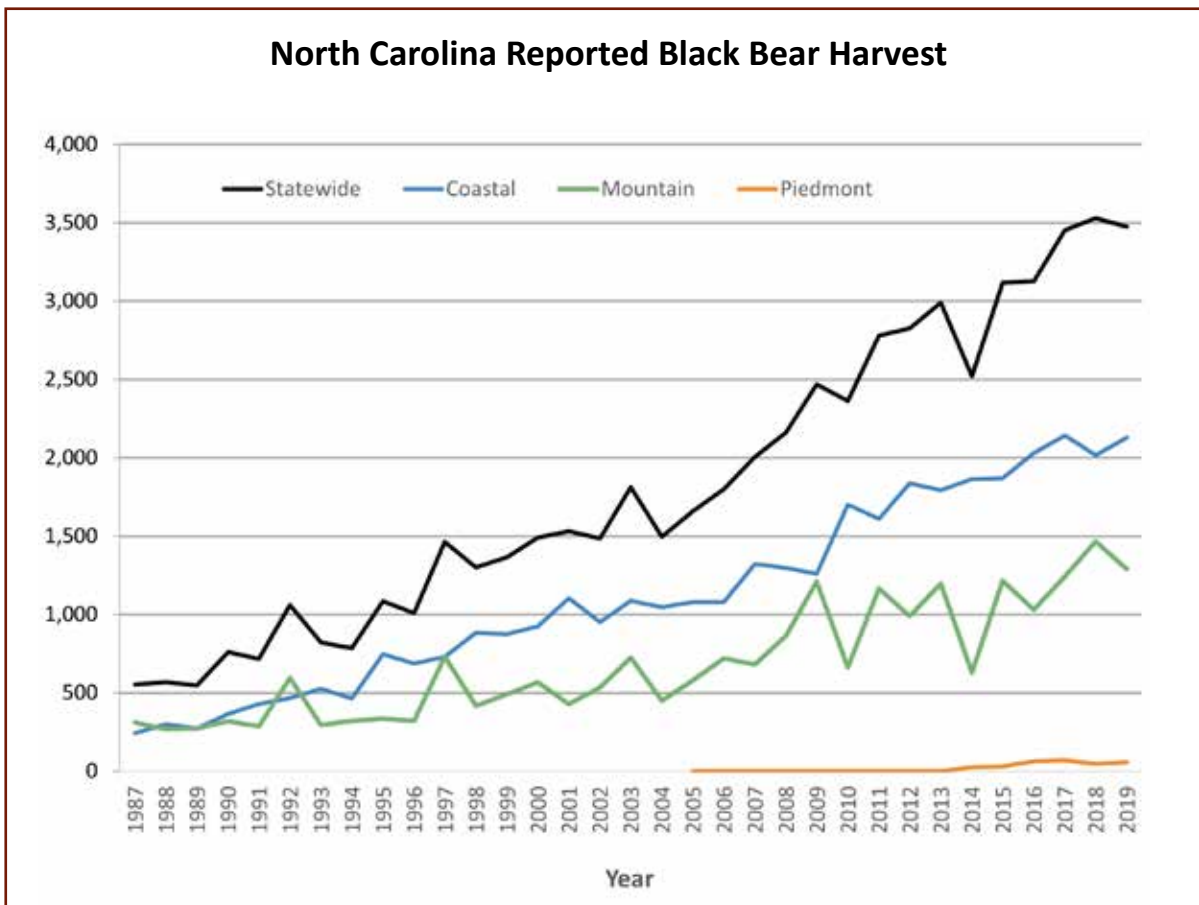
For more information on black bears, including the Black Bear Annual Report in North Carolina, visit: ncwildlife.org/bears and click “Surveys and Reports” tab.

Bear Harvest and Mortality

Statewide in 2019, reported black bear harvest was 3,476, consisting of 2,096 male (60%) and 1,380 (40%) female bears. Total statewide harvest was down 2% from the 2018 season, largely driven by a 12% decrease in the Mountain Bear

Management Unit (BMU), which experienced a fair acorn crop. Changes in mast abundance often influence harvest levels in the Mountain BMU. The Coastal BMU harvest increased 6% from the previous year. Total known 2019 black bear

mortality was 3,700 bears, including the statewide harvest plus additional non-harvest mortality as follows: Auto=205 bears, Depredation=8 bears, Illegal=3 bears, Other=2 bears, and Unknown=6 bears.



North Carolina reported black bear harvest

Black Bear Cooperator Program

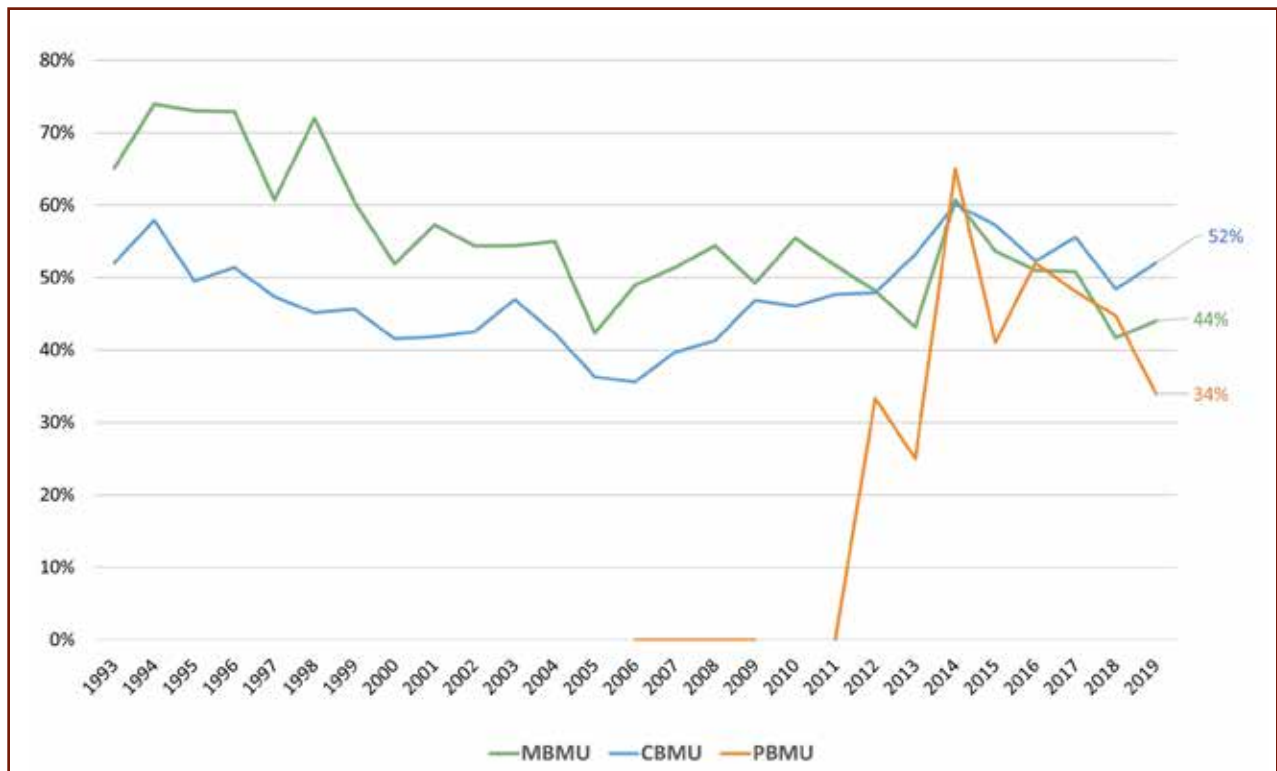
Mortality information from harvested bears began in 1969 under the voluntary Black Bear Cooperator Program. Age and sex information gathered from biological samples is used for analyzing the age structure of the harvested population and for monitoring population growth trends. During the 2019 bear hunting season, the NCWRC collected 1,685 upper pre-molars from cooperating hunters (1,100 Coastal BMU, 565 Mountain BMU, 20 Piedmont BMU), an increase of 5% from the previous year. The percentage of teeth submitted

by hunters from harvested bears statewide has declined since the 1990s from 57-64% to 49% in 2019, despite intensive efforts expended by staff prior to and during the bear hunting seasons. Submission rates for the 2019 seasons were 52% in the CBMU, 44% in the MBMU and 34% in the PBMU. Bear houndsmen participation in the Bear Cooperator Program has been substantially higher than participation by still hunters; in 2019, 63% of houndsmen and 37% of still hunters who harvested a bear also submitted biological information.

Bear Hunters: Submit Your Harvested Bear Teeth

The percentage of teeth submitted by hunters from harvested bears statewide has declined since the 1990s from 57-64% to 49% in 2019. Help the NCWRC monitor bear populations by submitting harvested bear teeth. Learn more:

ncwildlife.org/bearcooperator



Bear tooth submission rates, 1993-2019, for the Mountain BMU, Coastal BMU and Piedmont BMU

Bear E-Stamp Survey

NCWRC staff mailed surveys to 2019 bear e-stamp holders in late January 2020 and received a 35% response rate. Similar to the 2018 season, 61% of respondents had not hunted black bears prior to the 2019 bear hunting season, while 30% responded that they usually hunt bears and planned on doing so during the 2019 bear hunting season. Twenty-six percent of respondents consider themselves a bear hunter.

When asked to describe their bear hunting efforts during the 2019 bear hunting season, 14% of respondents specifically hunted for bear, 53% hunted for other game species but may have taken a bear, and 33% did not hunt for bears. These descriptions of bear hunting efforts have remained fairly consistent over the last few years. Of the hunters who described they hunted specifically for bear during the 2019 season,

56% reported hound hunting and 44% reported still/stand hunting — similar to the previous years. Six percent of respondents who hunted during the 2019 season were successful at harvesting a bear; hunters specifically hunting for bear were responsible for 85% of the surveyed harvest. Fifty-six percent of successful respondents reported using the aid of unprocessed food to harvest their bear.

Mast Surveys

Mountain hard mast (acorns, hickory nuts, etc.) surveys were conducted along 13 routes in fall 2019 with over 1,400 trees sampled. The hard mast crop was rated as “fair” with an overall index of 2.63. This represented an improvement from the previous year’s “poor” mast crop (index of 1.58). Since 1983, North Carolina

has experienced 23 years out of 37 years in which the hard mast index was rated as fair. Soft mast surveys were conducted during the 2019 summer bait station survey and fall hard mast surveys. The 2019 blueberry, huckleberry, and pokeberry crops rated as poor and below the long-term averages, while blackberry

rated as fair. The 2019 fall soft mast production was slightly above the production observed in 2018 with pokeberry and grape rated as fair, while cherry and black gum were poor. Both hard and soft mast is an important food source for many species of wildlife, and it is important to monitor for its multi-species impacts.

Hard mast provides an outstanding food source for many wildlife species. The NCWRC, along with partners, has conducted a hard mast survey in the western region each year since 1983.

Sardine Bait Station Surveys

Bait station surveys in the Mountain BMU were initiated in 1992 and provide a monitoring tool that is independent of harvest and human-bear interaction data, which both have biases. All surveys are conducted on public lands (i.e., game lands, National Forest), where the NCWRC has long-term access.

The most recent bait station survey was conducted in July 2019 by Land & Water Access staff. Black bears visited 791 stations 423 times for a visitation rate of 53%. This is a slight increase in visitation rate since 2017. While the decline in visitation rates from 2009 through 2013 reflects a host of factors,

including influence of weather and changes made to the survey lines in 2011 and 2013, data from North Carolina and adjacent states indicate that there were likely localized declines in bear population growth rates as a result of mast failures and harvest rates.



Mountain BMU Black Bear Sardine Bait Station Survey Visitation Rate, 1992-2019

Wildlife Underpass Camera Survey

In 2005, a new 12-mile section of U.S. Highway 64 in Washington County was completed. The new 4-lane divided highway section cut through high-quality black bear habitat with a dense bear population. To reduce impacts on the bear population and increase driver safety, three wildlife underpasses were incorporated into this section. A 10-foot-high chain link fence extended a minimum of ½ mile from each underpass in both directions and parallel to the highway. University of Tennessee Knoxville (UTK), in collaboration with the NCWRC and N.C. Department of Transportation (NCDOT), conducted a study on the impacts of this highway on bear ecology. UTK found that bear population abundance declined after the new highway was built, likely due to mortality from vehicle collisions, habitat loss and fragmentation, and displacement. However, gene flow was not impacted, likely due to the mitigating factors of the

wildlife underpasses. Using cameras, UTK monitored each underpass for wildlife use for one year after highway construction. Bears used all three underpasses, but use was limited to 10 bears on 17 occasions. UTK recommended that a follow-up survey be conducted to see if bear use of the underpasses increased over time.

In November 2019, 11 cameras were placed at the three underpasses and one camera placed at 15 gaps found in the fencing to document wildlife use. Local volunteers from the North Carolina Wildlife

Federation assist the NCWRC in checking the cameras and University of North Carolina Wilmington reviews and catalogs the pictures. The camera sites will be maintained through winter 2021 to allow at least one year of data collection. Results will provide recommendations to NCDOT for maintaining and improving fencing and managing vegetation in and around underpasses. The agency's study will show the importance of continued monitoring of highway wildlife passages to determine long-term effectiveness and maintenance needs.

Kimberly McCargo (left), Conservation Biologist I, and NCWRC Eastern NCDOT Permit Coordinator, Travis Wilson, monitor trail cameras as part of the Highway 64 Underpass Camera Study. (Colleen Offenbuttel/NCWRC)



Movements & Survival of Rehabilitated Bear Cubs

Post-release movements and behaviors of rehabilitated bears contribute greatly to survivorship and their propensity to be involved in human-bear conflicts. In collaboration with the University of North Carolina Wilmington, from 2015 through 2018, NCWRC staff fitted 28 bears with Vectronic GPS collars upon release in June and July from the NCWRC's rehab facility. The objectives of the study were to determine if any of the rehabilitated bears established a home range or continued to be a transient; quantify the average distance moved from the release location and daily movement rates; and determine if the release location affected the first-year survival and movement patterns. These results will directly aid in evaluating the bear cub rehabilitation program for the NCWRC. Upon release, male bears weighed an average of 37% more than female bears; release weight was positively correlated with survival probability, likely by providing a buffer as the released bears search for reliable food resources as they settle into their novel environment. Bears released weighing ≥ 150 pounds had an estimated annual survival of $\geq 80\%$.

Hunter harvest was the primary cause of mortality for released bears, which was similar to other studies. Bears in the Mountain BMU had a greater probability of survival than those released in the Coastal BMU. Bears released in the Coastal BMU were harvested at a

greater rate than those released in the Mountain BMU. Additionally, because of agricultural crops and deer feeders as an additional food resource, bears in the Coastal BMU may be more vulnerable to harvest by hunters than bears in the Mountain BMU.

The composite modeled survival estimate for released black bears was 68% and was within the range other studies of released rehabilitated black bears. Road density and the percent developed land were the

leading influences on bear survival. Because few mortalities were attributed to vehicular incidents, road density may be acting as proxy to hunting accessibility. Bears in the study did not show a propensity for conflict behavior, which confirms the idea that reduced human contact during rehabilitation limits habituation. To enhance the probability for survival post release, NCWRC staff recommend selecting sites that may limit harvest vulnerability and ensuring bears are of the greatest weight at release.



A bear looks back at Technical Assistance Biologist Deanna Noble after it is released on game lands in the Coastal Plain. (Chesley Ward/NCWRC)

Human-Bear Interactions

The NCWRC has been collecting data on human-bear interactions since 1993. In 2019, biologists recorded 1,329 human-bear interactions statewide, a 24% decrease from the previous year

(2018=1,751 human-bear interactions). As observed in previous years, the majority (51%, n=676) of these reports came from the far western counties of the NCWRC's District 9 (see map on

page 4). While the Coastal BMU experienced a 43% increase in human-bear interactions, the Mountain and Piedmont BMUs experienced a 39% and 17% decline, respectively.

BearWise Program

BearWise® (bearwise.org) is 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 FY19-20, the BearWise Committee took steps to initiate the certification of several communities in western North Carolina. While the certification process was hindered by the effects of COVID 19, staff hope to have at least two of those

communities certified in Asheville by the end of the year.

Additional BearWise outreach materials were created, and NCWRC's BearWise page (ncwildlife.org/bearwise) now contains Spanish versions of all handouts to improve accessibility. Staff developed a BearWise commercial outlining the six BearWise Basics that was aired through streaming services in western North Carolina and promoted on the NCWRC's social media platforms. Staff conducted



approximately 46 BearWise outreach events with an estimated 5,200 people in attendance. Due to Covid-19, staff have shifted to virtual events to maintain their "in-person" outreach.

The BearWise Committee aided the city of Asheville's sanitation department in moving forward with a proposal for a pilot bear-resistant cart program. Because Buncombe County receives anywhere from 30-60% of the state's bear complaints each year, this is a significant step forward toward reducing human-bear conflict in North Carolina.



NCWRC's BearWise webpage now has Spanish versions of BearWise handouts available for download.

Furbearers

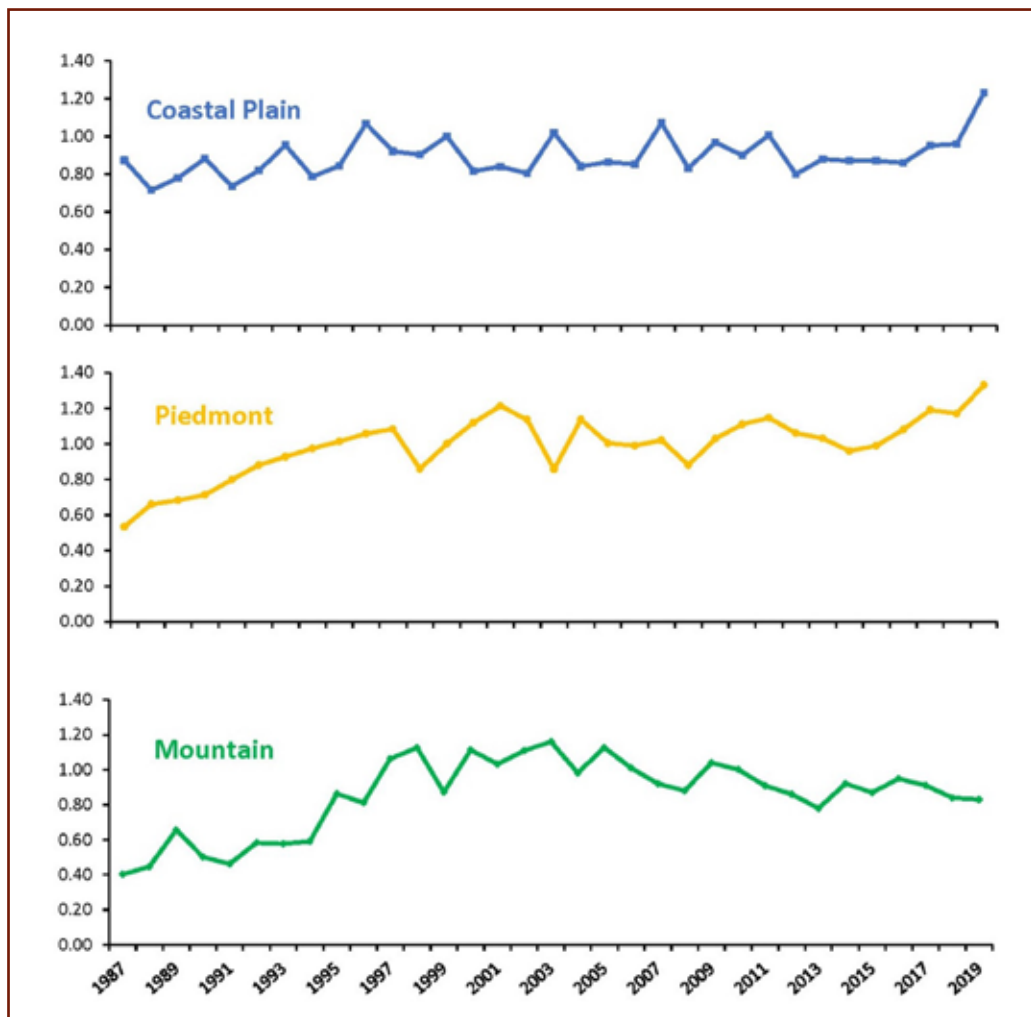
For more information, including reports, on furbearers and trapping in North Carolina, see also: ncwildlife.org/trapping

Raccoon Field Trial Survey

Data were collected on raccoon field trials conducted from May 1987 through February 2020. 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 24,130 field trial casts with 43,283 raccoons observed. The statewide hunting success (1.03 raccoons/hour) was higher than the previous survey year (0.99 raccoons/hour), and also above the 33-year average (0.93 raccoons/hour).

Data indicate that the Coastal (1.23 raccoons/hours) and Piedmont (1.33 raccoons/hour) regions saw an increase in the number of raccoons seen per hour, while the Mountain (0.83 raccoons/hour) Region saw a slight decrease in the number of raccoons seen per hour.



Regional hunter Success (raccoons/hour) as determined from the annual Raccoon Field Trial Survey (1987-2020)

Eastern Spotted Skunk Population Camera Survey

Since January 2015, North Carolina, in coordination with Clemson University, has conducted a winter camera survey to document the presence of eastern spotted skunks (ESSK). 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. In 2018, NCWRC staff had 45 detections and in 2019, they had 94 detections. For winter 2020, they established 51 new sites and had 67 detections of ESSKs.



Spotted skunk (Angieszka Bacal)

Eastern Spotted Skunk Detection Dog Pilot Study

The eastern spotted skunk (ESSK) is a cryptic mesocarnivore and various survey techniques are currently being explored by the NCWRC and other states to determine the best methodology for surveying and monitoring spotted skunk populations. Detection dogs have been trained to survey and detect other elusive or rare species (e.g., grizzly bears,

black-footed ferrets, kit fox) in the United States, but have not been trained or used on spotted skunks. Starting in July 2019, the NCWRC and Clemson University partnered with EcoNoseK9 on a pilot study to determine 1) if detection dogs could be trained to efficiently detect ESSKs, 2) the recommended survey design, and 3) if detection dogs are more efficient and effec-

tive than other survey techniques. From July 2019 through January 2020, EcoNoseK9 used spotted skunk scat to train two detection dogs. Starting in February 2020, staff conducted field trials with the detection dogs in Dupont State Recreational Forest. The field trials were to determine the dogs' ability to detect ESSK scat while ignoring scat from other wild animals, as

Continued on next page

well as determine what factors (e.g., temperature, wind direction) would influence the dogs' ability to detect spotted skunk scat. Detection dogs ran transects in which spotted skunk scat and scat from other wild animals were randomly placed along the transect.

Due to Covid-19, the field trials were placed on hold until June 2020, at which time surveys were reinitiated using a grid search approach. If detection dogs are determined to be an efficient and effective survey method for ESSKs, this may help the NCWRC in detecting and monitoring spotted skunk populations, as well as collecting scat for genetic analysis.



Emily Moreno of EcoNoseK9 with Raya, her detection dog, who has detected an Eastern Spotted Skunk scat placed out during test field trials. (Colleen Olfenbittel/ NCWRC)

Pilot Camera Survey of Weasels

Work continued on testing the effectiveness of weasel camera trapping. 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. 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. Staff are testing another camera trap design after testing the effectiveness of a baited-tube camera trap, which used a 10 x 30 cm tube staked into the ground ~1 meter from a camera trap, baited with raw chicken liver and Caven Gusto's scent lure. They currently have nine camera traps

(three in each furbearer management unit), which have been deployed since late spring 2020 using the "Mostela" design that has been used successfully to survey weasels in Europe. This design involves placing a camera inside a wooden box that contains a PVC tube running perpendicular to the camera. The PVC tube creates two openings on each side of the box, allowing a weasel to enter and exit the box. Inside the box, the tube is cut open, which allows the camera to capture any wild animal going through the tube. The tube serves as a visual attractant for the weasel, while the lure is used as an olfactory attractant. The Mostela design may reduce non-targets (e.g., raccoons) from tampering with the camera trap, while also increasing weasel detections due to the design. The results of this study will evaluate the effectiveness of using

the Mostela camera trap design to detect weasels in North Carolina. If the design is effective, agency staff will initiate a formal survey using this camera trap design in order to detect weasels throughout the state, which they hope will contribute to their understanding about the distribution and abundance of weasels in North Carolina.



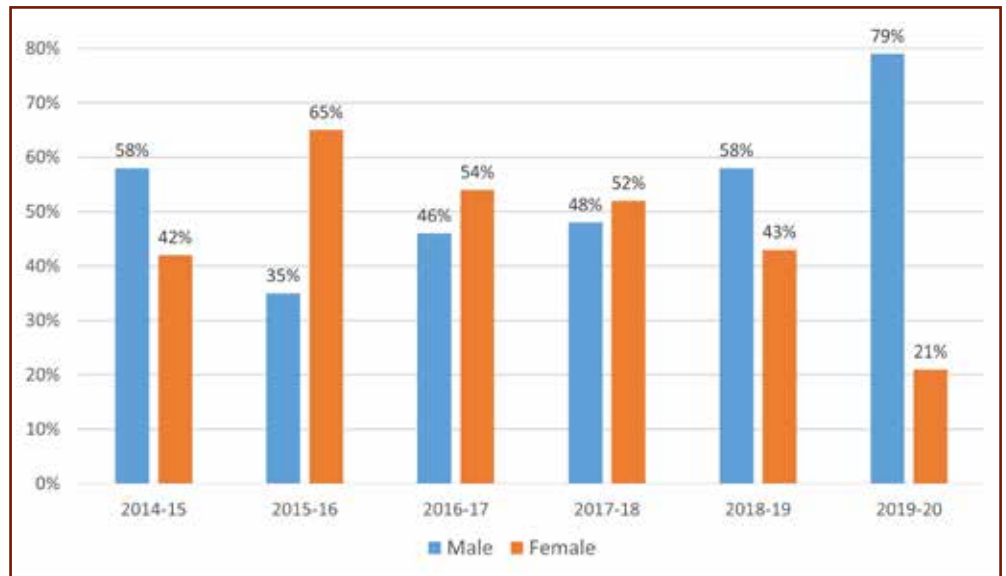
"Mostela" camera trap used in the pilot camera survey of weasels (NCWRC)

Bobcat & River Otter Sex and Age Ratio

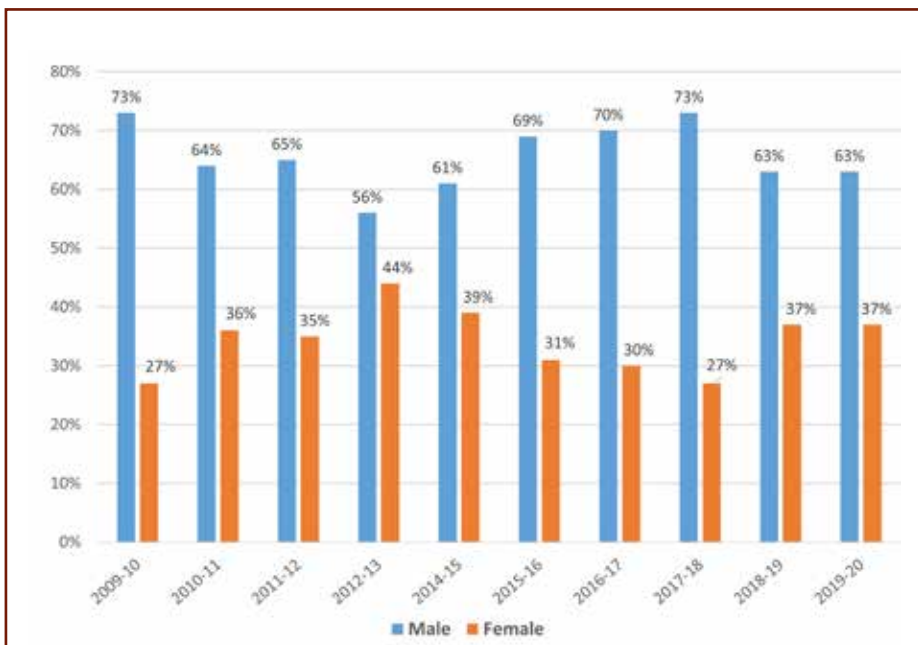
Starting with the 2013-14 season, North Carolina started collecting bobcat skulls or lower jaw bones from licensed trappers. The information will be used to determine the sex and age ratio of the harvest. The sampling objective is 10-15% of the trapper harvest for five consecutive years. Due to low pelt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

Since the 2013-14 season, staff have collected 275 skulls, though not all teeth extracted from the skull could be successfully aged. During the 2019-20 season, they

collected 29 skulls. The majority of the harvest is of 1-year old bobcats (32%), followed by 2-year old bobcats (25%). The oldest bobcats staff have documented were two 9-year old male bobcats. Overall, the sex ratio of the bobcat trapper harvest is slightly biased toward male bobcats (56%), though variation occurs among trapping seasons.



Sex ratio of bobcats sampled during the 2009-10 to 2019-20 trapping seasons



Sex ratio of river otters sampled during the 2009-10 to 2019-20 trapping seasons

River otter skulls are also collected to gather data on the age structure and sex ratio of harvested 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 1,338 skulls, though not all teeth extracted from the skull could be successfully aged. During the 2019-2020 season, they collected 97 skulls. The oldest otter they have documented was a 13-year old female otter. The oldest male otter was 12 years old. The majority of the harvest is of 1-year old otters (40%), followed by 2-year old otters (18%). The overall sex ratio of the harvest is biased towards male otters (65%), but variation occurs annually.

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 2019-20 season, NCWRC staff sampled 231 muskrats, a decline from the 2018-19 season, due to both a decline in the harvest of muskrats as a result of low pelt prices and restrictions on fieldwork due to Covid-19 safety restrictions. The ratio of juveniles to adults and

juveniles to adult females was the second lowest ratio 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. Staff 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.



Examination of hair growth patterns via flesh pigmentation in pelts can be used to determine age of muskrats. The mottled pattern of adult muskrats (center) is distinguished from the linear striped pattern of juveniles. Additionally, close examination of the pelts for teats is indicative of females. (NCWRC)

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 2019-2020 survey are not complete, as surveys were still being received in July and August 2020. For the 2018-19 trapping season, there was a 12% decrease (51,376 estimat-

ed harvest) in the overall furbearer harvest compared to 2017-18. As with previous seasons, beavers (26%), followed by raccoons (22%), opossums (17%), and coyotes (16%) comprised a majority of the harvest. Of the 2,958 trappers who had a trapping license during the 2018-19 trapping season, staff estimated 1,432 actively trapped, a decrease of 7% from the previous year.

The three furbearers showing the largest change in 2018-19 trapper harvest from the previous year



Muskrat : - 47%



Nutria: - 44%



Gray fox: - 31%

Photos from left to right: Wikimedia; Petar Milošević; Mark Buckler

Pelt Prices

Licensed fur dealers and the North American Fur Auction (NAFA) are contacted to solicit average pelt prices paid to North Carolina fur harvesters during the 2019-2020 trapping season. However, due to travel restrictions and fur sale cancellations related to Covid-19, as well the closure of NAFA in December 2019, data on fur prices are very limited from the 2019-2020 trapping season. Overall fur prices decreased by 40%, with all furbearer species experiencing pelt price declines. Declines were as follows: mink (-58%), gray fox (-54%), red fox (-52%), raccoon (-49%), striped skunk (-34%), opos-

Overall fur prices decreased by 40%, with all furbearer species experiencing pelt price declines.

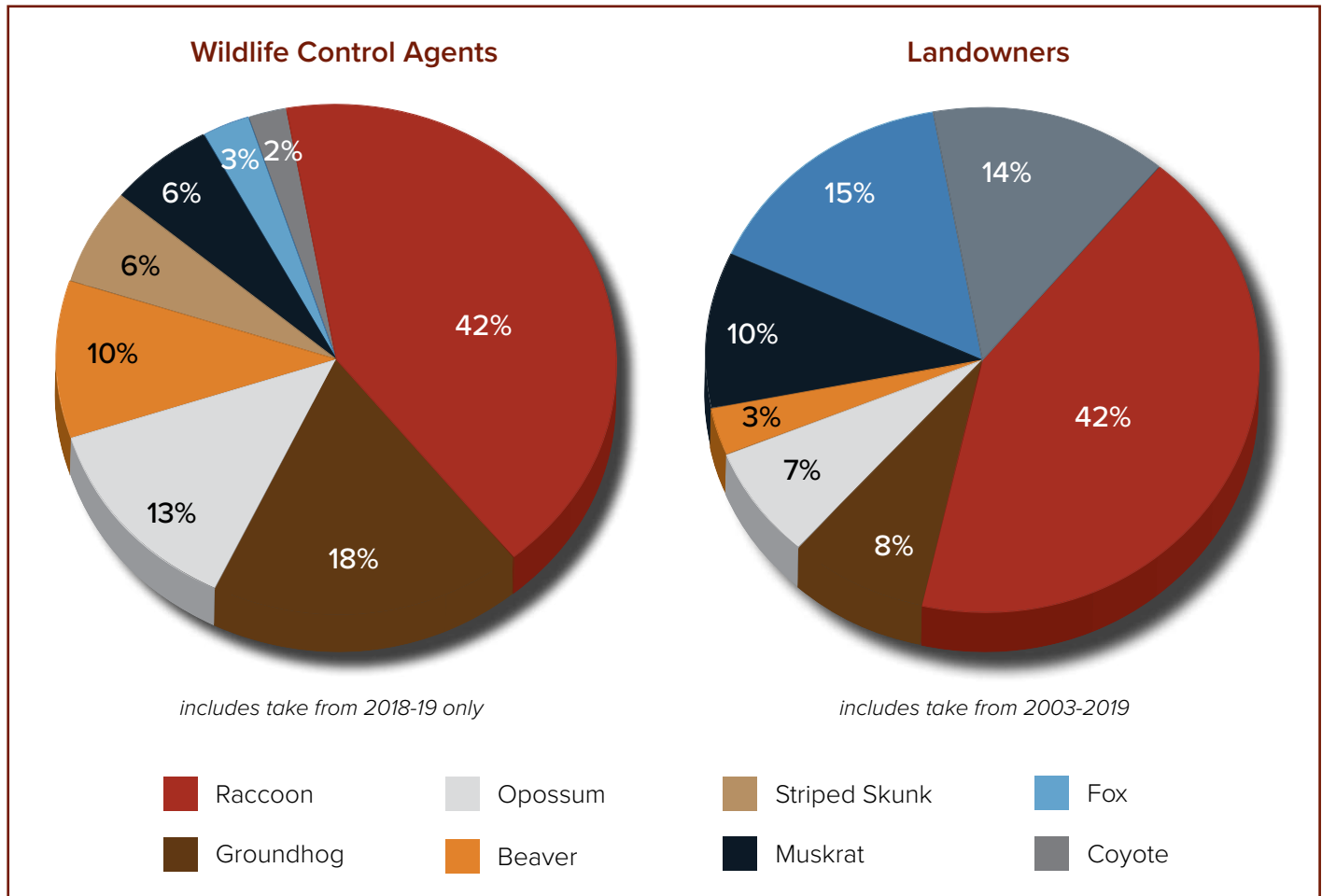
sum (-33%), otter (-31%), coyote (-26%), beaver (-23%), and bobcat (-19%). There were 16 licensed fur dealers during the 2019-2020 furbearer harvest season.

Depredation Take

Furbearers taken under depredation permits have been monitored since 1993. USDA-Wildlife Services and licensed Wildlife Control Agents (WCAs) are required to submit reports on activity under the depredation permits. With few exceptions, landowners issued depredation permits for furbearer species are not required to submit data on number of animals taken. Complete data are available through Dec. 31, 2019. During 2018-

19, there was an estimated 6% increase in the number of furbearers taken under depredation permit from the prior year. Raccoons comprised 42% of furbearer take from WCAs followed by groundhogs at 18%. In the Coastal Plain and Piedmont Furbearer Management Units (FMUs), raccoons were the most common species taken by WCAs, whereas in the Mountain FMU, groundhogs were the most common species taken by WCAs.

Cage traps (60% of captures) are the most common method used by WCAs, followed by body-gripping traps (16%). Though not required, the NCWRC does have some take data from depredation permits issued to landowners. The majority of furbearers taken by landowners were raccoons (42%), followed by fox (15%). The majority of furbearers taken by USDA-Wildlife Services were beavers, comprising 78% of the take.



Percentage of furbearer species take under depredation permit by licensed Wildlife Control Agents and landowners.

Rabies and Canine Distemper in Furbearers

During 2019, positive rabies results were obtained from 82 raccoons, 48 skunks, 42 foxes, three bobcats, and one deer. The total number of terrestrial rabies cases (n=176) was a 24% decrease from the number of cases detected during 2018 (n=259). The number of positive terrestrial rabies cases since 2005 remains below levels seen in the mid-1990s and mid-2000s. All but three western North Carolina counties have had positive terrestrial rabies cases at the end of the reporting period. Skunks and raccoons are the primary species of wildlife in which rabies is observed in North Carolina, excluding bats. Guilford County (n=12) had the highest number of positive terrestrial rabies, followed by Gaston, Iredell, and Mecklenburg counties (n=9 in each county).

Due to potential species bias in rabies-testing submissions of terrestrial wildlife, the NCWRC partnered with University of North

Carolina Wilmington to determine if demographic factors influenced rabies submissions across North Carolina. Due to the high cost for each rabies test, the North Carolina Division of Public Health (NCDPH) only tests individual wild animals that are suspected of having rabies and have possibly exposed humans to the virus. From 2008 to 2018, animal control offices submitted 300-1,000 wild terrestrial animals annually for rabies testing; however, only 30-46% of total submissions tested positive for rabies annually. Given that approximately 60% of submitted wild terrestrial animals regularly test negative for the virus, submission bias may exist in some counties or throughout the state. The high percent of non-rabid wild animals may also be indicative of canine distemper virus (CDV), which the NCDPH does not test for, but which is a disease that can negatively impact wildlife populations. High submission totals paired with

low percent positive submissions may indicate an unwarranted heightened perceived risk of rabies by residents and/or a general lack of knowledge regarding the disease and normal wildlife behavior (e.g., raccoons out during day-time). Determining what groups of people and areas of the state that are showing bias in submissions will help target rabies and wildlife technical guidance programs. It may also assist the NCWRC in identifying areas that warrant further investigation for CDV investigations.

The number of terrestrial wildlife rabies cases decreased by 24% from 2018 to 2019, with Guilford County seeing the highest number of rabies cases.

Positive Terrestrial Wildlife Cases in 2019 submitted to the NC Division of Public Health



82 raccoons



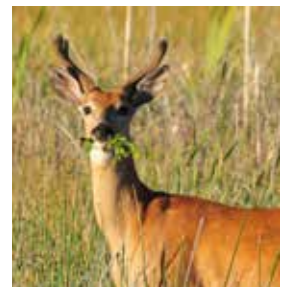
48 skunks



42 foxes



3 bobcats



1 deer

All photos: U.S. Fish & Wildlife Service

White-Tailed Deer

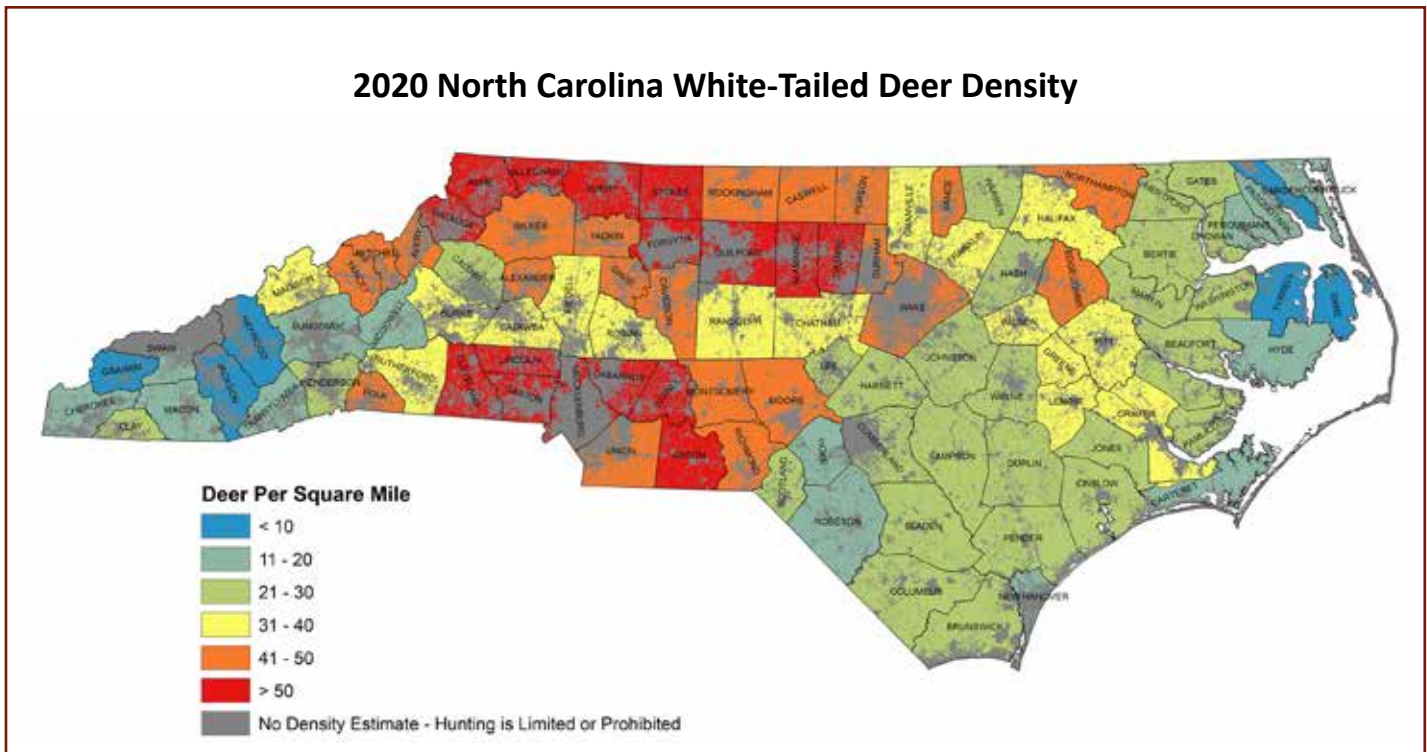
For information on white-tailed deer in North Carolina, see also: ncwildlife.org/deer

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 evalu-

ate proposed deer rules relative to statewide biological objectives. Agency personnel obtained biological data (e.g., age, sex, weight, antler measurements, fetal/reproductive information) from 5,421 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 were used in a population reconstruction model to estimate and map deer density at the county level.



2020 NC Deer Density Map: County deer density estimates as determined through population reconstruction modeling

Deer Harvest and Hunter Numbers

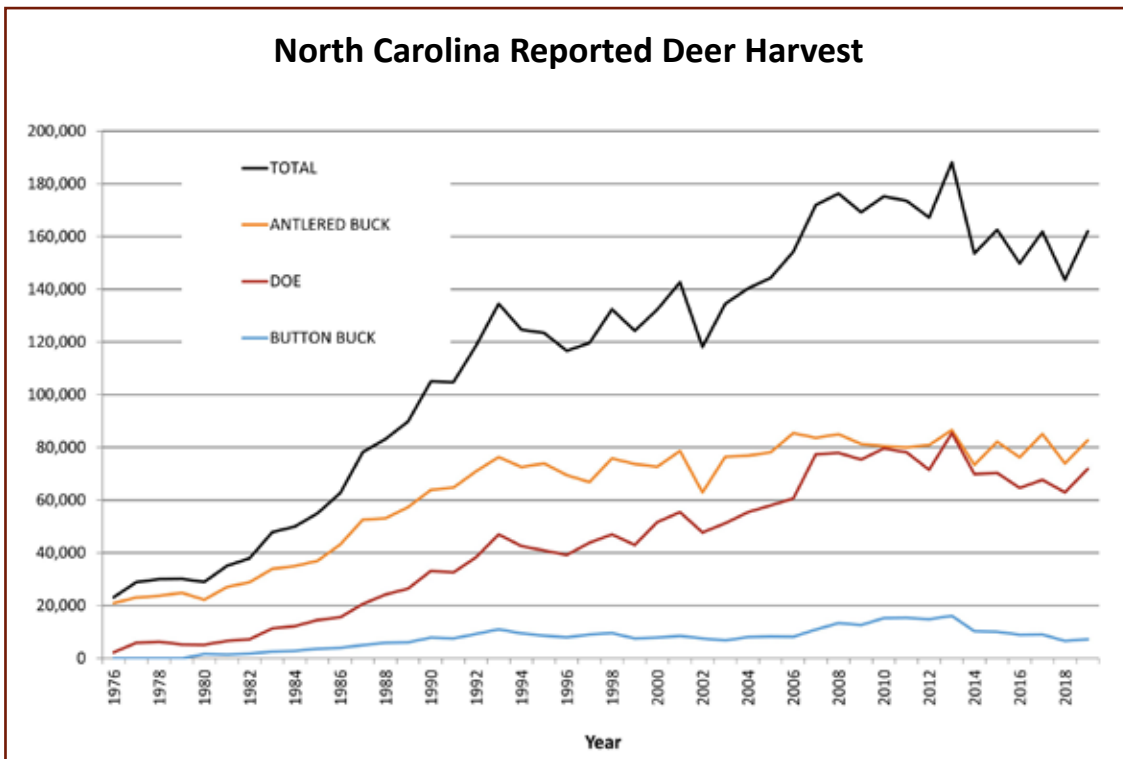
North Carolina hunters reported harvesting 161,941 deer during the 2019-2020 hunting season, consisting of 51.1% antlered bucks, 4.5% button bucks, and 44.4% does. Total statewide harvest was up 6.7% from the previous three-year average, ranging from a 2% decline in the Northeastern Zone to a 20.8% increase in the Western Zone. Reporting compliance remains around 75-85%.

The NCWRC implemented rule changes in 2018-2019 with objectives to stabilize deer numbers and improve the sex ratio and age-structure of the herd. A statewide antlered bag limit of two and

antlerless bag limit of four was established, and antlerless harvest opportunity was shifted toward the opening of the season in the Western Zone. Preliminary data in the second year of significant rule changes indicate the agency is moving closer toward meeting most biological objectives. Comparing the prior three-year average with the first two years following rule changes, antlered buck harvest declined at a higher rate (-19%) than doe harvest (-3%) in the former four-buck area. Percentage of button bucks in the antlerless harvest dropped from 12% to 9% statewide. The proportion of yearling bucks

in the antlered buck harvest declined from 38% to 33% statewide. Although timing of harvest was not adequately addressed across most of the state through the rule changes, the proportion of does in the harvest prior to peak breeding increased 10% in the Western Zone.

Total statewide white-tailed deer harvest was up 6.7% from the previous 3-year average, with a 2% decline in the Northeastern Zone and a 20.8% increase in the Western Zone.



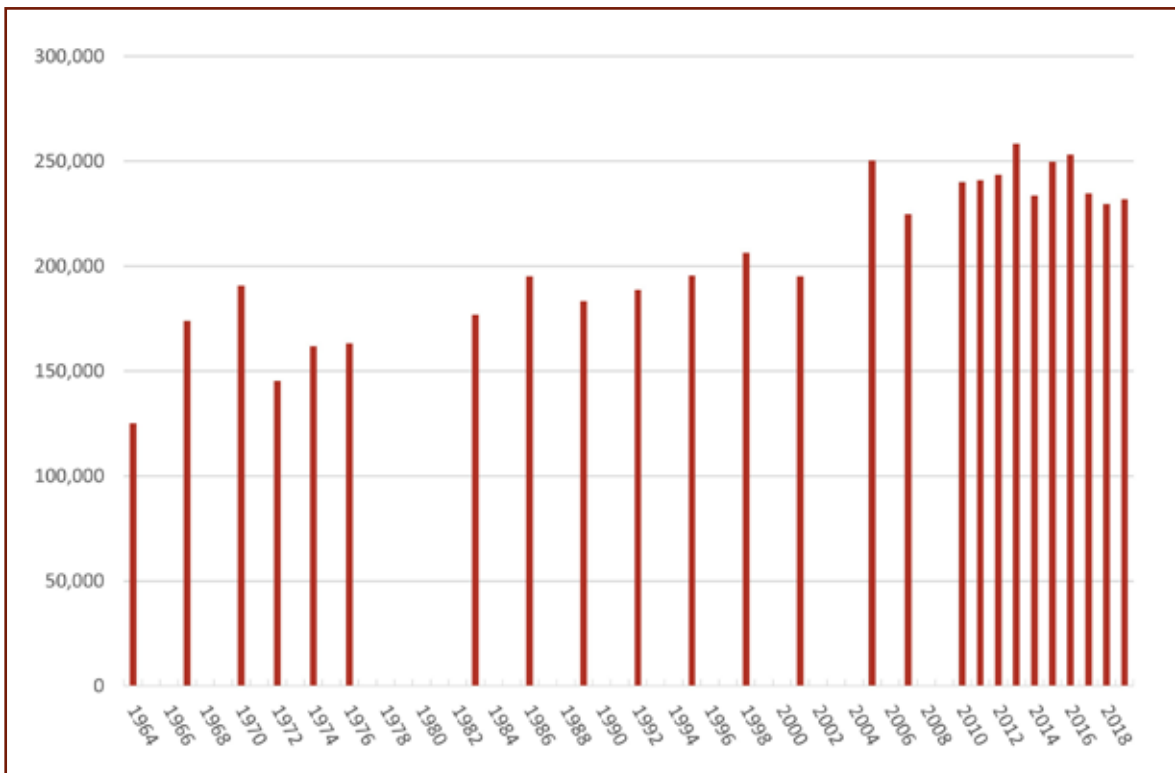
North Carolina reported deer harvest

Deer Harvest and Hunter Numbers (continued from previous page)

Since 2010, the NCWRC has conducted an annual 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 species can be tallied through the agency's mandatory reporting systems, the annual hunter harvest survey provides an estimate of the number of hunters pursuing various game species.

Prior to 2010, the survey was conducted periodically with the first survey in 1949. Estimates for the number of deer hunters were first calculated in 1964. For the 2019 hunting season, staff estimated 231,872 deer hunters, which represents a 3% decrease from the previous three-year average and is 10% lower than the largest number of deer hunters recorded in 2013 at 258,409.

Estimated number of deer hunters for the 2019 hunting season dropped 3% from the previous 3-year average and is 10% lower than the largest number of deer hunters recorded, which was in 2013.



Estimated number of deer hunters as determined by the NCWRC Hunter Harvest Survey, 1964-2019

Deer Hunter Observation Survey

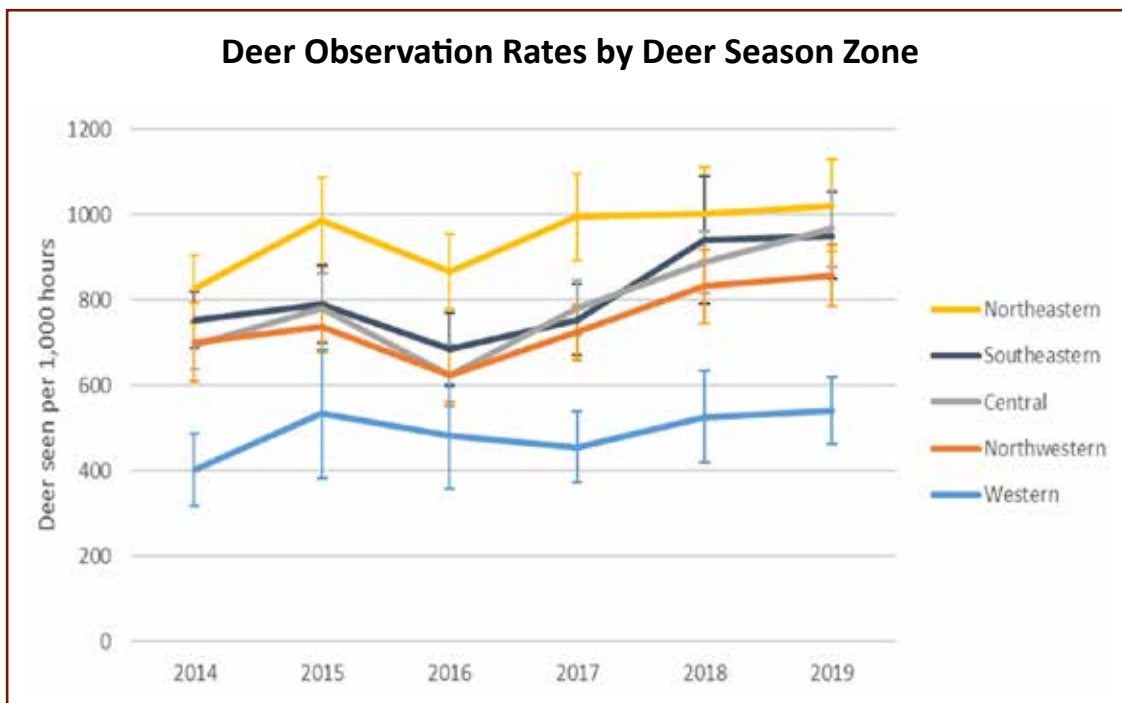
To provide an economical and statistically robust means of monitoring the relative observation rates of several game species (including white-tailed deer), an annual North Carolina Deer Hunter Observation Survey has been conducted since 2014.

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. Observation estimates provide an independent measure of overall deer abundance needed for comparison of harvest trends.

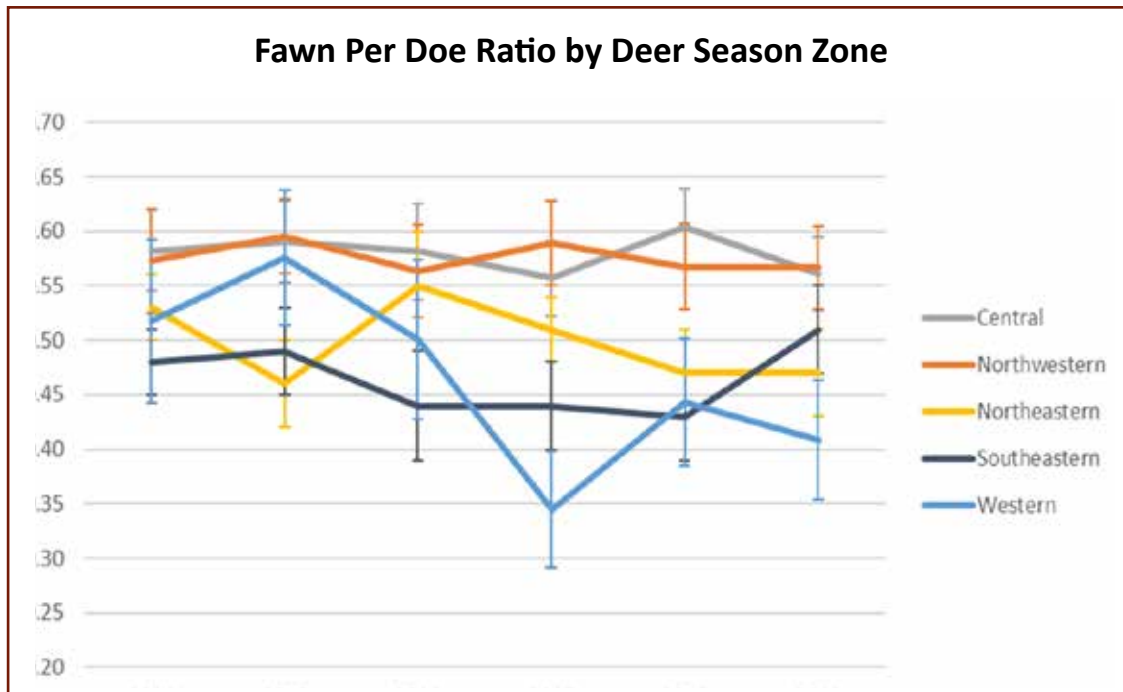
During the 2019 hunting season, 1,779 deer hunters participated in the survey and reported over 86,000 observations of deer. In 2019, hunters observed on average 0.88 deer/hr., 2.3 does/buck, and 0.50 fawns/doe. The overall observation rate generally increased in all management zones compared to 2018. Over the past six years, statewide observation rates have increased over

time (+34.8 deer per 1,000 hours annually, $P < 0.01$). The increase has appeared to be very similar across all five season zones with the highest number of deer observed during the most recent season.

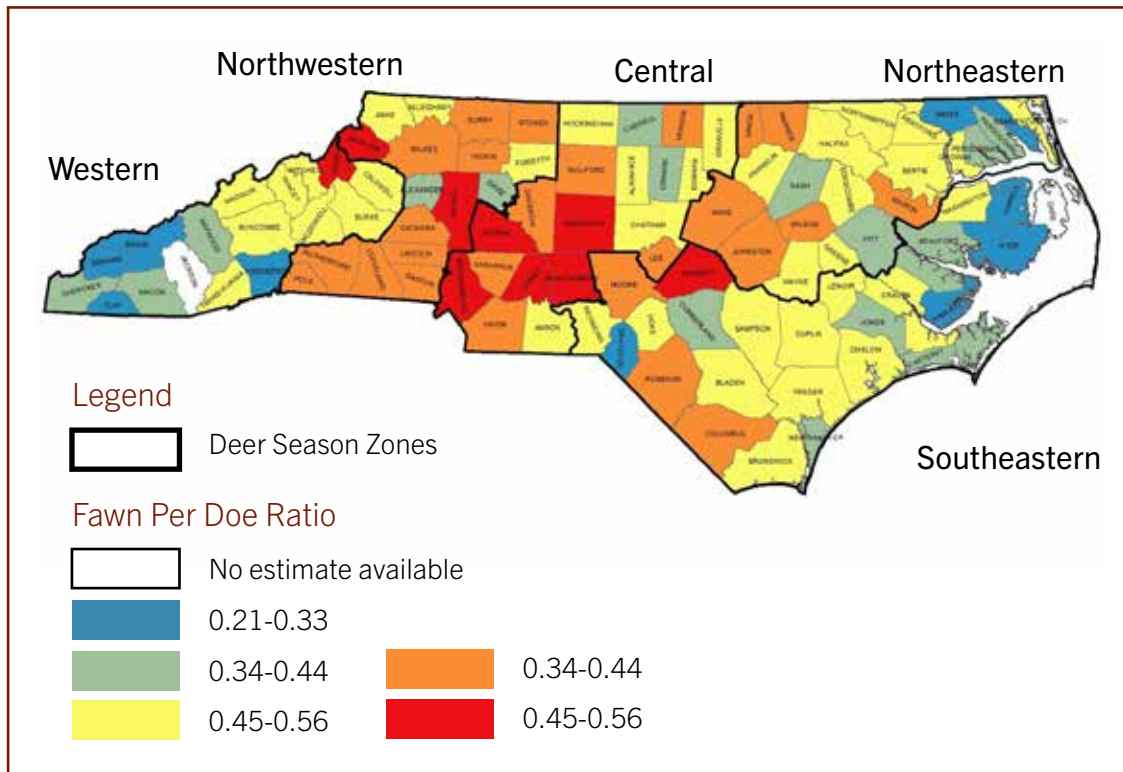
The observed fawn/doe ratio offers insight into deer population recruitment and provides a more comprehensive assessment of deer population dynamics and sustainable harvest rates. The observed fawn/doe ratio was highest in the Central and Northwestern zones (0.55-0.60 fawns for every adult doe), compared to the other three season zones (0.40-0.55 fawns for every adult doe). There is no evidence that statewide ratios have significantly changed within the past six years (0.51 fawns for every adult doe). Rates within each of the season zones also showed no significant change within the past five years. Considerable annual variation existed in the Western season zone, most notably a low ratio in 2017. Weather and most likely influence reproductive output and fawn mortality, but the relationship is complex and currently unclear.



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



Fawn per doe observation rates by county based on 5-year averages, North Carolina Deer Hunter Observation Survey, 2015-2019. Note that several coastal and mountain counties exhibit high amounts of annual variation and observation rates for some counties cannot be estimated due to low sample sizes.

Chronic Wasting Disease Surveillance

2019-20 marked the second year of a revised Chronic Wasting Disease (CWD) surveillance plan. Previously, the NCWRC had focused on intensive, statewide sampling once every five years. The current plan calls for annual sampling based on 5-year sampling goals. During the 2019-20 sampling year, the NCWRC processed 2,700 samples (including clinical samples) with testing by the Wisconsin Veterinarian Diagnostic Lab. To date, CWD has not been detected in North Carolina. Samples were obtained from a variety of sources and include meat processors (27% of samples) and vehicle kills (23%). As part of the Cervid Health Cooperator Program, 341 of the 2,700 samples were collected by 20 participating taxidermists. These collectors were compensated \$10 per sample for up to 20 samples.

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



Jason Allen, District 5 wildlife biologist, extracts deer lymph nodes for CWD surveillance. (NCWRC)

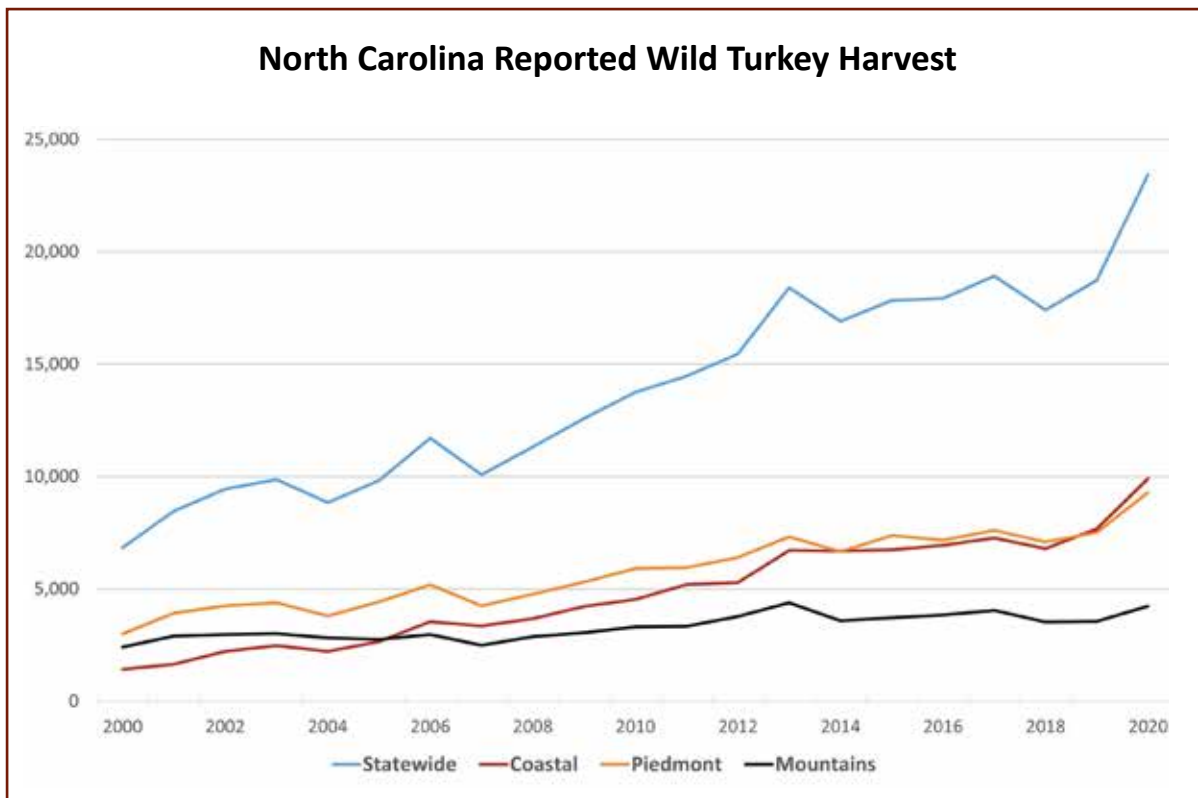
Upland Game Birds & Small Game Mammals

Wild Turkey Harvest

The 2020 spring wild turkey season in North Carolina ran from April 11-May 9 statewide. The dates for the Youth Season were April 4-10. Male or bearded turkeys were legal with a daily limit of one bird and a season limit of two birds. Youth could only harvest one bird during the Youth Season. Reporting of wild turkey harvests is mandatory via the agency's telephone or online reporting systems. Including 2,763 birds harvested during the Youth Season, the

2020 reported spring turkey harvest was 23,431 birds. This year's total statewide harvest was up nearly 28% from 2019, far surpassing the previous record of 18,919 from 2017. All the issues associated with COVID-19 undoubtedly had a major influence on hunting pressure and harvest during the spring 2020 season. The top five counties for the number of turkeys harvested were Duplin (686), Bladen (571), Columbus (539), Pender (532), and Franklin (516).

The total statewide harvest for wild turkey in 2020 was 23,431 birds, which was up nearly 28% and far surpassing the previous record of 18,919 from 2017.



North Carolina reported Wild Turkey harvest

Wild Turkey Summer Observation Survey

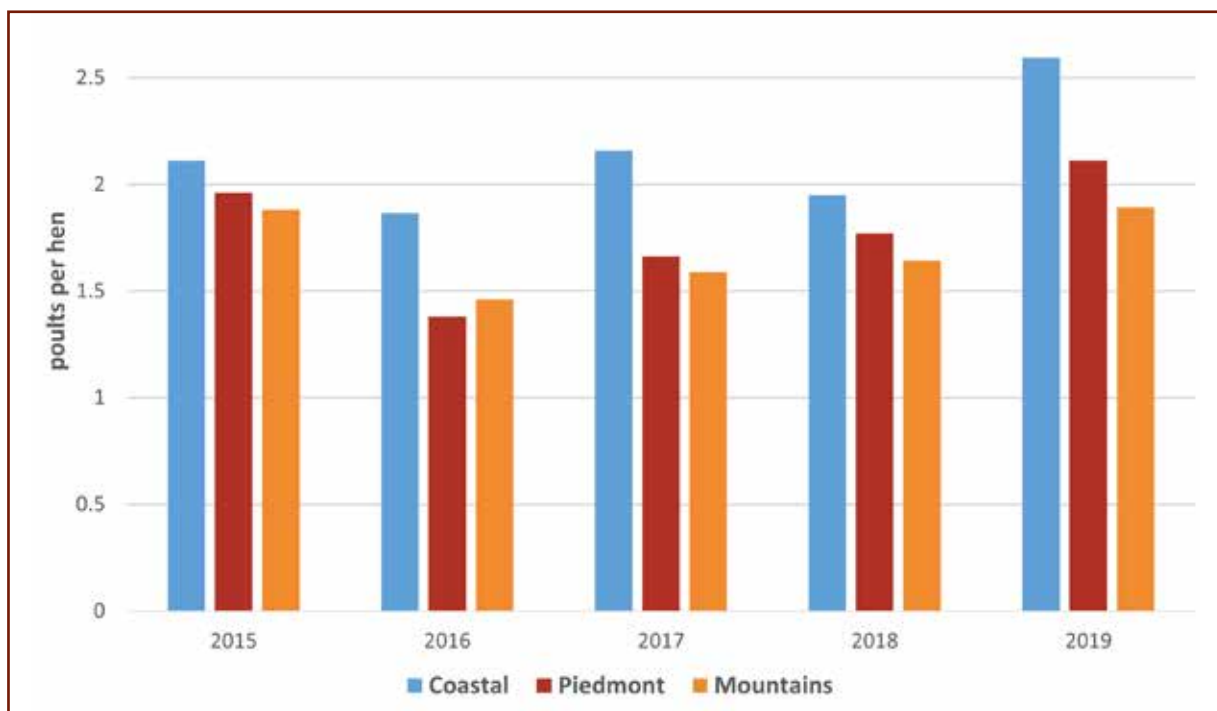
Each summer (July-August), the agency coordinates an observation survey to gain insight into wild turkey productivity and carryover of gobblers from the previous spring turkey season. In 2019, 2,671 individuals helped with the survey, including a mix of NCWRC employees, National Wild Turkey Federation members, and other individuals who had participated in the survey previously. Participants recorded 10,075 unique observations totaling 64,044 turkeys. Most of the increase in participation can be attributed to the effectiveness of social media and news releases, as well as the opportunity to enter observations on mobile devices. Productivity statewide was estimat-

ed to be 2.2 poult/hen, an increase from the 1.8 poult/hen recorded in 2018. Productivity was higher in the Coastal Region (2.5 poult/hen) than the Piedmont and Mountain regions (each 2.0 poult/hen) representing meaningful biological differences among regions. Poulth survival statewide was 4.0 poult per brood, but varied across the regions, with poulth survival highest in the Coastal Region and lowest in the mountains. The percentage of hens observed with poulth was highest in the Coastal Region as well. Estimates of turkey reproduction in 2019 were much higher than observations over the course of much of the last decade. Statewide estimates of productivity and poulth survival were the highest

since 2011. Though productivity in the Piedmont and mountains was lower than the Coastal Region, it was still higher than the average statewide productivity estimates since 2013.



AK Slocum



Regional observations of turkey production, 2015 through 2019

Wild Turkey Research

During the year, a cooperative research project with North Carolina State University was undertaken to better understand several key aspects of wild turkey ecology. Primary objectives for the project are to: 1) determine nesting chronology in each of three regions within the state, with emphasis on identifying the range and mean dates of egg-laying, incubation, hatching, and re-nesting; 2) determine nesting success for each of three regions within the state; and 3) determine seasonal

and annual survival rates in each of three regions within the state, partitioning mortality by cause (e.g., hunter harvest, predation, disease, and other causes), for juvenile and adult turkeys of each sex.

The primary means of data collection includes capture of wild turkeys and attachment of several types of tracking transmitters. Field work began in earnest in January 2020 with rocket netting and capture of turkeys with trapping continuing until the end of March.

Marking goals were 50 females and 30 males in each region of the state.

Statewide, 287 turkeys were captured with 249 being marked with either GPS or VHF transmitters. Marking goals were met in the mountains and Piedmont but fell a little short on the coast. Through June, 84 mortalities were attributed to a variety of causes, including 12 legally harvested adult males. Additional marking and tracking will continue for two more field seasons; through August 2022.



Evin Stanford, the agency's Private Lands Program Coastal Plain Supervisor, prepares boxes, which will be used to temporarily contain captured turkeys. (ncwrc)



Land & Water Access (LAWA) Burnsville Technician, Chris Henline (left), and LAWA Mountain Region Supervisor, Kip Hollifield, (right) preparing a turkey for release. (ncwrc)



Closeup view of a transmitter (ncwrc)



Reloading a rocket net (David Gladkowski)

Wild Turkey Gobbling Chronology Project

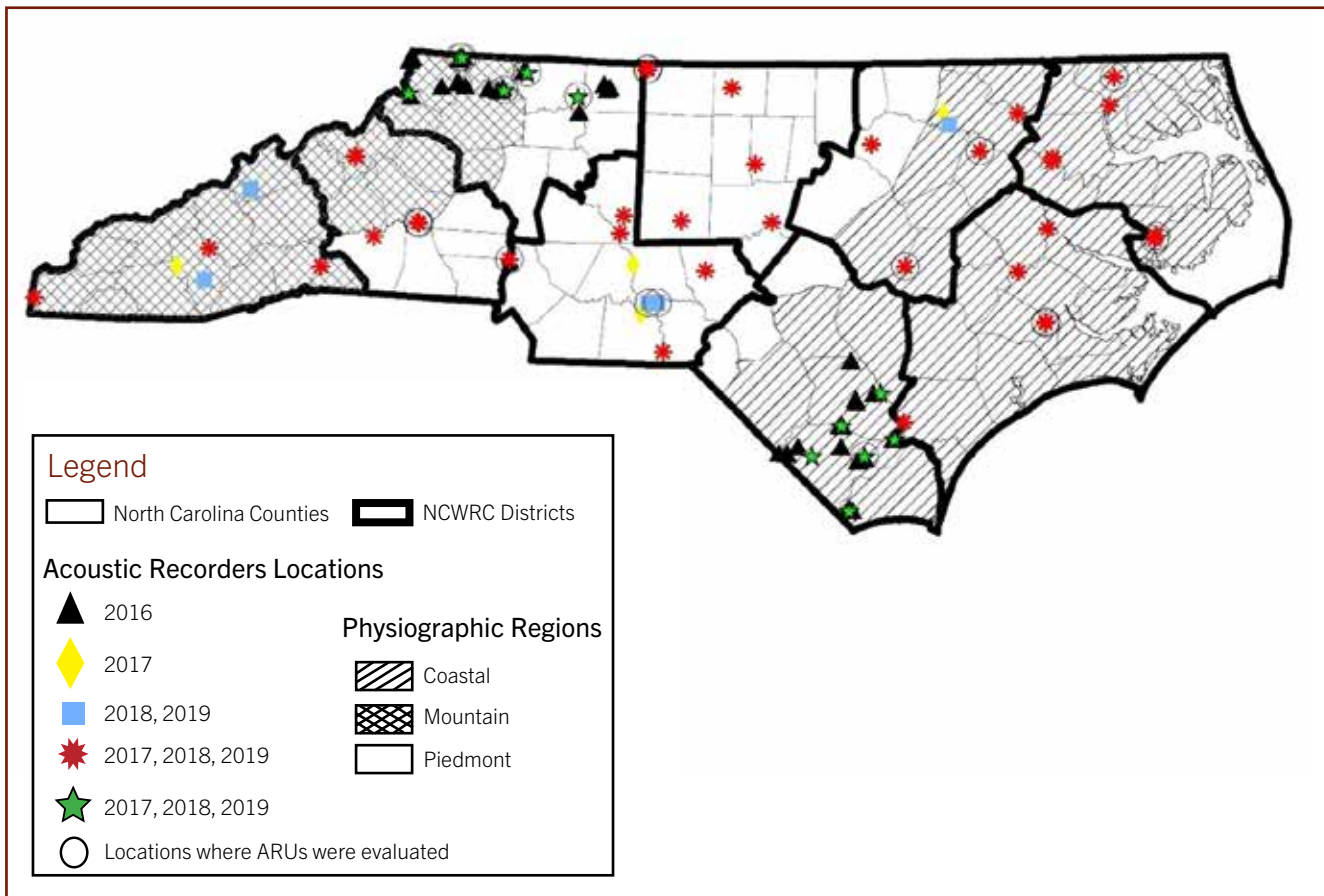
To determine the timing of wild turkey gobbling, agency staff deployed autonomous recording units (ARUs) across North Carolina during the springs of 2016-2019. A thorough understanding of gobbling chronology is important due to its relationship with turkey reproductive ecology and spring turkey hunting success and hunter satisfaction. During the time period, staff deployed ARUs at 94 locations on 60 properties in 41 counties across North Carolina. To the greatest extent possible, they selected properties that were relatively large, had

robust turkey populations, and received very little-to no-turkey hunting pressure. Minimal hunting was important as a way to factor out the influence that hunting pressure may have on gobbling activity. During the year, staff thoroughly analyzed all data and have nearly completed a summary report of this project.

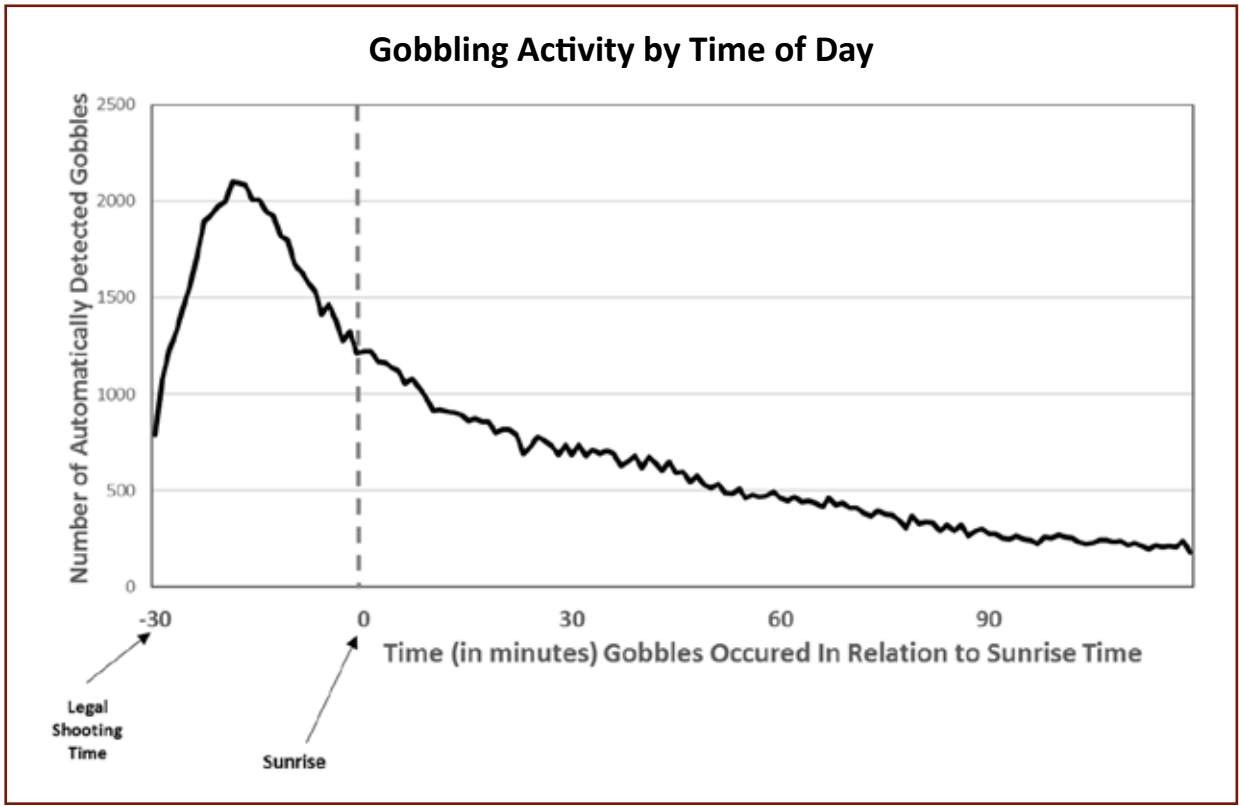
Final results and conclusions are pending, but the project has generated a tremendous amount of data with over 53,000 hours of audio files recorded. Using Raven Pro automated software and verification by employees, staff tallied

more than 113,000 turkey gobbles. Along with a better understanding of gobbling activity throughout the spring, data analysis also yielded interesting (although predictable) patterns in daily turkey gobbling. As expected, turkey gobbling peaked prior to sunrise with a steady decline throughout the morning.

In conjunction with an ongoing statewide turkey reproductive ecology research project, staff expect results will help ensure that wild turkey hunting seasons are timed appropriately to maximize both turkey reproduction and hunter satisfaction.



Locations of autonomous recording units (ARU's) used to determine wild turkey gobbling patterns, 2016-2019



Statewide turkey gobbling activity by time of day as determined by autonomous recording units (ARUs), 2016-2019



Grouse/West Nile Virus Surveillance

Surveillance for exposure to West Nile virus (WNV) in ruffed grouse continued during the 2019-20 hunt-ing season. WNV is a mosquito-borne disease that has had a devastating effect on numerous North American bird species since it first found its way to North America. Research conducted in 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 the local effects of WNV in the North Carolina ruffed grouse population.

Avid grouse hunters provided feathers and blood samples from 36 ruffed grouse (35 birds from North Carolina and one from Tennessee); a decrease from

the 63 samples received in 2018. The 35 grouse from North Carolina were harvested in 11 different counties with nearly 50% from Haywood and Macon counties. For those individuals that submitted cor-rect feather samples, the age and sex breakdown of the birds included: 18 adult males, three adult females, six immature females and three immature males.

All feathers and blood samples were submitted to the Southeastern Co-operative Wildlife Disease Study in Athens, Georgia.

Sample collections will occur for at least one more year, and afterwards, staff hope to have a better un-derstanding of how exposure rates vary across the range of participating states and the relationship of exposure rates and population impacts.



Agnieszka Bacal



Close examination of ruffed grouse rump feathers provides a reliable indi-cator of sex. Rump feathers with one white dot indicate a female grouse (left) whereas two dots indicate a male (right). (NCWRC)

Examination of centrally located tail feathers of ruffed grouse can be used to assist in determining sex. All female grouse will have broken or blotched tail bands (left). While male grouse may have complete tail bands (right), up to half of males may also have broken bands similar to females. (NCWRC)

Avid Quail and Grouse Hunter Surveys

Staff continue to work with avid hunters to monitor ruffed grouse and bobwhite quail hunting activity. Forty-seven avid grouse hunters submitted hunt data during the 2019-20 hunting season, providing statistics for 454 hunting trips. 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 2019-20, participants flushed, on average, 0.4 grouse per hour and 1.5 grouse per hunting trip; both decreases from the previous year.

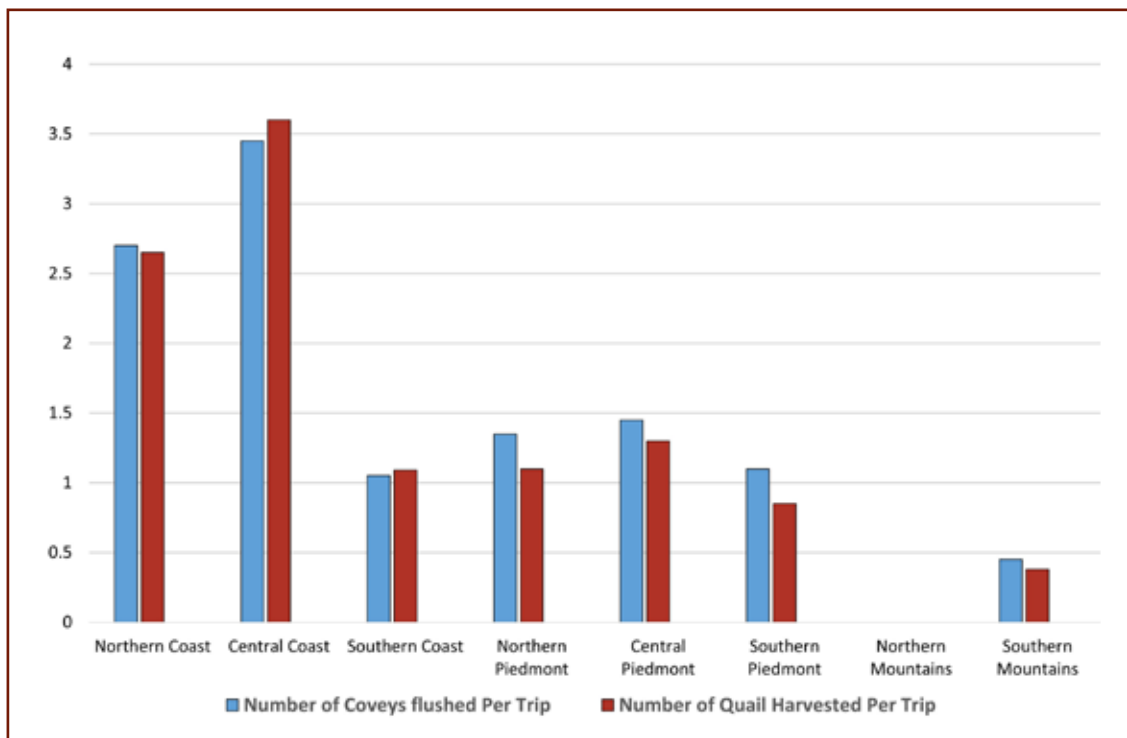
On 43% of the hunting trips, no grouse were found. Likely as a function of declining hunt success, total

grouse hunting trips by participants have also declined. While flush rates have certainly declined over time, flush rates are not a direct indicator of grouse abundance because it is recognized that hunters will change their hunting locations over time to focus on areas with more grouse.

Fifty-one avid quail hunters provided hunting data during the 2019-20 hunting season on 758 quail hunting trips. On an average hunt day, 1.6 coveys were flushed and 1.5 quail bagged per hunt party; both unchanged from the previous year. Quail hunting success varied within the state depending on the region and landowner type. By region, flush rates were 0.51 coveys per hour in

the Coastal Plain and 0.36 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.

Hunting success also varies considerably by management unit with highest success in the northern and central coast. Over the last two decades, flush rates have generally increased on private lands and generally decreased on game lands. This may be the result of the skill level of the relatively few remaining quail hunters for these land types, as well as the overall habitat conditions and quail populations.



Average number of coveys flushed and quail harvested per hunting trip by management unit in the avid quail hunter survey, 2019-20 hunting season

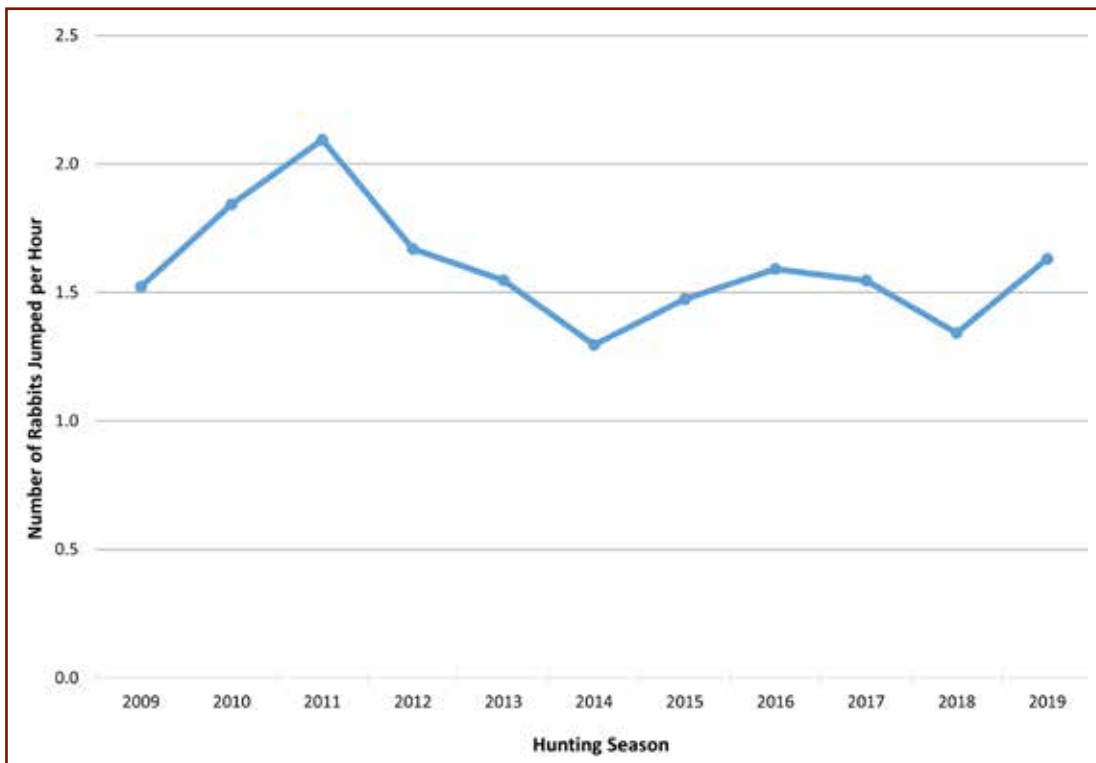


Eastern cottontail rabbit (Shutterstock)

Avid Rabbit Hunter Surveys

Thirty-two respondents reported harvesting 2,150 rabbits during 487 hunting trips throughout 57 counties in North Carolina. Marsh rabbits were harvested in 26 of the 57 counties and accounted for 15% of the reported harvest. There were 14 reported hunts in October, 39 in November, 58 in December, 189 in January, and 187 in February with 84% percent of the harvest occurring in

January and February. Hunters jumped approximately 1.6 rabbits per hour and harvested approximately 55% of those rabbits. On an average hunt, 8 rabbits were jumped, and 4.4 rabbits were harvested. Both rabbits jumped per hour and rabbits jumped per trip increased compared to the previous hunting season and were above the long-term averages since the survey began in 2009.



Average number of rabbits jumped per hour, as determined from the annual North Carolina Avid Rabbit Hunter Survey.

Appalachian Cottontail Research

In spring 2020, work wrapped-up on a two-year research project investigating several aspects of Appalachian cottontail ecology including distribution, habitat preferences, and population genetics. Several field techniques were employed including scat surveys necessary to predict large-scale occupancy and genetic structure, as well as, live-trapping and radio telemetry to determine home range and habitat use. Occupied habitat can best be predicted by areas with moderate to cool temperatures and those with consistent year-round precipitation. Elevation itself does not appear to be a predictor of occupied habitat

as Appalachian cottontails can be found in elevations as low as 1,250 feet. Regarding habitat preferences from a landscape scale perspective,

The Appalachian cottontail rabbit is considered a Species of Concern by the U.S. Fish and Wildlife Service and classified as vulnerable to critically imperiled throughout most of its range.

at high elevation sites, cottontail home ranges included heath balds more than expected and oak forests less than expected. At low elevation sites, cottontail home ranges were selected in pine/hemlock, early successional, and heath bald

habitat more than expected and in oak forests less than expected based on overall availability of these habitat types. From radio tracking of 22 Appalachian cottontails, staff determined average home range size was 8.4 acres with no difference between males and females or high and low elevation sites. Genetic sampling results included the identification of multiple, isolated populations of Appalachian cottontails in western North Carolina suggesting that these populations have been isolated for some time with limited gene flow between their habitat patches. Although populations were isolated, genetic issues arising from inbreeding would not appear to be a concern at this time.



In North Carolina, the Appalachian cottontail is found only in the western part of the state at higher elevations. (Andrea Shipley/NCWRC)

Migratory Game Birds

Waterfowl Surveys

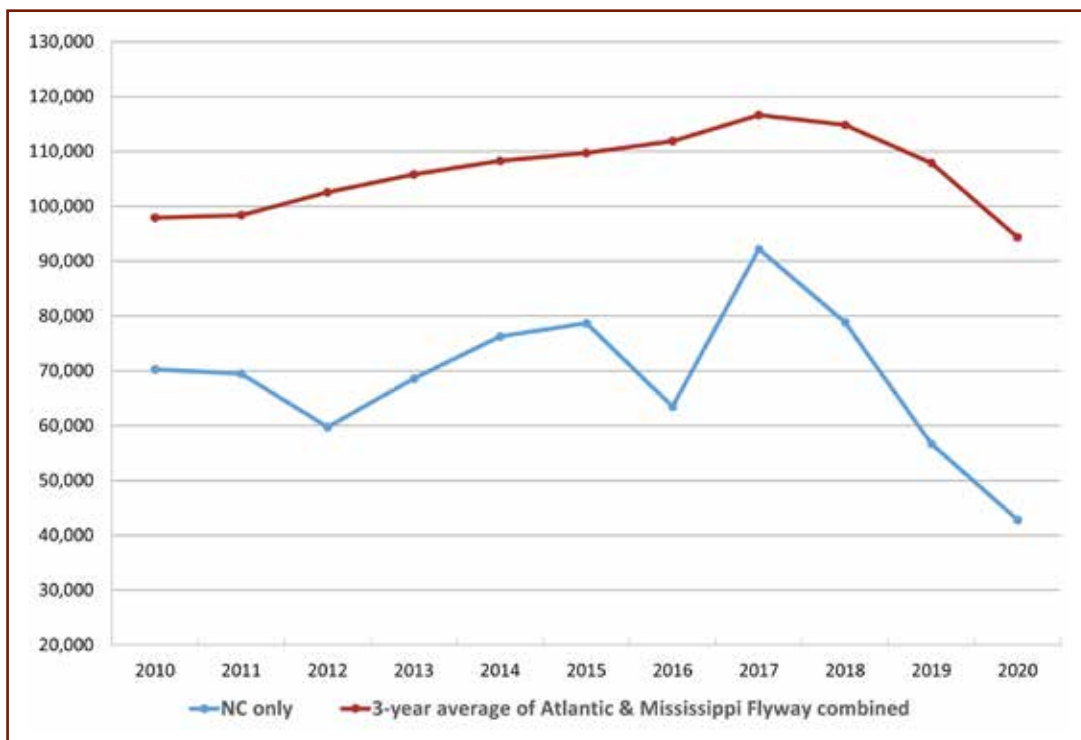
Mid-winter Waterfowl Survey

The mid-winter waterfowl survey is a fixed-wing aerial survey conducted annually in cooperation with the U.S. Fish & Wildlife Service (USFWS) that estimates numbers of wintering tundra swans and Atlantic brant. Permit allocation among tundra swan hunt states is based on the combined Atlantic and Mississippi Flyway mid-winter surveys, while the observed numbers of brant in the Atlantic Flyway inform the annual USFWS brant harvest decision.

During the January 2020 survey, staff observed 42,778 tundra swans and 285 brant. The number of tundra swans observed in North Carolina was 25% lower than 2019 and 50% lower than the previous nine-year average and was the lowest since 1982 when 42,200

swans were observed. The three-year running average of the number of tundra swans observed in the Atlantic and Mississippi Flyways declined to 94,340 birds, resulting in a 25% decrease in the number of permits allocated to tundra swan hunt states for the 2020-21 hunting season. In North Carolina, tundra swan permits will be reduced from 6,115 to 4,895 permits.

In the future, if the three-year running average of tundra swans observed in both flyways exceeds 110,000 birds, permit allocation will increase by 25%. Alternatively, if the three-year average falls below 70,000 birds, permit allocation will decrease by 25%, and if the tundra count falls below 50,000 birds, the tundra swan hunting season will be closed.



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

Northeast Hunt Zone Resident Goose Survey

In most years, staff conduct an aerial survey for resident Canada geese in early fall in the Northeast Canada Goose Hunt Zone. The primary purpose is to gauge the level of migrant Canada goose abun-

dance in the area when compared to results of the annual mid-winter survey occurring in the same area. In late September 2019, staff observed 4,561 Canada geese in the area; an increase of 19% compared

to the last survey conducted in 2017. While results of the survey tend to fluctuate a bit, the population of resident Canada geese in the survey area has remained fairly consistent since the mid 1990s.

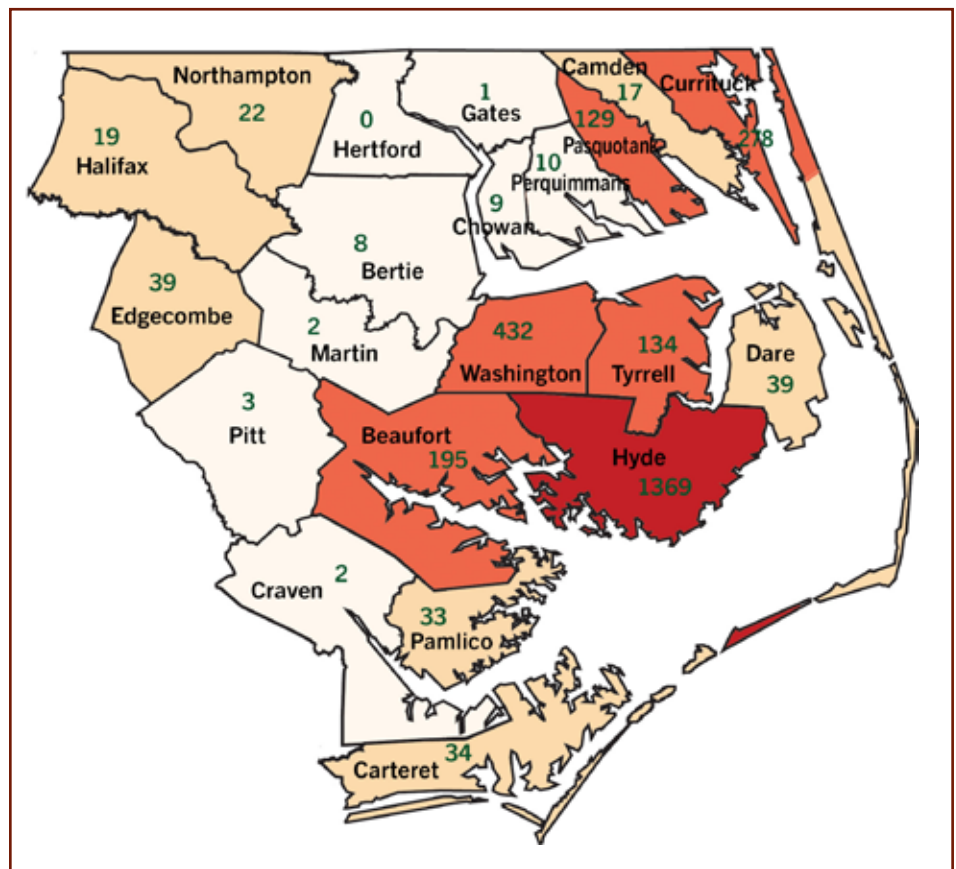
Tundra Swan & Canada Goose Harvest Surveys

Harvest and hunter participation estimates for most migratory game birds in North Carolina are generated by the U.S. Fish & Wildlife Service (USFWS) through the Harvest Information Program (HIP) and through NCWRC annual hunter harvest surveys. Through a Memorandum of Agreement with the USFWS, the NCWRC conducts a survey to estimate harvest and hunting activity for tundra swans. During the 2019-20 hunting season, an estimated 5,124 swan hunters hunted 10,876

hunter days. An estimated 2,999 tundra swans were harvested, representing a 5% increase from the previous season. In the Northeast Canada Goose Hunt Zone, staff estimated that 1,351 hunters killed 648 Canada geese (includes unretrieved birds) during the 14-day Canada goose season in January 2020; a 33% increase from the previous season and a 10% increase from long-term average back to 2009.



Canada geese in flight (Steve Oehlenschläger)



County distribution of the 2019-20 tundra swan harvest within the principal swan harvest counties. Counties not shown: Bladen(3), Columbus (2), Jackson (2), Montgomery (1), Onslow (1), Randolph (1).



Adult and juvenile tundra swans (NCWRC)

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 have conducted an annual 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 distributed 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 productivity.

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. Prior to 2018, the previous 10-year average indicated that nearly 13% of the Eastern Population Tundra Swan population consisted of im-

mature swans. The fall 2019 survey in the Atlantic Flyway estimated that 8% of the population consisted of juvenile swans, which was only marginally better than 2018 estimate of 5%. This indicates that Eastern Population Tundra Swans experienced largely failed reproduction during both the 2018 and 2019 breeding seasons, likely due to snow and ice being present during the time most nests are initiated, shortening the window for successful reproduction.

Waterfowl and Webless Species Monitoring

Wood Duck Banding

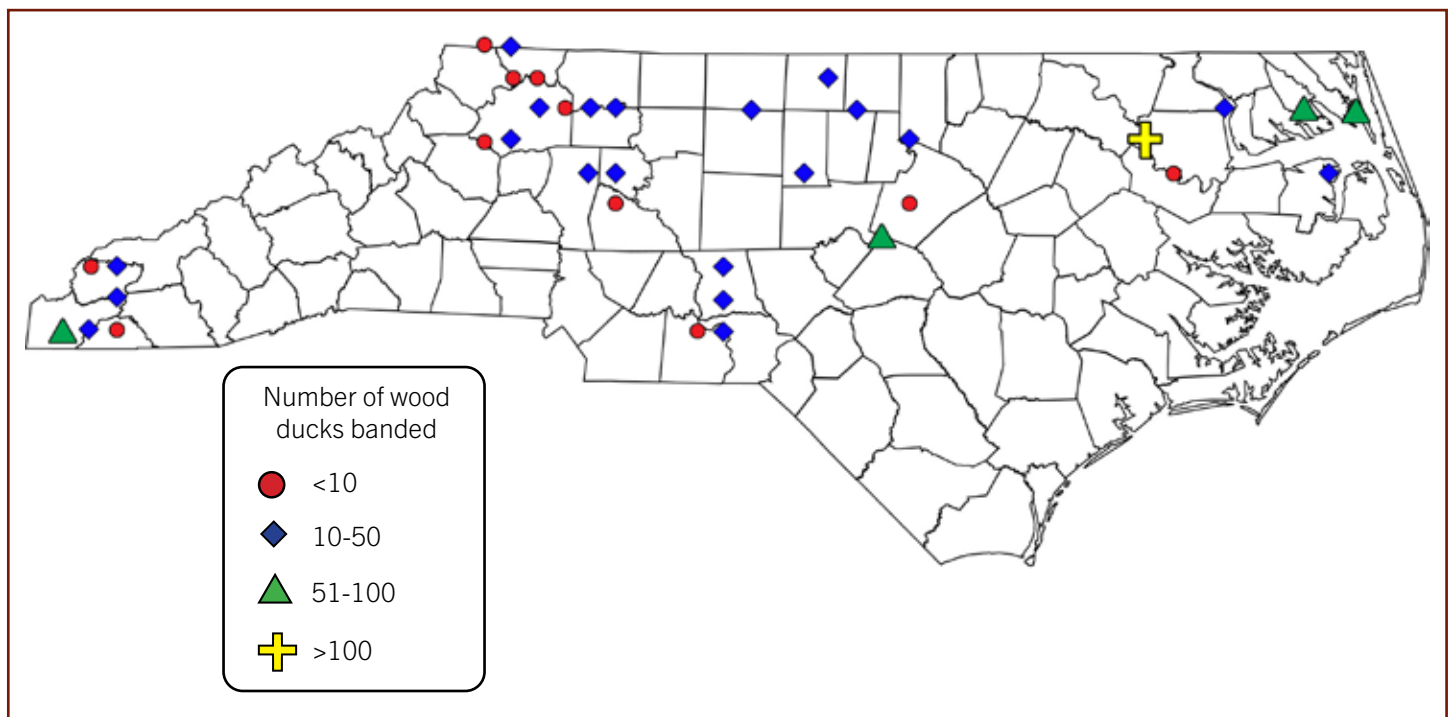
As part of the NCWRC's long-term and ongoing monitoring efforts, agency staff continue to capture and band wood ducks each summer during July-September. When combined with similar efforts by other state wildlife agencies and the U.S. Fish and Wildlife Service, the data obtained from hunter band recoveries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

During the 2019 banding period, staff captured and banded 925 wood ducks statewide, down 4% from the previous year and a 15% 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. As has occurred in recent years, the majority of wood duck banding in 2019 occurred in Districts 1, 5, 6, 7, and 9.



Casey Dukes, a Conservation Biologist I, bands a wood duck. (NCWRC)



2019 Wood Duck Banding distribution

Mourning Dove Banding

Since 2003, and as part of a nationwide program, agency staff have captured and banded mourning doves each summer (July-August) 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 (EMU) — an administrative boundary that includes all dove hunting states east of the Mississippi river.

In summer 2019, staff banded 1,387 mourning doves representing the sixth highest total since 2003. The Land and Water Access Sandhills crew banded 348 doves in their work area. Included in the 2019 statewide totals are 200 reward and control bands that are part of a study being conducted by the EMU to understand the current band reporting rate. An accurate estimate of the band reporting rate is necessary to estimate harvest rate (the proportion of the population harvested each year). Reward banding will continue for another two years.



Banded dove (NCWRC)

Waterfowl and Webless Species Research

American Black Duck Nesting Ecology

Phase 1 of a research project focusing on black duck nesting ecology was completed in 2019. The project was headed by the University of Delaware with several key objectives: determine nest initiation and peak nesting dates; examine factors influencing nesting success; determine preferred nesting habitat of black ducks in coastal marshes; and to model the impacts of sea-level rise on preferred black duck nesting habitat. Additionally, research examined hybridization rates with feral mallards and the genetic structure of North Carolina's black duck breeding population.

During the two-year field season, 140 black duck nests were

located and monitored. Average nest initiation dates for both years combined was April 16, and mean nest success was estimated at 62%. Predation was the leading cause of nest failure in both years, but spring storm events in 2017 also destroyed some nests leading to a noticeable re-nesting effort that was not observed in 2018. Nests were located in both natural marsh and on man-made dredge spoil islands in areas classified as irregularly flooded estuarine "high marsh." Black ducks almost exclusively nested in saltmeadow cordgrass (*Spartina patens*) patches on the open-water perimeter of the high marsh. Based on the results of this study, marsh

habitat in Hyde and Dare counties is important for black duck nesting appears resilient to the impacts of sea-level rise out to 2100.



Black duck nest located on Swan Quarter National Wildlife Refuge, Hyde County (NCWRC)

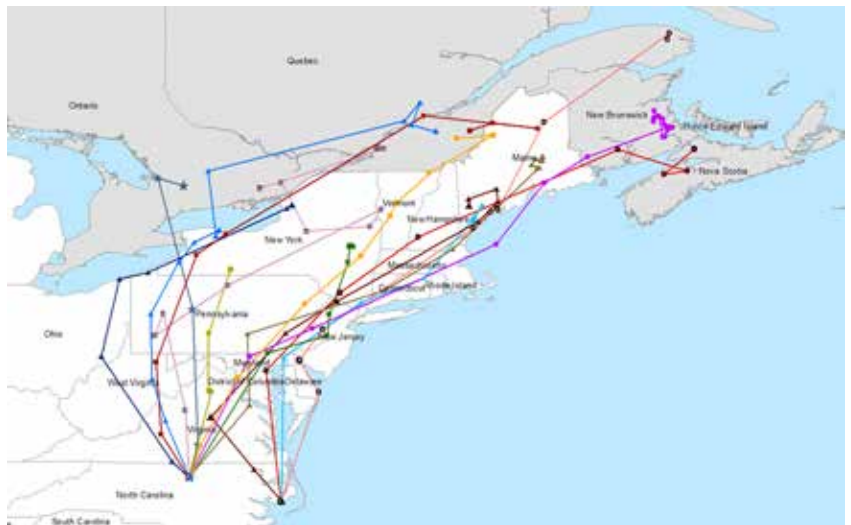
American Woodcock Migration Ecology

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. During the year, NCWRC continued its collaboration with the University of Maine, 12 states, and three Canadian provinces that represent the woodcock breeding, stopover, and wintering range in eastern North America.

The principal objective of the Eastern Woodcock Migration Ecology Project is 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, 18,255 locations from 304 transmitters have been collected, including locations from breeding, migration, and wintering areas. In North Carolina, NCWRC biologists and staff captured and fitted 15 woodcock with transmitters during February 2020 at Outfall Farms in Hyde County and at Butner Falls of Neuse Game Land in Granville County. Woodcock captured in North Carolina in 2020 migrated to Quebec (4), Maine (4), New York (3), Ontario (1), New Brunswick (1) and Nova Scotia (1). One woodcock remained in North Carolina before the signal was lost. During the next two years, NCWRC biologists and staff will continue to deploy 15 transmitters each year.



Doug Howell, the NCWRC's Migratory Game Bird Coordinator, fits an American woodcock with a GPS transmitter. (ncwrc)



Migration of American woodcock fitted with GPS transmitters in February, 2020 from capture locations in North Carolina

Multi-Species Surveys & Research

Deer Hunter Observation Survey

As mentioned on page 25, a deer hunter observation survey has been conducted each year since 2014. During the six deer hunting seasons from 2014-2019, volunteer deer hunters recorded wildlife observations on 161,145 hunting trips encompassing nearly 550,000 observation hours. While the survey provides insight into deer herd parameters, it may also have long-term utility in monitoring many additional game and furbearer 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 many other

species. NCWRC staff believe that over time this survey will provide insight into changes in species abun-

Deer hunter observation survey participants have recorded observations of many other species, giving NCWRC biologists valuable information on game and furbearer species that are typically difficult to monitor.

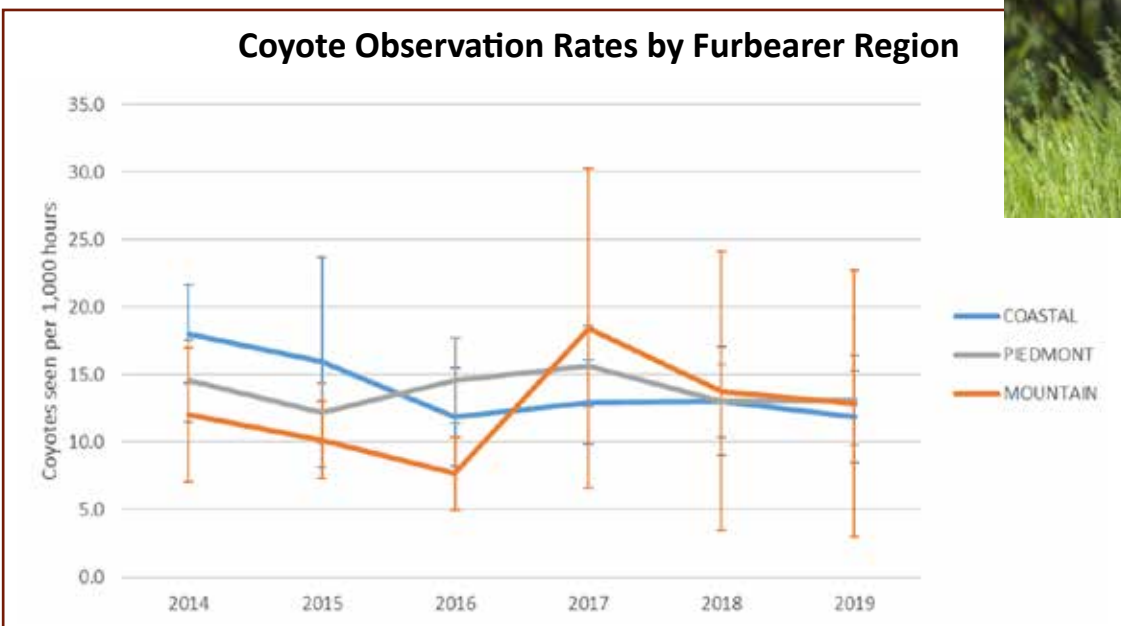
dance that may occur from both a spatial and temporal perspective.

To provide an example within this report, staff highlight observation trends of foxes and coyotes. While all three canid species can be found statewide, standardized observations suggest some regional

distribution differences and provide insight into long-term trends. Coyote observation rates have appeared to remain relatively stable and are similar within all three furbearer management units (FMUs) in recent years. Annual red fox observation rates are relatively low and tend to fluctuate due to small sample sizes. Gray fox observation rates are slightly higher than red fox, and observations are higher in the Coastal and Piedmont FMUs than in the Mountain FMU. Results indicate there may be a declining trend since 2014 in the Coastal FMU.



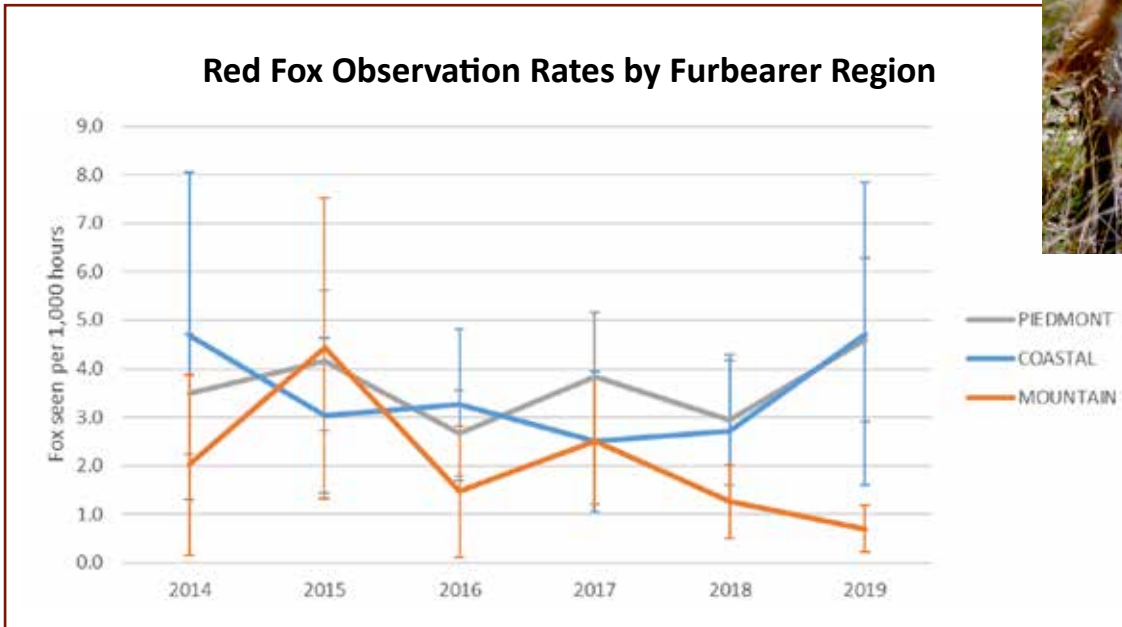
(Josef Pittner)



Regional coyote observation rates (with 95% confidence intervals) as determined from the annual North Carolina Deer Hunter Observation Survey



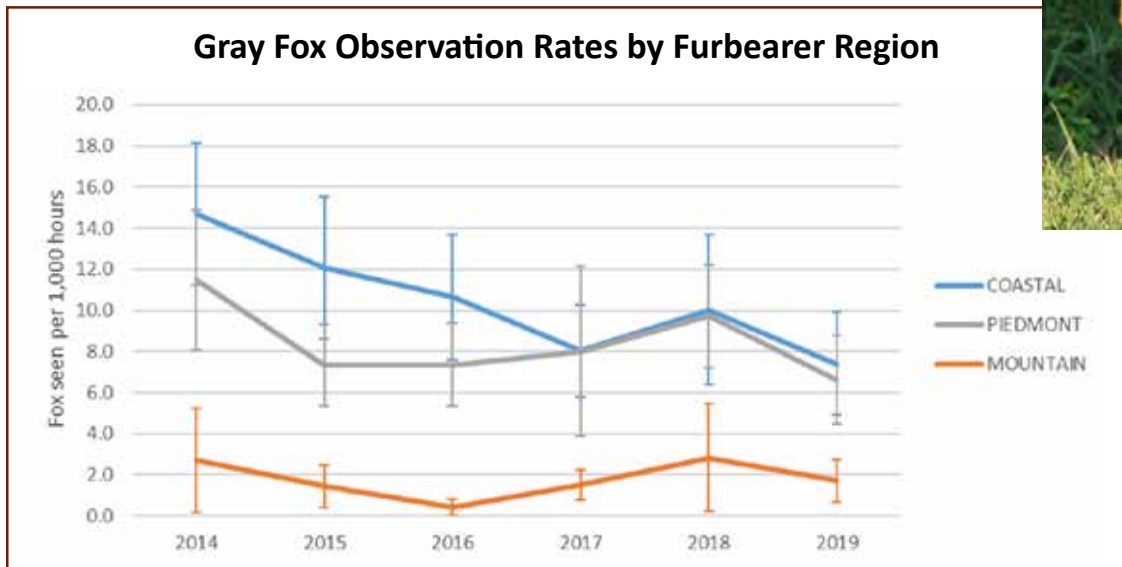
(USFWS)



Regional red fox observation rates (with 95% confidence intervals) as determined from the annual North Carolina Deer Hunter Observation Survey



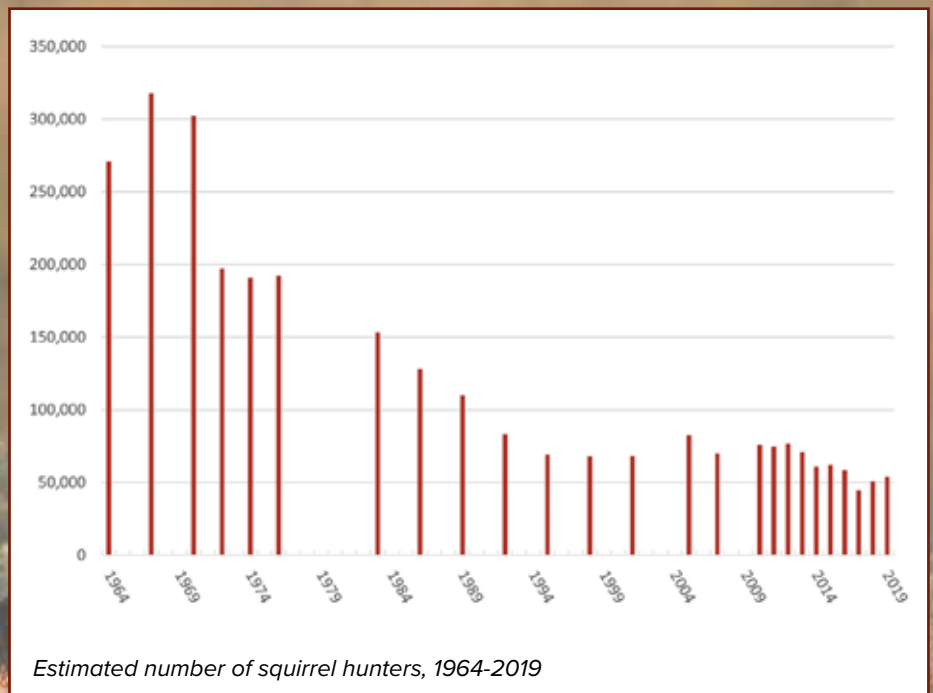
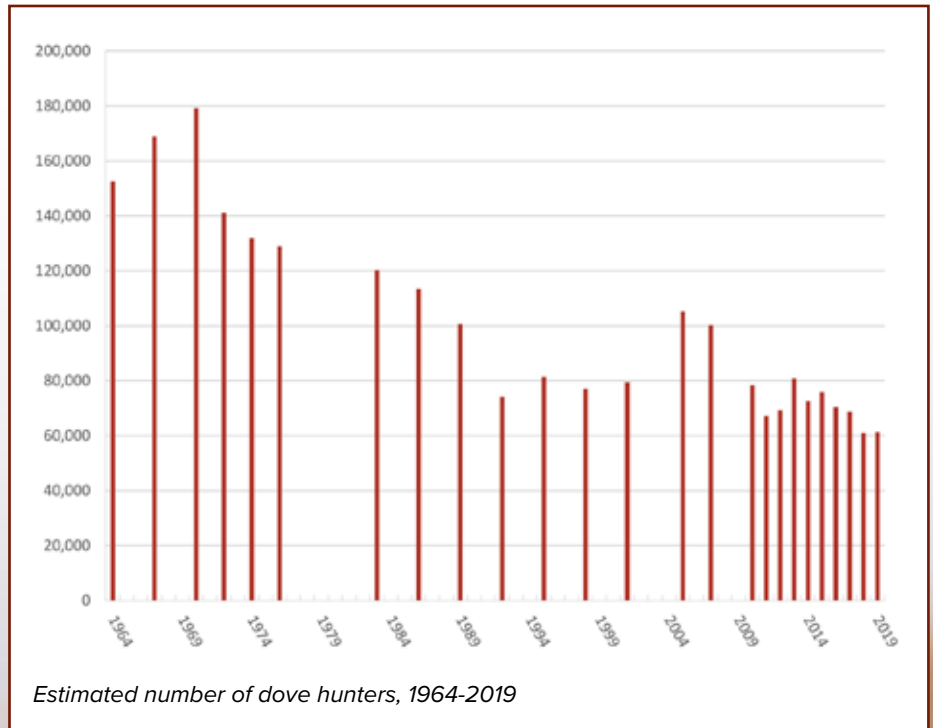
(USFWS)

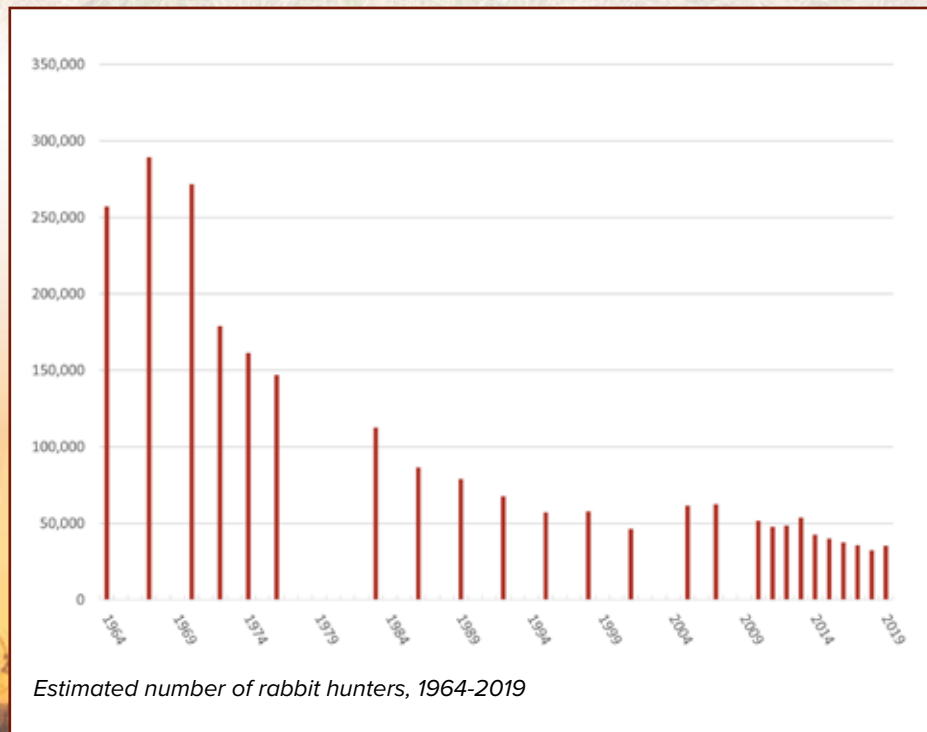
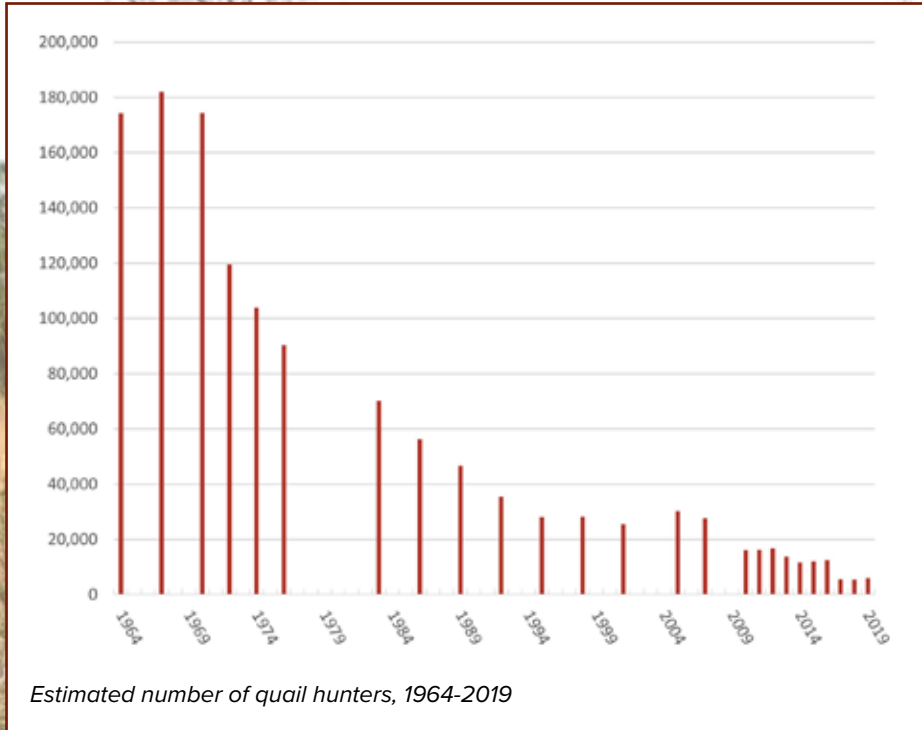


Regional gray fox observation rates (with 95% confidence intervals) as determined from the annual North Carolina Deer Hunter Observation Survey

Annual Hunter Harvest Survey

The NCWRC routinely conducts surveys of randomly selected hunting license holders for the purpose of estimating hunter participation and harvest of multiple species. These surveys occurred every few years from 1964 through 2007, and annually since 2010. This is the only method to track harvest and hunter numbers for many game species. The charts highlight long-term trends in hunting participation for several small game species. Reasons for long-term downward trends in small game hunting participation are complex and likely a reflection of multiple factors including population declines in some species (quail and ruffed grouse), loss of access to adequate hunting lands and a long-term switch to pursuit of big game (deer and turkey).





General Disease Surveillance

Staff investigated 198 disease reports and submitted several cases to laboratories for disease surveillance efforts. Disease reports included 19 different species with 118 deer, 13 raccoon, nine black bear, eight big brown bats, eight elk and eight wild turkey. Of the 118 deer submitted and/or investigated, six were diagnosed as positive for Epizootic Hemorrhagic Disease Virus (EHDV) and three positive for the closely related Blue-tongue virus (BTV). Forty-six additional cases were suspected EHDV. EHDV/BTV was confirmed or suspected in nine counties with most cases occurring in Buncombe, Henderson, Macon and Madison counties.

Of special note this year was the detection of canine distemper in five spotted skunks in Dupont State Forest. Spotted skunks are elusive, relatively rare and found only in western North Carolina at higher elevations. The ability to document disease mortality events in spotted skunks is unique and was facilitated by an ongoing research project with Clemson University (see page 15). It is concerning that an outbreak of this magnitude oc-

curred in this species. Continued monitoring will occur to see if this outbreak had a long-term negative impact on the spotted skunk population in Dupont State Forest.

Two herd health checks were performed during the 2019-20 period with 11 animals euthanized and necropsied. Samples from all relevant tissues were sent to Southeastern Cooperative Wildlife Disease Study (SCWDS) for diagnostics. The results for Cowan's Ford Wildlife Refuge (Mecklenburg County) Herd Health Check indicated that the deer population level is compatible with carrying capacity of the habitat and herd increases should be avoided by maintaining the current management program.

As part of an ongoing wild turkey research project, diagnostic samples were collected from over 150 live wild turkeys. Samples will be tested at SCWDS for a variety of pathogens or toxins that may impact health of wild turkeys. Samples collected during this study should provide a statewide baseline of these pathogens or toxins occurrence in the environment.



Commission staff and volunteers collect diagnostic samples as part of the Cowan's Ford (Mecklenburg County) deer herd health check. (Sarah Vandeberg/NCWRC)

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.



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