2021
GAME & FURBEARER PROGRAM SUMMARY REPORT

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

The North Carolina Wildlife Resources Commission's Game & Furbearer (G&F) Program is housed within the agency's Wildlife Management Division. Program responsibilities principally include surveys, research and regulations for game and furbearer species. During the year, the Program's name was changed from its previous Surveys & Research Program title in order to more appropriately reflect the Program's focus and to avoid confusion with other agency programs that also conduct wildlife surveys and research. This report represents an overview of many of the recurring survey activities and current research within the G&F Program for fiscal year 2020-21. 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 (www.ncwildlife.org) or by request.

Game and Furbearer Program Staff during FY 2020-21 included:

David Sawyer (CWB®) – Program Coordinator
Wilkes County
Years with the NCWRC: 32, retired May 2021

Joe Fuller (CWB®) – Program Supervisor
Chowan County
Years with the NCWRC: 29

Merril Cook – Wildlife Health Biologist (Support Unit)
Wake County
Years with the NCWRC: 6

Doug Howell (CWB®) – Migratory Game Bird Coordinator
Chowan County
Years with the NCWRC: 23

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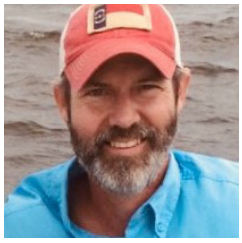
Casey Dukes (AWB®) – Conservation Biologist I
Orange County
Years with the NCWRC: 4;
Position transferred to WMD Operations Program, January 2021

Chris Kreh (CWB®) – Upland Game Bird Biologist
Surry County
Years with the NCWRC: 19

Kimberly McCargo – Conservation Biologist I
Perquimans County
Years with the NCWRC: 25;
Position transferred to WMD Operations Program, January 2021

Ryan Myers (CWB®) – Wildlife Surveys Biologist
Chatham County
Years with the NCWRC: 20

Colleen Olfenbuttel (CWB®) – Black Bear and Furbearer Biologist
Chatham County
Years with the NCWRC: 14



Dr. Jonathan Shaw (CWB®) – Deer Biologist
Onslow County
Years with the NCWRC: 15
Promoted to WMD Operations Coastal Supervisor, May 2021

Andrea Shipley – Mammalogist (shared staff with Wildlife Diversity Program)
Nash County
Years with the NCWRC: 3

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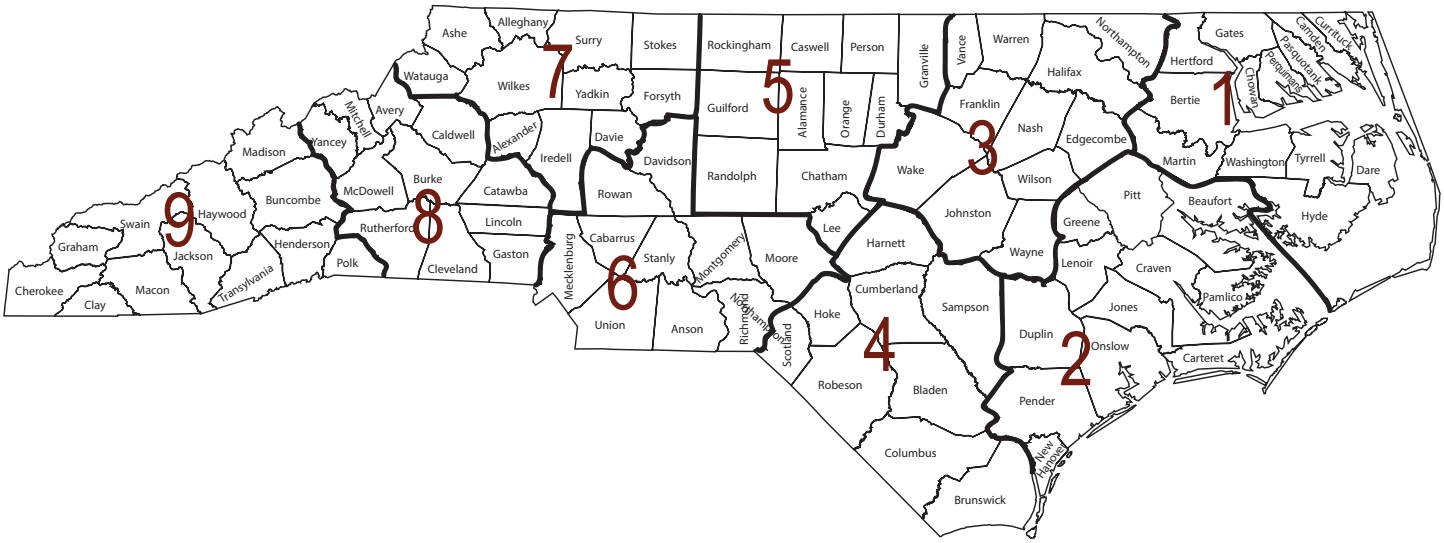
N.C. Wildlife Resources Commission District Map



Cover photos (l to r, clockwise): North Carolina State University Phd student David Moscicki monitoring movements of wild turkeys via radio telemetry (NCWRC); Casey Dukes (Central Region Wildlife Conservation Biologist) prepares to set a trail camera for eastern spotted skunks at Pond Mountain Game Land in Ashe County (NCWRC); American woodcock on nest at Prince Edward Island, Canada in April, 2021 after being fitted with GPS transmitter on Mackey Island National Wildlife Refuge, North Carolina in February 2021. (Spencer Haakman). Unless noted otherwise, all photos are credited to the N.C. Wildlife Resources Commission (NCWRC)

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FURBEARERS

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

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 (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. For winter 2021, we established 52 sites, 50 of which were sites surveyed in 2017 and two were new sites. We had 38 detections of ESSKs among 10 sites.

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 Commission 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) in the United States, and in July 2019, the Commission and Clemson University partnered with EcoNoseK9 on a pilot study to determine if detection dogs could be trained to efficiently detect ESSKs, and if so, the recommended survey design.

Through January 2021, we conducted field trials with the detection dog and her handler in Dupont State Recreational Forest. The field trials were conducted to determine the dog's ability to detect ESSK scat and ignore scat from other wild animals, as well as determine what factors (e.g., temperature, wind direction) would influence the dog's ability to detect ESSK scat. Our initial trial efforts suggest that detection dogs can be trained to detect ESSK scat. However, there was difficulty in determining how various factors (e.g., weather) can influence the detection dog's efficacy to detect spotted skunk scat, partly due to the low abundance of spotted skunks in our study area. Topography and vegetation density can also impact a dog's behavior, so an awareness of how habitat conditions influence searching would be beneficial for future scat detection studies. We plan on conducting field trials in other areas to record

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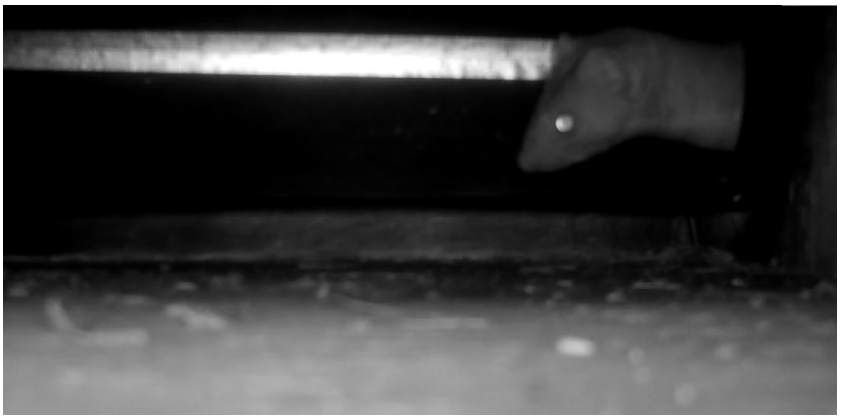
Emily Moreno of EcoNoseK9 with Raya, her detection dog, who has detected an Eastern Spotted Skunk scat placed out during our test field trials. (Colleen Olfenbuttel/NCWRC)

more information on detection dog efficacy in detecting spotted skunk scat, and based on those trials, refine field protocols for detection dog surveys to optimize future research studies using this method. In addition, the relative rareness of ESSKs can impact the search motivation of the detection dog. To address this, as well as aid us in detecting raccoon scat around woodrat colony sites to determine presence of raccoon roundworm, we will train the detection dog to detect raccoon scat.

Pilot Camera Survey of Weasels

Work continued on testing the effectiveness of weasel camera trapping. Weasels are rarely observed in the southeastern USA 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 not effective at detecting weasels, with only four weasel detections recorded by the ~4,000 cameras in the NC Candid Critter and eMammal database. We deployed nine camera traps from summer 2020 through summer 2021 using a camera trap design similar to the "Mostela" design used successfully 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 has been cut open, allowing the camera to capture any wild animal going through the tube. The tube serves as a visual attractant for the weasel, while 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. We had one weasel detection on a camera trap in the Mountain Furbearer Management Unit (FMU). Weasels are attracted to fresh bait, which may explain our low detection rate. However, fresh bait not only attracts non-targets (e.g., raccoons, opossums), but requires frequent replenishment, a requirement not feasible due to the level of manpower required. Another potential cause for low number of detections was the low density of camera traps on the landscape. We will continue to experiment with study designs (e.g., density of cameras in an area, lure) to determine which design is most efficient and effective at detecting weasels. Once this study design has been identified, we hope to use it to survey for weasels throughout the state, which will contribute to our understanding about the distribution and abundance of weasels in North Carolina.



Long-tailed weasel captured on the "Mostela" camera trap used in the pilot camera survey of weasels.

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 is used to determine the sex and age ratio of the harvest. We have not yet achieved our sampling objective of 10-15% of the trapper harvest, and an incentive is likely needed to encourage submission. Since the 2013-14 season, we have collected and aged 296 skulls. During the 2020-21 season, we collected 24 skulls. The majority of the harvest is of 1-year old bobcats (31%), followed by 2-year old bobcats (26%). The oldest bobcat we have documented was a 13-year old male bobcat and the oldest female was 7 years old. Overall, the sex ratio of the bobcat trapper harvest is slightly biased toward male bobcats (57%).

Victor Arita

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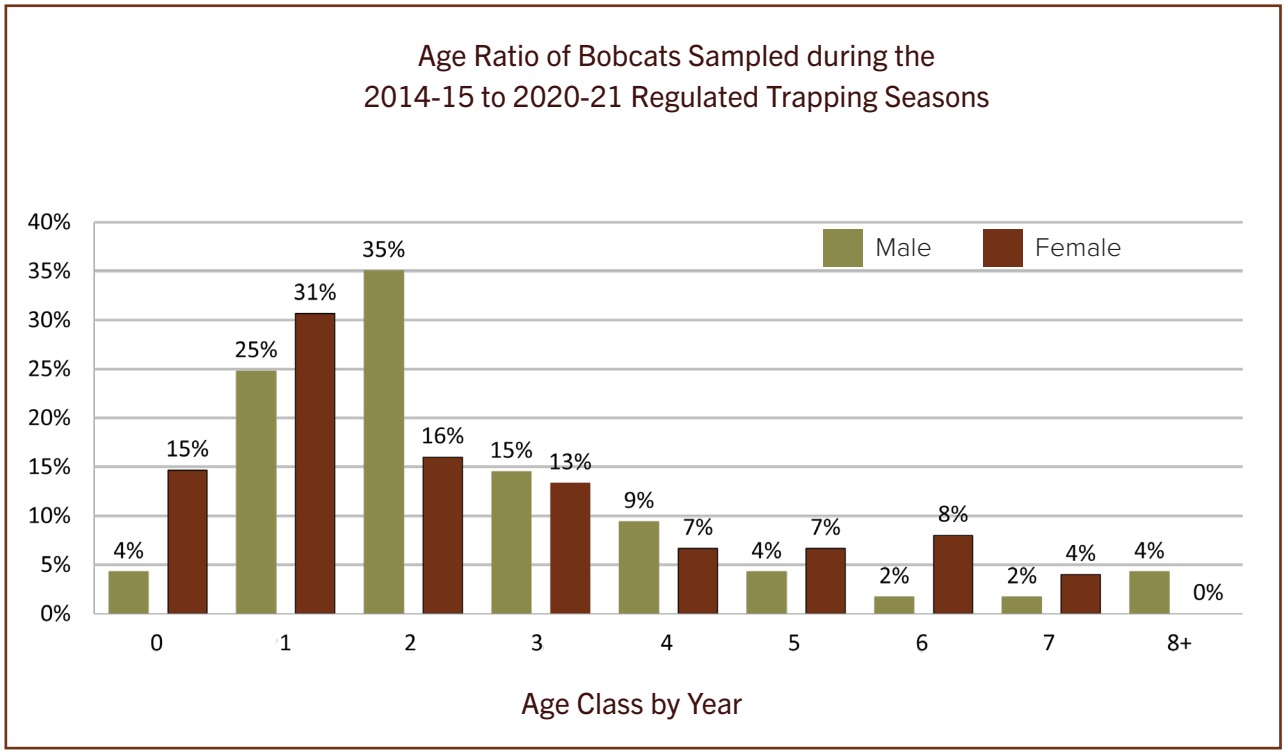

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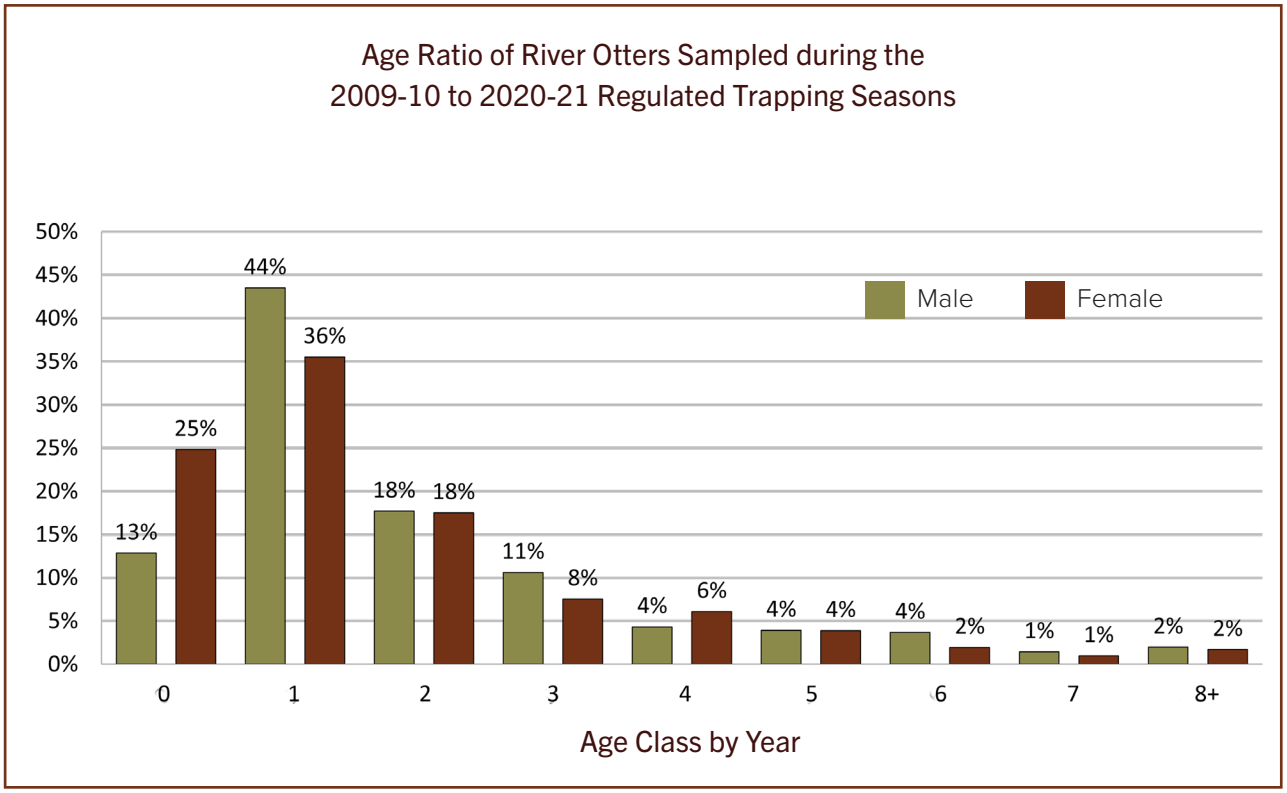
River otter skulls are also collected to gather data on the age structure and sex ratio of harvested otters. The annual sampling period is from November through February, which is concurrent with the regulated furbearer trapping season. Since the 2010-11 season, we have collected and aged 1,382 skulls. During the 2020-2021 season, we collected 39 skulls. The oldest male and female otters documented were 12 years old. The majority of the harvest is of 1-year old otters (41%), followed by 2-year old otters (18%). The overall sex ratio of the harvest is biased toward male otters (65%).



Rabies Testing Bias

To determine if there is potential bias in rabies testing submissions of terrestrial wildlife, the Wildlife Commission partnered with University of North Carolina-Wilmington to determine if demographic factors influenced rabies submissions across North Carolina. From 2008-2018, animal control offices submitted 300-1,000 wild terrestrial animals for rabies testing each year; however, only 30-46% of total submissions tested positive for rabies annually. Given that approximately 60% of submitted wild terrestrial animals test negative for the virus, submission bias may exist in some areas. Counties with higher percentages of White residents, denser human populations and

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housing density, and more tourism income located in the Piedmont FMU submitted the most animals for rabies testing. Alternatively, counties that had higher percentages of residents who had attended some college submitted fewer animals for testing. Counties located within the Piedmont and Coastal Plain FMUs that had higher percentages of Black and Hispanic residents had the highest percentages of positive rabies cases. Alternatively, Mountain FMU counties with higher percentages of White residents had lower percentages of positive rabies cases. Median age also had a negative effect on the percent of positive rabies cases. Determining the factors that influence submissions will help both wildlife and public health professionals identify where targeted educational rabies and wildlife programs are needed. We suggest rabies education should be focused toward the Mountain FMU, White residents, and older individuals in North Carolina since these groups of residents were more likely to request rabies testing on non-rabid wildlife. Specifically, counties with higher populations of White individuals had higher annual total submissions, but fewer positive tests for rabies, indicating this demographic group had the most bias and they, as well as local and county animal control departments, should be the main focus for targeted educational programs.

Prevalence of Raccoon Roundworm in North Carolina

In winter 2021, the Wildlife Commission partnered with USDA-Wildlife Services (WS) to initiate a statewide survey to determine the prevalence of raccoon roundworm (*Baylisascaris procyonis*) in North Carolina. This survey was initiated to follow up on an earlier survey conducted from 2010 to 2011 that detected raccoon roundworm in five western counties bordering Tennessee (12% of raccoons sampled). It is currently unknown what impacts this nematode has on both humans and mammals in North Carolina, and specifically, the woodrat. Studies that have occurred outside of North Carolina have documented woodrat mortality associated with raccoon roundworm, and the 2015 N.C. Wildlife Action Plan recognized raccoon roundworm as a possible threat to woodrat populations. In summer and early fall 2020, a pilot study to collect raccoon feces around active woodrat colonies found little to no raccoon feces while performing woodrat trapping efforts. As a result, we are now partnering with WS to sample raccoons opportunistically collected as part of various

From left to right, Colleen Olfenbuttel, Kelly Douglass (USDA-WS), and Ashley Hobbs sample raccoons for raccoon roundworm and canine distemper virus.

WS projects across the state. Since January 2021, 141 raccoons have been sampled, and roundworm has been detected in eight raccoons from six western counties, of which

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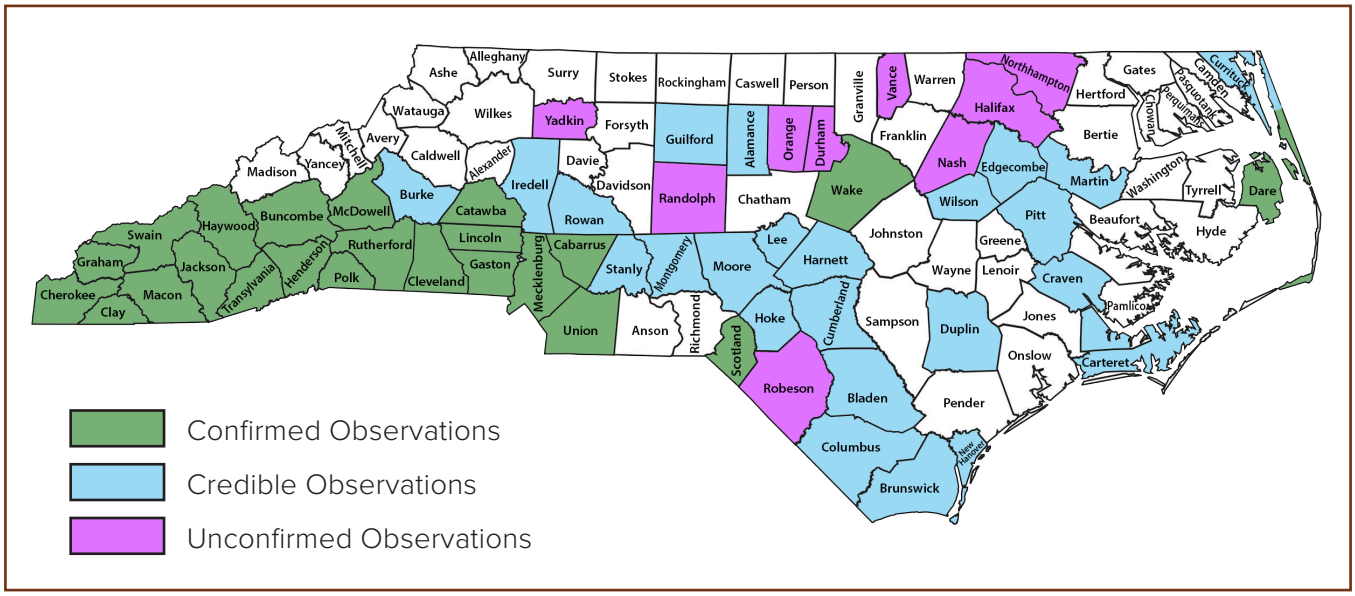
five counties are new detections. Our goal is to opportunistically sample 20-30 raccoons per county in North Carolina, with a focus on the Mountain Furbearer Management Unit. In addition, we are working with a detection dog team to train a dog to detect raccoon feces, which will be used to search for raccoon feces around active woodrat colony sites.

Monitoring of Nine-Banded Armadillo Range Expansion

The Commission has compiled observations of the nine-banded armadillo (*Dasypus novemcinctus*) since the first credible observation (Macon County) was received in 2007. The NCWRC actively seeks observations from the public to help determine range expansion and population establishment in North Carolina. To participate, volunteers who spot an armadillo in the wild are asked to upload and share their photos on the NC Armadillo project, which is on the free online platform iNaturalist or send their armadillo observations to armadillo@ncwildlife.org. Since 2007, the agency has received 440 reports (unconfirmed, credible, and confirmed) in 57 counties. Based on observations, it appears the armadillo is naturally expanding its range throughout North Carolina, rather than being helped by human intervention (e.g., brought in illegally). The number of counties with confirmed observations is 23, stretching from Cherokee to Dare counties. And in several western counties, based on the number of reports, we are starting to see the establishment of a population, with breeding and reproduction occurring. Most reports are received in the summer months from June through September, which likely reflects increased movements and activity by armadillos, as well as more members of the public spending time outdoors. Observations decline in winter months, but armadillos will remain active during this time period, primarily during the day when it is warm.



Armadillo observations reported to the North Carolina Wildlife Resources Commission from 2007 through 2020.

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WHITE-TAILED DEER

For more 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 information) from 3,074 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. COVID-19 safety measures restricted staff's ability to conduct numerous annually recurring biological data collection efforts resulting in a 40% decrease in biological data collected in 2020 compared to the prior 3-year average. This information continues to be used to evaluate the status of populations in relation to habitat, reproductive output, and current hunting season frameworks, including the impact of the bag limit changes implemented during the 2018-19 season. Based on age data collected from over 11,000 deer, since bag limit changes were implemented, older age bucks (2.5 years+) now represent a larger percentage of the harvest than they did previously.

Jawbones collected from harvested deer are used to track the age structure of the deer population and can be used to inform harvest management decisions. (NCWRC)

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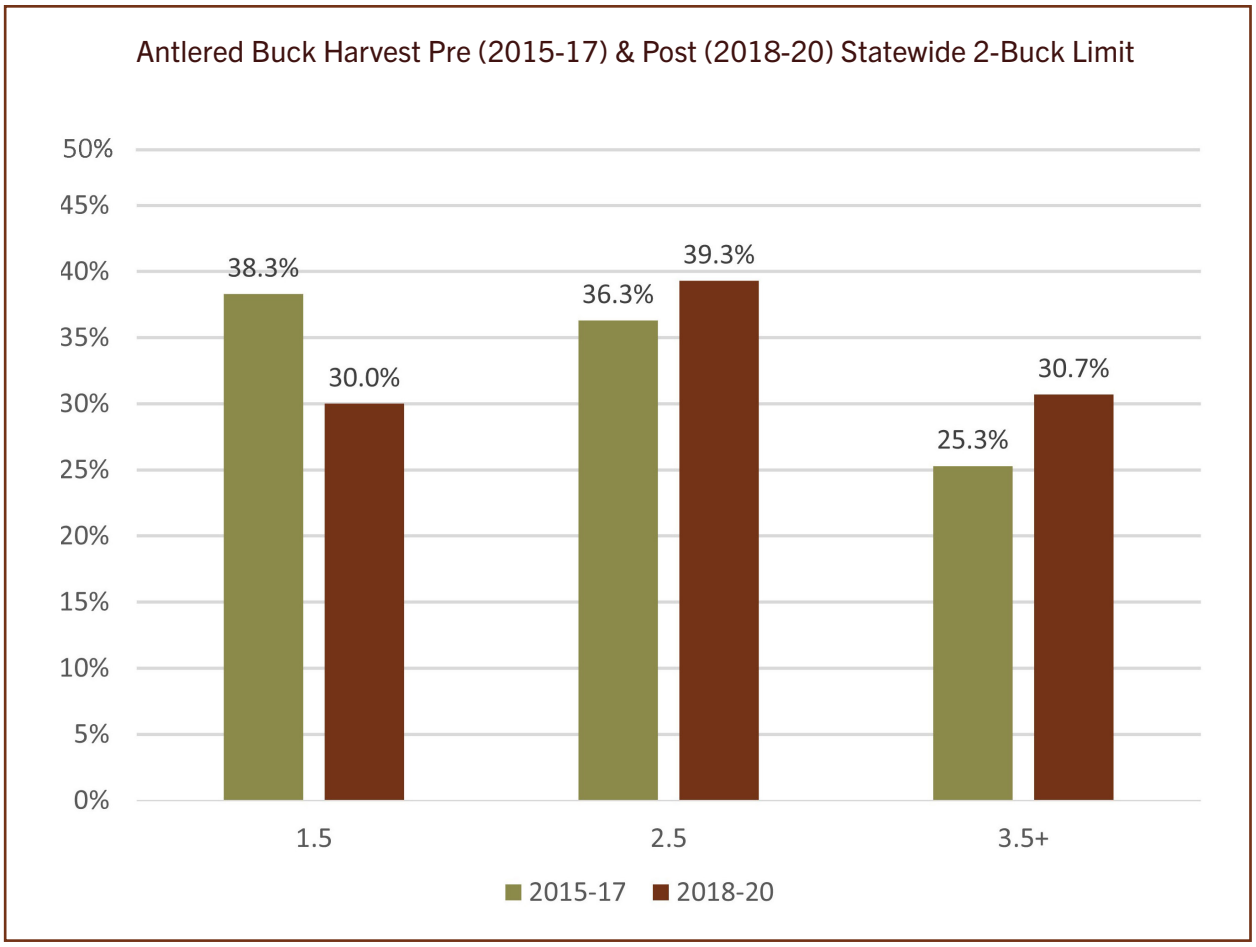

Percentage of the antlered buck harvest in the 1.5, 2.5 and 3.5+ age classes occurring prior to and after the statewide 2-buck limit instituted in 2018.

Deer Harvest & Hunter Numbers

North Carolina hunters reported harvesting 169,973 deer during the 2020-2021 hunting season, consisting of 50.8% antlered bucks, 4.7% button bucks, and 44.5% does. Total statewide harvest was up 9.1% from the previous 3-year average, ranging from a 3.7% increase in the Northeastern Zone to a 23.7% increase in the Western Zone. Reporting compliance remains around 75-85%.

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 our mandatory reporting systems, our annual hunter harvest survey also provides an estimate of the number of hunters and

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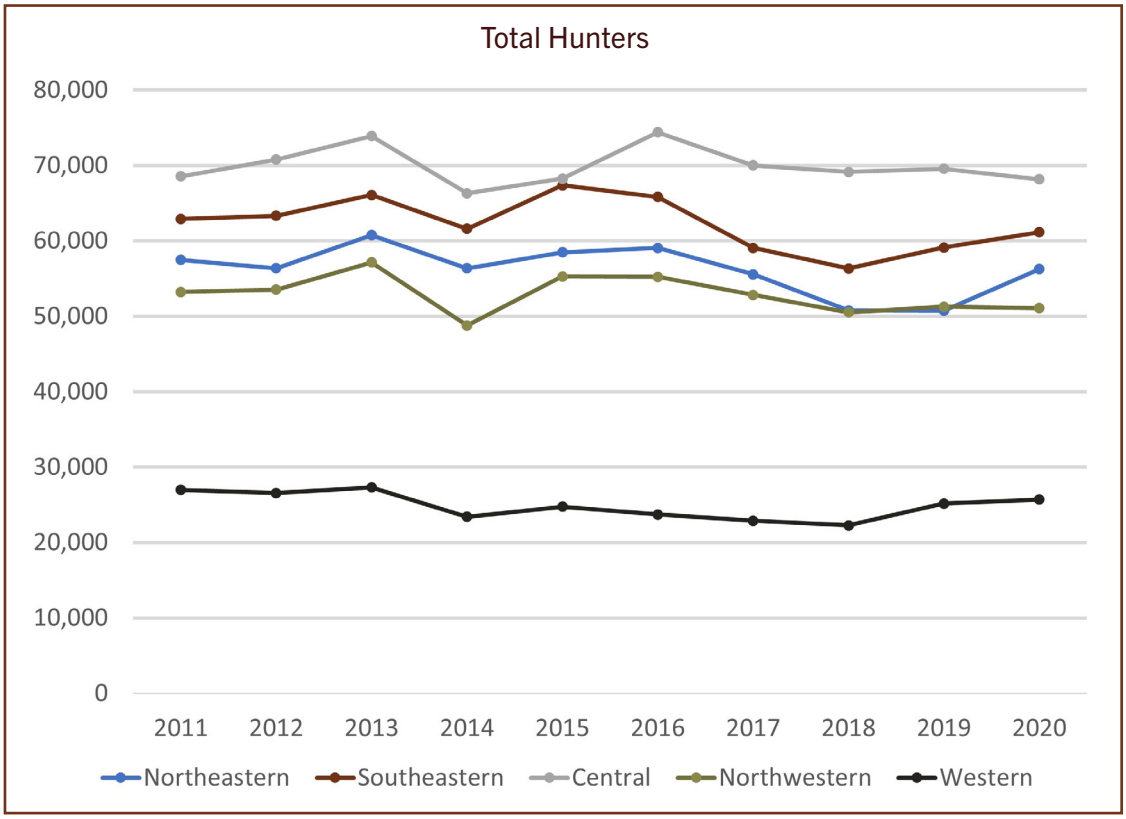
days pursing various game species. Trendlines in each management zone suggest slight declines in total deer hunters in each zone across the last 10 years, with the exception of the Western Deer Zone which shows some annual fluctuation. It is interesting to note that irrespective of zone, hunters average around 12-15 days of deer hunting each year, despite Gun Season varying in length from 20 to 77 days across various zones.



Estimated number of deer hunters in each management zone as determined by the NCWRC Hunter Harvest Survey, 2011-2020.

Deer Hunter Observation Survey

In order to provide an economical and statistically robust means of monitoring the relative hunter observation rates of several game species (including white-tailed deer), the agency has conducted an annual North Carolina Deer Hunter Observation Survey (DHOS) since 2014. These observation data provide valuable insight into geographical and temporal variation in deer population parameters, otherwise not captured in the harvest report trends. Harvest estimates can be heavily influenced by hunter selectivity, and harvest trends do not always accurately reflect current population trends. In comparison, trends in observation data may better represent real trends in deer populations. During the 2020

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hunting season, 1,641 deer hunters participated in the Deer Hunter Observation Survey and reported 83,000 deer observations.

Observation Rates of Deer

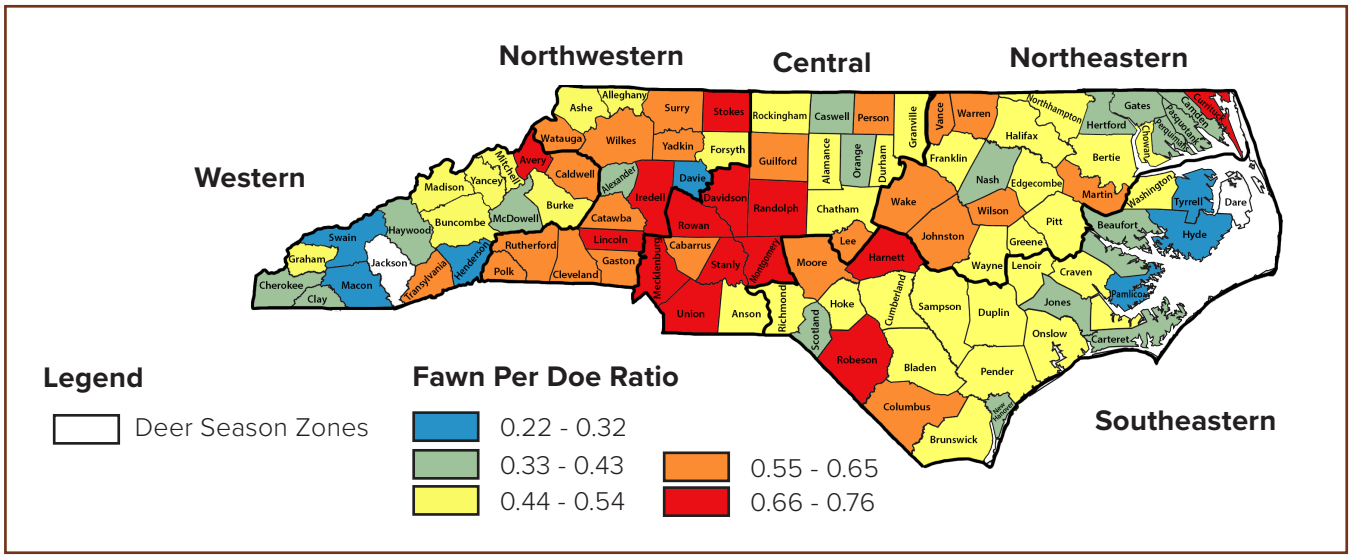
In 2020, deer were the most observed wildlife species (802.1 deer per 1,000 hours) and were observed in all 100 counties. Adult does were observed at a higher rate (383.7 does per 1,000 hours) than either fawns (174.7 fawns per 1,000 hours), or antlered bucks (160.5 bucks per 1,000 hours).

The highest observation rates for deer occurred in the Northeastern season zone (1,054.5 deer per 1,000 hours) and were lowest in the Western season zone (540.9 deer per 1,000 hours). Over the past seven years, there has been significant evidence that statewide deer observation rates have increased over time (+27.9 deer per 1,000 hours annually, $P<0.01$). The increase in deer observation rates has occurred similarly across all 5 season zones, with the highest observation rate recorded during the 2020 season.

Ratio of Fawns Per Doe

This ratio offers insight into the fawn recruitment value of a population, or the number of fawns surviving until hunting season. The two primary influences on fawn/doe ratios are adult doe (1.5+ years) reproductive output and fawn mortality. Changes in this ratio over time can be indication of potential problems or improvements in a deer population's viability; however, this ratio does not identify what factors might be driving these changes, e.g. habitat quality, doe condition, predation, and weather events. This ratio is extremely valuable and provides a more comprehensive assessment of deer population dynamics and sustainable harvest rates can be obtained from harvest data alone.

The observed fawn/doe ratio was highest in the Central and Northwestern zones (0.59-0.57 fawns for every adult doe), compared to the other three season zones (0.46-0.50 fawns for every adult doe). There is no evidence that the statewide fawn/doe ratio has changed significantly over the last seven years (0.52 fawns for every adult doe). Ratios within each of the season zones also showed no significant change over the last seven years.



Fawn per doe observation rates by county based on 5-year averages, North Carolina Deer Hunter Observation Survey, 2016-2020. Counties with no shading had an insufficient sample size for estimation purposes.

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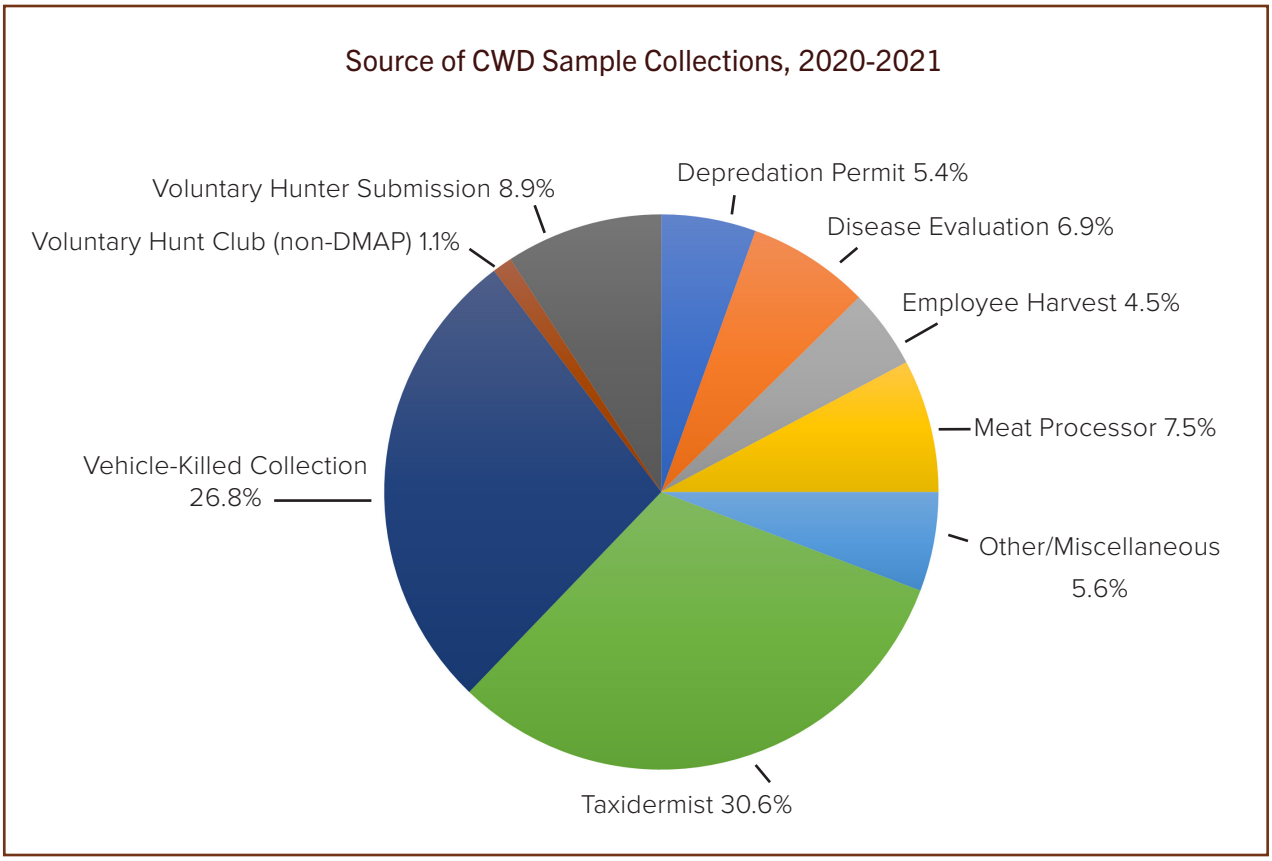
Chronic Wasting Disease Surveillance

The 2020-21 sampling season marked the third year of a revised Chronic Wasting Disease (CWD) surveillance plan. Previously, the NCWRC had focused on intensive, statewide sampling once every five years. However, the current plan calls for annual sampling based on 5-year sampling goals for each county. During the 2020-21 sampling year, the NCWRC processed 1,143 samples including 1,117 from white-tailed deer, eight from elk and 18 from illegally imported white-tailed deer carcasses. Testing was conducted by the Wisconsin Veterinarian Diagnostic Lab. To date, CWD has not been detected in North Carolina. Samples are obtained from a variety of sources with 31% of samples being collected by cooperating taxidermists. To date, 87 of 100 counties are at least 75% complete with their 5-year sampling goals after only three years of surveillance.

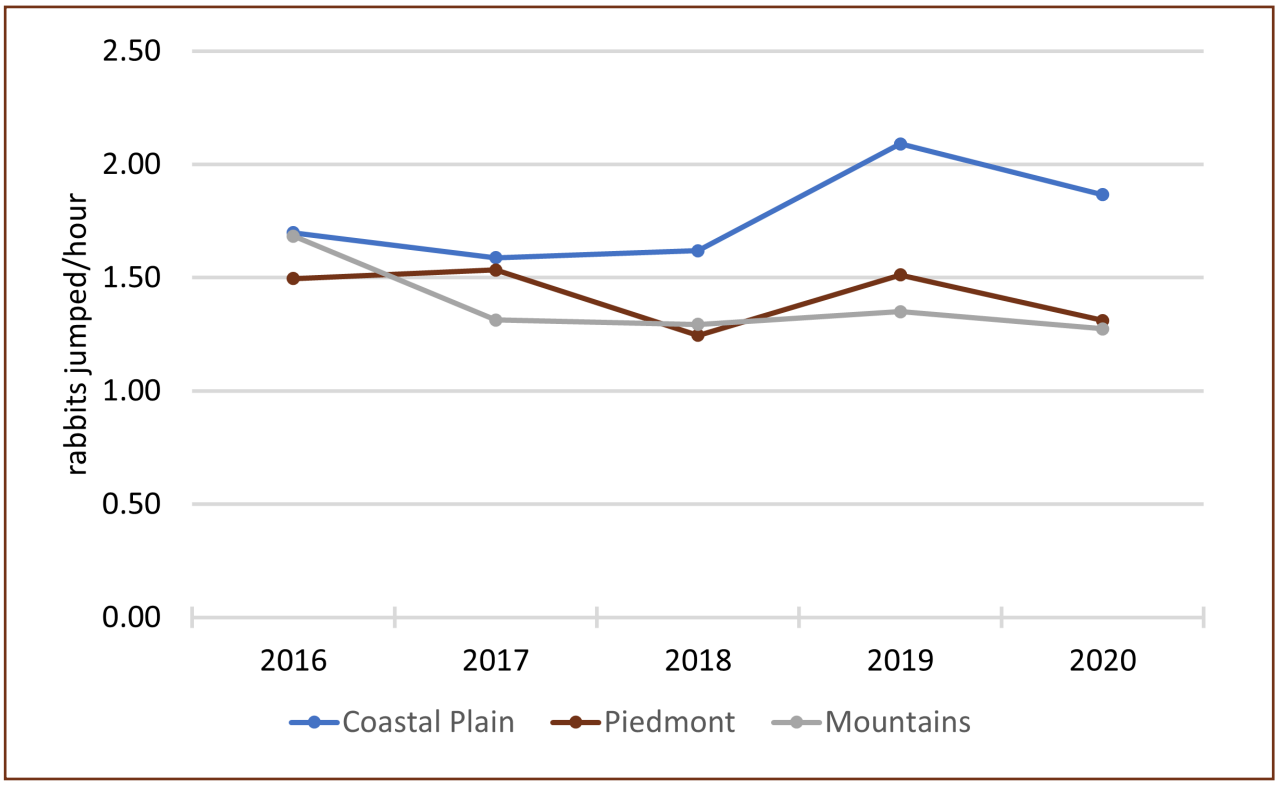


Collection sources for CWD samples during the 2020-21 sampling year. Most samples were collected from taxidermists cooperating in the Cervid Health Cooperator Program or by NCWRC biologists testing road-killed deer.

UPLAND GAME BIRDS & SMALL GAME MAMMALS

Avid Rabbit Hunter Survey

Thirty-seven respondents reported harvesting 1,998 rabbits during 474 hunting trips throughout 55 counties in North Carolina. Marsh rabbits accounted for nearly 10% of the reported harvest. Statewide, hunters jumped approximately 1.4 rabbits per hour and harvested approximately 57% of those rabbits. On an average hunt, 7.4 rabbits were jumped, and 4.2 rabbits were harvested. Both rabbits jumped per hour and rabbits jumped per trip decreased compared to the previous hunting season. From a regional perspective, coastal plain hunters typically have higher success rates.



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

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Wild Turkey Harvest

The 2021 spring wild turkey season in North Carolina ran from April 10 - May 8 statewide. The dates for the Youth Season were April 3 - 9. 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 our agency's telephone or online reporting systems. Including 2,172 birds harvested during the Youth Season, the 2021 reported spring turkey harvest was 21,974 birds. This year's total statewide harvest was down 6% from the record harvest in 2020 but still 16% higher than the previous high set in 2017. We believe all the issues associated with COVID-19 undoubtedly had a major influence on hunting pressure and harvest during the spring 2020 and 2021 seasons. The top five counties for the number of turkeys harvested were Duplin (780), Pender (583), Bladen (526), Halifax (519), and Columbus (513).

The 2021 statewide turkey harvest of 21,974 birds was down 6% from the record harvest in 2020, but 16% higher than the previous record, set back in 2017.

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 2020, 1,539 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 8,061 unique observations totaling 42,118 turkeys. This was the 3rd year that participants could report turkey sightings on smartphones or other small-screen devices, and 23% of all observations were recorded online. Productivity statewide was estimated to be 1.3 poults/hen, a decrease from the 2.2 poults/hen recorded in 2019. Productivity was higher in the coastal region (1.5 poults/hen) than the Piedmont and mountain regions (each 1.2 poults/hen) representing meaningful biological differences among regions. Poult survival statewide was 3.1 poults per brood, consistent across regions, but lower than the 4.0 poults per brood recorded in 2019. Estimates of turkey reproduction in 2020 were much lower than observations over the course of much of the last decade with estimates of productivity and poult survival the lowest on record. However, it is important to note that the 2019 survey documented unusually high levels of productivity, such that there were likely many 1-year old hens (and jakes) in the population during 2020. Hens rarely nest successfully in their first year, so lower estimates of productivity recorded in 2020 may in part be a result of having a greater number of young hens in the population.

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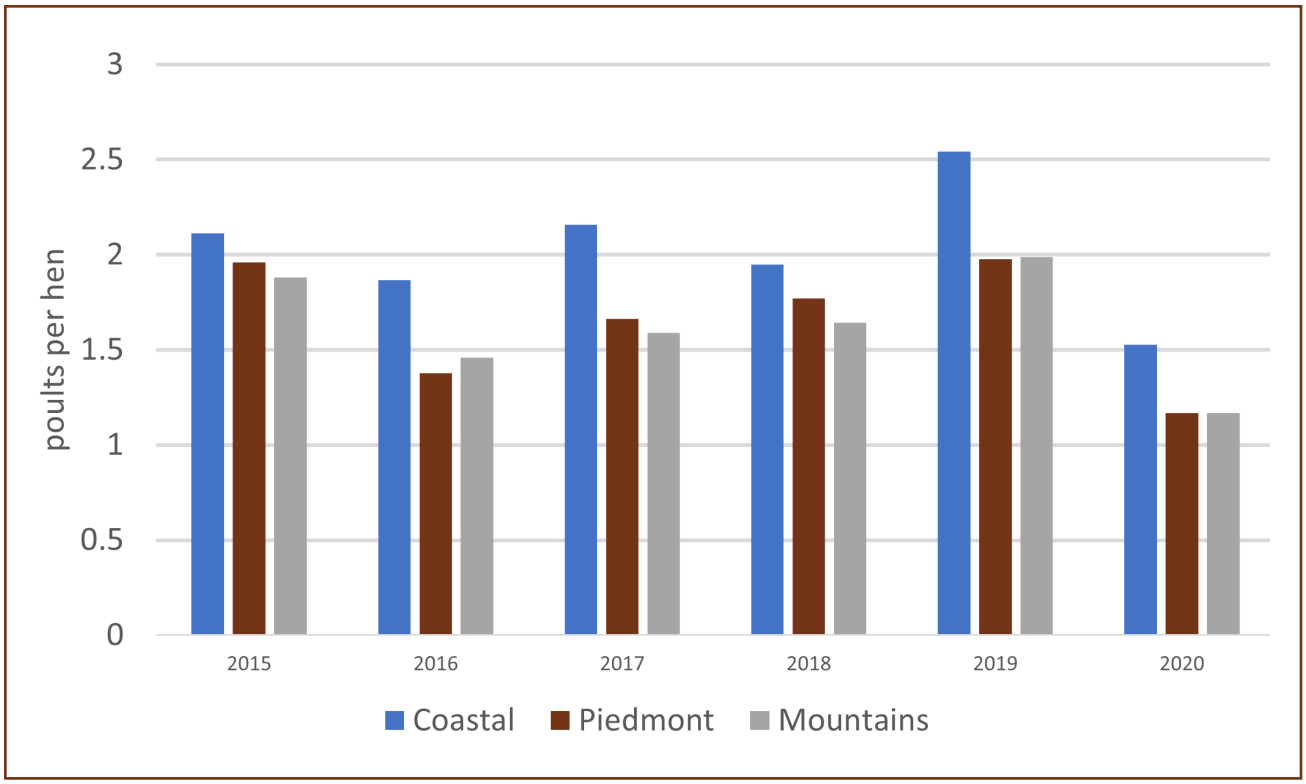

Regional observations of turkey production, 2015 through 2020.

Wild Turkey Research

For the past two years North Carolina State University, the National Wild Turkey Federation, and the NCWRC have collaborated 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. As of July 2021, more than 480 turkeys have been captured and radio-tracked, 257 nesting attempts have been documented, and 59 broods have been tracked. Additional capture, marking, and tracking will continue through August 2022.

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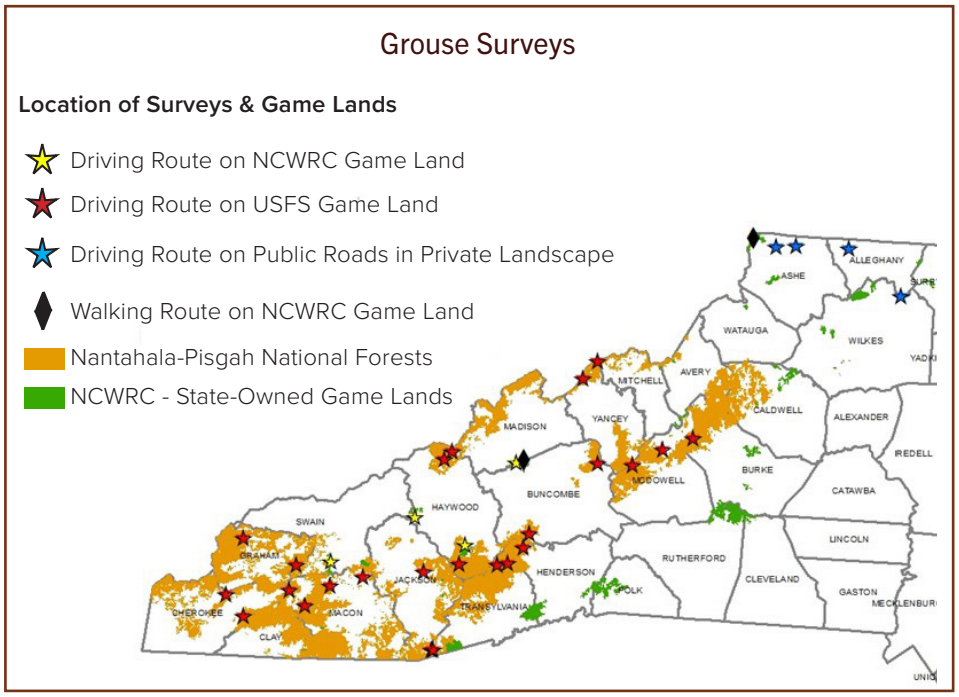
Grouse Drumming Survey

Since 2002, staff have conducted an annual drumming survey in order to monitor ruffed grouse populations. Each spring (late March/early April), we listen for drumming grouse on U.S. Forest Service property in western North Carolina and in 2018 began including survey routes on state-owned game lands. In 2021, ruffed grouse were monitored by counting drumming males at 402 listening stations distributed across 23 routes on the Nantahala-Pisgah National Forests. Additionally, we surveyed routes on Cold Mountain, Needmore, Sandy Mush, and Silver game lands (64 stations in total). All survey routes were driven twice. On national forest routes, 81 drumming males were heard; lower than the rate observed in 2020. On state-owned game lands, 11 drumming males were heard, a considerably lower rate than in 2020, but similar to 2019. Walking surveys also continued on Pond Mountain and Sandy Mush game lands as they provide insight into those local populations. For the first time, staff also conducted four grouse drumming survey routes on private lands via roadside surveys. Routes occurred on lightly traveled state-maintained roads in Ashe and Alleghany counties, an area that has been underrepresented in our surveys due to the lack of national forests in that portion of the state. Actual survey points were identified through an in-depth GIS process where we identified habitat characteristics that would likely increase our chances of hearing a grouse if located nearby. These 80 listening stations (surveyed twice), yielded two drumming grouse. The feasibility and utility of conducting additional roadside surveys on private lands are being considered.



Location of grouse drumming survey routes in western North Carolina.


View of high quality grouse habitat taken from a roadside grouse drumming route in Ashe County

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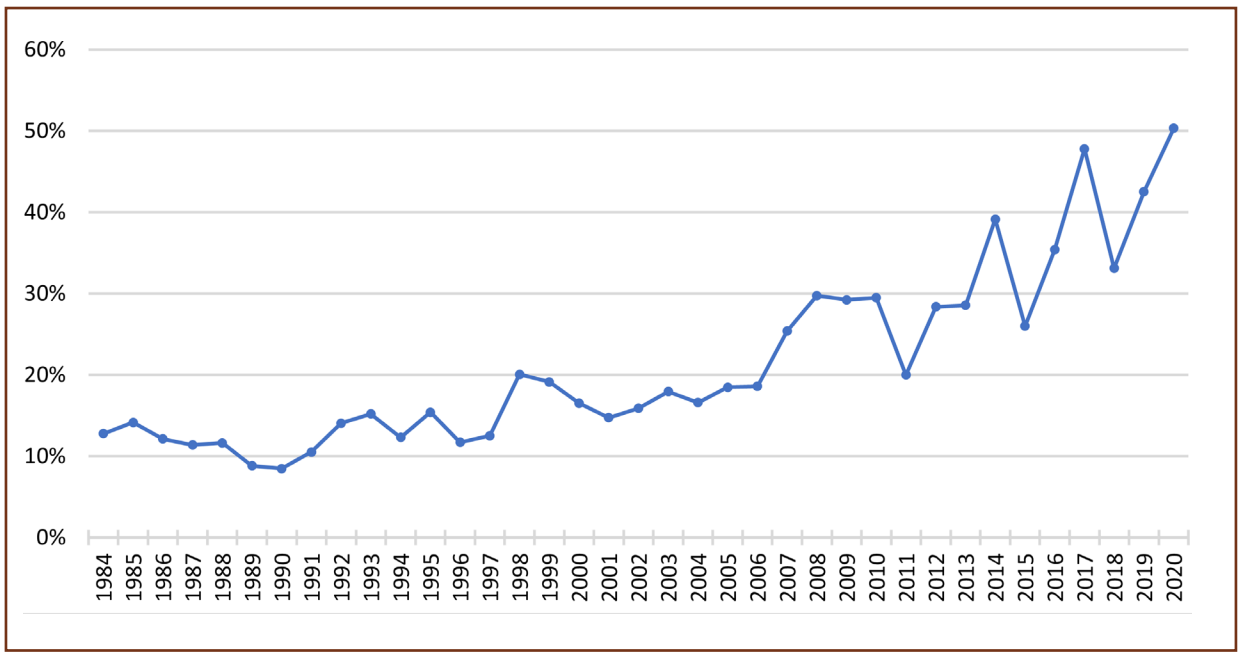
Avid Quail and Grouse Hunter Surveys

Staff continue to work with avid hunters to monitor ruffed grouse and bobwhite quail hunting activity. Fifty-two avid quail hunters provided hunting data during the 2020-21 hunting season on 745 quail hunting trips. On an average hunt day, 1.7 coveys were flushed and 1.5 quail bagged per hunt party; essentially unchanged from the previous year. As is typical, quail hunting success varied within the state depending on the region. By region, flush rates were 0.57 coveys per hour in the Coastal Plain and 0.38 coveys per hour in the Piedmont; representing minimal increases from the previous season. While respondents reported 31 quail hunting trips in the mountains, no coveys were flushed; suggesting that quail are likely extirpated (locally extinct) in much of the mountain region. Excluding the mountain region where no quail were flushed, coveys flushed per trip were highest in the central coastal plain (3.78) and lowest in the northern Piedmont (1.16).

Forty-eight avid grouse hunters submitted hunt data during the 2020-21 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 2020-21, participants flushed on average 0.4 grouse per hour and 1.3 grouse per hunting trip; essentially unchanged from the previous year. Flush rates are typically higher on private lands. Perhaps the best indicator of hunt success over time and indicative of the declining grouse population is the percentage of hunts where no grouse were flushed. During the 2020-21 hunting season, respondents reported 51% of hunts with no grouse flushed compared to 43% of hunts the previous year. This statistic has steadily increased over time with less than 30% of hunts with no grouse flushed recorded as recent as 2015.



Percentage of hunts where no grouse were flushed according to the avid grouse hunter survey 1984 through 2020.

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MIGRATORY GAME BIRDS

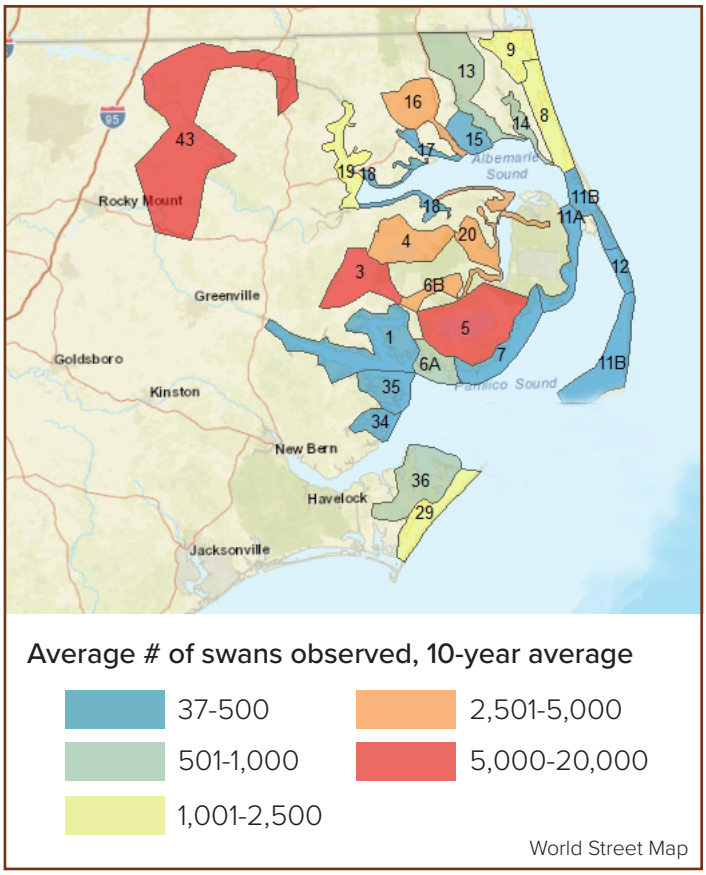
Waterfowl Surveys

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 North Carolina survey, numbers of swans and brant are counted within discrete geographic units established in the early 1960s when the Atlantic Flyway's mid-winter survey was being developed. Only Unit 43 encompassing portions of Bertie, Hertford, Edgecombe, Halifax and Northampton counties has seen significant boundary changes in order to account for increasing numbers and distribution of tundra swans in that area of the state. As might be expected, more swans are generally observed in Unit 5 (Mattamuskeet and surrounding fields and impoundments in Hyde County), Unit 3 (Pungo Lake and surrounding fields) and Unit 43.

During the January 2021 survey, we observed 61,295 tundra swans, 43% higher than numbers recorded in 2020. The count in 2020 had been the lowest number of swans observed since 1982. Due to the necessity to limit survey time because of COVID-19 related concerns, no areas were flown that traditionally contain brant.

Aerial view of tundra swans, Washington County.



Average number of tundra swans observed in discrete geographic survey units in North Carolina, 2011-2021.

1	Pamlico River
3	Pungo Lake & adjacent fields
4	Lake Phelps & adjacent fields
5	Lake Mattamuskeet & adjacent fields/impountments
6A	Swanquarter NWR
6B	New Lake & adjacent fields
7	Hyde County shoreline
8	Currituck Sound - southern portion
9	Knotts Island and Bells Island
11A	mainland Dare County shoreline
11B	Hatteras to Kitty Hawk (not including Pea Island)
12	Pea Island NWR
13	Pasquotank River & fields in Camden & Currituck counties
14	North River
15	Weeksville area
16	Little River & fields in Pasquotank & Perquimans counties
17	Perquimans River
18	Albemarle Sound (western portion)
19	Chowan River & adjacent fields
20	Alligator River & adjacent fields (incl. Alligator River NWR)
29	Core Sound
34	Bay River
35	Upper Pamlico County marshes
36	Cedar Island NWR
43	portions of Bertie, Hertford, Edgecombe, Halifax & Northampton counties

Tundra Swan Harvest

The harvest of tundra swans in North Carolina is guided by an Eastern Population Tundra Swan Management Plan approved by all 4 flyways. The management plan recommends a recreational harvest at or below 5% of the population size as measured by the Atlantic & Mississippi flyway's mid-winter survey. Harvest is achieved through the issuance of permits in participating jurisdictions, and it is assumed that two issued permits result in the harvest of one swan. Number of permits allocated to states may be adjusted based on the rise and fall of the population and also if and when additional states or provinces implement new hunt programs. Over time, annual harvest of tundra swans in North Carolina has remained fairly consistent as there were no changes to allocated permits. However, an increase in harvest was noted in 2017 when allocated permits increased (due to an increase in the tundra swan population), but decreased in 2020 due to a reduction in permits (due to a population decline) along with a limited number of permits being allocated to Delaware when it implemented a new hunt program in 2019. As expected, success rate of permit holders in North Carolina hovers around 50%. For the 2020-21 season, the estimated retrieved harvest was 2,473, with 9,074 persons applying for the 4,895 available permits. The response rate for the harvest survey was 90%.

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Waterfowl and Webless Species Monitoring

Wood Duck Banding

As part of our 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 2020 banding period, staff captured and banded 999 wood ducks statewide, up 8% from the previous year, but an 18% decrease from the previous 10-year average.

Wood duck drake (Liz Weber)

Wood ducks captured by rocket net, Texas Plantation Game Land.

Canada Goose Banding

In June 2021, staff captured and banded 2,895 geese statewide. Legband recoveries from the 2021-22 hunting season along with harvest estimates will allow the size of the adult resident goose population to be estimated through a technique referred to as the Lincoln Estimator.

Prior to 2014, no standardized methodology existed to estimate the size of the North Carolina breeding, resident Canada goose population, or trends in this population over time. To address this shortcoming, the Commission contracted with NC State University to compare precision and efficiency (i.e. costs and staff time) between two common methods to estimate goose abundance. The first method (band return estimation) uses hunter band returns, and the second (plot survey) uses surveys of 1-km2 plots randomly located in potential goose habitat. In 2014, Canada geese were captured and banded statewide to evaluate the band return estimation method, and in 2015 staff visited randomly selected 1-km2 plots across the state to evaluate the plot survey method.

Although the two methods were similar in terms of efficiency, it was determined that using band recoveries to estimate the size of the Canada goose breeding population in North Carolina was the better method because it provided a more precise estimate with similar overall costs and, if continued for multiple years, allows calculation of additional population metrics including survival, recovery rates, and harvest distributions. Additionally, it was decided an operational Canada goose banding program would occur statewide every three years into the future. Statewide banding continued in 2017 and was scheduled for 2020 before the COVID-19 pandemic forced it to be cancelled. Previous population size estimates generated through this technique included 154,516 adult geese in 2014 and 166,924 adult geese in 2017.

Commission staff using portable aluminum frame and mesh net panels to capture a large group of geese near Bladenboro, Bladen County, June 2021.

Waterfowl and Webless Species Research

Mallard-Black Duck Hybridization and Population Genetic Structure

The final component of a collaborative research project with the University of Delaware on American black duck nesting ecology in North Carolina was completed in March 2021. This portion of the research examined mallard-black duck hybridization and population genetic structure within the resident black duck population in coastal North Carolina. Objectives of this research were to assess the genetic integrity and population structure of our black duck population and to measure the relationship among samples (i.e., sibship, parentage) to determine the extent to which interrelatedness is present in the black duck population in North Carolina. Because captive-reared mallard releases occur in eastern North Carolina, it was predicted that most hybrids would be of feral mallard × black duck ancestry.

DNA from egg membranes and adult hen contour feathers from monitored black duck nests were collected and analyzed, then they were compared against 199 genetically vetted mallards, black ducks, and mallard × black duck hybrids that served as genetic references. Next, the analysis tested for parentage and sibling relationship and overall relatedness of black ducks in North Carolina. We recovered strong population structure and high co-ancestry across genetic markers due to interrelatedness among sampled nests in North Carolina and concluded that black ducks have been locally breeding in this area for a prolonged period of time. Despite a high level of interrelatedness among the samples, nucleotide diversity was similar to the reference continental black duck population, suggesting little effect of genetic drift, including inbreeding. Additionally, we conclude that molecular diversity of black ducks in North Carolina is maintained at reference population levels through the influx of genetic material from unrelated, migrating male black ducks. Finally, we report a hybridization level of 47.5%, covering three filial generations. Of identified hybrids, 54.7% and 53% were the direct result of interbreeding between black ducks and captive-reared or wild mallards, respectively. We conclude that because of high rates of interspecific hybridization and successive backcrossing events, introgression from wild and feral mallards is occurring into this population of breeding black ducks and requires careful consideration in future management.

American black duck (Elliotte Rusty Harold)

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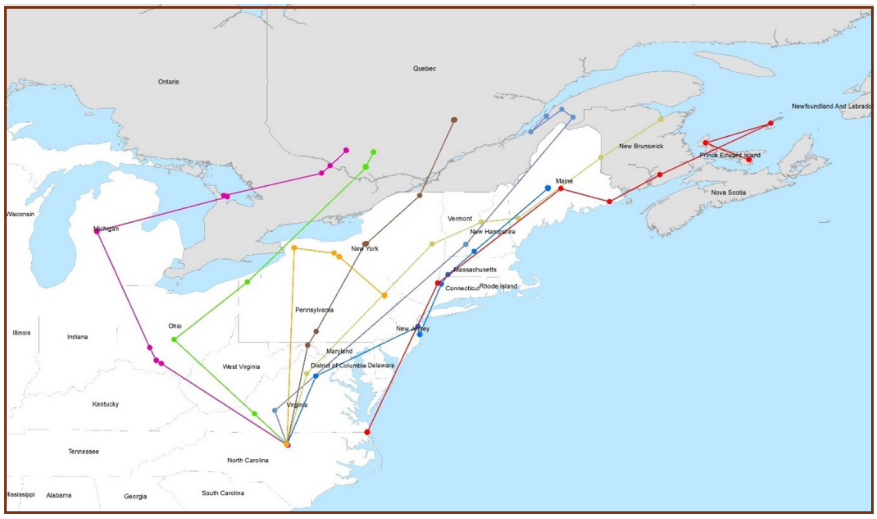
American Woodcock Migration Ecology

The American woodcock is a migratory forest bird that has experienced population declines of 0.8 percent 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, the 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.

One 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. Thus far, 22,419 locations from 405 transmitters have been collected, including locations from breeding, migration, and wintering areas. In North Carolina, NCWRC biologists and staff captured and fitted 11 woodcock with transmitters during February 2021 at Mackey Island National Wildlife Refuge in Currituck County and at Butner-Falls of Neuse Game Land in Granville County. Woodcock captured in North Carolina in 2021 migrated to Quebec (4), Maine (1), Pennsylvania (1), New Brunswick (1) and Prince Edward Island (1). Three woodcock remained in North Carolina before the signal was lost. During the next year, NCWRC biologists and staff will attempt to deploy 15 additional transmitters.



Migration of American woodcock fitted with GPS transmitters in February 2021 from capture locations in North Carolina.

Staff measuring bill length of an American woodcock to aid in determining sex.

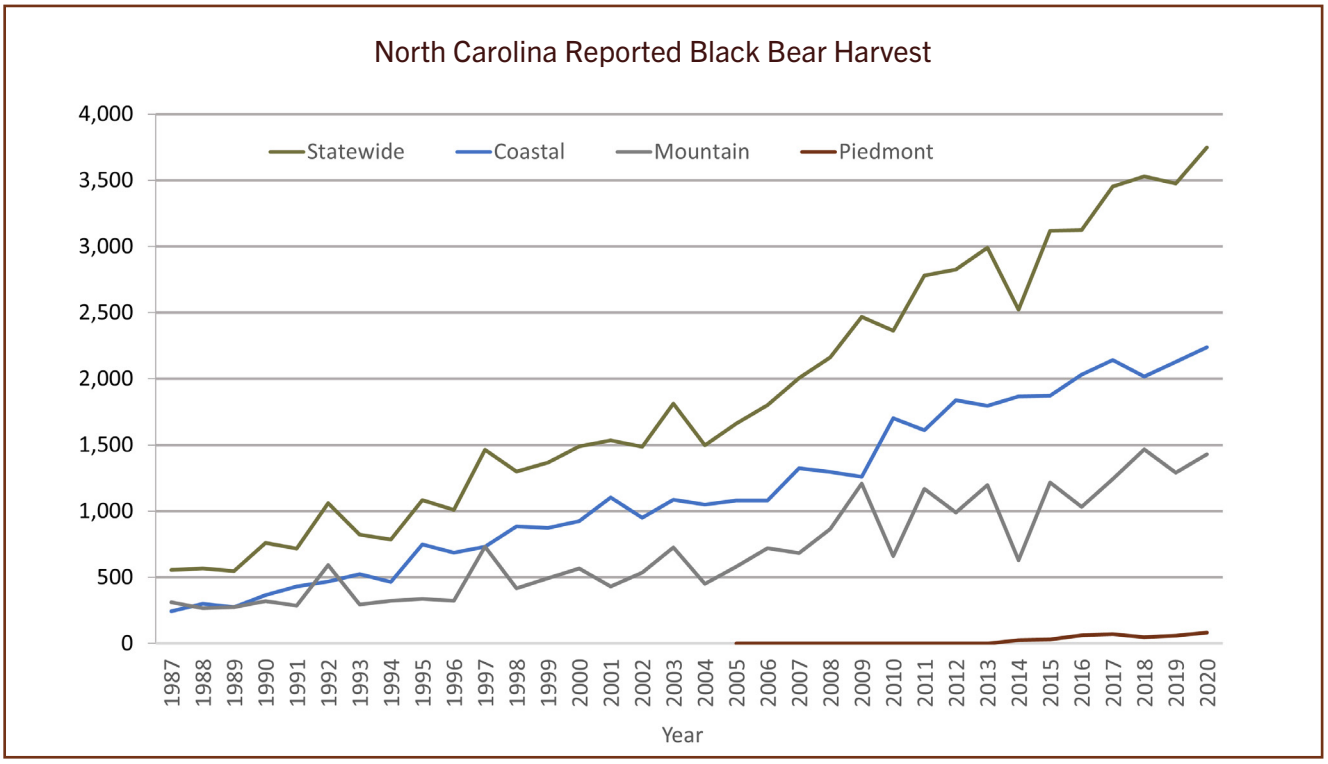
BLACK BEARS

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

Bear Harvest and Mortality

Statewide in 2020, reported black bear harvest was 3,748, consisting of 2,183 male (58%) and 1,565 (42%) female bears. Total statewide harvest was up 8% from the 2019 season, representing a record harvest. The Coastal Bear Management Unit (BMU) harvest increased 5% from the previous year while the Mountain BMU increased 10%. Total known 2020 black bear mortality was 4,030 bears, including the statewide harvest plus additional non-harvest mortality as follows: Auto=244 bears, Depredation=13 bears, Illegal=3 bears, Other=13 bears, and Unknown=9 bears.

The 2020 statewide bear harvest of 3,748 animals was up 8% from the 2019 season and is the largest harvest on record in the state.



North Carolina reported black bear harvest.

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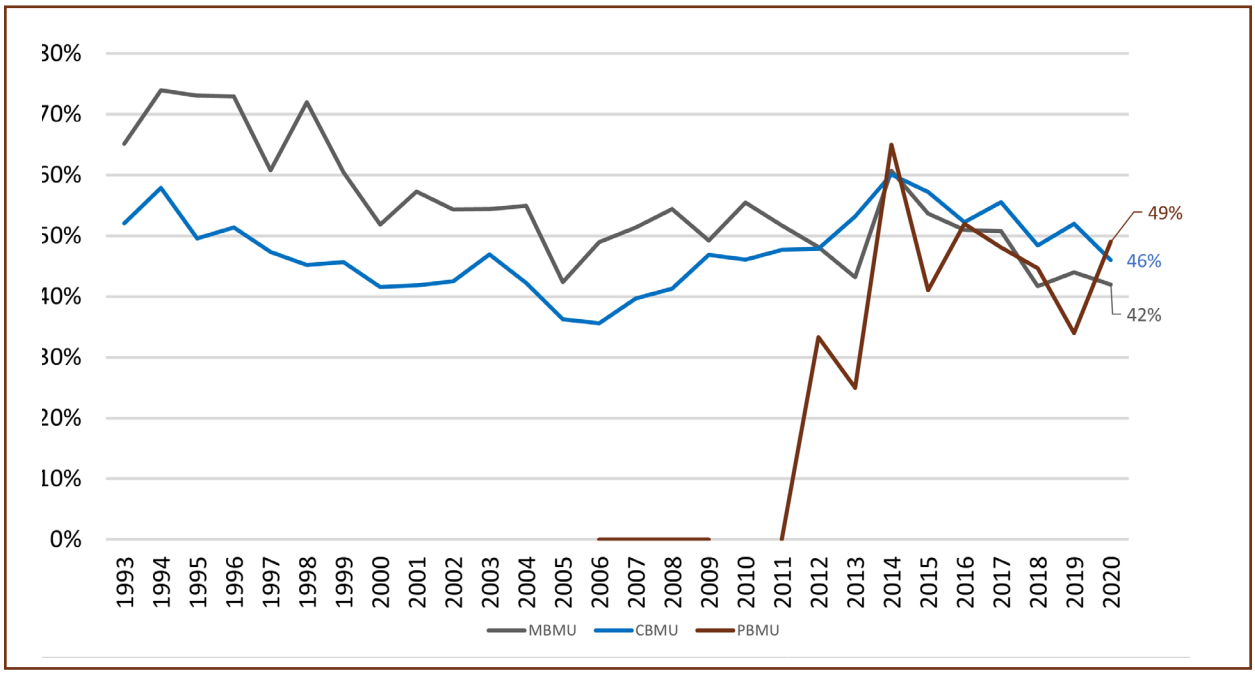
Black Bear Cooperator Program

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 2020 bear hunting season, the Commission was unable to conduct roving check stations due to COVID-19 safety restrictions. Rather, staff contacted hunters via phone after they registered a bear to encourage them to submit the teeth. For the 2020 season, 1,679 pre-molars were submitted from cooperating hunters (1,033 Coastal BMU, 605 Mountain BMU, 40 Piedmont BMU), a decrease of 5% from the previous year, despite the 8% increase in the reported harvest. Submission rates for the 2020 season were 46% in the Coastal BMU, 42% in the Mountain BMU and 49% in the Piedmont BMU. Bear houndsmen participation in the Bear Cooperator Program has been substantially higher than participation by still hunters; in 2020, 51% of houndsmen and 35% of still hunters who harvested a bear also submitted biological information. Because the

percentage of teeth submitted by hunters has declined over the decades, despite intensive efforts expended by staff prior to and during the bear hunting seasons, H181 was introduced in the NC General Assembly in February 2021 to require hunters to submit a premolar tooth from their harvested bear.



Bear tooth submission rates, 1993-2020, for the Mountain BMU, Coastal BMU and Piedmont BMU.

Mast Surveys

Mountain hard mast (acorns, hickory nuts, etc.) surveys were conducted along 12 routes in fall 2020 with over 1,400 trees sampled. The hard mast crop was rated as fair with an overall index of 2.47, a slight decline from last year's mast crop also rated as fair. Since 1983, North Carolina has experienced 24 years out of 38 years in which the hard mast index was rated as fair. In general, white oak production rated as poor, red oak rated fair, hickory production rated fair, while beech production rated as good.

Hard mast is an important food source for many species of wildlife and is important to monitor for its multi-species impacts.

Wildlife Underpass Camera Survey

In 2005, a new 12-mile section of U.S. Highway 64 in Washington County was completed that 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. Ten-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 Commission and the NC 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, each underpass was monitored 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, cameras were placed at the three underpasses and at 15 gaps

A female bear with her two cubs using a wildlife underpass located on Highway 64 in Washington County, North Carolina

continued on next page

found in the fencing to document wildlife use. The University of North Carolina Wilmington is assisting the Commission in reviewing the pictures.

The camera sites at the fencing gaps will be maintained through October 2021, while we will continue long-term monitoring with cameras at the wildlife underpasses.

Preliminary results indicate that while only 59% of observed bear events were in underpasses, this use represents an increase (3.3 events/month) since 2007 survey (1.4 events/month). Forty-one of bear events were at fencing gaps, which is of concern, as this places them on the unsafe side of Highway 64. Bears and deer used 40% and 93%, respectively, of the 15 fence gaps monitored. Coyotes and foxes used fence gaps (84% to 98%) rather than underpasses, while 63% of bobcat events took place at the underpasses. Results will provide recommendations to NCDOT for maintaining and improving fencing and managing vegetation in and around underpasses. Our study will show the importance of continued monitoring of highway wildlife passages to determine long-term effectiveness and maintenance needs.

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, staff fitted 28 bears with GPS collars upon release in from the Commission's rehab facility. Results from this research were reported in last year's report. In 2020, the Commission released 4 cubs (2M:2F) on designated bear sanctuaries in the Mountain BMU with GPS tracking collars. This release event was featured on National Geographic's Secrets of the Zoo. Two cubs (2F) slipped their collars soon after release, but two bears (2M) retained their collars until early March 2021, when the collars' drop off timer mechanism activated. Both males stayed within the area of release and hibernated over the winter. One male hibernated in a rock cavity, and the other male hibernated in an open tree snag. Based on staff observations of the bears while retrieving the collars, both bears appeared in good condition. We are not aware that any of the released bears showed a propensity for conflict behavior and recommend that

Brooks Long (NC Zoo) and District 8 wildlife biologist, Danny Ray, prepare to open the door to release a rehabilitated black bear cub. (Colleen Olfenbuttel/NCWRC)

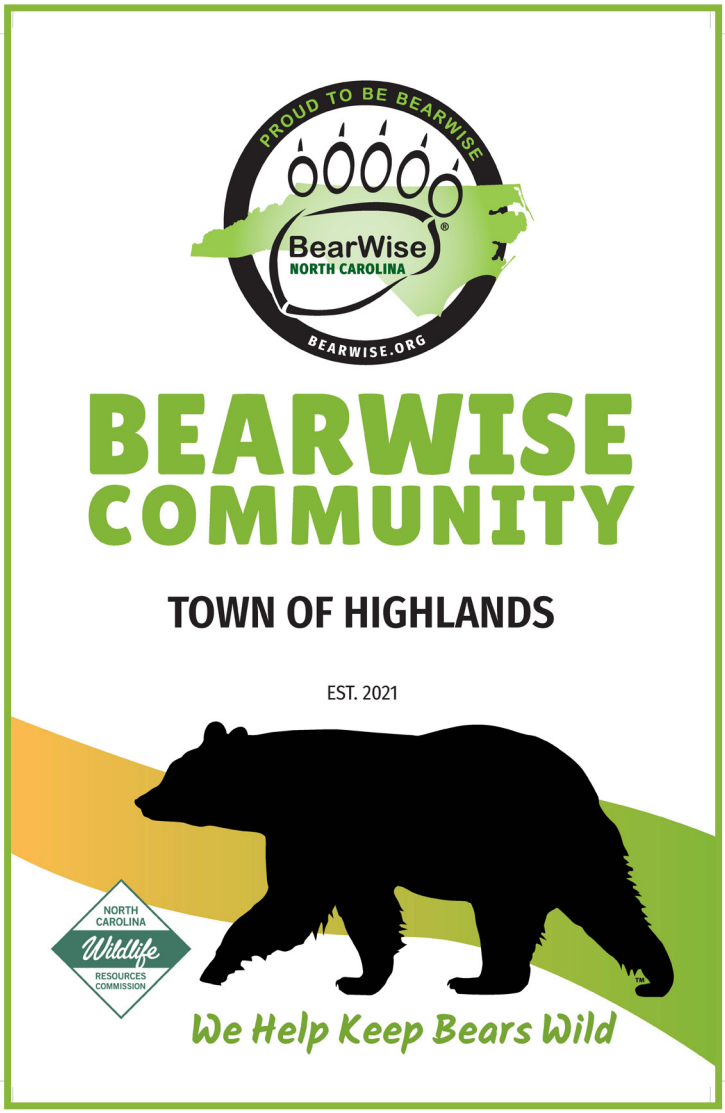
to enhance the probability for survival post-release, sites are selected that may limit harvest vulnerability and ensure bears are of the greatest weight at release. We will continue to investigate the post-release movements and fates of rehabilitated orphaned cubs.

BearWise® Program

BearWise (www.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 2020-21, we were successful in creating the first Recognized BearWise Communities in North Carolina. The Town of Highlands is the first town in the United States to achieve BearWise recognition. The other three recognized BearWise communities are two neighborhoods in the Town Mountain area of Asheville and an unincorporated group of homes in downtown Black Mountain. Additional BearWise outreach materials were created, and the Commission's BearWise page (www.ncwildlife.org/bearwise) now contains updated versions of all handouts in English and Spanish to improve accessibility. Despite restrictions due to Covid-19, we conducted approximately 30 BearWise outreach events with an estimated 3.000 people in attendance in FY20-21. We have shifted almost entirely to virtual events to maintain our "in-person" outreach.

We continued to support the city of Asheville's Sanitation department in launching its pilot bear-resistant cart program. Because Buncombe County is the source for 30-60% of all phone calls the Commission receives on black bears, this is a significant step forward toward reducing human-bear conflict in North Carolina. Since the deployment of over 300 bear-resistant carts, the city has received positive feedback. Asheville is examining whether it can increase budgeting for these carts in the coming fiscal years to meet the demands of its extensive waiting list.



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MULTI-SPECIES SURVEYS & RESEARCH

General Disease Surveillance

Staff investigated 214 disease reports and submitted several cases to laboratories for disease surveillance efforts. Disease reports included 24 different species with 98 deer, 30 raccoons, 15 boat-tailed grackles, 11 wild turkeys and nine eastern cottontail rabbits. Of the 98 deer submitted and/or investigated, 15 were diagnosed as positive for Epizootic Hemorrhagic Disease Virus (EHDV) with 37 additional cases as suspected EHDV. EHDV was confirmed or suspected in 23 counties across all nine Commission districts. A cluster centered around Surry and Wilkes counties appeared most significant. Of the 30 raccoon cases, 29 were submitted for laboratory diagnosis, and 27 were positive for canine distemper.

In March 2020, Rabbit Hemorrhagic Disease Variant 2 (RHDV2) was discovered in the United States in native hare and rabbit species. Since then, RHDV2 has rapidly spread throughout the western states in both domestic and native populations and into the southeast states of Florida and Georgia in domestic rabbits. In response to the discovery and spread, staff established an RHDV2 team and worked with agency personnel to initiate passive mortality investigations. Additionally, staff increased its level of coordination with partners, including the N.C. Department of Agriculture and USDA Wildlife Services.

Outreach materials were also developed targeting the North Carolina general population, avid rabbit hunters, rabbit pen operators and wildlife rehabilitators. During the time period, nine suspect eastern cottontail rabbits were submitted for testing. All were negative for RHDV2.

One deer herd health check was performed during the 2020-21 period for a total of six animals euthanized and necropsied. Samples from all relevant tissues were sent to Southeastern Cooperative Wildlife Disease Study for diagnostics. The results for Anchors Landing Community (Caldwell County) Herd Health Check indicated that the deer population level is below carrying capacity of the habitat and the lack of detectable antibodies in the deer sampled suggests little to no herd immunity and vulnerability to a Hemorrhagic Disease outbreak.

Deer Hunter Observation Survey

As mentioned on page 15, a deer hunter observation survey has been conducted each year since 2014. During the 2020 deer hunting season, 1,641 volunteer deer hunters recorded wildlife observations on greater than 28,000 hunting trips encompassing nearly 94,000 observation hours. While the survey provides insight into deer herd parameters, it also has 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

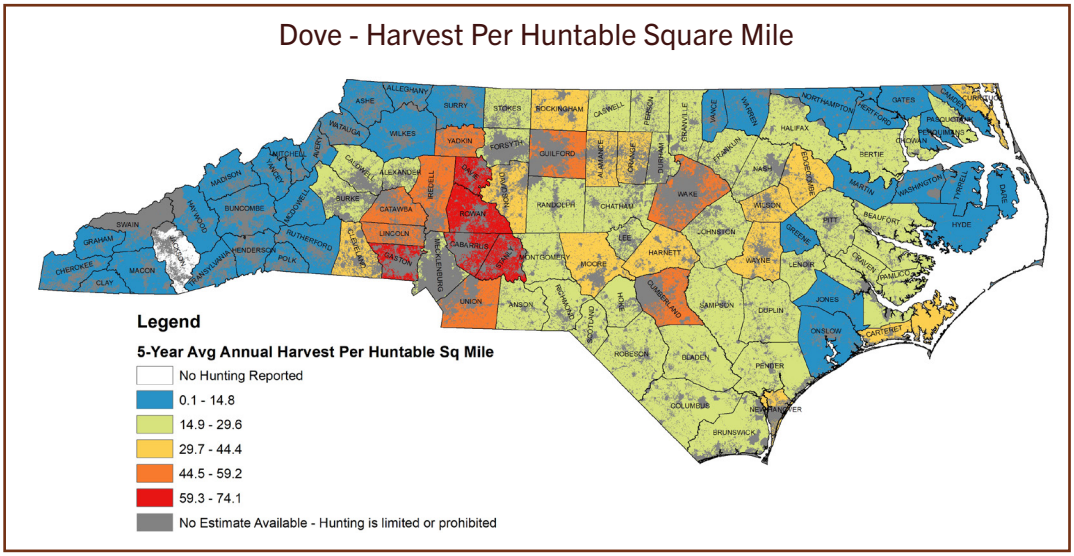
continued on next page

but they are also requested to record observations of many other species. We believe that over time this survey will provide insight into changes in species abundance that may occur from both a spatial and temporal perspective. The following is an interesting observation from the survey.

The relative percentage of bearded and non-bearded turkeys observed during the fall may provide insight into the previous spring's production. Observations of turkeys in the fall will generally consist of bearded adult gobblers, un-bearded hens and un-bearded juveniles (hens & toms) that hatched earlier in the summer. In general, a relatively high percentage of bearded turkeys (adult gobblers) observed would suggest relatively poor production as there are many fewer juveniles in the population. In our Deer Hunter Observation survey from 2014 through 2019, the percentage of non-bearded turkeys observed ranged from 30 to 41%; however, this estimate increased to 47% in 2020. This relatively high percentage of bearded turkeys observed correlates well with the extremely poor production also observed in the 2020 summer brood survey. Additionally, the relatively high proportion (41%) of bearded turkeys observed in 2016 also correlates with the reduced production that year, and the relatively low proportion (30%) of bearded turkeys observed in 2019 also corresponds to excellent production observed in 2019.

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. Below, and on the two next pages, we highlight statewide harvest distribution for several small game species.



Dove harvest distribution, 2016-2020.

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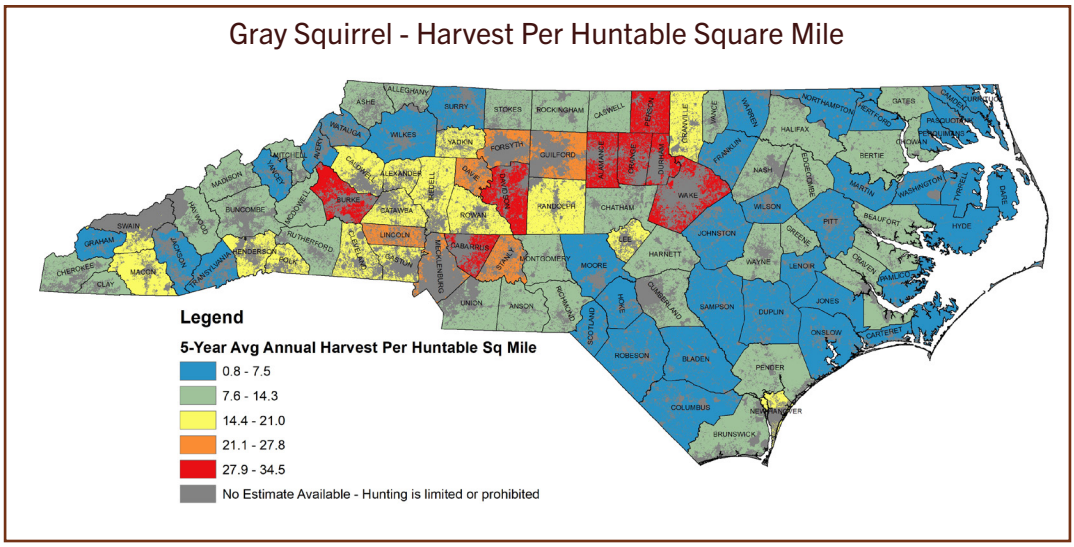
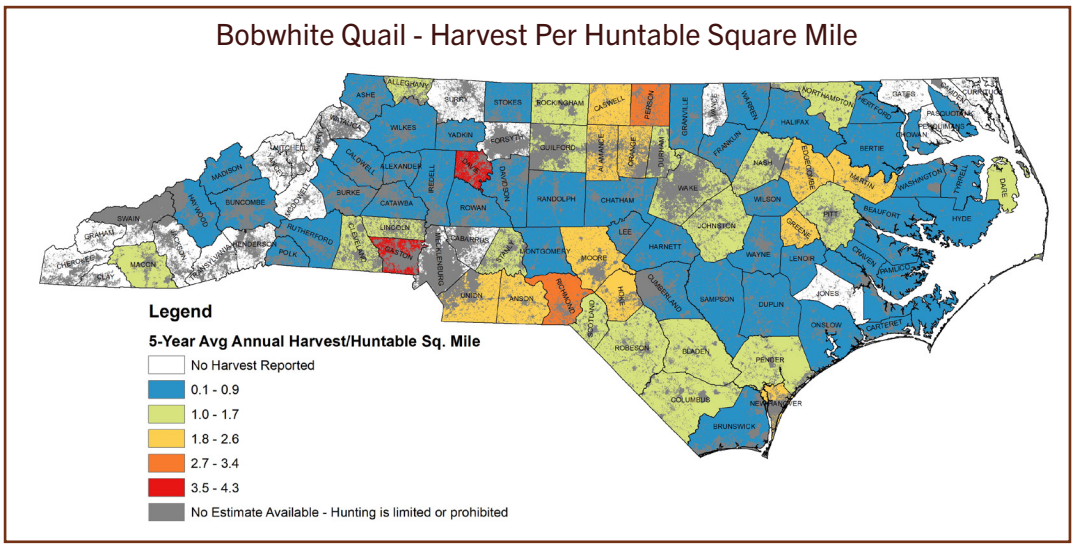
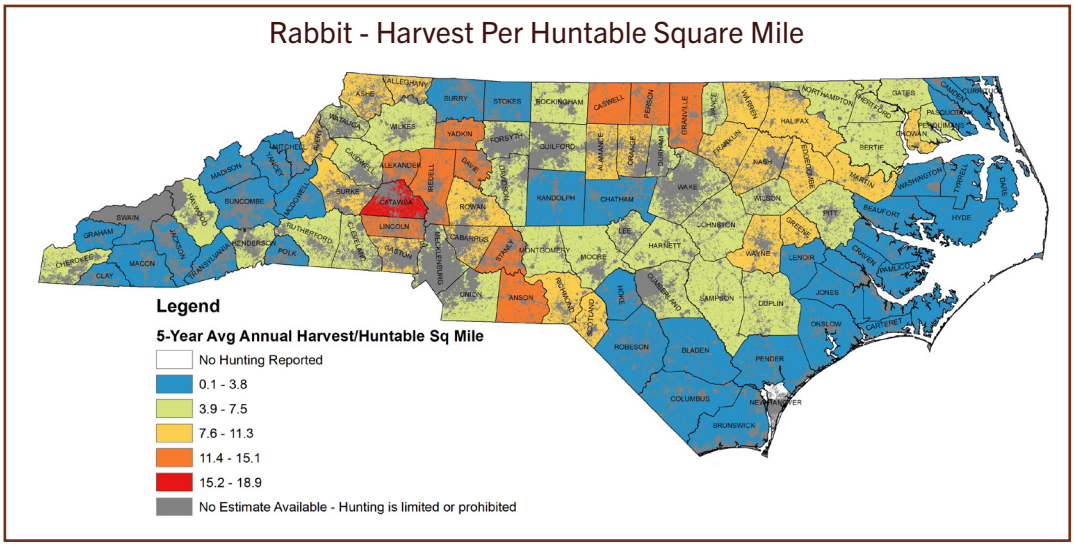


Gray squirrel harvest distribution, 2016-2020.



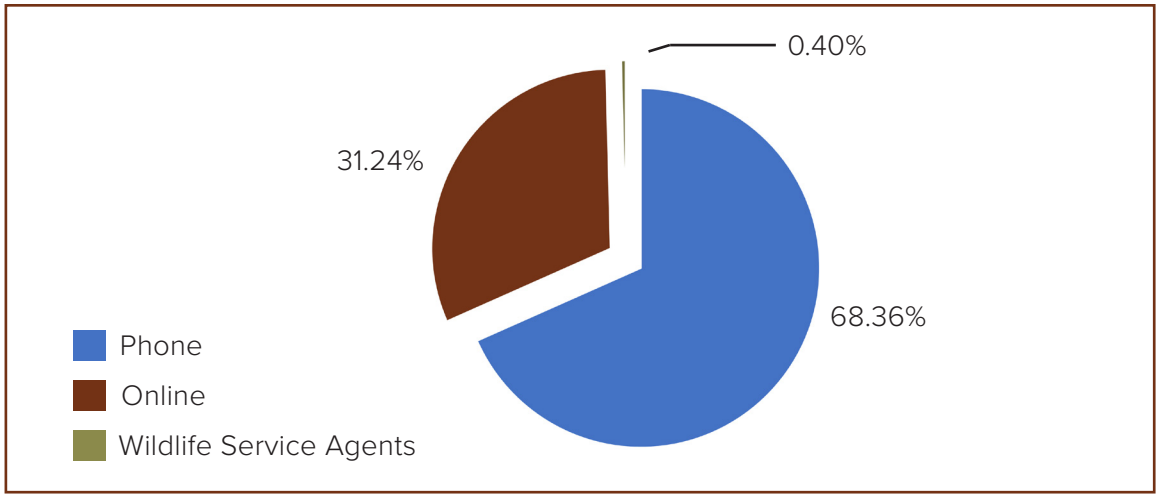
Bobwhite quail harvest distribution, 2016-2020. ***Note: Although we ask hunters to include harvest of wild quail only, we suspect harvest of pen-reared quail are included as well. This likely influences overall harvest estimates and harvest distribution.***



Rabbit harvest distribution, 2016-2020.

Big Game Harvest Reporting

Mandatory reporting of big-game (deer, bear, turkey) harvest is required by General Statue and provides a long-term dataset of reported harvests for these species. In coordination with the IT Department, Game & Furbearer Program personnel provide oversight of some technical aspects of the reporting system. Currently, reporting is allowed by either automated telephone, internet or through service provided by 320 Wildlife Service Agents. During the 2020-21 big game hunting seasons, over 68% of harvests were recorded via phone, while less than 1% were recorded by cooperating Wildlife Service Agents. Prior to the advent of the telephone reporting system in 1993, reporting of all big game harvests was completed either by Wildlife Service Agents or by additional cooperators issued registration books. In years following the addition of an online reporting option and the discontinuation of paper registration forms, the utilization of Wildlife Service Agents for registrations has greatly diminished.



Reporting Source of Big Game Harvest Registrations for the 2020-21 Big Game Seasons.

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Game & Furbearer Program *(those highlighted in red are described in this report)*

Annual Surveys

Raccoon Field Trial Survey
Eastern Spotted Skunk Camera Survey
Eastern Spotted Skunk Observation Project
Armadillo Observation Project
Bobcat and River Otter Sex & Age Ratios
Muskrat Sex and Age Ratios
Trapper Harvest Survey
Fur Dealer Transactions
Fur Tag Sales
Furbearer Pelt Prices
Furbearer Depredation Take
White-tailed Deer Reported Harvest
Deer Hunter Observation Survey
Deer Biological Data Collection (age & reproduction)
Chronic Wasting Disease Surveillance
Avid Rabbit Hunter Survey
Wild Turkey Reported Harvest
Wild Turkey Summer Observation Survey
Grouse Drumming Survey
Avid Grouse Hunter Survey
Avid Quail Hunter Survey
Mid-winter Aerial Survey for Tundra Swans & Atlantic Brant
Tundra Swan Productivity Survey
Northeast Canada Goose Hunt Zone Hunter Harvest & Participation Survey
Tundra Swan Hunter Harvest & Participation Survey
Light Goose Conservation Order Hunter Harvest & Participation Survey
American Black Duck Spring Breeding Population Survey
Sea Duck Fecundity Survey
Wood Duck Banding
Mourning Dove Banding
Black Bear Reported Harvest
Black Bear Cooperator Program (tooth collections)
Black Bear Non-Harvest Mortality
Bear E-stamp Holder Survey
Hard and Soft Mast survey
Human-Bear Interactions Tracking
Hunter Harvest Survey (all game species)
General Disease Surveillance

Periodic & Limited Duration Surveys & Research

(Conducted in-house or in conjunction with university or partner research projects)

Weasel Camera Survey
Eastern Spotted Skunk Detection Dog Pilot Study
Prevalence of Raccoon Roundworm
Bias Reporting of Rabies
Ecological Studies and Monitoring Strategies for Eastern Spotted Skunks in North Carolina
Prevalence and Occurrence of Canine Distemper Virus
Comparison of Raccoon Field Trial Survey Data to Deer Hunter Observation Data to Track Trends in Raccoon Populations
Ruffed Grouse/West Nile Virus Surveillance
Wild Turkey Reproductive Ecology Research
Resident Canada Goose Banding – every 3 years
Migration Patterns of American Woodcock Research
Mallard-Black Duck Hybridization and Population Genetic Structure Research
Black Duck Brood Survival and Movements Research
Migration Ecology of Eastern Mallards Research
Fine-scale Resource Selection, Diet, and Reproduction of Urban Black Bears and a Before-after Design to Evaluate the Impacts of BearWise Outreach
SEAFWA Bear-Resistant Products Testing Program
Highway 64 Underpass Camera Survey
Sardine Bear Bait Station Survey – every other year
Movements and Survivorship of Rehabilitated Black Bear Cubs

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 Operations Program in the Wildlife Management Division and staff of the Land & Water Access Division for their year-round commitment to many of these projects.

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.

Game and Furbearer Program Mission Statement

The mission of the Game and Furbearer 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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