



Deer Hunter Observation Survey 2014-2018

By Joe Fuller Surveys Support Unit Supervisor, Chris Kreh Upland Game Bird Biologist, Ryan Myers Surveys Biologist, Colleen Olfenbittel Black Bear and Furbearer Biologist, Jon Shaw Deer Biologist, and Andrea Shipley Mammalogist

Abstract

The North Carolina Deer Hunter Observation Survey (DHOS) provides an economical and statistically robust means of monitoring populations of several wildlife species. During the 5 deer hunting seasons from 2014-2018, volunteer deer hunters recorded wildlife observations on 132,247 hunting trips encompassing 452,429 observation hours. Deer, gray squirrels, and turkeys were the most commonly observed animals. Results include annual state and regional observation rates, including the effects of baiting and location types (private and game lands).

Introduction

The North Carolina Wildlife Resources Commission (NCWRC) initiated an annual volunteer deer hunter observation survey (DHOS) in 2014. Hunters were asked to record their daily observations of deer and other wildlife while still-hunting for deer. The primary objective of the DHOS was to provide long-term indices of wildlife occurrences and demographics across North Carolina. These data increase understanding of spatial differences and temporal changes in populations, and supplement other survey, harvest, and biological data collected by the NCWRC to monitor wildlife and evaluate management actions.

Since deer hunters are one of the most common hunter types across the state (~250K hunters) and spend many hours in the field (~3.8 million days, average 15 days/hunter/year), volunteer observers provide an economically viable means of monitoring several species of wildlife while providing statistically robust observation estimates at varying spatial scales for many species. Still-hunting from stand locations provides an ideal sampling scenario for detecting and counting many wildlife species within relatively comparable sized areas (area located around a stationary hunting location). When combined with measure of time (hours hunted), observation records can provide a standardized measure of sampling effort. Volunteer hunter observation projects continue to be used by many state wildlife agencies to provide a robust measure of species abundance and occurrence.

Methods

Participant Recruitment: Potential volunteers were initially identified in 2014 from the NCWRC big game harvest registration database. Avid deer hunters (those hunters registering ≥ 3 deer during the previous hunting season) were initially selected for the mailing since it was assumed that they also spent more time afield. Because of a pressing question regarding the distribution

of fox squirrels in North Carolina, an initial survey design was developed to focus recruitment of volunteer wildlife observers in known counties of the fox squirrel range. Our initial goal was to obtain approximately 30-40 volunteers in each of North Carolina's priority fox squirrel counties.

An initial statewide sample of 30K avid deer hunters was selected for the 2014 mailing and produced a 4.6% volunteer response rate (1,350 participating hunters). As other species informational needs were recognized by biologists (i.e. deer fawn recruitment), all deer hunters across the state were invited to participate in following years via public news releases, email blasts, and various staff contacts. Annual survey mailings incorporated the previous season respondents and any additional volunteer signups. Additional avid deer hunters were identified and mailed survey forms each season to help boost sampling rates in counties with low participation. Currently, 5,845 volunteer hunters are enrolled in the project's annual mailing list.

Survey Materials and Logistics: A standardized paper survey form was developed for hunters to report their wildlife observations (Appendix 1). Surveys were mailed just before the start of the archery deer season, and the survey observation period was open until the close of general deer season. Immediately upon the end of deer season, hunters were instructed to fold and submit their form via the incorporated, pre-paid postage business reply address block, which was printed on the back of form. Also, printed on the back of the form were the observation collection instructions, and the original hunter mailing information/identification number, which was used to uniquely account for each response. A small open text block was inserted for the hunter to list the name and address of any other individuals that would also potentially participate in the DHOS in future hunting seasons.

Hunters were asked to record the date they hunted, county, number of hours, location type, use of bait, and the number of animals seen. Hunters were instructed to separate morning and evening hunts when applicable. "Location type" was categorized into two options: 1) Game Lands – which included areas enrolled in the NCWRC Game Lands program, and 2) Private Lands – which included all other private and public lands not enrolled in the NCWRC Game Lands program. "Animal type" categories included antlered deer, adult doe deer, fawn deer (button bucks and doe fawns combined), unknown deer, gray squirrel, fox squirrel, bearded turkey, no beard turkey, unknown turkey, bobcat, red fox, gray fox, coyote, raccoon, adult bear, cub bear, and feral swine. When imprecise responses were recorded by the hunter (e.g. "a lot of squirrels"), a mean data imputation method was used. Mean imputation is a method in which the missing value on a certain variable is replaced by the mean of the available cases. The form also contained a comment field where hunters could write in any other wildlife not listed that they may have observed. Hunters were specifically instructed to list species of special interest which included: armadillo, domestic cat, elk, mink, red squirrel, spotted skunk, and weasel. Hunters were also instructed to report their hunting activity even if no wildlife was observed.

All responses and hunter contact information were entered and stored using the NCWRC's online PAWS (Portal Access to Wildlife System) database for maintenance and processing. A Hunter Observation Survey application was developed to allow staff to dynamically query the raw dataset for any selected survey parameter (e.g. year, location type, date range within season, use of bait) and to produce basic survey summary outputs at any desired scale (e.g. state, regional or county). For the purposes of this report, most results and analyses are limited to the statewide or management region scale.

Analyses: We refined hunter submitted observations into sampling units in order to reduce the effects of pseudoreplication. Pseudoreplication occurs when some hunters remain in the same hunting stand for multiple days and often repeatedly count the same individual animals each day. We use the term “sampling unit” to describe unique combinations of hunter-location-county-bait observations. As a simple example of the refinement process, if a deer hunter hunts 20 days in County A on private land with bait, observation records are averaged for that single independent sampling unit. If a hunter hunts 20 days (10 days in County A and 10 days in County B, both on private land without bait), those records constitute 2 sampling units. Averaging data into refined sampling units for each scenario decreases sample size and increases variance in some cases, but provides a conservative statistic based on truly independent samples.

Based on the 2018 survey, most sampling unit responses originated from counties within the central part of the state (Figure 2). The unbalanced distribution across counties was likely a combination of the original 2014 participant recruitment mailings, regionally-specific distribution efforts by district biologists, and actual deer hunter gradients within the state.

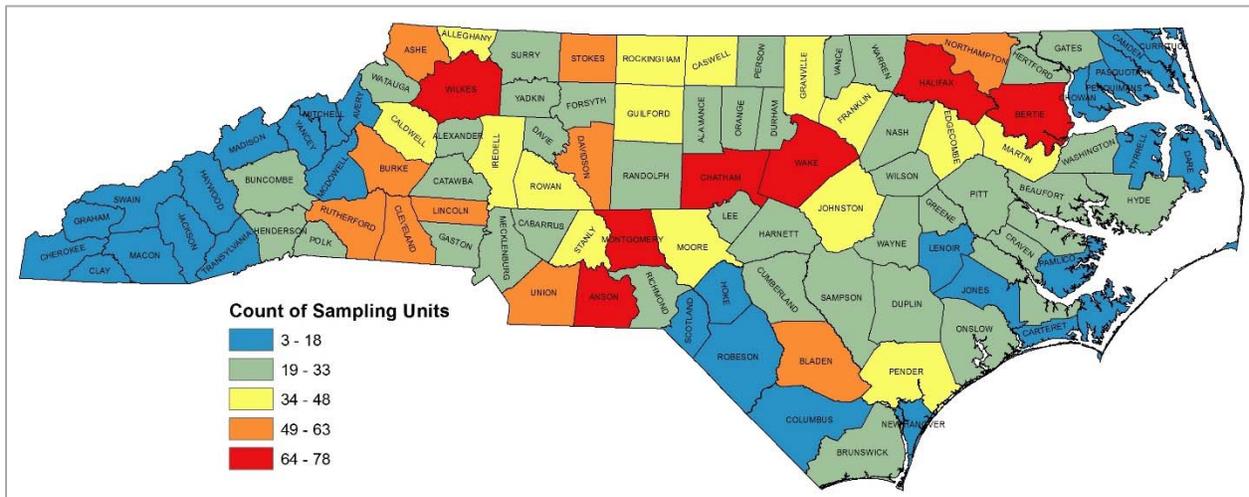


Figure 2. Total number of sampling units by county, North Carolina Deer Hunter Observation Survey, 2018.

When calculating annual regional and statewide estimates, sampling units were weighted within each county to balance unequal sampling effort across the state. Small sample sizes occurred in 2-4 counties, primarily during the first 3 years of the project, and were located mostly in the far western counties, e.g. Graham, Jackson, Swain, and Cherokee. Counties with fewer than 3 sampling units per year were excluded from regional and statewide analyses. Analysis of variance and linear regression were used to determine the effects of year, location type, and use of bait, after accounting for year, for each animal type.

Observation rates were standardized to observations per 1,000 hours, and 95% confidence intervals were computed for each of the 17 animal types (Table 4). A higher number of records per hunter and a higher number of sampling units within a county generally provided a higher-level of precision within each animal type. Precision among annual estimates for common species, such as gray squirrel and deer was high: proportional standard error (PSE) values were generally within $\pm 10\%$ at the state scale. However, for less common species, such as swine, bobcat, and fox, statewide precision was lower and there was considerable uncertainty at

smaller spatial scales. The scale within most of the species observation rate maps (Figures 3 – 32) was dictated by the precision of the data and were limited to average county PSE values within $\pm 30\%$.

For the purposes in this report, tables and figures are presented as either 5-year annual averages or 5-year trends. Inherently, wildlife survey counts do vary annually; annual variation in observations is due in part to weather, wildlife movements, observer inconsistencies, and other factors that may not be related to wildlife numbers. Averaging annual estimates over multiple years or analyzing trends helps account for some of this fluctuation and provides measures that are more accurately related to the overall status and trajectory of populations.

Results

During the 2014-2018 hunting seasons, approximately 132,247 hunting trips encompassing over 452,429 observation hours were reported by hunters (Table 2). Hunters reported an average of 19 hunts per year and hunted 3.4 hours per hunt during the 114-day survey seasons. Each hunter provided an average of 2.2 sampling units per season. Total animal counts by year are presented below (Table 3). Other animals reported included (listed in descending order): rabbits, domestic cats, crows, hawks, doves, opossums, ducks, owls, skunks, groundhogs, chipmunks, and quail.

More trips and observation hours occurred on private lands (125,472 trips; 419,260 hours hunted) than on game lands (5,194 trips; 25,695 hours hunted). Game land hunting accounted for 3.9% of trips and 5.6% of hunting hours, which is comparable to the overall percentage of the landscape (roughly 5%) that are game lands. Use of bait by hunters was relatively consistent across years. Baiting was reported on approximately half the hunting trips on private lands, but was not reported on game lands, where its use is prohibited. Since the use of location types and baiting were comparable to their availability, not adjustments were made to statewide observation rates (Table 4).

Table 2. Statewide total survey responses, North Carolina Deer Hunter Observation Survey, 2014-2018.

Year	Hunters	Observation Records	Hours Hunted	Hours Hunted /Hunter	Observation Records/Hunter	Hours Hunted/ Observation Record	# of Sampling Units
2014	1,342	27,548	97,845	73	21	3.6	3,131
2015	1,385	26,498	92,206	67	19	3.5	3,052
2016	986	20,060	68,101	69	20	3.4	2,198
2017	1,705	31,646	106,310	62	19	3.4	3,558
2018	1,451	26,495	87,968	61	18	3.3	2,988
			Average	66	19	3.4	

Table 3. Statewide estimated total counts of animals observed, North Carolina Deer Hunter Observation Survey, 2014-2018. Counts include mean imputations for imprecise observer responses.

Year	Antlered Buck	Adult Doe	Total Adult Deer	Button Buck & Doe Fawn	Unknown Deer	Total Deer
2014	13,832	34,123	47,956	15,751	5,587	69,294
2015	13,692	35,447	49,139	17,377	5,766	72,281
2016	9,898	22,385	32,282	10,580	3,808	46,671
2017	17,035	42,039	59,074	19,388	6,632	85,094
2018	15,424	35,693	51,117	16,855	5,747	73,719

Year	Gray Squirrel	Fox Squirrel	Total Squirrels
2014	62,713	1,994	64,707
2015	69,225	1,549	70,774
2016	51,745	1,159	52,905
2017	90,284	2,071	92,355
2018	72,255	1,732	73,987

Year	Bearded Turkey	No Beard Turkey	Total Known Turkey	Unknown Turkey	Total Turkey
2014	6,598	17,697	24,295	8,261	32,556
2015	5,649	17,936	23,585	8,897	32,482
2016	4,403	10,804	15,207	5,365	20,572
2017	6,806	18,625	25,431	8,989	34,420
2018	6,202	17,549	23,751	6,410	30,160

Year	Coyote	Bobcat	Gray Fox	Red Fox	Raccoon
2014	1,533	346	988	289	2,546
2015	1,190	237	645	310	1,888
2016	982	168	532	151	1,589
2017	1,474	298	713	282	2,682
2018	1,216	209	601	178	2,503

Year	Bear Adult	Bear Cub	Feral Swine
2014	791	468	410
2015	724	385	183
2016	401	184	86
2017	672	390	276
2018	559	335	322

Caution should be taken when comparing observation rates between species or species groups. No correction for observer bias has been made and it is very likely that larger, more mobile species that move more during daylight or twilight hours are more likely to be seen than smaller more nocturnal animals. It is also important to note that animal type identifications are made solely by individual hunters and not authenticated by NCWRC staff.

Table 4. Observation rates for animal types, North Carolina Deer Hunter Observation Survey, 2014-2018. Statewide mean estimates derived from 5-year annual state averages.

Animal Type	Observation Rate (animals seen per 1,000 hours)	95% Confidence interval
All Deer (including unknown age/sex)	775.8	(685.6-887.5)
Gray Squirrel	769.9	(678.3-894.1)
Doe Deer	382.9	(335.5-438.2)
All Turkey (including unknown beard status)	335.7	(315.7-382.3)
Non-Bearded Turkey	171.1	(152.6-203.2)
Fawn Deer	168.0	(144.3-194.3)
Antlered Buck	153.6	(137.5-178.5)
Bearded turkey	60.8	(54.1-67.6)
Raccoon	28.3	(26-30.9)
Fox Squirrel	17.2	(15.1-19.8)
Coyote	13.9	(12.7-15.3)
Adult Bear	12.1	(10.3-13.4)
Gray Fox	8.2	(6.7-10.8)
Cub Bear	6.1	(5.4-6.6)
Bobcat	3.4	(2.7-4.1)
Red Fox	3.3	(2.5-4.1)
Swine	3.3	(1.2-6.1)
Doe/Buck	2.42	(2.26-2.58)
Fawn/Doe	0.57	(0.55-0.6)
Bearded/Non-Bearded Turkey	0.36	(0.31-0.41)
Fox Squirrel/Total Squirrel	0.04	(0.03-0.04)

Roughly half of the observations occurred from hunts that used bait within and across all 5 years (45%-47% hunts with bait per year). After accounting for year, baiting proved to affect observation rates for many animal types. In most cases baiting increased observation rates, except for coyote where the use of bait seems to make observations less likely (Table 5).

Table 5. Species observation rates by use of bait and no bait, North Carolina Deer Hunter Observation Survey, 2014-2018. Statewide mean estimates derived from annual county averages. Parentheses indicate a 95% confidence interval.

Animal Type	Animals seen per 1,000 hours				P
	Bait	95% CI	No Bait	95% CI	
Gray Squirrel	896.8	(762.2-1,031.4)	677.9	(598-757.8)	0.00
All Deer (including unknown age/sex)	868.3	(715.8-1,020.8)	734.7	(659.8-809.6)	0.00
Doe Deer	421.1	(348.7-493.4)	370.3	(324.8-415.7)	0.01
All Turkey (including unknown beard status)	356.5	(316.2-396.9)	321.9	(276.9-366.8)	0.07
Non-Bearded Turkey	197.5	(161.6-233.4)	150.4	(131.8-169)	0.01
Fawn Deer	207.7	(165.8-249.4)	145.4	(130.6-160.3)	0.00
Antlered Buck	173.7	(141.5-205.8)	142.7	(133.7-151.6)	0.00
Bearded turkey	69.7	(60.5-78.9)	53.0	(47.7-58.3)	0.00
Raccoon	39.3	(31.5-47.1)	18.2	(16.5-19.9)	0.00
Fox Squirrel	18.1	(13.4-22.7)	17.3	(15.4-19.2)	0.68
Coyote	12.1	(9.6-14.5)	15.4	(13.7-17.0)	0.03
Adult Bear	10.0	(6.7-13.2)	11.4	(10.1-12.6)	0.42
Gray Fox	10.2	(7.1-13.3)	6.9	(4.3-9.5)	0.04
Cub Bear	5.6	(4.3-6.9)	5.8	(3.8-7.7)	0.84
Red Fox	3.4	(2.4-4.4)	3.4	(2.2-4.5)	0.96
Bobcat	2.9	(2.6-3.2)	3.7	(2.4-5.0)	0.23
Swine	1.6	(1.1-2.1)	4.4	(0.1-8.7)	0.13
Doe/Buck	2.57	(2.43-2.70)	2.81	(2.64-2.97)	0.01
Fawn/Doe	0.68	(0.64-0.72)	0.50	(0.47-0.53)	0.00
Bearded/Non-Bearded Turkey	0.51	(0.40-0.62)	0.59	(0.44-0.73)	0.03
Fox Squirrel/Total Squirrel	0.03	(0.03-0.04)	0.05	(0.04-0.05)	0.02

*significant differences indicated in bold (P<0.05).

Private land observations comprised of considerably more of the sampling unit location types (91.7%, n=14,072) than game lands (8.3%, n=1,273). Since baiting is prohibited on all game lands, observation rates comparing game lands to private lands were limited to “no use of bait” records only (Table 6). After accounting for annual differences, private land observation rates for most animal types were higher than game lands, except for feral swine.

Table 6. Species observation rates by location type (private versus game lands), North Carolina Deer Hunter Observation Survey, 2014-2018. Statewide mean estimates derived from annual county averages with no use of bait. Parentheses indicate a 95% confidence interval.

Animal Type	Animals seen per 1,000 hours				P
	Private Lands	95% CI	Game Lands	95% CI	
All Deer (including unknown age/sex)	816.5	(714.7-918.3)	301.2	(235.5-367)	0.00
Gray Squirrel	705.0	(618-792)	564.1	(503.3-625)	0.00
Doe Deer	411.5	(352.9-470.1)	154.4	(118.3-190.5)	0.00
All Turkey (including unknown beard status)	352.8	(303.4-402.2)	164.0	(119.1-208.9)	0.00
Non-Bearded Turkey	168.6	(141.5-195.8)	63.9	(49.8-78)	0.00
Fawn Deer	163.7	(139.9-187.6)	38.0	(35.4-40.6)	0.00
Antlered Buck	158.9	(145.9-171.9)	57.7	(44.4-71)	0.00
Bearded turkey	58.2	(50.5-65.9)	25.4	(18.8-32)	0.00
Raccoon	19.1	(17.8-20.3)	8.8	(8.8-12.3)	0.00
Fox Squirrel	17.5	(14.7-20.3)	11.9	(1.5-22.3)	0.19
Coyote	15.8	(13.8-17.7)	7.5	(4-11.1)	0.01
Adult Bear	10.8	(9-12.5)	14.6	(0-33.6)	0.62
Gray Fox	7.3	(4.2-10.5)	3.5	(1.8-5.2)	0.07
Cub Bear	5.0	(3.1-6.9)	11.8	(0.3-23.3)	0.16
Red Fox	3.6	(2.1-5.2)	1.1	(0-2.5)	0.04
Bobcat	3.7	(2.4-4.9)	2.2	(0.4-4.1)	0.16
Swine	2.2	(0.4-3.9)	18.7	(0-49.9)	0.22
Doe/Buck	2.80	(2.69-2.9)	2.77	(2.22-3.32)	0.87
Fawn/Doe	0.51	(0.48-0.54)	0.43	(0.35-0.5)	0.01
Bearded/Non-Bearded Turkey	0.54	(0.41-0.66)	0.29	(0.14-0.44)	0.04
Fox Squirrel/Total Squirrel	0.05	(0.04-0.05)	0.03	(0.02-0.05)	0.05

*significant differences indicated in bold (P<0.05).

Species Specific Results and Comments:

When looking at each of the following sections and charts, we urge caution in making direct comparisons between regional estimates for any species. Observation rates between regions may reflect population levels but can also be biased by differences in many factors such as habitat, topography, land use, or any other factor affecting the sightability of animals. For each of the selected species, any differences between regions may NOT be entirely related to regional differences in population size. We feel that trend data (i.e. changes through time within specific areas) generally can be relied on for assessing changes in population levels during the 2014-2018 time frame.

Deer

Hunters were asked to report deer they saw according to four categories: Antlered Buck, Adult Doe, Doe Fawn/Button Buck, or Unknown. These observations provide a solid baseline to enable biologists to begin to monitor trends in deer observation rates (deer/hour) and ratios (fawns/doe, does/buck) over space and time. Observation data complement other annual deer data sets (reported harvest, hunter harvest survey, biological data collections) that biologists rely on to manage the herd.

It is important to note these observation data have not been scientifically tested to determine their accuracy as a true measure or estimate of herd demographics, so results should be interpreted with caution. For example, bait appears to inflate fawn observation rates and fawn/doe ratios (Table 5), so if differences in fawns are observed over time or space, those differences could be the result of differences in the use of bait over time or space rather than differences in actual fawns in the population. Even if the use of bait is accounted for, it remains unknown whether observed fawn/doe ratios are an accurate measure of the true fawn/doe ratio of the herd.

In addition to bait, deer observations can vary throughout the deer hunting season, and time of observations should be critically considered before assuming observations are an accurate depiction of population demographics. Deer observation rates and ratios can change over the course of a hunting season because of seasonal changes in 1) deer movements (ex: rut activity, response to hunting pressure, shorter day length, variable food sources, fawns becoming more active), 2) a hunter's ability to detect (ex: leaf fall, crop harvest) deer, 3) correct identification of types of deer (ex: fawns maturing, bucks shedding antlers), and 4) removal of deer from the herd (ex: disproportionate harvest of bucks to does or does to fawns). To further confound this issue, the influence of these factors may vary geographically and between years.

Deer observed per hour is slightly lower near the end of the deer hunting season when day length is short, and many deer have been harvested or exposed to hunting pressure (Figure 3). Because buck movements and home-ranges increase around the rut, the lowest doe/buck ratio is typically observed during that time period. Fawn/doe ratios are highest at the beginning of the season, even though hunters harvest proportionally more adult does than fawns throughout the season. Natural mortality (predation, disease, etc.) is similar for adult does and fawns older than 3-4 months of age, so the observed decline in the ratio at the end of the season is not likely due to an actual decline in fawns per doe in the herd. The higher early season ratio may indicate hunters have a higher tendency to incorrectly identify fawns as adults as they mature during the season.

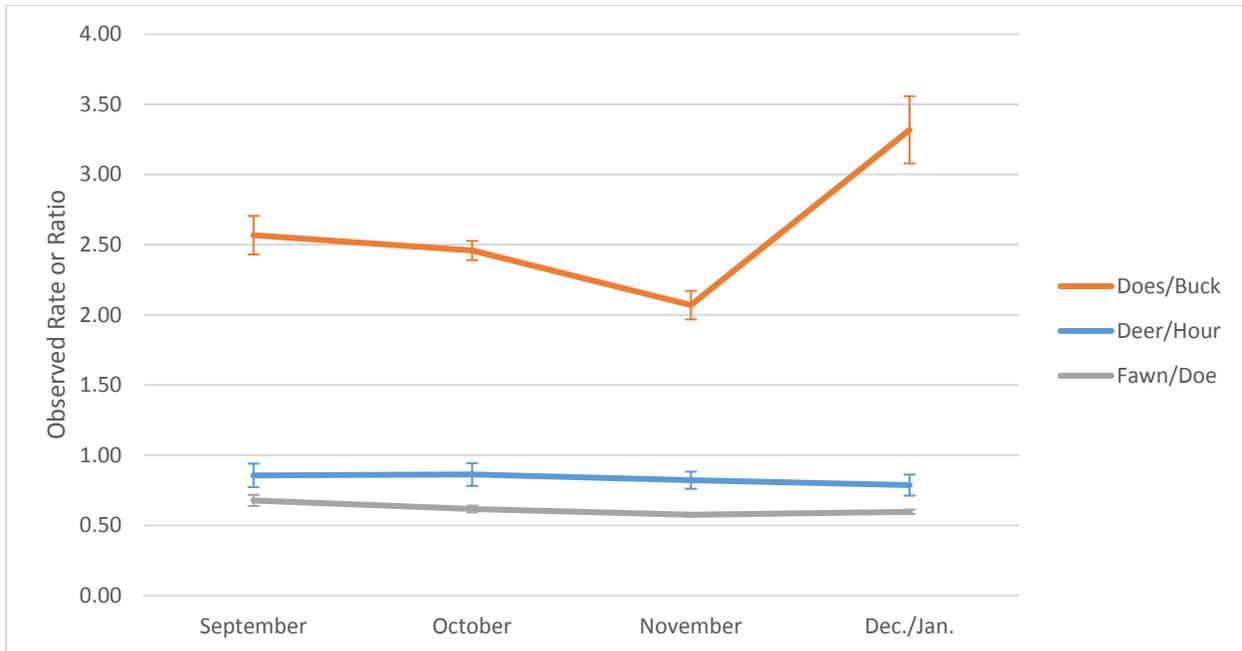


Figure 3. Deer observation rates and ratios by month, North Carolina Deer Hunter Observation Survey, 2014-2018. Deer observations vary over time of year due to changes in deer movements, hunter ability to detect and correctly identify types of deer, and deer harvest. For the raw data used for this chart, see Appendix B1.

Observation Rates of Deer

Deer were the most commonly observed animal type (775.8 deer per 1,000 hours) and were seen in all 100 counties (Figure 4). Adult does were seen at a higher rate (382.9 does per 1,000 hours), than either fawns (168.0 fawns per 1,000 hours), or antlered bucks (153.6 bucks per 1,000 hours). Significantly more deer were observed on stand locations with bait (843.1 per 1,000 hours, than without bait (727.5 deer per 1,000 hours) (Table 5). Significantly more deer were observed on private lands (792.7 per 1,000 hours, than on game lands (293.3 deer per 1,000 hours) (Table 6).

The highest observation rates for deer occurred in the Northeastern season zone (952.8 deer per 1,000 hours) and were lowest in the Western season zone (499.3 deer per 1,000 hours). Within the past 5 years, there is significant evidence that statewide observation rates have increased over time ($P < 0.01$). Additionally, there's a general increasing trend in observation rates within all 5 deer season zones with the highest number of deer observed per 1,000 hours occurring in the most recent year (2018) in all zones.

County estimates maintained relatively consistent observation rates across years ($PSE \pm 12\%$), reliable enough to estimate rates within most counties (Figure 5). However, counties in the extreme eastern and western ends of the state exhibited a high amount of annual variation due to small sample sizes.

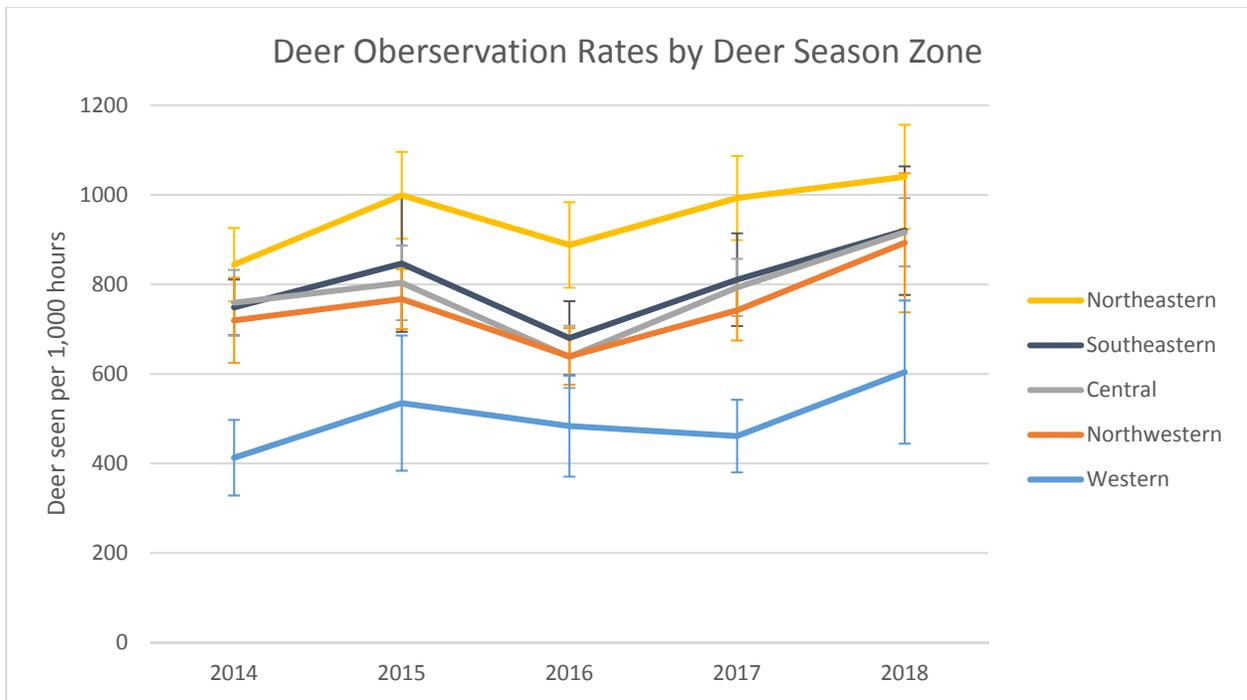


Figure 4. Annual deer observation rates by deer season zone (# of deer seen per 1,000 hours) with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018. For the raw data used for this chart, see Appendix B2.

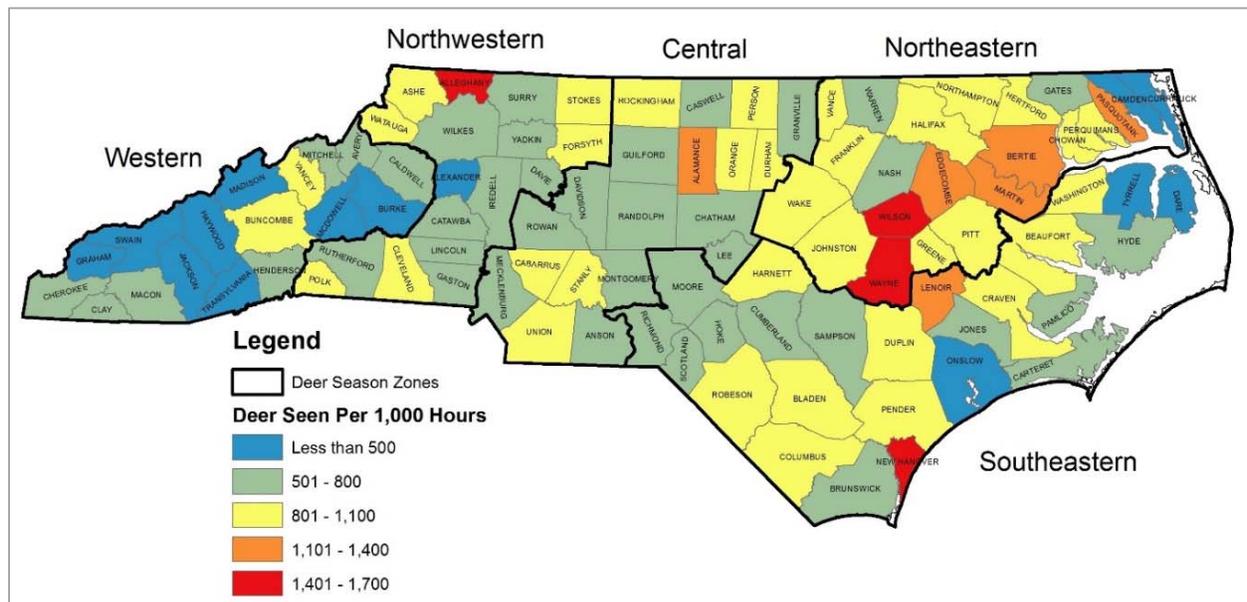


Figure 5. Deer observation rates by county, North Carolina Deer Hunter Observation Survey, 2014-2018.

Ratio of Fawns Per Doe

This ratio offers insight into deer population recruitment. The two main influences on this ratio are adult doe (1.5+ years) reproductive output and fawn mortality. When changes in the ratio are observed over time, it will never be entirely clear which of these factors might be responsible, i.e. habitat quality, doe age/health, predation, and weather events. However, this ratio is extremely valuable 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 for most years (0.65-0.66 fawns for every adult doe) (Figure 6). Annual ratios were typically the lowest in the Southeastern and Western zones (0.52 fawns for every adult doe). Baiting analyses suggest that the use of bait significantly increases the observed fawn per doe ratio by ~25% (0.62 fawns per doe with bait, 0.49 fawns per doe without bait). This appears to be influenced by fawns having a higher tendency to visit baited sites compared to adult does.

There is no evidence that statewide ratios have significantly changed within the past 5 years (0.57 fawns for every adult doe, $P=0.26$). Rates within each of the season zones also showed no significant change within the past 5 years ($P>0.05$). Considerable annual variation existed in the Western season zone, most notably in 2015. Weather and most likely influence reproductive output and fawn mortality, but the relationship is complex and currently unclear.

Annual county estimates maintained relatively consistent observation rates, reliable enough to estimate recruitment for most counties (Figure 7). However, several counties in the mountains and coast exhibited the highest amount of annual variation due to small sample sizes.

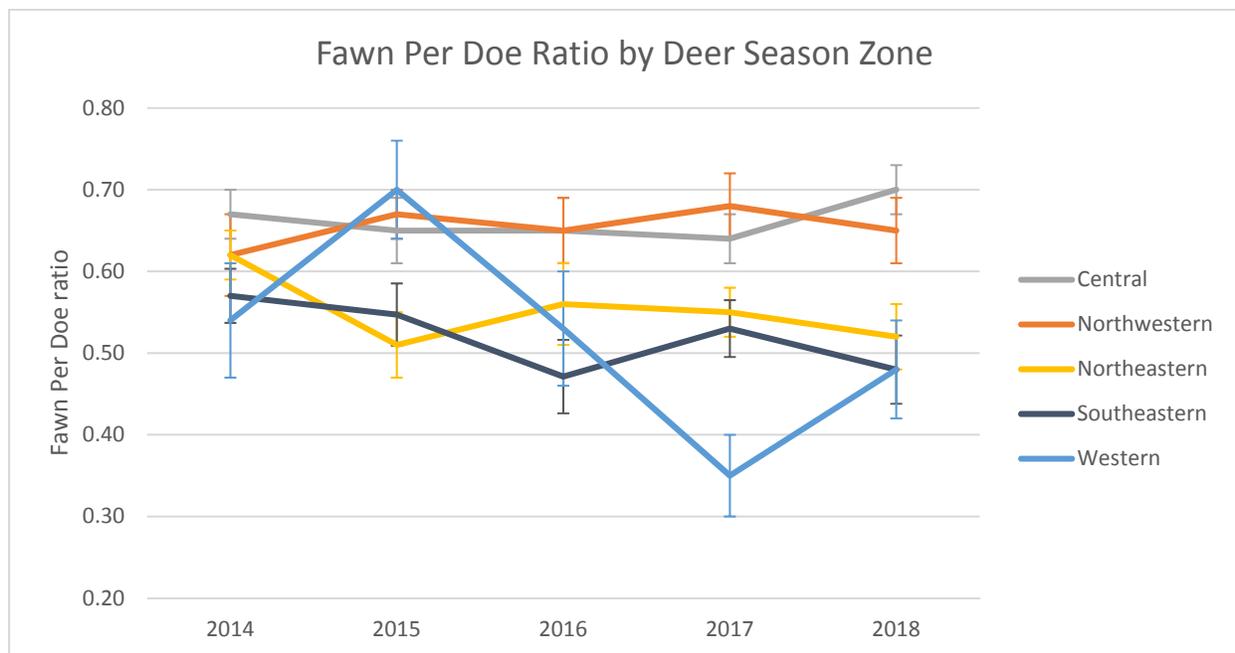


Figure 6. Annual fawn per doe observation rates by deer season zone with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018. For the raw data used for this chart, see Appendix B3.

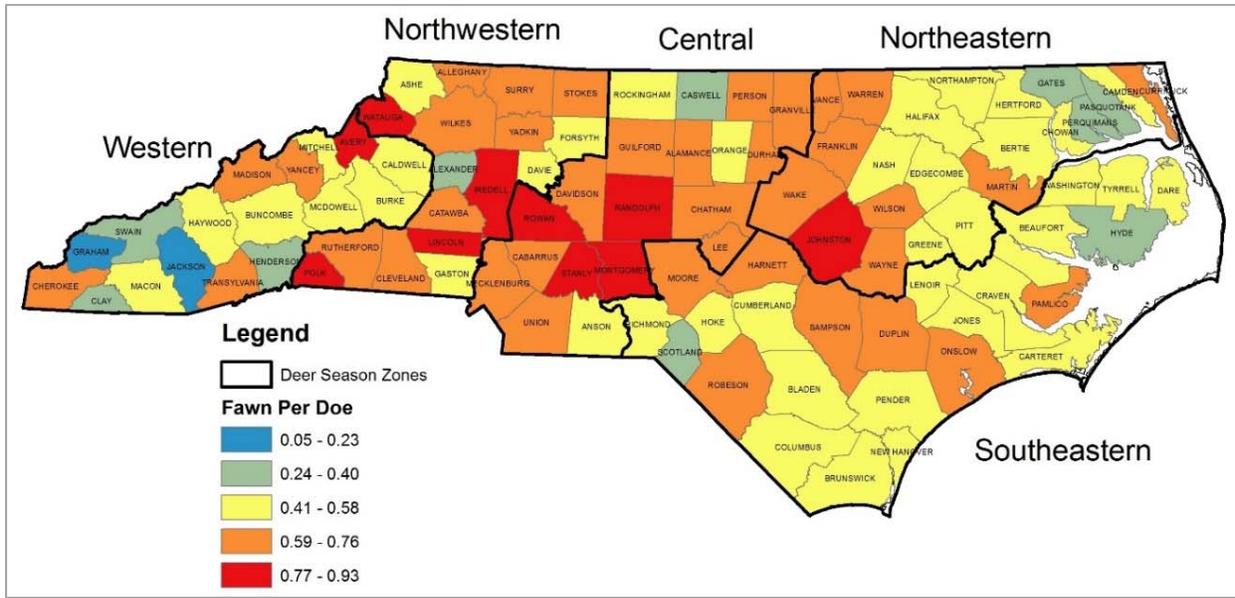


Figure 7. Fawn per doe observation rates by county, North Carolina Deer Hunter Observation Survey, 2014-2018.

Ratio of Adult Does Per Antlered Buck

This ratio offers insight into the sex ratio of the deer herd. Since the birth rates and survival for male and female fawns are relatively equal, and natural survival of adult males and females is similar, the two main influences on this ratio are the harvest rates of males and the harvest rates of females. When changes in the ratio are observed over time, harvest management strategies are likely responsible for our reported annual harvest numbers to provide a more comprehensive assessment of the deer management strategies.

There is no evidence that statewide ratios have changed within the past 5 years (2.42 adult does per antlered buck, $P=0.71$) (Figure 8). Rates within most season zones also show no significant change within the past 5 years ($P>0.05$). Baiting analyses suggest that the use of bait potentially reduces the observed doe per buck ratio by ~8% (2.57 does per buck with bait, 2.81 does per buck without bait). This appears to be influenced by antlered bucks having a slightly higher tendency to visit baited sites compared to adult does. Location type analyses showed no significant evidence that the doe per buck ratio is different on private lands than on game lands.

Annual county estimates maintained relatively consistent observation rates, reliable enough to estimate the adult sex ratio for most counties (Figure 9). However, several counties in the mountains and coast exhibited the highest amount of annual variation due to small sample sizes.

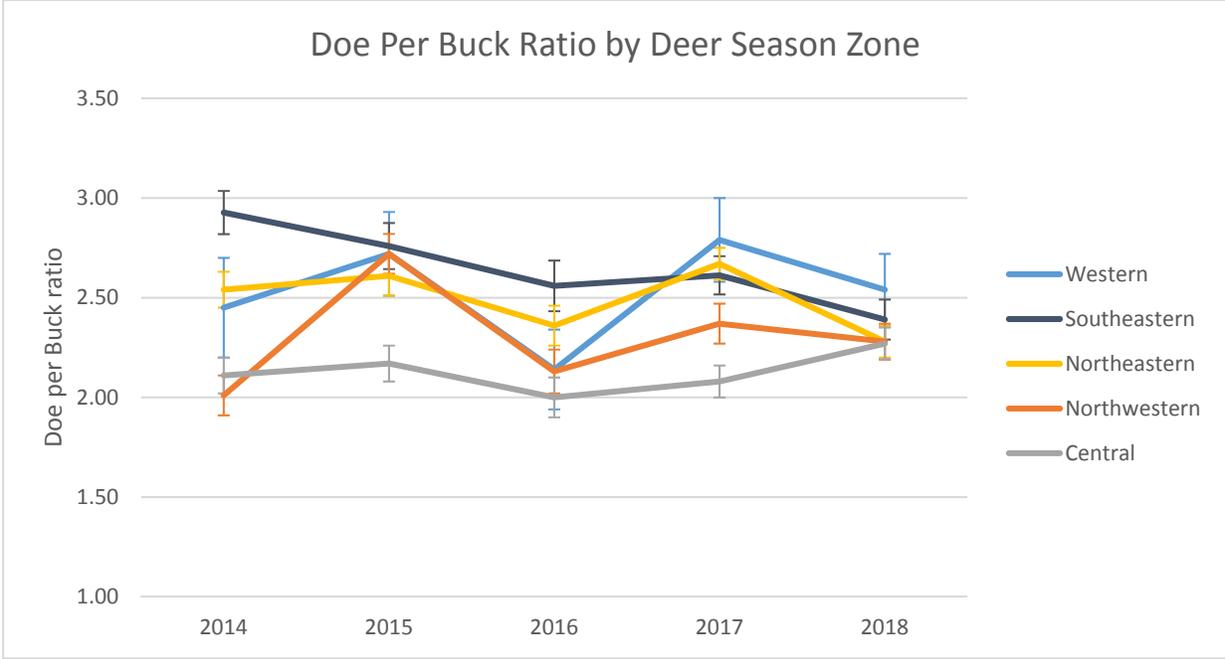


Figure 8. Adult doe per antlered buck observation rates by deer season zone (with 95% confidence intervals), North Carolina Deer Hunter Observation Survey, 2014-2018. For the raw data used for this chart, see Appendix B4.

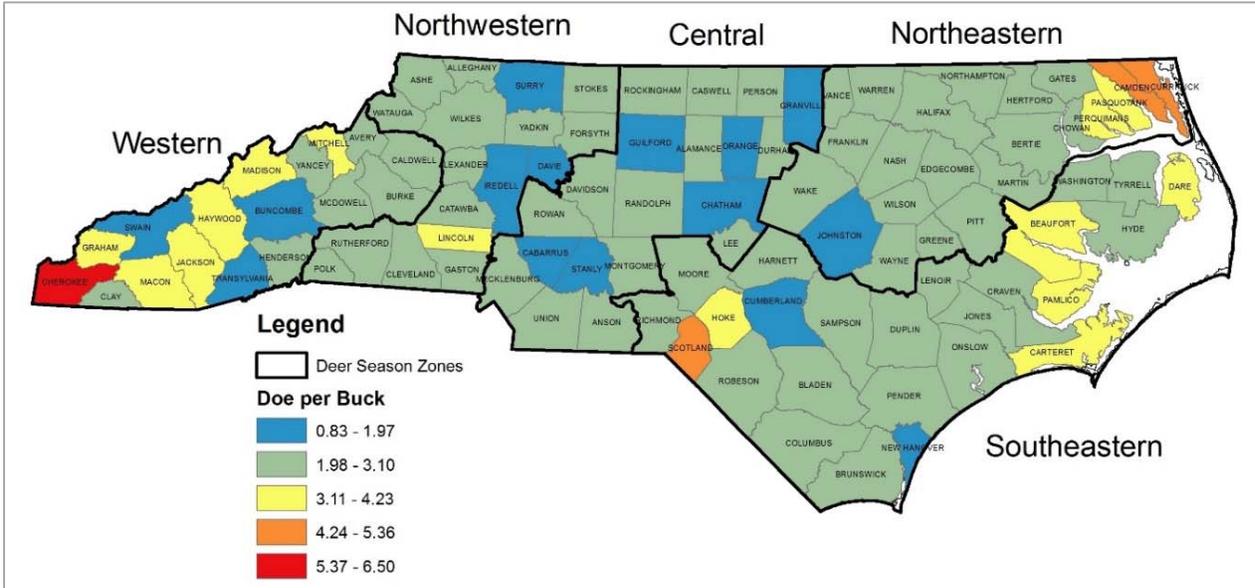


Figure 9. Adult does per antlered buck observation rates by county, North Carolina Deer Hunter Observation Survey, 2014-2018.

Gray Squirrel

Gray squirrels were the second most commonly observed animal type (769.9 squirrels per 1,000 hours) and were seen in all 100 counties (Figure 10). Significantly more gray squirrels were observed on stand locations with bait (8.5 squirrels per hour), than without bait (6.8 squirrels per hour), since squirrels appear to utilize bait as a direct food source (Table 5). Significantly more gray squirrels were also observed on private lands (7.0 squirrels per hour), than on game lands (5.6 squirrels per hour) (Table 6).

Highest observations rates occurred in the central piedmont of the state (Figure 11). Within the past 5 years, there is significant evidence that statewide observation rates have increased over time ($P < 0.01$). Annual county estimates have also maintained relatively precise observation rates, reliable enough to estimate observation rates for most counties.

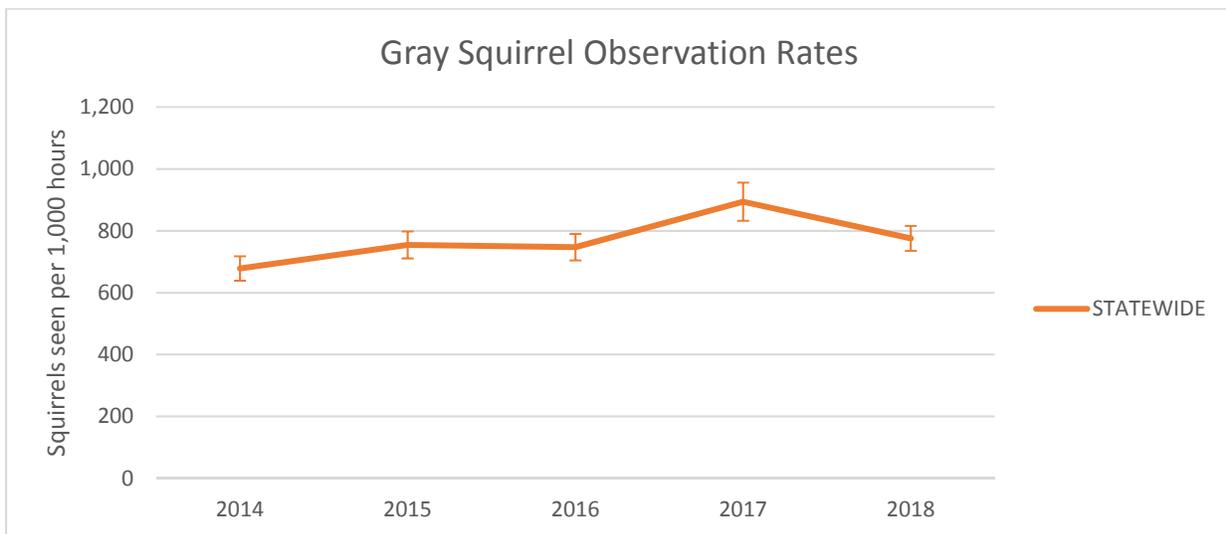


Figure 10. Annual statewide gray squirrel observation rates (# of gray squirrels seen per 1,000 hours) with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018. For the raw data used for this chart, see Appendix B5.

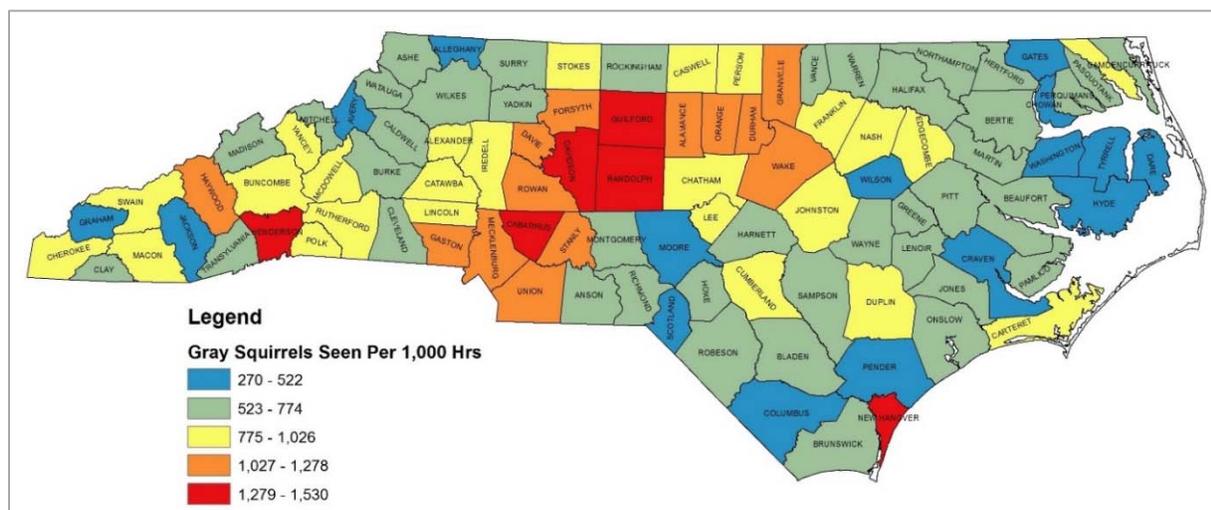


Figure 11. North Carolina gray squirrel observation rates by county (# of gray squirrels seen per 1,000 hours), Deer Hunter Observation Survey 2014-2018.

Fox Squirrel

Fox squirrels were a relatively uncommon animal type (17.7 squirrels per 1,000 hours) and were seen in 69 counties. Since observations are relatively rare within years, annual estimates are relatively imprecise (Figure 12). As opposed to gray squirrels, the use of bait and location types did not appear to have a significant influence on observation rates. There was no significant evidence that statewide observation rates have changed within the past 5 years ($P=0.25$).

Highest observations rates occurred in the Sandhills region and the central coastal area of the state (Figure 13). Observations included records in counties outside of the previous known range of the species and have been used to update the known range distribution of fox squirrels throughout the state.

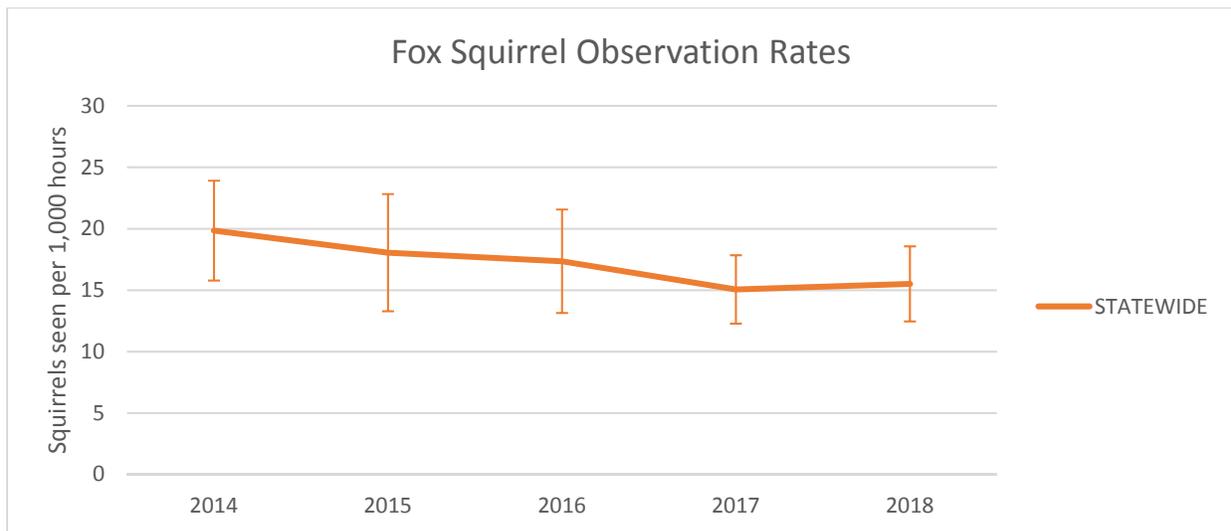


Figure 12. Annual statewide fox squirrel observation rates (# of fox squirrels seen per 1,000 hours) with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018. For the raw data used for this chart, see Appendix B6.

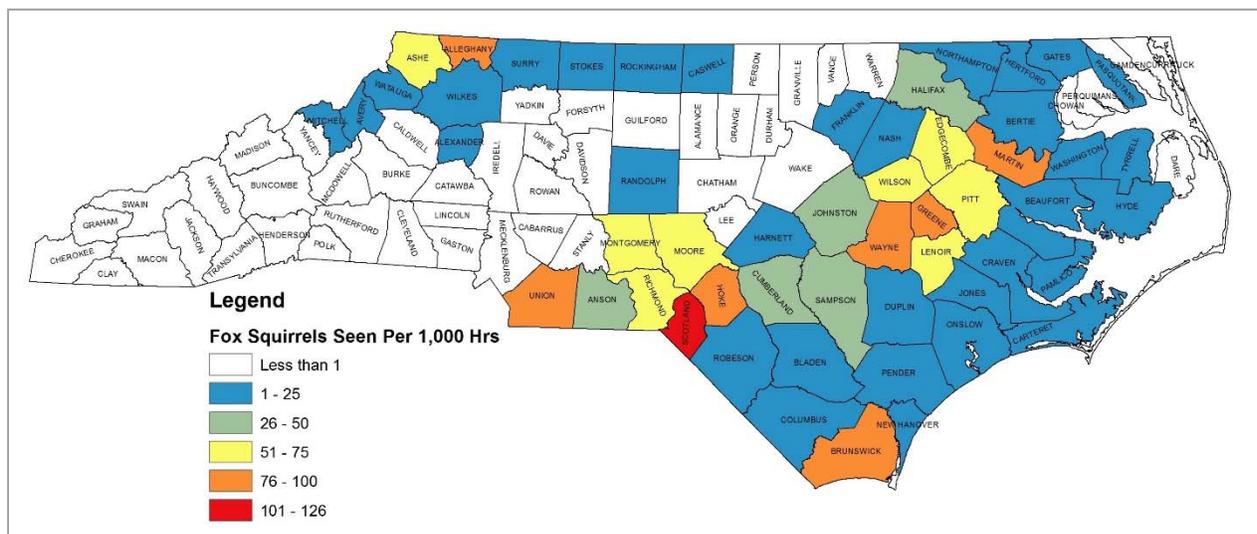


Figure 13. North Carolina fox squirrel observation rates by county (# of fox squirrels seen per 1,000 hours), Deer Hunter Observation Survey 2014-2018.

Turkey

Hunters were asked to report all turkeys they saw according to three categories: Bearded, No Beard, or Unknown. Turkey observation data can be used in several ways. Primarily, they are used to compute observation rates (i.e., turkeys seen/1,000 hours) and a ratio of bearded (adult males) to non-bearded (females and young of the year).

Observation Rates of Turkeys

Turkey were a commonly observed animal type (335.7 turkeys per 1,000 hours) and were seen in all 100 counties. Non-bearded turkeys were seen at a higher rate (171.1 turkeys per 1,000 hours), than bearded turkeys (60.8 turkeys per 1,000 hours). There is no evidence that statewide observation rates have changed within the past 5 years ($P=0.95$, Figure 14).

Turkey observations contained a relatively high degree of variance due to the flocking characteristic of turkeys making estimates less precise. When the status of turkeys was identifiable, the use of bait was significantly different (Table 5). However, with the inclusion of “unknown status” turkeys, the influence of bait became insignificant. There was significant evidence that observation rates for all turkey types were higher on private lands, than on game lands (Table 6).

Observation rates for turkeys were significantly higher in the coastal region (449.6 turkeys per 1,000 hours, $P<0.01$) and were lowest in the piedmont (223.3 turkeys per 1,000 hours, $P<0.01$). Annual county estimates have also maintained relatively precise (i.e proportional standard error $< 30\%$) observation rates, reliable enough to estimate observation rates for most counties. (Figure 15).

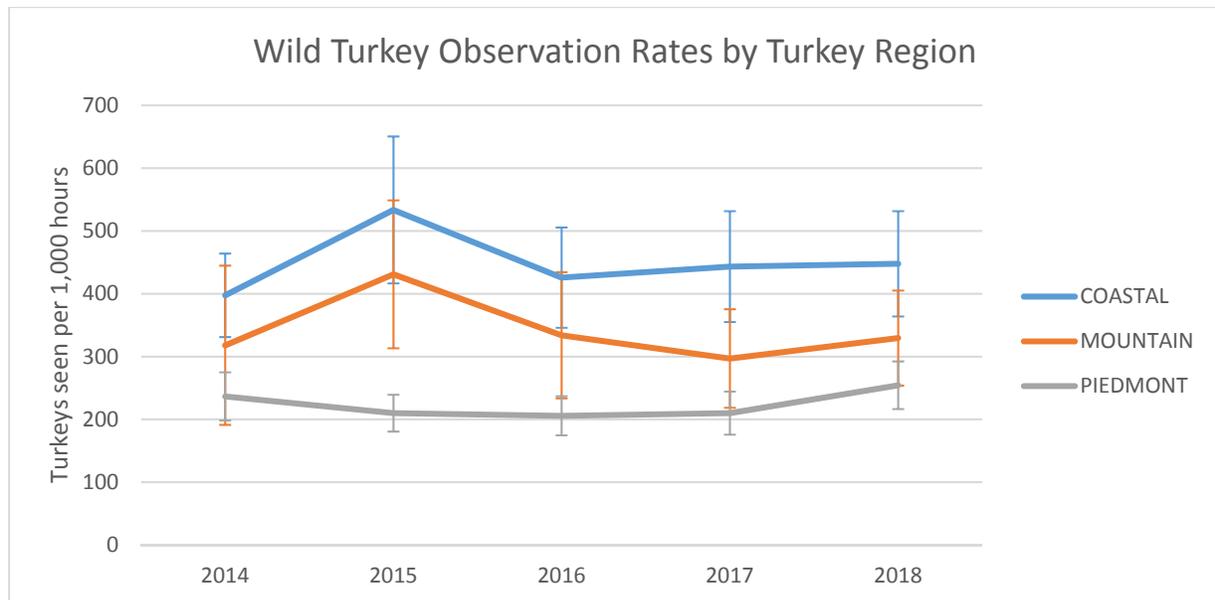


Figure 14. Annual turkey observation rates (# of turkeys seen per 1,000 hours) by turkey management region with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018. For the raw data used for this chart, see Appendix B7.

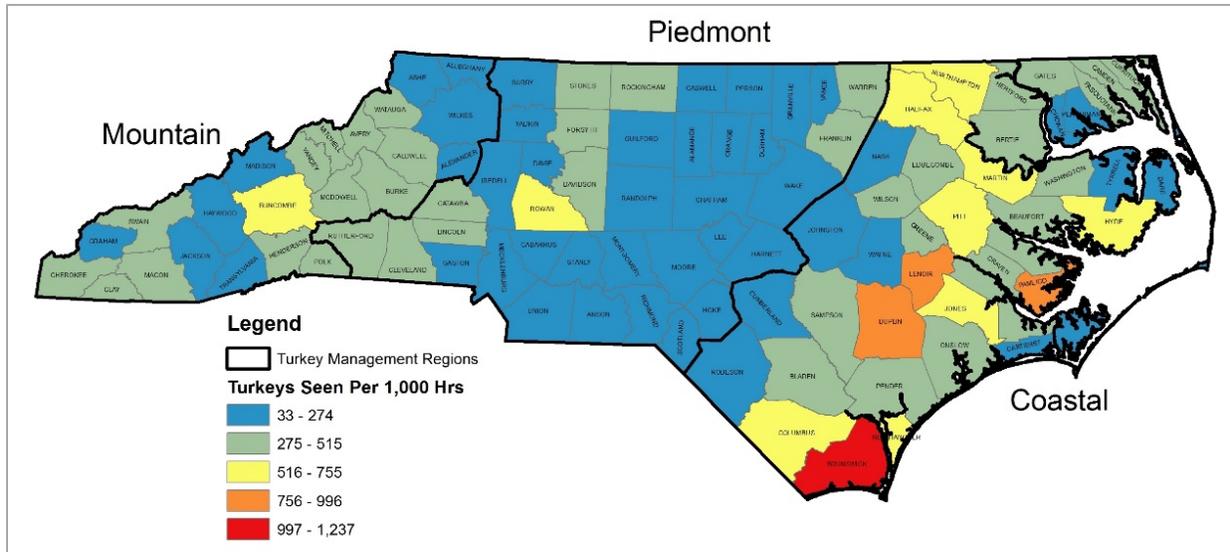


Figure 15. North Carolina turkey observation rates by county, North Carolina Deer Hunter Observation Survey, 2014-2018.

Ratio of Bearded/No Beard Turkeys

This ratio offers insight into turkey population dynamics. The two influences on this ratio are the survival/harvest rates of males, survival of females, and production of young turkeys during summer nesting and brood rearing. Changes in the ratio over time may indicate changes in these parameters, though it may not be clear which parameters have changed. For example, if the ratio of bearded to non-bearded turkeys decreased over time, over-harvest of males during the spring hunting season might be responsible. Data from the DHOS are extremely valuable and can be used in combination with information from our annual Summer Wild Turkey Observation Survey and reported annual spring harvest numbers to provide a more comprehensive assessment of the turkey population and management strategies.

There is no evidence that statewide ratios have changed within the past 5 years (0.36 bearded turkeys per non-bearded turkeys, $P=0.45$) (Figure 16). Rates within most season zones also show no significant change within the past 5 years. Baiting analyses suggest that the use of bait does not significantly affect the bearded/no beard turkey ratio, since all “identifiable” turkey types significantly take advantage of bait equally (Table 5). However, location type analyses show significant evidence that the ratio is more than twice as large on private lands than on game lands (0.54 bearded per non-bearded turkey on private lands, 0.29 bearded per non-bearded turkey on game lands) (Table 6). This maybe a result of gobblers having higher harvest rates on public game lands as compared to private lands.

There is no evidence that observation ratios are different between turkey management regions over the past 5 years (Figure 16). Annual county estimates maintained relatively consistent observation rates, reliable enough to estimate ratios for most counties (Figure 9). However, several counties in the mountains and coast exhibited the highest amount of annual variation due to small sample sizes.

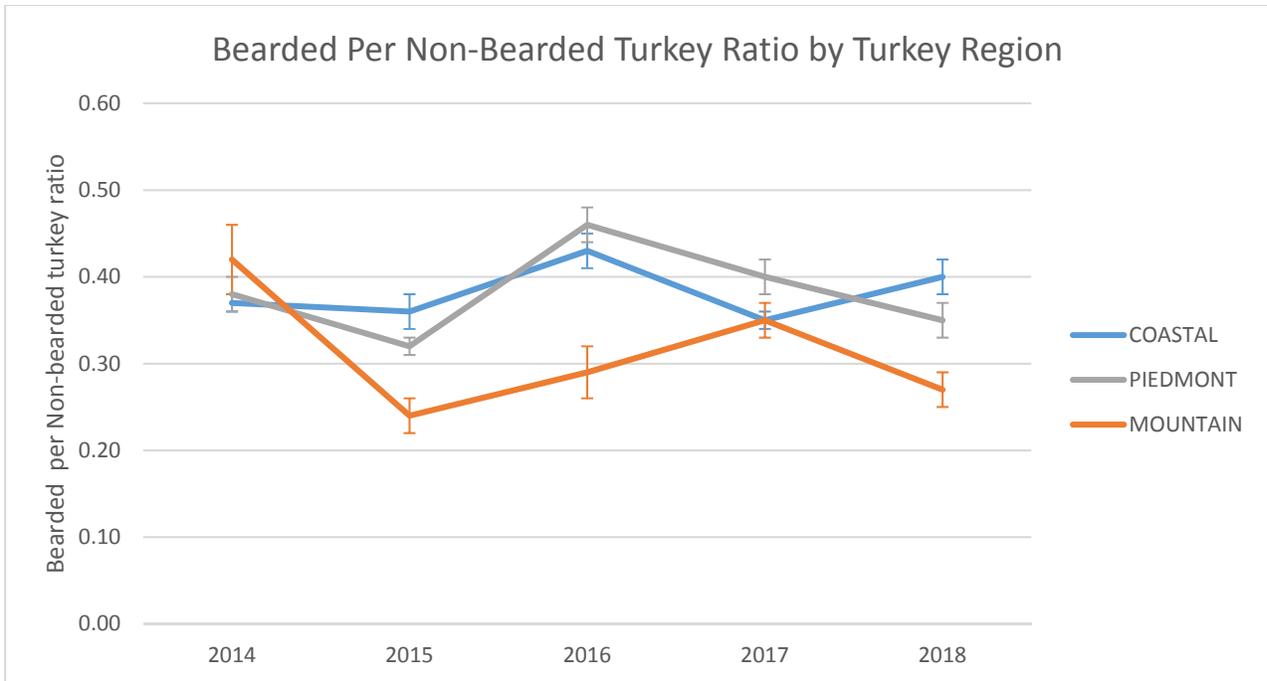


Figure 16. Annual bearded per non-bearded turkey observation rates with 95% confidence intervals by turkey management region, North Carolina Deer Hunter Observation Survey, 2014-2018. For the raw data used for this chart, see Appendix B8.

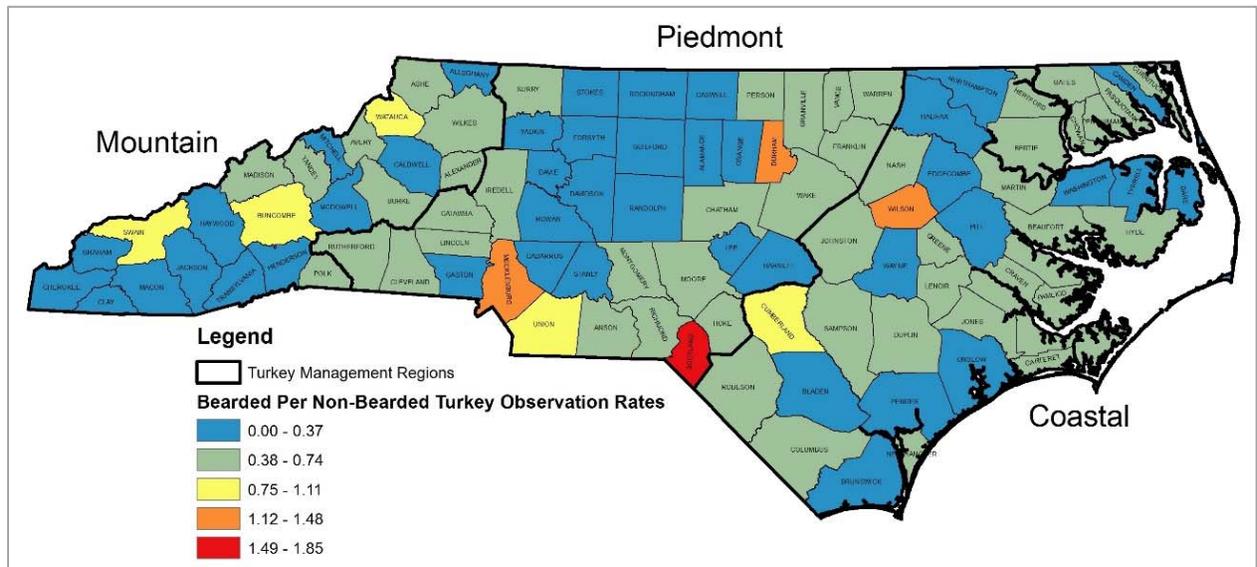


Figure 17. Bearded turkey per non-bearded turkey observation ratio by turkey management unit, North Carolina Deer Hunter Observation Survey, 2014-2018.

Raccoon

Observations of raccoon have generally followed their statewide range and were recorded in 97 of the 100 counties. Statewide raccoon observation rates were the highest for any furbearer species, but were still relatively rare (28.3 raccoons per 1,000 hours), especially when compared to other game species, including deer, gray squirrel and turkey (Figure 18). Significantly more raccoons were observed on stand locations with bait (38.9 raccoons per 1,000 hours), than without bait (18.2 raccoons per 1,000 hours) (Table 5). Baited sites likely attract raccoons since they provide a direct food source. Location type was also significant with more raccoons observed on private lands (20.1 raccoons per 1,000 hours), than on game lands (10.4 raccoons per 1,000 hours) (Table 6).

Observation rates were significantly higher in the Coastal Plain Furbearer Management Unit (FMU) (44.8 raccoons per 1,000 hours), and lowest in the Mountain FMU (12.0 raccoons per 1,000 hours). There is no significant evidence that statewide observation rates have changed within the past 5 years, and regional trends appear stable in all 3 FMUs. Annual county estimates maintained relatively consistent observation rates, reliable enough to estimate ratios for most counties (Figure 19).

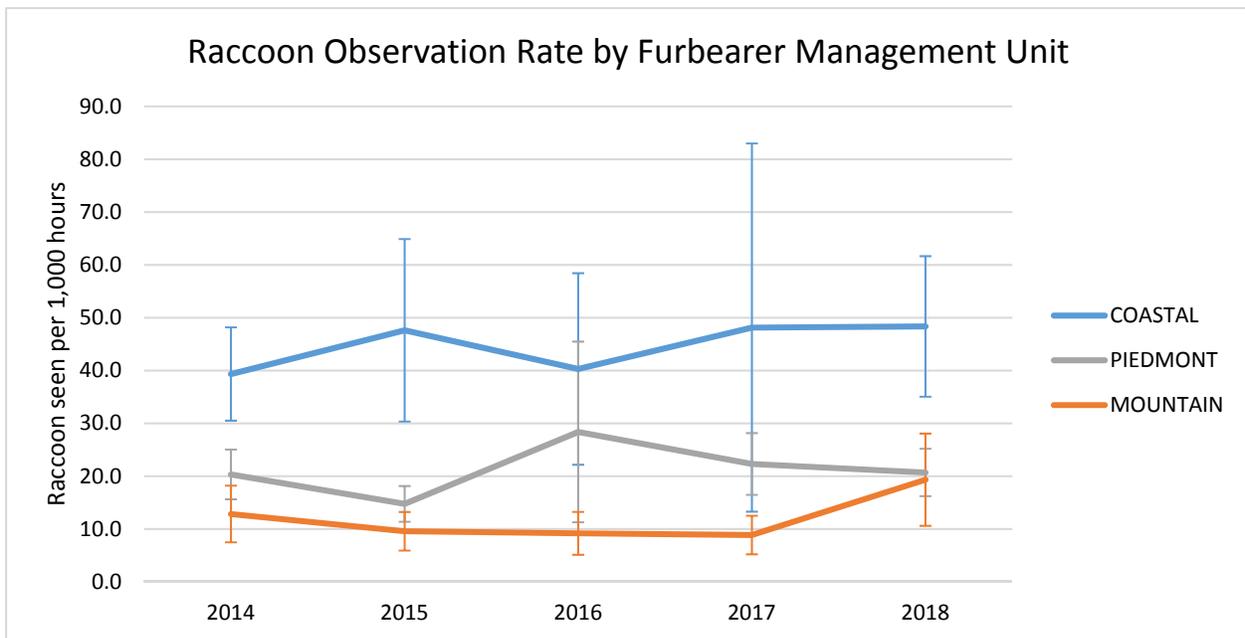


Figure 18. Annual raccoon observation rates by furbearer management unit with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018. For the raw data used for this chart, see Appendix B9.

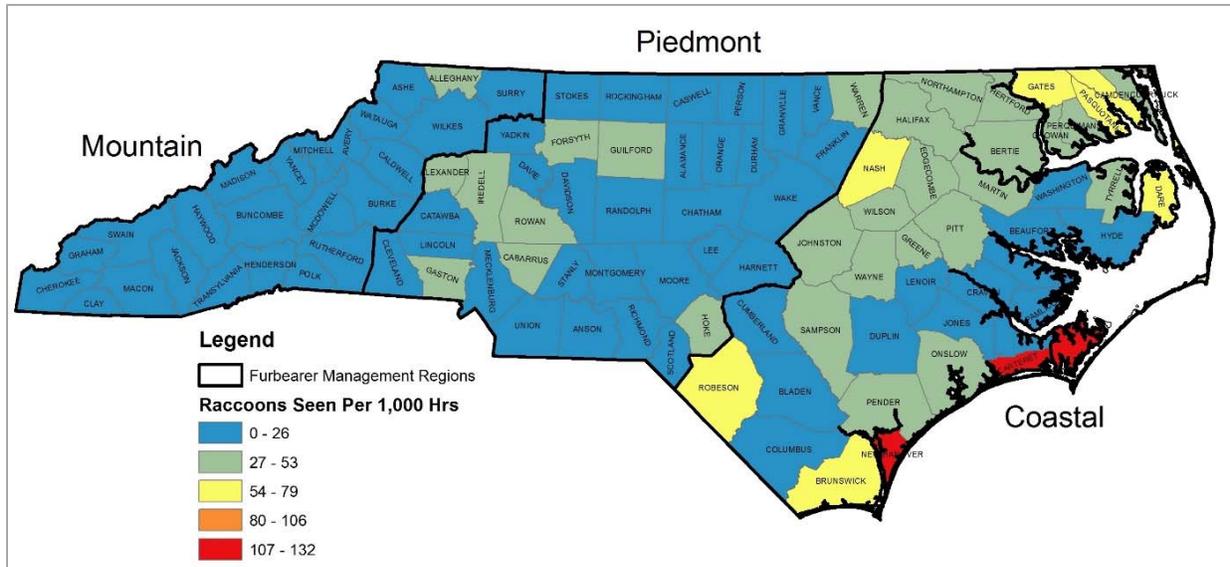


Figure 19. North Carolina raccoon observation rates by county, North Carolina Deer Hunter Observation Survey, 2014-2018. For the raw data used for this chart, see Appendix B10.

Coyote

Observations for coyote have generally followed their statewide range and were observed in 99 of the 100 counties. Statewide coyote observation rates were generally rare (13.9 coyotes per 1,000 hours) (Figure 20). Significantly less coyotes were observed on stand locations with bait (11.7 coyotes per 1,000 hours, than without bait (16.6 coyotes per 1,000 hours) (Table 5). As baited sites likely have higher human activity, this negative relationship may be the likely result of coyote’s human avoidance behavior. As opposed to foxes, location type did not appear to have a significant influence on observation rates (Table 6).

There is no evidence that coyote observation rates are different among the three furbearer management units (Figure 21). There is also no evidence that statewide or regional observation rates have changed within the past 5 years. This result matches that of other indices the Commission uses to track coyote population trends and indicates that at a statewide and regional level, coyote populations are stable. Annual county estimates from the past 5 years maintained a high level of variation due to the scarcity of observations, and were only reliable enough to estimate observation rates at the regional scale.

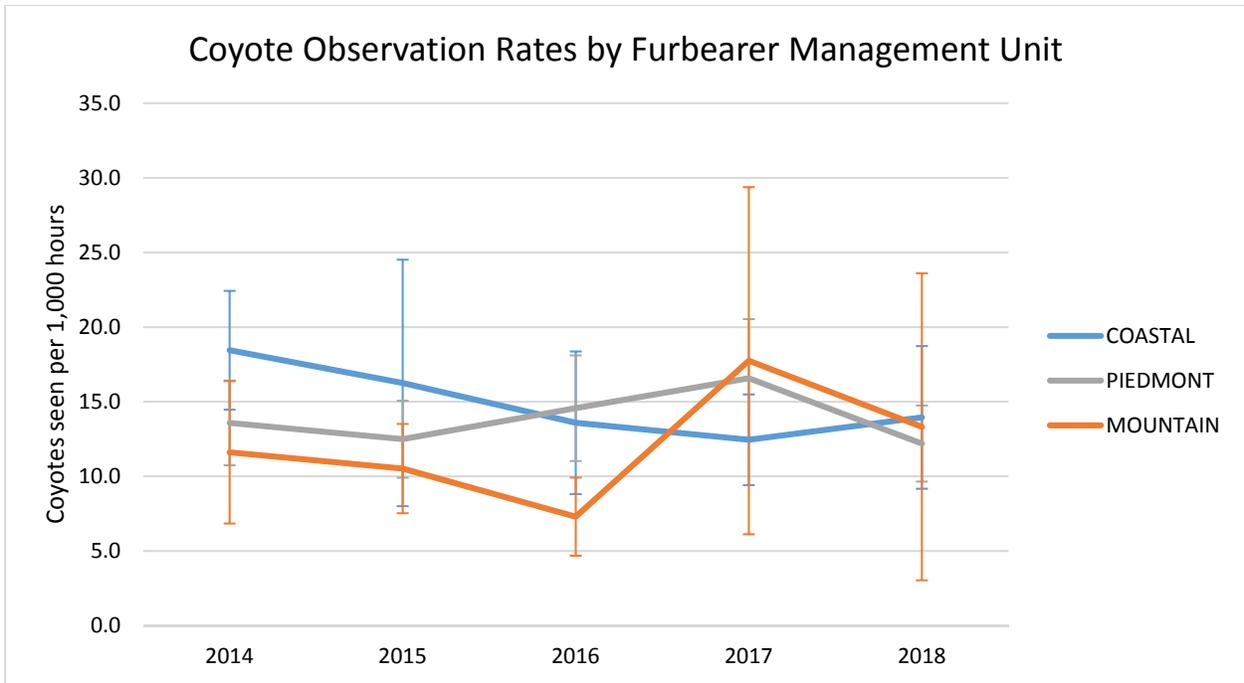


Figure 20. Annual coyote observation rates by furbearer management unit with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018. For the raw data used for this chart, see Appendix B10.

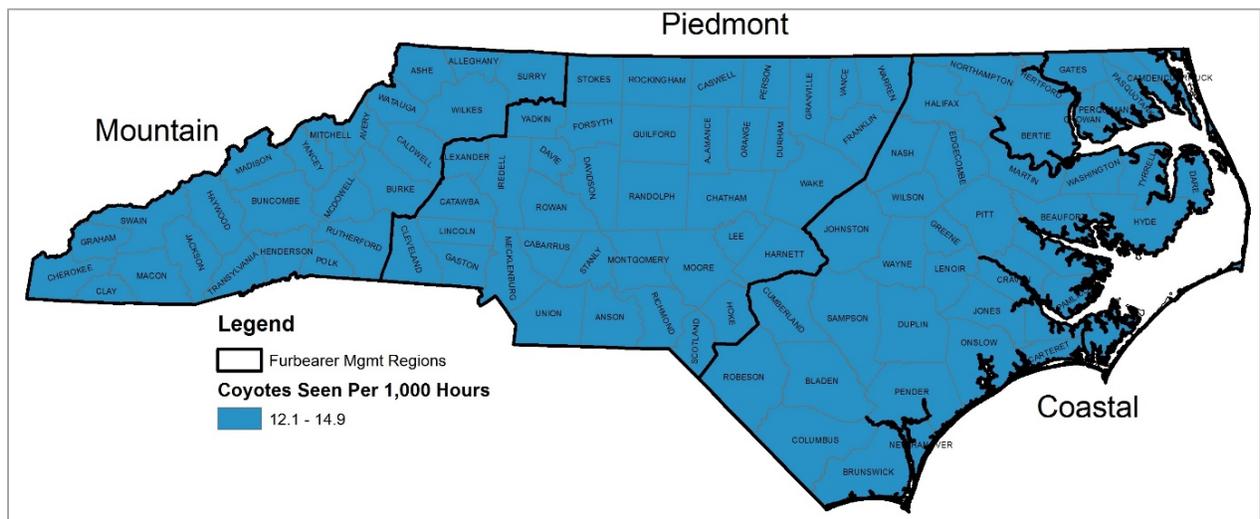


Figure 21. Coyote observation rates by furbearer management unit, North Carolina Deer Hunter Observation Survey, 2014-2018.

Gray Fox

Observations of gray fox have generally followed their statewide range and were seen in 93 of the 100 counties. Statewide gray fox observation rates were relatively rare (8.2 gray fox per 1,000 hours, Figure 22). Significantly more gray foxes were observed on stand locations with bait (9.8 gray fox per 1,000 hours, than without bait (6.8 gray fox per 1,000 hours) (Table 5). As baited sites likely attract more bird and small mammal activity, gray foxes may be attracted both indirectly and directly to these food resources. Location type was also significant with more gray foxes observed on private lands (7.3 gray foxes per 1,000 hours), than on game lands (3.5 gray foxes per 1,000 hours) (Table 6).

Within the past 5 years, there is significant evidence that statewide observation rates have declined over time. This decline is primarily driven by the decrease occurring in the Coastal Plain Furbearer Management Unit (FMU; Figure 22). Gray fox observation rates in the Mountain and Piedmont FMUs appear stable. After accounting for yearly effects, highest observation rates were recorded in the Coastal Plain and Piedmont FMUs, and lowest in the Mountain FMU (Figure 23). Annual county estimates from the past 5 years maintained a high level of variation due to the scarcity of observations, and were only reliable enough to estimate observation rates at the regional scale.

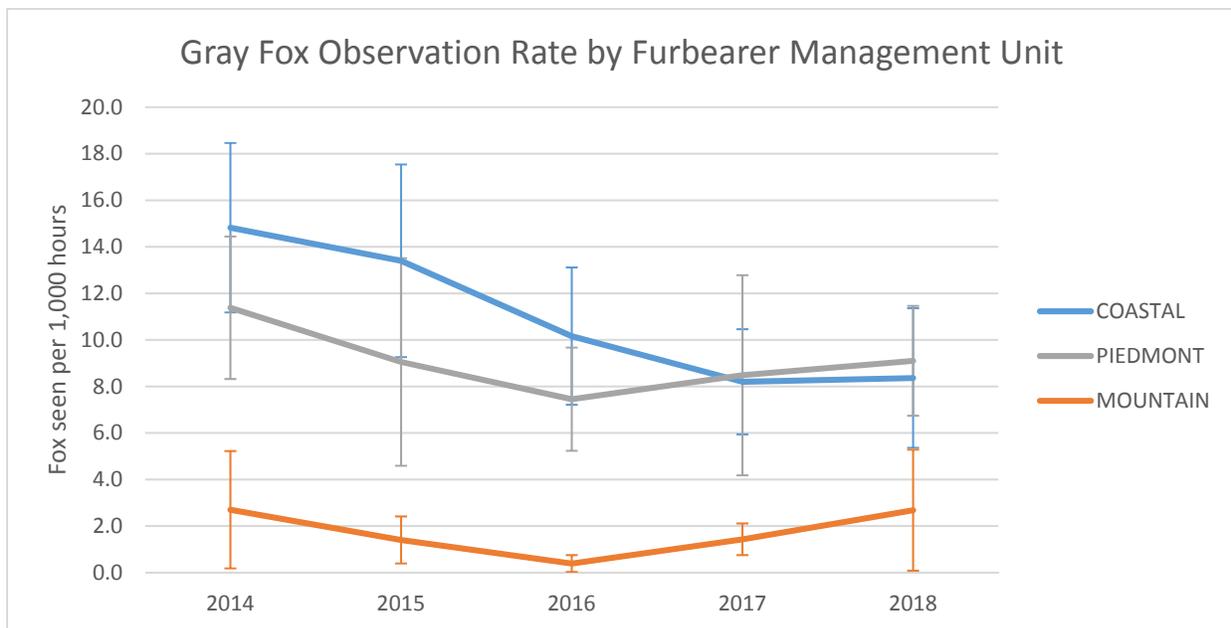


Figure 22. Annual gray fox observation rates by furbearer management unit with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018. For the raw data used for this chart, see Appendix B11.

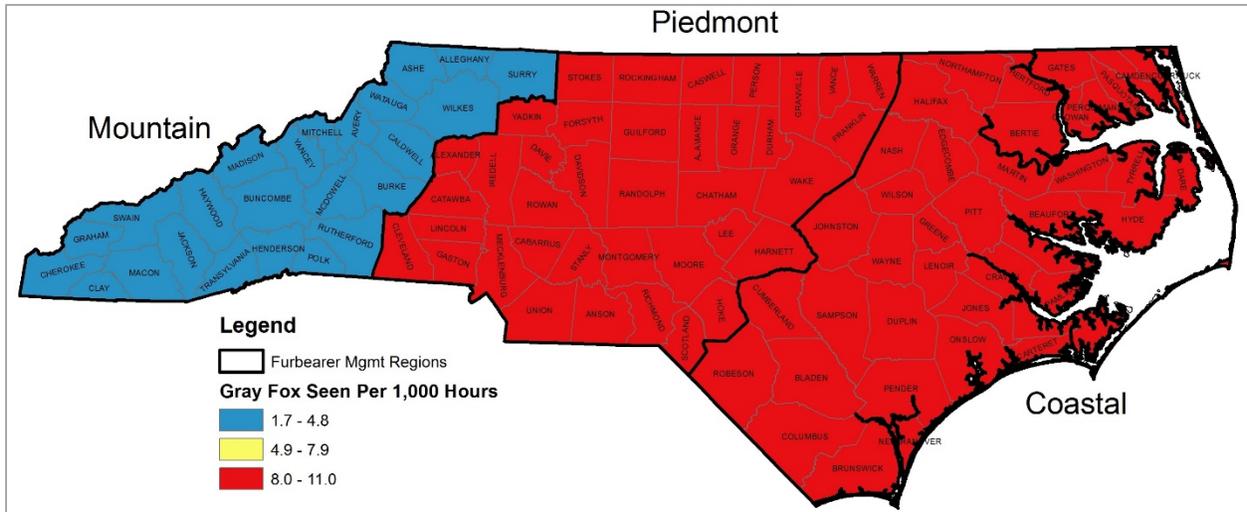


Figure 23. Gray fox observation rates by furbearer management unit, North Carolina Deer Hunter Observation Survey, 2014-2018.

Red Fox

Observations for red foxes have generally followed their statewide range and were seen in 89 of the 100 counties. Red foxes were a relatively rare observation for deer hunters (3.3 red fox per 1,000 hours, Figure 24). There is no significant evidence that baited sites has any influence on red fox observation rates, as compared to coyotes or gray fox (Table 5). However, observation rates were significantly higher on private lands (3.4 red foxes per 1,000 hours), than on game lands (1.5 red foxes per 1,000 hours) (Table 6).

Within the past 5 years, there has been no evidence that statewide observation rates have changed over time. Statewide and regional annual estimates are relatively imprecise generally due to the scarcity of observations. However, the Mountain FMU estimates were significantly lower than either the Piedmont and Coastal Plain FMUs (Figure 25). Annual county estimates from the past 5 years maintained a high level of variation due to the scarcity of observations, and were only reliable enough to estimate observation rates at the regional scale.

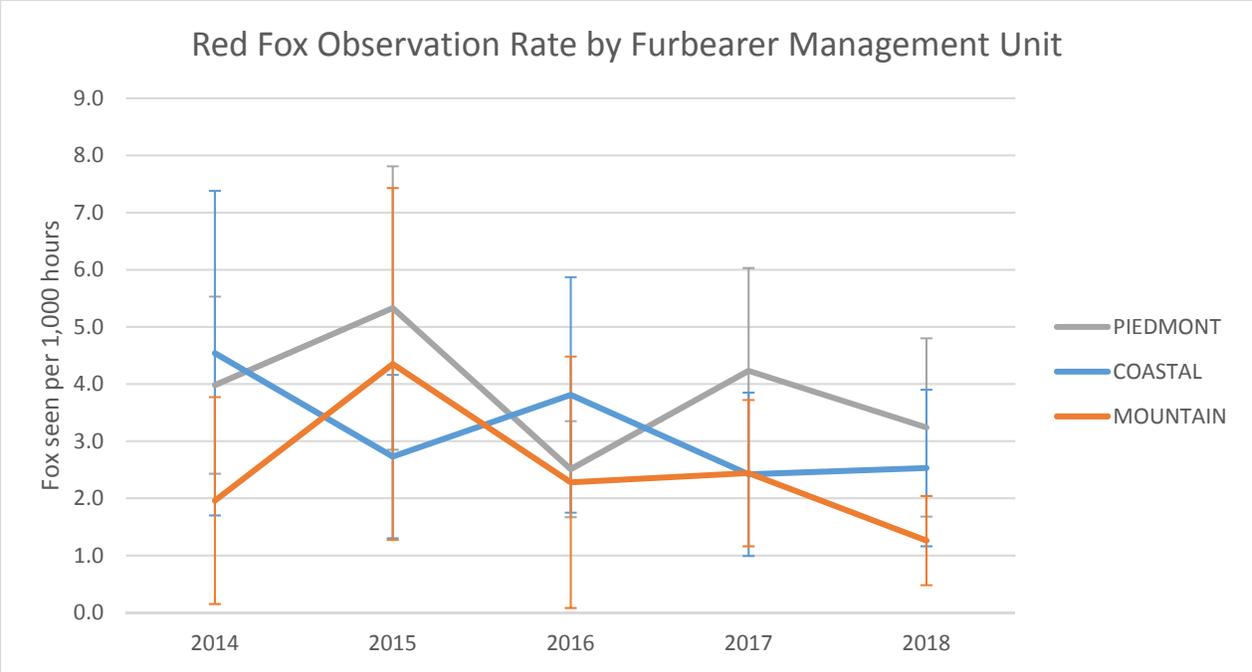


Figure 24. Annual red fox observation rates by furbearer management unit with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018. For the raw data used for this chart, see Appendix B12.

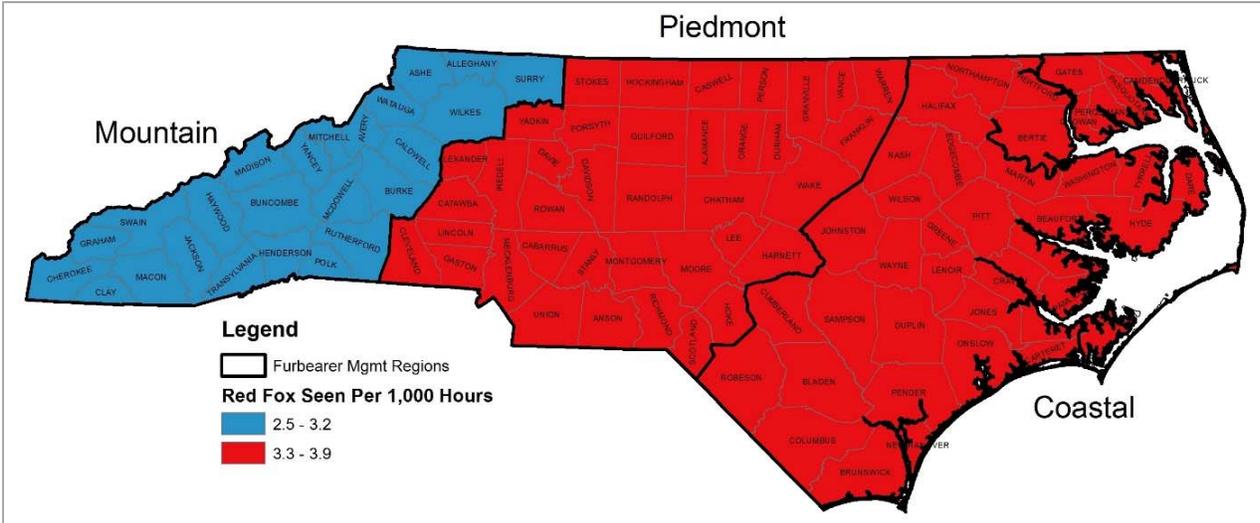


Figure 25. Red fox observation rates by furbearer management unit, North Carolina Deer Hunter Observation Survey, 2014-2018.

Bobcat

Observations of bobcat have generally followed their statewide range and were seen in 91 of the 100 counties. Bobcat observations were relatively rare (3.4 bobcat per 1,000 hours, Figure 26). There is no significant evidence that the use of bait or location type (game land vs. private land) had any influence on bobcat observation rates (Table 5 and 6).

Highest observation rates were recorded in the Coastal Plain FMU (4.8 bobcat per 1,000 hours), which was significantly higher than the Piedmont FMU. Within the past 5 years, there has been no evidence that statewide or regional observation rates have changed over time. Annual county estimates from the past 5 years maintained a high level of variation due to the scarcity of observations, and were only reliable enough to estimate observation rates at the regional scale. (Figure 27).

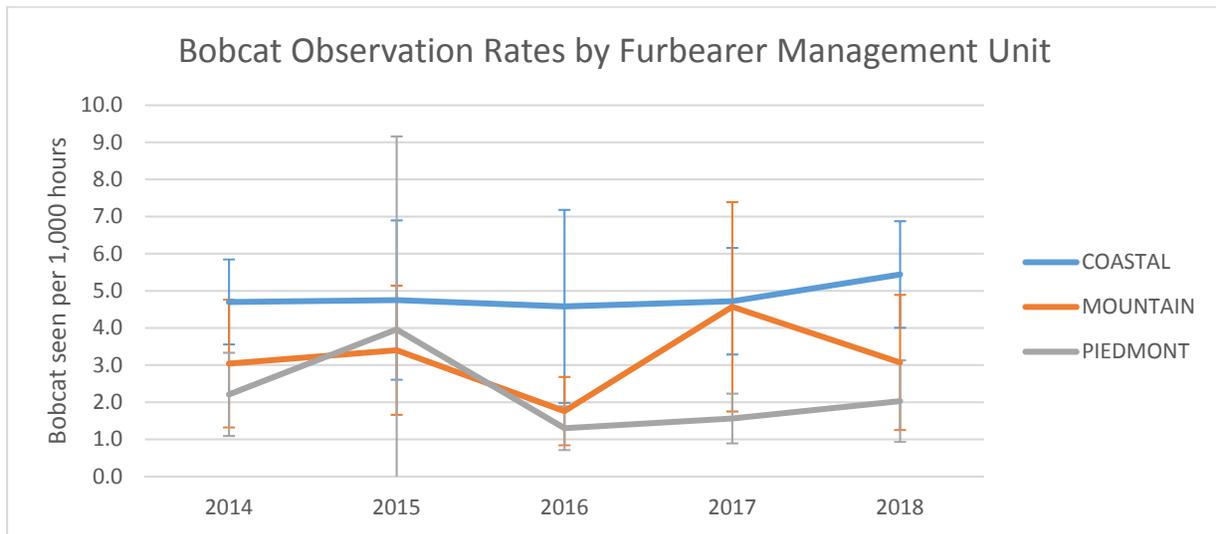


Figure 26. Annual bobcat observation rates by furbearer management unit with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018. For the raw data used for this chart, see Appendix B13.

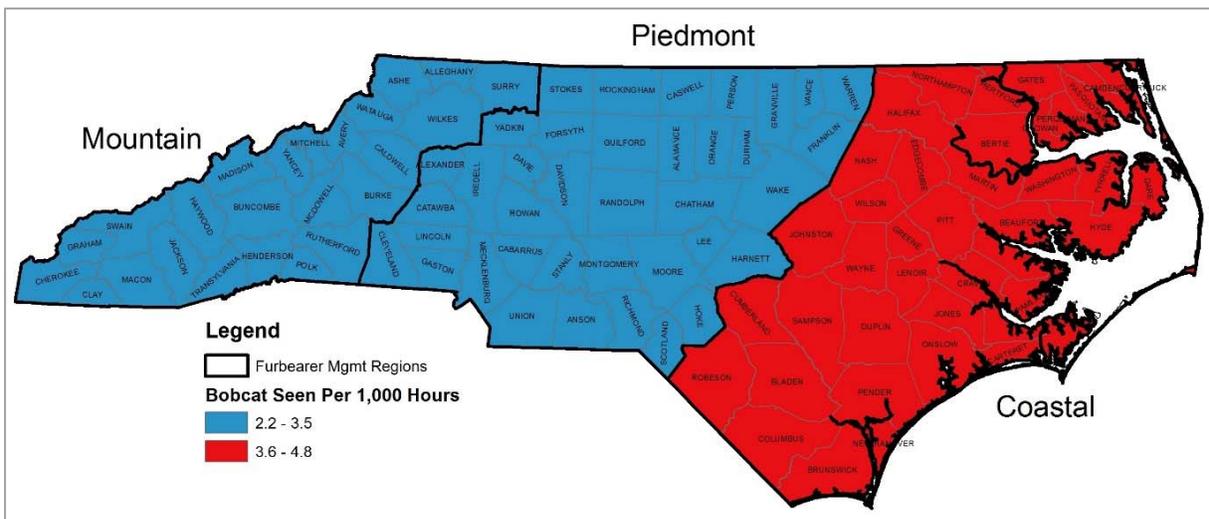


Figure 27. Bobcat observation rates by furbearer management unit, North Carolina Deer Hunter Observation Survey, 2014-2018.

Bear

Adult bears were observed in 77 of the 100 counties. Bear observations were relatively rare (12.1 adult bears and per 1,000 hours, Figure 28). Annual management unit estimates from the past 5 years maintained a high level of variation due to the scarcity of observations. There is no significant evidence that the use of bait or location type had any influence on bear observation rates by deer hunters (Table 5 and 6).

Within the past 5 years, there is no statistical evidence that statewide observation rates have changed over time ($P=0.5$). However adult bear observation rates have significantly increased in the Mountain Bear Management Unit (MBMU) ($P<0.01$, Figure 28). Annual county estimates maintained a high level of variation due to the scarcity of observations, and were only reliable enough to estimate observation rates at the bear management unit scale. (Figure 29).

The bulk of the bear observations occurred in the Coastal Bear Management Unit (CBMU) and observation rates were substantially higher in the CBMU versus the other two bear management units (Figure 28 and 29). While there is a well-established bear population in the Mountain Bear Management Unit (MBMU), the MBMU bear population is lower than the CBMU and has fewer bears per square mile, resulting in fewer observations when compared to the CBMU. In addition, the more open habitat (e.g., agricultural fields), coupled with the more widespread use of bait also resulted in higher bear observation rates in the CBMU vs. the MBMU.

Observations of adult bears generally followed their known presence within counties across the state, including the Piedmont Bear Management Unit (PBMU), which are a combination of transient or new colonized young males and an expanding bear population, especially along the Virginia and North Carolina state line (Figure 30). Cubs of the year were observed in 58 of the 100 counties (Figure 31). The presence of cub bears is used to determine the establishment of a locally reproducing and established bear population. Hunter observations of cubs generally followed the known presence of bears across the state, including the upper PBMU.

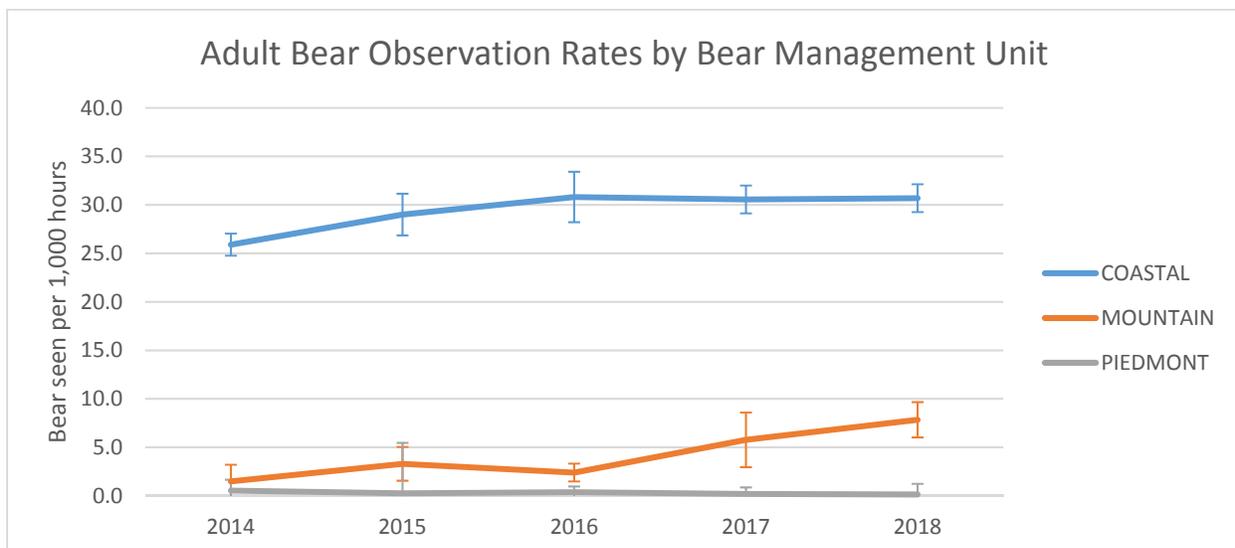


Figure 28. Adult bear observation rates by bear management unit with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018. For the raw data used for this chart, see Appendix B14.

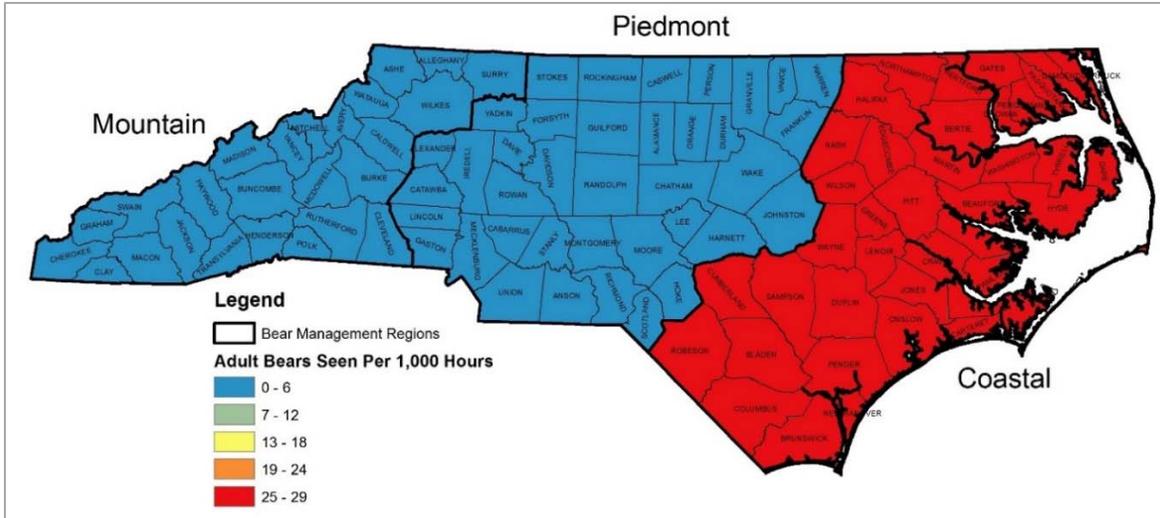


Figure 29. Adult bear observation rates by bear management unit, North Carolina Deer Hunter Observation Survey, 2014-2018.

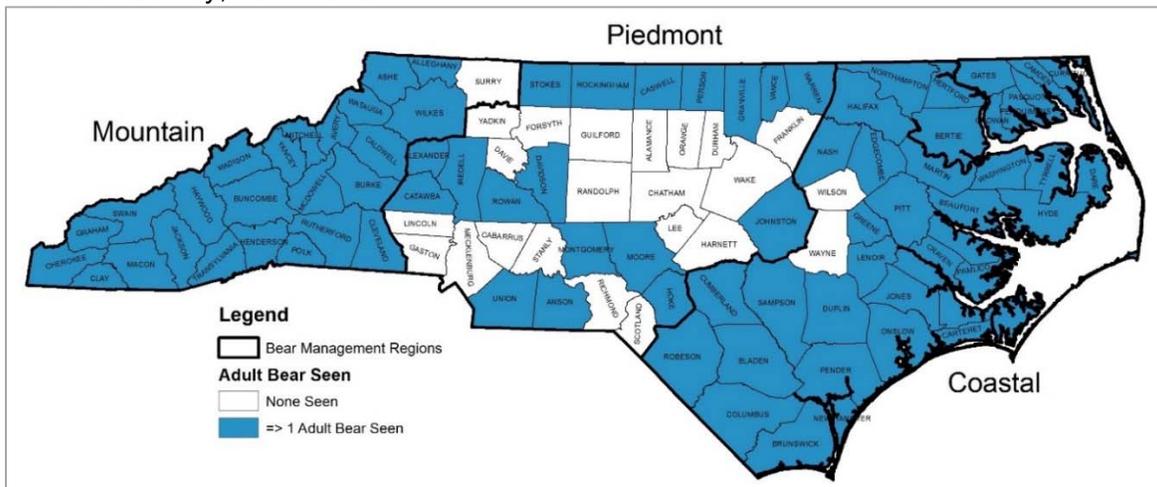


Figure 30. Adult bear presence (≥ 1 animal observed) by county, North Carolina Deer Hunter Observation Survey, 2014-2018.

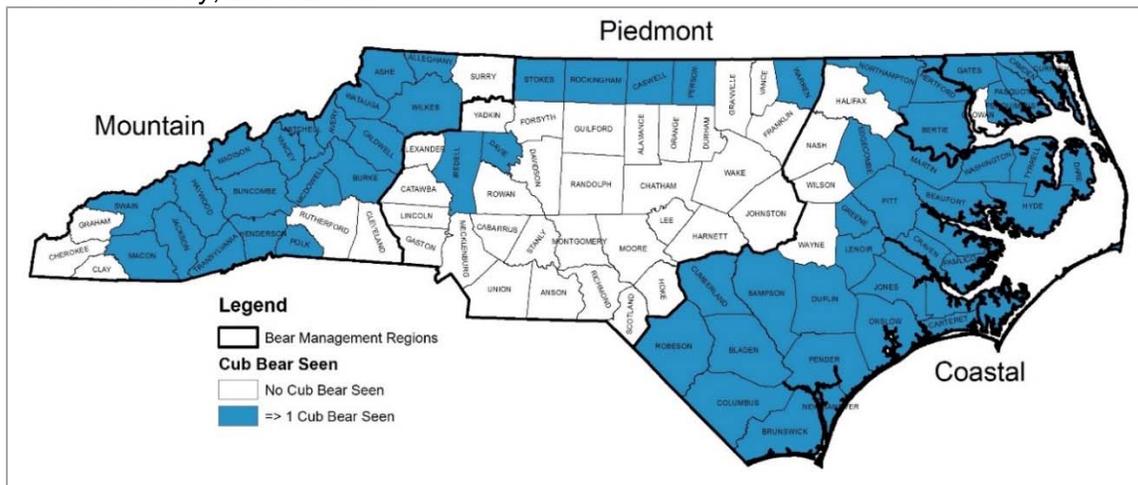


Figure 31. Cub bear presence (≥ 1 animal observed) by county, North Carolina Deer Hunter Observation Survey, 2014-2018.

Feral Swine

Swine were observed in 52 of the 100 counties and statewide observation rates were relatively low (3.3 feral swine per 1,000 hours). There was no significant evidence that baited sites had any influence on swine observation rates (Table 5). However, a majority of observations occurred on game lands where baiting is prohibited (Table 6).

Confident observation rate estimates could not be derived due to the relatively low observation count and high variability due to swine's herding behavior. For the purposes of this section, analyses were limited to the occurrence of the species (≥ 1 feral swine seen per hunting trip, Figure 32). Within the past 5 years, there has been no evidence that statewide occurrence rates have changed over time. Occurrences of feral swine generally followed their known presence within most counties across the state in the southern part of the state (Figure 33).

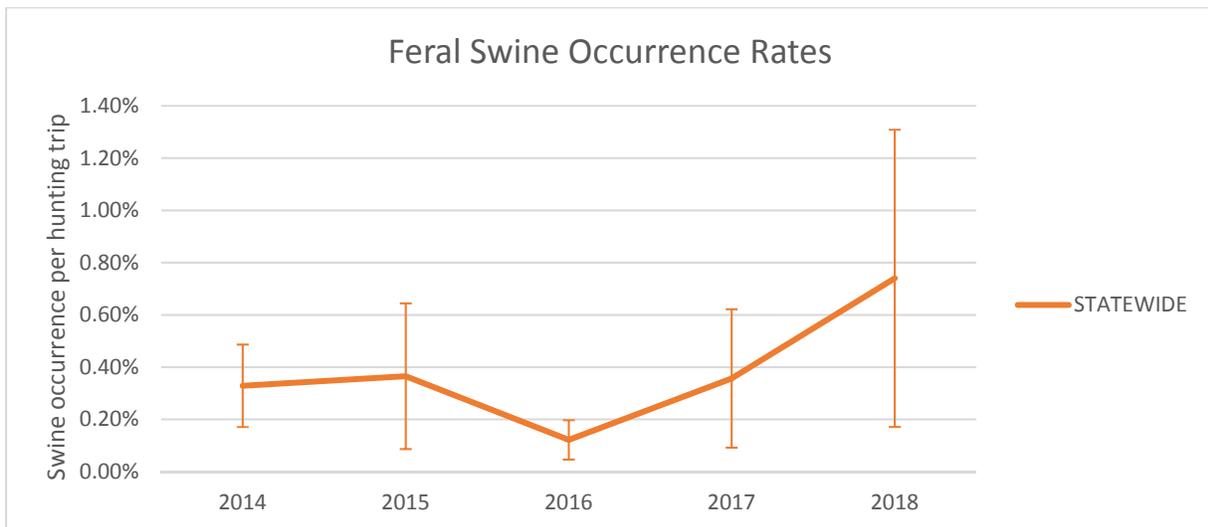


Figure 32. Feral swine occurrence rates (≥ 1 animal seen per hunting trip) with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018. For the raw data used for this chart, see Appendix B15.

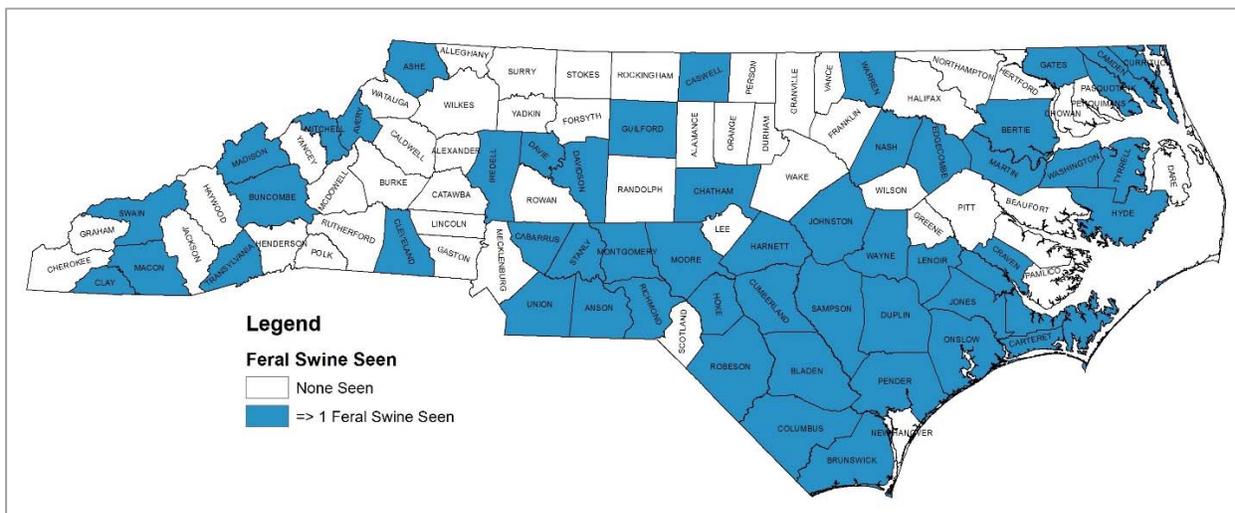


Figure 33. Feral swine presence (≥ 1 animal observed) by county, North Carolina Deer Hunter Observation Survey, 2014-2018.

Appendix A: Deer Hunter Observation Survey Form

Thank you for taking an active part in the conservation of North Carolina's wildlife resources!

Do you know of other deer hunters who would like to participate in the Deer Hunter Observation Survey?
If so, please enter their information in the block below.

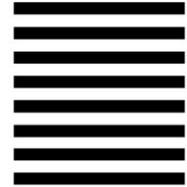
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INSTRUCTIONS

The NC Wildlife Resources Commission is seeking volunteers to report wildlife observations this deer season to help biologists improve management decisions. These observations help track long-term wildlife population and distribution changes. Deer observations also provide information on fawn survival and buck to doe ratios.

Observations should only be recorded while *still/stand hunting* for deer. Please attempt to provide an accurate count for the animals listed in the table on the front of this form. Record observations from each hunt (morning, evening, or daily) on a single row on the table. Separate morning and evening hunts on different rows for the same day, when applicable. Record all the animals you observe on each hunt, even if you suspect you have seen some of them on previous hunts. Record hours spent hunting even if no animals were observed. Do not record observations of others with whom you hunted.

Please return this form immediately after the deer season (no later than January 15). To return, *fold* this form along the lines above so that the Business Reply Mail address shows and *tape* on the areas indicated. If you have any questions about this survey, please call Ryan Myers at (919)218-3376, or email at ryan.myers@ncwildlife.org.

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Appendix B: Raw data tables

Table B1. Statewide deer observation rates and ratios by month, North Carolina Deer Hunter Observation Survey, 2014-2018.

Month	Deer/Hour	95% CI	Does/Buck	95% CI	Fawn/Doe	95% CI
September	0.86	±0.08	2.57	±0.14	0.68	±0.04
October	0.86	±0.08	2.46	±0.07	0.62	±0.02
November	0.82	±0.06	2.07	±0.10	0.58	±0.01
Dec./Jan.	0.79	±0.07	3.32	±0.24	0.60	±0.02

Table B2. Annual deer observation rates (# of deer seen per 1,000 hours) by deer season zone, North Carolina Deer Hunter Observation Survey, 2014-2018.

Year	Western	95% CI	Northwestern	95% CI	Central	95% CI	Northeastern	95% CI	Southeastern	95% CI	STATEWIDE	95% CI
2014	412.8	±84.6	719.8	±94.9	758.9	±73.4	844.1	±82.0	748.7	±62.3	715.7	±35.4
2015	534.8	±151.0	767.3	±67.2	803.6	±83.4	999.0	±97.1	846.6	±152.5	813.7	±54.7
2016	483.5	±113.0	639.2	±63.4	638.1	±69.5	888.1	±95.5	680.1	±82.6	685.6	±39.1
2017	461.2	±81.1	741.9	±67.3	793.3	±63.9	992.8	±93.9	810.6	±103.5	776.3	±39.7
2018	604.1	±159.9	892.9	±155.4	916.6	±76.2	1,040.3	±116.3	920.0	±143.5	887.5	±60.4
Avg.	499.3	±64.1	752.2	±80.8	782.1	±87.6	952.8	±72.5	801.2	±80.5	775.8	±70.2

Table B3. Annual fawn per doe observation rates by deer season zone with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018.

Year	Western	95% CI	Northwestern	95% CI	Central	95% CI	Northeastern	95% CI	Southeastern	95% CI	STATEWIDE	95% CI
2014	0.54	±0.07	0.62	±0.05	0.67	±0.03	0.62	±0.03	0.57	±0.03	0.60	±0.02
2015	0.70	±0.06	0.67	±0.03	0.65	±0.04	0.51	±0.04	0.55	±0.04	0.60	±0.02
2016	0.53	±0.07	0.65	±0.04	0.65	±0.04	0.56	±0.05	0.47	±0.04	0.57	±0.02
2017	0.35	±0.05	0.68	±0.04	0.64	±0.03	0.55	±0.03	0.53	±0.03	0.55	±0.02
2018	0.48	±0.06	0.65	±0.04	0.70	±0.03	0.52	±0.04	0.48	±0.04	0.55	±0.02
Avg.	0.52	±0.11	0.65	±0.02	0.66	±0.02	0.55	±0.04	0.52	±0.04	0.57	±0.02

Table B4. Annual adult doe per antlered buck observation rates by deer season zone with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018.

Year	Western	95% CI	Northwestern	95% CI	Central	95% CI	Northeastern	95% CI	Southeastern	95% CI	STATEWIDE	95% CI
2014	2.45	±0.25	2.01	±0.10	2.11	±0.09	2.54	±0.09	2.93	±0.11	2.47	±0.05
2015	2.72	±0.21	2.72	±0.10	2.17	±0.09	2.61	±0.10	2.76	±0.12	2.58	±0.05
2016	2.14	±0.20	2.13	±0.11	2.00	±0.10	2.36	±0.10	2.56	±0.13	2.26	±0.05
2017	2.79	±0.21	2.37	±0.10	2.08	±0.08	2.67	±0.08	2.61	±0.10	2.47	±0.04
2018	2.54	±0.18	2.28	±0.09	2.27	±0.08	2.28	±0.08	2.39	±0.10	2.31	±0.04
Avg.	2.53	±0.22	2.30	±0.24	2.13	±0.09	2.49	±0.15	2.65	±0.18	2.42	±0.11

Table B5. Annual statewide gray squirrel observation rates (# of gray squirrels seen per 1,000 hours) with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018.

Year	STATEWIDE	95% CI
2014	678.29	±39.39
2015	754.43	±43.50
2016	747.11	±42.79
2017	894.11	±61.70
2018	775.64	±40.39
Avg.	769.9	±68.8

Table B6. Annual statewide fox squirrel observation rates (# of fox squirrels seen per 1,000 hours) with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018.

Year	STATEWIDE	95% CI
2014	19.8	+4.1
2015	18.1	+4.8
2016	17.4	+4.2
2017	15.1	+2.8
2018	15.5	+3.1
Avg.	17.2	+1.7

Table B7. Annual turkey observation rates by turkey management region intervals (# of turkeys seen per 1,000 hours) with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018

Year	MOUNTAIN	95% CI	PIEDMONT	95% CI	COASTAL	95% CI	STATEWIDE	95% CI
2014	318.0	+126.7	236.6	+38.4	397.5	+66.5	316.5	+40.6
2015	431.0	+117.8	209.9	+29.3	533.5	+117.0	382.3	+53.8
2016	333.9	+100.5	205.7	+31.1	425.8	+79.8	315.7	+39.3
2017	296.9	+78.5	210.0	+34.3	443.3	+88.3	318.6	+40.6
2018	329.5	+75.6	254.4	+37.9	447.7	+83.9	345.1	+39.6
Avg.	341.9	+45.4	223.3	+18.7	449.6	+44.6	335.7	+25.2

Table B8. Bearded per non-bearded turkey observation rates by turkey management region and year with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018.

Year	MOUNTAIN	95% CI	PIEDMONT	95% CI	COASTAL	95% CI	STATEWIDE	95% CI
2014	0.42	+0.04	0.38	+0.02	0.37	+0.01	0.38	+0.01
2015	0.24	+0.02	0.32	+0.01	0.36	+0.02	0.31	+0.01
2016	0.29	+0.03	0.46	+0.02	0.43	+0.02	0.41	+0.01
2017	0.35	+0.02	0.40	+0.02	0.35	+0.01	0.37	+0.01
2018	0.27	+0.02	0.35	+0.02	0.40	+0.02	0.35	+0.01
Avg.	0.31	+0.06	0.38	+0.05	0.38	+0.03	0.36	+0.03

Table B9. Annual raccoon observation rates (# of raccoons seen per 1,000 hours) by furbearer management unit with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018.

Year	MOUNTAIN	95% CI	PIEDMONT	95% CI	COASTAL	95% CI	STATEWIDE	95% CI
2014	12.9	+5.4	20.3	+4.7	39.3	+8.8	26.0	+4.1
2015	9.6	+3.7	14.8	+3.4	47.6	+17.3	26.5	+7.0
2016	9.2	+4.1	28.4	+17.1	40.3	+18.1	29.1	+10.0
2017	8.9	+3.7	22.3	+5.9	48.1	+34.9	28.9	+13.5
2018	19.3	+8.7	20.7	+4.5	48.4	+13.3	30.9	+5.8
Avg.	12.0	+3.9	21.3	+4.3	44.8	+4.0	28.3	+1.8

Table B10. Annual coyote observation rates (# of coyotes seen per 1,000 hours) by furbearer management unit with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018.

Year	MOUNTAIN	95% CI	PIEDMONT	95% CI	COASTAL	95% CI	STATEWIDE	95% CI
2014	11.6	+4.8	13.6	+2.8	18.5	+4.0	15.0	+2.2
2015	10.5	+3.0	12.5	+2.6	16.3	+8.3	13.5	+3.5
2016	7.3	+2.6	14.6	+3.5	13.6	+4.8	12.7	+2.4
2017	17.8	+11.6	16.6	+4.0	12.5	+3.0	15.3	+3.4
2018	13.3	+10.3	12.2	+2.6	14.0	+4.8	13.1	+3.2
Avg.	12.1	+3.4	13.9	+1.6	14.9	+2.1	13.9	+1.0

Table B11. Annual gray fox observation rates (# of gray fox seen per 1,000 hours) by furbearer management unit with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018.

Year	MOUNTAIN	95% CI	PIEDMONT	95% CI	COASTAL	95% CI	STATEWIDE	95% CI
2014	2.7	+2.5	11.4	+3.1	14.8	+3.6	10.8	+1.9
2015	1.4	+1.0	9.1	+4.5	13.4	+4.1	9.1	+2.4
2016	0.4	+0.4	7.5	+2.2	10.2	+3.0	7.1	+1.5
2017	1.4	+0.7	8.5	+4.3	8.2	+2.3	6.7	+1.9
2018	2.7	+2.6	9.1	+2.4	8.4	+3.0	7.3	+1.6
Avg.	1.7	+0.9	9.1	+1.3	11.0	+2.6	8.2	+1.5

Table B12. Annual red fox observation rates (# of red fox seen per 1,000 hours) by furbearer management unit with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018.

Year	MOUNTAIN	95% CI	PIEDMONT	95% CI	COASTAL	95% CI	STATEWIDE	95% CI
2014	2.0	+1.8	4.0	+1.6	4.5	+2.8	3.7	+1.3
2015	4.4	+3.1	5.3	+2.5	2.7	+1.4	4.1	+1.3
2016	2.3	+2.2	2.5	+0.8	3.8	+2.1	3.0	+1.0
2017	2.4	+1.3	4.2	+1.8	2.4	+1.4	3.1	+0.9
2018	1.3	+0.8	3.2	+1.6	2.5	+1.4	2.5	+0.8
Avg.	2.5	+1.0	3.9	+0.9	3.2	+0.8	3.3	+0.6

Table B13. Annual bobcat observation rates (# of bobcat seen per 1,000 hours) by furbearer management unit with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018.

Year	MOUNTAIN	95% CI	PIEDMONT	95% CI	COASTAL	95% CI	STATEWIDE	95% CI
2014	3.0	+1.7	2.2	+1.1	4.7	+1.1	3.4	+0.7
2015	3.4	+1.7	4.0	+5.2	4.8	+2.1	4.1	+2.2
2016	1.8	+0.9	1.3	+0.6	4.6	+2.6	2.7	+1.0
2017	4.6	+2.8	1.6	+0.7	4.7	+1.4	3.5	+0.9
2018	3.1	+1.8	2.0	+1.1	5.4	+1.4	3.6	+1.1
Avg.	3.2	+0.9	2.2	+0.9	4.8	+0.3	3.4	+0.5

Table B14. Adult bear observation rates (# of bear seen per 1,000 hours) by bear management unit with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018.

Year	MOUNTAIN	95% CI	PIEDMONT	95% CI	COASTAL	95% CI	STATEWIDE	95% CI
2014	1.5	+1.1	0.5	+0.7	25.9	+6.3	10.3	+2.4
2015	3.3	+1.6	0.3	+0.3	29.0	+9.3	11.9	+3.6
2016	2.4	+1.5	0.4	+0.4	30.8	+12.5	12.3	+4.8
2017	5.8	+3.1	0.2	+0.2	30.6	+11.8	12.8	+4.5
2018	7.8	+4.7	0.1	+0.1	30.7	+12.3	13.4	+4.7
Avg.	4.2	+2.3	0.3	+0.1	29.4	+1.8	12.1	+1.0

Table B15. Feral swine occurrence rates (≥ 1 swine seen per hunting trip) with 95% confidence intervals, North Carolina Deer Hunter Observation Survey, 2014-2018.

Year	STATEWIDE	95% CI
2014	0.33%	+0.16%
2015	0.37%	+0.28%
2016	0.12%	+0.08%
2017	0.36%	+0.26%
2018	0.74%	+0.57%
Avg.	0.38%	+0.20%