

Population Characteristics of a White-tailed Deer Herd in an Industrial Pine Forest of North-central Louisiana

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Abstract: White-tailed deer (*Odocoileus virginianus*) are the most important game species in Louisiana and throughout the southeastern United States. Likewise, the forest products industry represents the most important agricultural commodity in Louisiana, and industrial landowners frequently lease their properties to sportsmen specifically for white-tailed deer hunting. We assessed survival, space use, and habitat selection of white-tailed deer on a 3885-ha industrial forest in Union Parish, Louisiana, 2009–2010. We radio-marked 47 (23M, 24F) mature deer and ear-tagged 13 (6M, 7F) fawns. Male home range sizes varied seasonally and were largest during spring, whereas female home range sizes did not differ seasonally. Forest openings were important to both sexes when establishing home ranges, whereas 0- to 4-year-old pine and 13- to 19-year-old pine stands were important when selecting core use areas. Within home ranges, males and females consistently used 5- to 12-year-old pine stands across all seasons. Survival differed by season but not by sex. Survival rates in spring, summer, and fall for adult males were 0.95, 0.97, and 0.54, respectively, and for adult females were 0.95, 0.97, and 0.56 respectively. All mortality during fall was hunting-related, whereas mortalities during spring and summer resulted from unknown causes. We suspect that the extensive use of bait by hunters influenced space use and survival, and further research is needed to determine effects of baiting on susceptibility of harvest of different age classes and sexes. Implementation of antler restrictions and education concerning aging deer and selectivity at harvest could likely improve age structure of the herd.

Key words: habitat selection, Louisiana, *Odocoileus virginianus*, space use, survival, white-tailed deer

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White-tailed deer (*Odocoileus virginianus*) are the most sought after big game species in the southeastern United States. In Louisiana, US\$286,233,000 was spent by 204,000 big game hunters representing 195,200 harvested deer (U.S. Fish and Wildlife Service 2006) in 2006. More recently, deer harvest in Louisiana has declined 17% with only 147,300 animals being harvested in the 2009–2010 season (Louisiana Department of Wildlife and Fisheries unpublished data). Although forestry represented Louisiana's top cash crop and a \$3.1 billion dollar industry in 2010 (Louisiana Forestry Association 2011), many forest products companies lease expansive tracts of property to recreational clubs for hunting purposes. Lessees in conjunction with state and private wildlife biologist are often allowed to manage wildlife populations to varying degrees. Many clubs enroll in a Deer Management Assistance Program (DMAP) which allows for additional harvest of females and provides assistance from a state biologist to reach management goals (S. Durham, LDWF, personal observation). As the idea of Quality Deer Management (QDM) continues to gain popularity so does the expectation for harvesting mature deer (Harper et al. 2012).

Estimates of space use by white-tailed deer vary widely throughout the Southeast (42–3614 ha; Lewis 1968, Mott 1981, Herriman 1983, Morrison 1985, Hellickson et al. 2008, Karns 2008, Thayer et al. 2009). These studies have occurred in many habitat types, but in Louisiana and adjacent states with similar habitats (e.g., Mississippi), work has been confined to bottomlands. Bottomlands are considered high quality habitat for deer (Stransky 1969), but the distribution of these forests is limited and industrial pine forests comprise a large percentage of available habitat for deer. Many recent studies reporting survival rates have been conducted on areas where harvest management is focused on producing mature males (Ditchkoff et al. 2001, Bowman et al. 2007, Thayer et al. 2009). Immature males are normally protected under this regime using antler restrictions, and hunters are asked to focus efforts on harvesting adult females, thus allowing a greater number of males to reach maturity.

An earlier study in bottomland forests of south-central Louisiana (Thayer et al. 2009) indicated that estimates of space use were among the least reported in the literature. Additionally, survival rates of males were reported to be approximately 50% annually, de-

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spite antler restrictions designed to increase survival of males. The Louisiana Department of Wildlife and Fisheries (LDWF) recognizes the immense variability in habitats across physiographic regions of Louisiana, and the relevance of collecting science-based information to improve management of deer throughout the state. Industrial pine forests comprise substantial portions of north-central and southeast Louisiana, and the highest annual deer harvest occurs in Union Parish, which is dominated by upland pine forests managed for wood fiber production. Therefore, our research was initiated to collect baseline information on ecological characteristics of deer populations in an industrial forest. Our objectives were to evaluate space use, habitat usage, and survival of adult male and female white-tailed deer within an industrial pine forest in north-central Louisiana.

Study Area

We conducted research on 3885 ha of upland pine forest owned by Plum Creek Timber Company in Union Parish, Louisiana. The area was composed primarily of loblolly pine (*Pinus taeda*) plantations harvested on an approximately 25-year rotation. First thinning of plantations occurred between ages 13–15 with a second thinning between 17–20 years. Fertilization through aerial application commonly occurred after each thinning. Most stands were 24–29 ha in size and maximum size of stands did not exceed 49 ha. Site preparation included rowing site debris into raised beds before planting and herbicide application to reduce competition from woody plants. The area was accessible through improved and unimproved roads including state highway 143 which bordered the eastern edge of the site. Hunting over bait (primarily corn and rice bran) was legal and widely practiced on our study area. Hunters began baiting hunting locations several weeks prior to archery season (October) and continued baiting until the end of the general firearms season (late January). Hunters on our study areas were allowed to harvest males of any age class, as no antler restrictions or other guidelines were in place. A week-long camera survey performed in early fall 2007 consisting of 24 camera sites indicated a deer density of 1 deer per 7 ha with a male:female ratio of 0.96 (Louisiana Department of Wildlife and Fisheries unpublished data).

Methods

We captured deer using drop nets during January–March and July–September in 2009 and 2010. We immobilized deer using an intramuscular injection of 5 mg/kg Telazol (Fort Dodge Animal Health, Fort Dodge, Iowa) and 2.49 mg/kg Xylazine (Phoenix Scientific, St. Joseph, Missouri) at the dosage of 1 ml/38.5 kg (Amass and Drew 2006). After processing was complete, we injected deer intravenously with Tolazoline (100 mg/ml, Tolazine; Lloyd Labo-

ratories, Shenandoah, Iowa) at 3.0 mg/kg and released all individuals at the capture site.

We marked deer in both ears with numbered Monel ear-tags (National Brand and Tag Company; Newport, Kentucky) and recorded sex, weight, age, and antler characteristics. We estimated age using tooth replacement and wear techniques (Severinghaus 1949) and categorized deer as fawns, 1.5, or ≥ 2.5 years of age. We fitted 1.5-year-old deer with expandable VHF radio-collars (Mod M4230B; Advanced Telemetry Systems, Isanti, Minnesota) to allow for growth of the animal. We placed 400-gram VHF radio-collars (Mod M2510B; Advanced Telemetry Systems, Isanti, Minnesota) on adult deer ($< 1\%$ of body weight). All radio-collars were equipped with an eight-hour mortality sensor. Capture and handling procedures were approved under Louisiana State University Agricultural Center Institutional Animal Care and Use Protocol (AE2009-18).

We estimated locations of radio-marked deer using triangulation (White and Garrott 1990) from 3–5 fixed telemetry stations ($n = 138$) with an ATS R2000 receiver (Advanced Telemetry Systems Inc., Isanti, Minnesota) and a hand-held three-element Yagi antenna. We obtained locations one–five times per week using three bearings taken within a 20-minute interval to minimize error associated with deer movement. Telemetry error was calculated with > 50 bearings per observer, per season, on dummy radio collars placed throughout the study area at neck height of deer. The average angle of error was $\pm 7.1^\circ$. We recorded the exact location of any visually observed radio-marked individual with a hand-held GPS.

If we detected a mortality signal or suspected mortality from lack of movement, we located the deer using homing, recorded the location using a hand-held GPS unit, and attempted to determine cause of death. We asked hunters to view radio-collared animals just like all other animals to limit bias and to report harvest of all radio-collared and ear-tagged animals.

We divided telemetry monitoring periods into three biologically relevant seasons: spring (1 February–30 May), summer (1 June–30 September), and fall (1 October–31 January). We delineated seasons based on biological cues of deer (fawning, breeding) and the hunting season in the study area (1 October–31 January). We input telemetry bearings into Location of a Signal (LOAS, Version 4.0 Ecological Software Solutions 1999) and used the maximum likelihood estimator method to estimate Universal Transverse Mercator (UTM) coordinates and error ellipse areas. We separated locations gathered on individual deer by a minimum of eight hrs to provide some measure of independence and only retained locations with an error ellipse area < 1 ha for use in analyses. We only included animals with ≥ 18 locations per season in home range analyses based on observation curves constructed on 16 animals (8 M, 8 F). We

imported locations into ArcMap 9.2 (ESRI, Redlands, California) and converted them to point themes. We used the Home Range extension in ArcMap to calculate estimates of home range (95%) and core area (50%) using an adaptive-kernel analysis (Worton 1989) in conjunction with the likelihood cross-validation method (Silverman 1986).

We used a one-way ANOVA to test for effects of year on home range and core area sizes. We used a factorial analysis of variance (ANOVA) to test for season by sex interactions in home range and core area sizes using the Proc Mixed procedure in SAS V9.2 (SAS 2009). Additionally, when significant differences were found in the factorial ANOVA we used least-squares means to test the effects of season and sex on home range and core area size using the LSMeans procedure in SAS. We collapsed all age classes for analysis because of 1) relatively low sample sizes within older age classes of males and 2) a skewed age ratio in females towards older individuals. Statistical differences were considered significant at $P \leq 0.05$.

Plum Creek provided land cover maps containing stand size, age, species planted, and habitat type (commercial pines, gas lines, gas wells, bottomland hardwoods, roads, etc.) for the study area. Commercial pine stands were further separated based on age, stand structure, and commercial management activities (thinning, herbicide application, harvest). We used this information to classify habitats as 0- to 4-year-old pine, 5- to 12-year-old pine, 13- to 19-year-old pine, ≥ 20 -year-old pine, hardwoods, and forest openings (roads, pipelines, natural gas well sites, forest paths). Habitats classified as 0- to 4-year-old pine included stands with an open overstory that were recently harvested or newly replanted. The 5- to 12-year-old pine stands included those ranging from closed canopy stands to the age of average first thinning. We classified pine stands old enough to receive a first and second thinning as 13- to 19-year-old pine. The ≥ 20 -year-old pine included the most mature pine stands on the study area, which were eligible for harvest under normal harvest conditions.

We intersected home ranges, core areas, and point themes with land cover maps using ArcMap to quantify seasonal use of habitats. We used compositional analysis to determine habitat selection at three spatial scales: home ranges vs. habitats available in the study area (1st order), core area vs. habitats available in the home range (2nd order), and locations vs. habitats available in the home range (3rd order; Chamberlain and Leopold 2000). When a habitat was not available at a given scale, we inserted a value of 0.7 to minimize Type I error rates (Bingham and Brennan 2004). We examined differences of log-ratios of habitat use and availability percentages using a multivariate analysis of variance (MANOVA) with sex, season, and sex and season interaction as the main effects. When differences between habitat availability and selection were found,

we constructed a ranking matrix of t-tests to determine order of habitat selection (Aebischer et al. 1993).

We used program MARK (White and Burnham 1999) to estimate seasonal and annual survival rates using known fate models with season as the interval. We constructed encounter histories for all adults for the 24-month-period between February 2009 and January 2011, and considered deer monitored during both years of the study as two separate samples in the analysis.

We applied five candidate models to determine effects of season, sex, and their interaction on survival rates. Models included those where survival was held constant by season and/or sex, and those without survival being held constant by season or sex. We used Akaike's information criterion adjusted for small sample sizes (AIC_c), change in AIC_c and ΔAIC_c values, and Akaike weights (AIC_w) to determine which candidate model was the best fit (Anderson et al. 2000). Age was not included as an effect in the models because most males in the dataset were in younger age classes, whereas most females were in older age classes. Because of small sample sizes of ear-tagged fawns, we did not include them in the analysis. Rather, the proportion of these individuals recovered and/or assumed to be alive at the end of the study are reported, and should be viewed as a maximum number due to lack of monitoring capabilities except for hunter reported harvests.

Results

We captured 61 deer (29 M, 32 F) and fitted 47 (23 M, 24 F) with radio transmitters and 13 fawns (6 M, 7 F) with ear-tags only. Home range ($F_{1,138} = 0.37$, $P = 0.545$) and core area ($F_{1,138} = 0.66$, $P = 0.418$) sizes did not differ by years; therefore, we pooled data to examine potential differences by season and sex. Factorial ANOVA indicated sex and season interacted to influence home range ($F_{2,139} = 7.03$, $P = 0.001$) and core area ($F_{2,139} = 8.55$, $P \leq 0.001$; Table 1) sizes. Analysis of least-squared means indicated home range ($F_{2,73} = 8.57$, $P \leq 0.001$) and core area ($F_{2,65} = 10.25$, $P \leq 0.001$)

Table 1. Mean seasonal home range (HR) and core area (CA) size (ha) of adult radio-marked white-tailed deer in Union Parish, Louisiana, 2009–2011.

Season ^a	Sex	HR \pm SE	CA \pm SE
Spring	M	231.8 \pm 145.8	39.2 \pm 25.2
	F	104 \pm 76.4	15.9 \pm 15.1
Summer	M	70.2 \pm 55.6	8.4 \pm 6.6
	F	89.7 \pm 84.9	13.6 \pm 13.8
Fall	M	128.7 \pm 147.3	18.4 \pm 27.2
	F	62.2 \pm 69.5	9.6 \pm 9.8
Yearly	M	169.8 \pm 76.6	14.9 \pm 14.5
	F	111.8 \pm 119.7	13.4 \pm 13

a. spring = 1 February–30 May; summer = 1 June–30 September; fall = 1 October–31 January

Table 2. Seasonal and mean ranks (1 = lowest, 5 = highest) of habitat selection across three spatial scales^a based on compositional analysis of male and female white-tailed deer in Union Parish, Louisiana, 2009–2011.

Sex	Habitat Type ^b	1st Order				2nd Order				3rd Order			
		Season				Season				Season			
		Spring	Summer	Fall	Mean	Spring	Summer	Fall	Mean	Spring	Summer	Fall	Mean
Male	A	1	2	3	2	0	0	4	1.33	1	1	2	1.33
	B	5	3	2	3.33	5	5	1	3.67	5	5	5	5
	C	0	0	0	0	2	2	5	3	3	3	4	3.33
	D	2	1	1	1.33	1	1	3	1.67	0	4	3	2.33
	E	3	4	4	3.67	3	4	2	3	2	2	1	1.67
	F	4	5	5	4.67	4	3	0	2.33	4	0	0	1.33
Female	A	2	4	2	2.67	1	1	4	2	0	0	1	0.33
	B	3	3	3	3	5	4	1	3.33	5	4	4	4.33
	C	0	0	0	0	3	5	5	4.33	2	5	3	3.33
	D	1	2	1	1.33	2	0	3	1.67	4	2	2	2.67
	E	4	1	4	3	0	2	2	1.33	3	3	5	3.67
	F	5	5	5	5	4	3	0	2.33	1	1	0	0.67

a. Habitat selection in home ranges vs. habitat availability across study area [1st order], habitat selection in core areas vs. habitat availability across home ranges [2nd order], and habitat used vs. habitat availability across home ranges [3rd order].

b. Habitat types include 0- to 4-year-old pine (A), 5- to 12-year-old pine (B), 13- to 19-year-old pine (C), ≥20-year-old pine (D), hardwoods (E), and forest openings (F).

size varied seasonally for males. Males maintained 230% and 80% larger home ranges in spring than summer ($t_{139} = -2.98$, $P < 0.003$) and fall ($t_{139} = 5.10$, $P < 0.001$), respectively. Core area size during fall was greater than during summer (366%; $t_{139} = 5.65$, $P < 0.001$) and spring (113%; $t_{139} = -3.53$, $P < 0.001$). Fall home range (83%; $t_{139} = 2.41$, $P < 0.017$) and core area (67%; $t_{139} = 2.40$, $P = 0.018$) size in males also was larger than in summer. Female home range ($F_{2,73} = 1.26$, $P = 0.289$) and core area ($F_{2,73} = 0.89$, $P = 0.415$) sizes did not differ across seasons.

Habitats selected when establishing a home range relative to habitats available in the study area varied by sex ($F_{5,115} = 8.99$, $P < 0.001$; Table 2), but not season ($F_{10,226} = 0.98$, $P = 0.464$), and season and sex did not interact to influence habitat selection ($F_{10,222} = 0.82$, $P = 0.609$). Forest openings were selected by both sexes when establishing home ranges, whereas 13- to 19-year-old pine stands were least important to deer at this scale. Sex and season interacted ($F_{10,222} = 2.51$, $P = 0.007$) to influence the composition of core areas in relation to habitats available within home ranges. Males selected hardwoods, and females selected 13- to 19-year-old pine stands in summer. Both males and females shifted selection in the fall to 0- to 4-year-old pine and 13- to 19-year-old pine stands. Use of habitats within home ranges did not vary by sex ($F_{5,111} = 0.38$, $P = 0.859$), season ($F_{10,222} = 0.35$, $P = 0.965$), or their interaction ($F_{10,222} = 0.61$, $P = 0.802$). Both males and females consistently used 5- to 12-year-old pine stands across all seasons. Habitat composition of the study area consisted of 8.6% 0- to 4-year-old pine (334 ha), 41.6% 5- to 12-year-old pine (1616 ha), 2.3% 13- to 19-year-old pine (89 ha), 24% ≥20-year-old pine (932 ha), 17.8% hardwoods (692 ha), and 5.1% openings (198 ha).

Table 3. Five a priori candidate models used to estimate survival rates for white-tailed deer from radio-telemetry data in Union Parish, Louisiana, 2009–2010.

Model ^a	AICc	Δ AICc	AICc Weight	K	Deviance
S(t)	173.6405	0	0.67162	3	0.4788
S(g+t)	175.3130	1.6725	0.29103	4	0.0831
S(g*t)	179.4194	5.7789	0.03735	6	0
S(.)	231.0979	57.4574	0	1	62.0207
S(g)	232.8221	59.1816	0	2	61.7112

a. S(.)—survival is constant across seasons and sex, S(t)—survival is not constant across seasons, S(g)—survival is not constant by sex, S(t*g)—survival is not constant across seasons by sex, S(t+g)—survival is not constant across seasons and sex.

We based survival rates on 23 males and 24 females resulting in 64 encounter histories. Of the 23 males radio-collared, 12 (52%) were harvested by hunters, 3 (13%) died of unknown causes, and 4 (17%) lost their transmitters. Of the 24 females radio-collared, 10 (42%) were harvested by hunters, 3 (13%) died of unknown causes, and 1 (4%) lost its transmitter. Of the 13 (6 M, 7 F) ear-tagged fawns, 4 (3 M, 1 F) were reported as harvested (31%). Hunting accounted for all mortality in the fall in both sexes, with 20 (91%) deer being harvested over bait (based on conversations with hunters harvesting each individual). Unknown causes accounted for all mortality in the spring and summer in both sexes. Of the 6 deer found dead of unknown causes, 5 (83%) had been scavenged prior to radio-collar retrieval. The best fit model showed survival differed across seasons but not by sex (Table 3). Annual survival was 0.51 ± 0.03 ($\pm SE$) during 2009–2011. Survival was lower in the fall (0.54 ± 0.07) than spring (0.95 ± 0.03) and summer (0.97 ± 0.02) in males. Females followed a similar trend with lower survival in fall (0.56 ± 0.06) than spring (0.95 ± 0.03) and summer (0.97 ± 0.02).

Discussion

Male space use increased 80% from fall to spring, and was likely influenced by dispersal of 1.5-year-olds, resource depletion, and physiological demands of new antler growth. Yearling males often exhibit their greatest movements during this period (Nelson and Mech 1984). Likewise, females increased space use by 62% in the spring, which was likely attributable to the search for food resources and the cessation of their family group for fawning (Schwede et al. 1993). Early spring coincides with a depletion of quality browse and a lack of hard mast availability as well as the cessation of baiting by hunters. Conversely, space use and movements during summer were similar in both sexes, likely in response to increased browse availability, lack of human disturbance, and climatic factors (Beier and McCullough 1990). Daily movements by females were likely impeded by the presence of fawns (D'Angelo et al. 2004), and decreasing space use at a time of high metabolic demand because of lactation and antlerogenesis in males could have been offset by the quantity of browse available (Beier and McCullough 1990).

The increase of male movement in fall coincides with a decline in browse quality, dispersion of males from summer aggregations, and the onset of breeding season (Thomas et al. 1965, Ivey and Causey 1988). Sedentary movement by females during fall could be an attempt to be more available to males as reported in Holzenbein and Schwede (1989). With an increased effort by hunters to harvest adult females to reduce overall density on the study area, females may have become more sedentary resulting in the energy-efficient breeding behavior observed by Kolodzinski et al. (2010). Alternatively, baiting can alter deer movements and increase use of areas close to bait sites (Kilpatrick et al. 2010).

The availability of openings was important to deer when selecting home ranges within the study area (1st order selection). This was likely related to the importance of browse species associated with edges (Poteet et al. 1996). Intensively managed pine stands similar to those on our study area are characterized by a noticeable reduction in browse species as stands succeed and canopy closes (Scanlon and Sharik 1986, Edwards et al. 2004), increasing the importance of openings and the browse associated with them. We offer that the apparent lack of use of openings at smaller spatial scales (3rd order selection) is an artifact of biases associated with radio-tracking and hence, the observed importance of openings at smaller spatial scales is under-estimated. We observed marked and un-marked deer using openings, but they would quickly move into adjacent escape cover, and it is likely that many radio relocations near forest edges were representative of animals that had moved into cover prior to visual detection. Additionally, most openings on the study area were narrow (30–50 m) and linear; therefore, telemetry error could have resulted in deer locations being assigned

to adjacent forest stands when they instead actually occurred within openings.

Hardwood forests in the study area were limited to streamside management zones and provided the only source of hard mast available in fall. These forests were selected by both sexes when establishing home ranges, regardless of season. During times with high summer temperatures and regular drought periods, hardwood forests associated with riparian areas may be used for access to shade, water, and cooler temperatures (Tucker 1981, Poteet et al. 1996). However, at successively smaller spatial scales 5- to 12-year-old and 13- to 19-year-old pine stands were important to both sexes, presumably due to the dense understory in these stands that is used as bedding cover (Larson et al. 1978, Brunjes et al. 2006) and escape cover from hunting pressure (Naugle 1994). Hunting pressure has been shown to shift habitat use (Kammermeyer and Marchinton 1976) and cause animals to move farther into cover away from human disturbance (Naugle 1994). These pine stands were often juxtaposed to pipelines and forest openings with readily accessible bait in fall, likely increasing use. Likewise, 13- to 19-year-old pine stands had been thinned and fertilized and likely offered an increase in available browse and cover for both sexes (Edwards et al. 2004). In fall, both sexes shifted core area selection away from 5- to 12-year-old pine to 0- to 4-year-old pine and 13- to 19-year-old pine. This shift is likely attributable to a lack of forage available due to canopy closure in 5- to 12-year-old pines.

Not surprisingly, survival was lowest during fall. The annual harvest rate for 1.5-year-old and 2.5-year-old radio-collared males (56%) was similar to rates previously reported by Nelson and Mech (1986; 68%) and Nixon et al. (1991; 66%), and greater than Ditchkoff et al. (2001; 26%) and Bowman et al. (2007; 46%). Significant harvest of 1.5-year-old and 2.5-year-old males over an extended period of time can skew age class structure towards younger males, as evidenced on our study area (Miller et al. 1995). However, annual survival of adult females (51 %) was lower than rates previously reported (65%–90%; Gavin et al. 1984, Nixon et al. 1991, Land et al. 1993, DePerno et al. 2000, Hansen and Beringer 2003). Harvest records from our study area indicate that females are harvested with almost equal frequency as males and are usually of older age classes.

We offer that the harvest rate of both sexes is partially influenced by the availability of bait throughout the fall hunting season. All radio-collared deer had multiple permanent stands and bait stations inside of their fall home range. Of the 22 adult radio-collared deer that were harvested, 20 (91%) were harvested at bait stations based on statements made by hunters harvesting them. Additional research is required to further quantify the effects and influences of baiting on susceptibility to harvest. Both animals that

were not harvested with the aid of bait were ≥ 3.5 year old males harvested during the breeding season.

Management Implications

Our estimates of seasonal space use suggest that intensively managed pine plantations can offer suitable habitat for white-tailed deer. Seasonal home ranges of both sexes were less than most previously reported findings in the Southeast, further indicating the potential for increased management activities in pine plantations to be effective. Given that survival rates were low compared to other studies and males were harvested regardless of age, if hunters and managers wish to increase survival of males, particularly younger males (1.5 years old), changes in harvest guidelines would be necessary. Specifically, introducing antler restrictions and educating hunters in regards to aging deer and selectivity at harvest could likely improve age structure of the herd. In addition, the use of bait to aid in harvest and the susceptibility of younger age class deer to this harvest technique should be examined. The cessation of baiting could allow for an increase in 1.5-year-old survival, but could diminish adult female harvest opportunities, which are necessary in herd management.

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