

Potential negative effects of baiting on regional white-tailed deer harvest rates in South Carolina: A state with conflicting baiting laws.

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Abstract: As in most states, baiting white-tailed deer (*Odocoileus virginianus*) is a controversial issue in South Carolina. Unlike other states, however, South Carolina is geographically divided on this issue. In the 18 county Piedmont, baiting is prohibited by South Carolina Department of Natural Resources (SCDNR) regulation. In the 28 county Coastal Plain, SCDNR lacks regulatory authority over baiting, the issue has not been addressed legislatively, and baiting is widespread. Past work concerning the effects of baiting on deer harvest rates have produced mixed results and focused primarily on success of individual hunters, however, advocates of baiting promote the practice as a way to increase deer harvests in order to control burgeoning populations. Due to ongoing pressures to legalize baiting in the Piedmont, hunter effort and harvest estimates from the 2 regions were compared to investigate the baiting harvest interaction. Results indicate that where baiting is prohibited total deer harvest rates were 33 percent greater, female harvest rates were 41 percent greater, doe to buck harvest ratios were 12 percent higher, hunter effort per deer was 6 percent less, and humans per deer-vehicle collision was 7 percent less than where baiting occurs. If there is a cause-effect relationship, data suggests a negative rather than a positive relationship between baiting and deer harvest rates at the regional level in South Carolina. Among the myriad of concerns that SCDNR staff has with baiting, information suggests that hunter dependence on bait and deer population and behavioral effects associated with baiting may be negatively affecting deer harvest rates in the Coastal Plain of South Carolina.

Key words: baiting, white-tailed deer, hunter success, harvest rates

Introduction

Issues related to hunting deer with bait

The use of bait for hunting deer is controversial and involves a complex set of biological, social, and ethical issues. Biologically, population influences related to baiting can be important in the dissemination and maintenance of disease (Schmitt et al. 1997), affect movement, distribution, and behavior of deer (Synatzke 1981, Darrow 1993), influence survival and reproduction, particularly when it moves towards supplemental feeding (Ozoga and Verme 1982), and concentrations of deer at bait sites may lead to affects on other species (DeCalesta 1994, Cooper and Ginnett 2000), habitats (Ozoga and Verme 1982, Doerner et al., 1997) and ecosystems (Williamson 2000, Brown 2001).

From a social standpoint, baiting can create conflicts between consumptive user groups due to real and perceived unnatural partitioning of the deer resource. Legal baiting for deer can create illegal baiting situations for other species (e.g. migratory birds) that may cause friction between local user groups. Finally, baiting may simply pit groups against one another from a philosophical standpoint.

Ethically, support for baiting is often split among hunters, however non-hunters and anti-hunting constituent groups typically do not support the practice. Controversy or lack of public support for baiting most often involves perceptions of fair chase and this fair chase challenge weakens public support not only for hunting programs, but also for wildlife conservation and management programs that have historically been accepted (Peyton 1998). Hunting is a tradition and an important tool with respect to deer management; however issues such as hunting deer over bait jeopardize the continued acceptance of hunting by an increasingly skeptical public at large (Williamson 2000).

Previous studies

Research concerning the effects of baiting on deer harvest have produced mixed results and focused primarily on success of individual hunters. A 1999 Michigan phone survey of deer hunters indicated that 44 percent were successful using bait while 52 Percent were successful without bait (Michigan Department of Natural Resources 1999). Langenau (1985) found Michigan hunters using bait were no more effective harvesting deer than those who did not use bait, however, Winterstein (1992) indicated that Michigan hunters were 20 percent more effective when they used bait. In Texas, Synatzke (1981) reported higher hunter success, reduced kill distance, more deer observed, and less time to harvest deer when hunting over bait. In any event, advocates of baiting often promote the practice as a way to increase deer harvests to control burgeoning populations.

History of baiting in South Carolina

From a legal standpoint, baiting for deer in South Carolina is regionally defined with the practice being prohibited in the Piedmont and not prohibited in the Coastal Plain. This divergent legal situation is rooted in the history of the respective deer populations and in the tradition and politics of deer hunting in the two regions. As was the case in most of North America, South Carolina's white-tailed deer population was nearly extirpated by 1900 primarily as a result of habitat loss due to agricultural development and overexploitation.

On one hand, the Coastal Plain (37,992-km²) held residual deer populations that were associated with major river flood plain systems that were relatively inaccessible and of little agricultural value. Even when deer populations were low and protection of deer high in other states, deer remained available and hunting of deer continued in some parts of the Coastal Plain. Pursuing deer with dogs was the customary method of hunting deer and notable figures like Archibald Rutledge frequently described this activity as it was carried out specifically in the Coastal Plain of South Carolina. Laws governing most deer related activities in the Coastal Plain were enacted prior to the existence of wildlife management as a science and prior to the

establishment of a wildlife agency in South Carolina. Even today, most restrictions on deer hunting are legislative rather than being regulatory functions of SCDNR.

Historically, there was no need for the South Carolina General Assembly to address the issue of baiting deer in the Coastal Plain because hunting deer with dogs was the only method used. However, due to changing land use and ownership patterns and the fact that hunters determined that still hunting was an effective way to hunt deer, there was a relatively rapid shift from hunting with dogs to still hunting by the mid-1980s. Today less than 10 percent of the Coastal Plain is under a regime of hunting only with dogs (unpublished data SCDNR). With this shift to still hunting and no restrictions on baiting deer, the practice began. Baiting is now widespread and could be characterized as feeding due to its availability on an annual basis.

In the Piedmont (18,777-km²) on the other hand, deer were nearly eliminated by the early 1900s and there are virtually no historical accounts of deer hunting in the Piedmont. By the 1950s, wildlife management as a science had been born and a wildlife agency, now SCDNR, had developed in South Carolina. SCDNR was charged with restoring deer in the Piedmont and with this charge the agency was given regulatory authority over seasons, bag limits, and methods of hunting deer under Title 50 of the South Carolina Code of Laws. Deer restoration began in 1951 and the first open season for deer in the Piedmont was in 1958. Since deer numbers were low and there was no tradition of hunting deer with dogs, still-hunting was the only method prescribed. At that time, baiting was prohibited in the Piedmont by SCDNR regulation. This took place when virtually all deer hunting in the Coastal Plain was with dogs and baiting, though not prohibited by the legislature, was not an issue.

This historical account brings us to the present. South Carolina has a fully recovered statewide deer population, still-hunting is the dominant method of hunting deer, and the state is divided regionally on the legality of baiting. In the Piedmont baiting is prohibited by SCDNR regulatory authority, whereas, in the Coastal Plain no such agency authority exists and baiting has not been addressed by the legislature. In essence, baiting in the Coastal Plain is a result of omission rather than provision in law.

There is a general lack of understanding among most hunters and legislators as to the history of baiting in South Carolina and how this conflicting legal situation arose. Hunters assume that SCDNR has ultimate control over wildlife and that the agency is being arbitrary and capricious in allowing baiting in the Coastal Plain and prohibiting it in the Piedmont. Legislators, most having little or no experience in wildlife or hunting, either know nothing about the issue or like hunters, feel the conflict is SCDNR's responsibility.

Due to pressure from some hunters and real and perceived problems with deer, there have been several attempts since 2000 to remove SCDNR authority over baiting in the Piedmont by legislatively prescribing baiting as an acceptable practice for hunting deer in that region. With deer populations at high levels, it is common knowledge that aggressively harvesting deer is key to management. In South Carolina, advocates of baiting insist that harvest rates and hunter efficiency are improved when bait is employed. SCDNR Wildlife Management Section biological staff opposes the practice of hunting deer over bait due to the aforementioned set of biological, social, and ethical concerns.

Methods

Since 1999, SCDNR has employed an annual Deer Hunter Survey to estimate deer harvest and hunter effort associated with the white-tailed deer resource in South Carolina. The survey is executed by mail with survey participants being selected from the agency database of Big Game Permit holders. The number of participants selected annually represents an attempted sampling rate of 12-15 percent of the permittee population. Wildlife Management Section personnel develop the survey questionnaire in order to estimate parameters at the county level. Data from completed surveys are compiled and statistical analysis is completed using the Statistical Analysis System (SAS 2000) and Statistix 7 (Analytical Software 2000). Results are printed as an annual internal agency Deer Project Report and disseminated to the public through various mediums, e.g. SCDNR web site, news releases, etc.

Information on deer-vehicle collisions is not collected by SCDNR. However, the annual Deer Project Report includes deer-vehicle collision data that is provided via personal communication with the South Carolina Department of Public Safety. Human population figures for this analysis are based on the 2000 census (Pender 2001).

Data analysis

Data for this regional analysis is statewide data from annual Deer Project Reports 2000-2003 segregated regionally on the basis of whether bait is prohibited (control group = Piedmont) or not prohibited (treatment group = Coastal Plain). A 2 x 4 ANOVA using a randomized complete blocks design was used to examine the main effects (differences between years) and least significant difference (LSD) to test for separation of means. Significance was based on $P \leq 0.05$ and all statistical procedures were performed using Statistix 7 (Analytical Software 2000).

Assumptions

Hunting seasons in South Carolina are characterized as being long and liberal. However, there are regional differences with respect to season length and bag limits. Statewide, seasons end on January 1. Opening date in the Piedmont is September 15 resulting in a 109-day season, whereas the season opens on either August 15 or September 1 in the Coastal Plain resulting in a 123 or 140-day season. The posted bag limit for bucks is 5 in the Piedmont and a portion of the Coastal Plain with the remainder of the Coastal Plain having no posted bag limit on bucks. Where the 5-buck bag limit is posted there is little opportunity for enforcement because tagging or checking of bucks is not required in either region. Opening dates and bag limits for antlerless deer are uniform across the regions. This analysis assumes that there are no season length or bag limit interactions. Also, since deer harvest rates are being compared, it is assumed that deer densities are similar between the two regions. SCDNR Wildlife Management staff believe that deer densities are in fact comparable because there is no data available that indicates otherwise.

Results

We determined that deer harvest rates were 33 percent greater in the Piedmont than in the Coastal Plain ($F_{1,3} = 22.14$, $P = 0.018$), doe harvest rates were 41 percent greater in the Piedmont than in the Coastal Plain ($F_{1,3} = 18.95$, $P = 0.022$), buck harvest rates were 26 percent greater in the Piedmont than in the Coastal Plain ($F_{1,3} = 26.32$, $P = 0.014$), and doe to buck harvest ratios were 12 percent greater in the Piedmont than in the Coastal Plain ($F_{1,3} = 10.33$, $P = 0.048$) (Table 1). In all cases, LSD means showed separation. Man-days hunted per hunter were 20 percent less in the Piedmont ($F_{1,3} = 20.02$, $P = 0.020$) and LSD means separated. Though days hunted per deer killed were 6 percent less in the Piedmont than in the Coastal Plain, there were no differences detected between years ($F_{1,3} = 2.61$, $P = 0.204$). Finally, humans per deer-vehicle collision were 7 percent less in the Piedmont than in the Coastal Plain with no differences detected ($F_{1,3} = 0.14$, $P = 0.734$).

Discussion

Baiting has been extremely widespread in the Coastal Plain since the late 1980s. We believe that most deer region wide have access to bait and that most hunters rely on baiting to harvest deer. There is competition among hunters and adjacent property owners to insure that bait is continually available to deer and that other hunters respect baited areas.

Baiting typically begins several weeks prior to the hunting season (123-140 day season), therefore, this food source is available for about 6 months annually. In many cases, baiting has moved towards supplemental feeding since it is made available regardless of season and for the purpose of increasing deer condition and density (Ruth 1990). In virtually all instances, shelled corn is the feed and it is typically provided free-choice, i.e. no timed feeders. Feeding rates on some properties are as high as 200-300 kilograms per week per square kilometer (Ruth 1990). On one Coastal Plain area where food habits were studied, utilization of feed by deer was 100 percent during a 5-month sampling period and the feed composed 53 percent of the rumen contents (Ruth and Simmons 1995).

Considering the availability, quantity, and in many cases the purpose, we believe that baiting is related to lower deer harvest rates and increased hunter effort observed in the Coastal Plain.

Effects on physical condition

The effects of feeding on physical condition in deer have been documented (Ozoga and Verme 1982) and may impact the interaction between baiting, hunter effort, and harvest rates. In the Coastal Plain of South Carolina, body weights of deer in 9 of 10 sex-age classes were significantly greater on a property where feeding took place than on a nearby State Wildlife Management Area where baiting or feeding did not occur (Ruth 1990). However, it required over 2 times more effort to harvest deer on the area where feeding took place (3.37 man-days/deer harvested) than on the area with no baiting or direct feeding (1.61 man-days/deer harvested) (Ruth 1990). We believe that as the availability of bait increases and ultimately moves towards supplemental feeding, there can be increased physical condition of deer at the local level. As deer condition increases, the selectivity of foraging should increase while the time spent foraging should decrease. Both factors, increased selectivity of foraging and decreased time foraging,

should reduce deer movements. Any decrease in deer movements should be expected to negatively impact hunter success and deer harvest rates because the animals are less available to hunters.

Effects on movement and behavior

Baiting can change the natural movements, distribution, and behavior of deer. Increased nocturnal behavior by deer related to bait has been noted in Texas (Synatzke 1981) and in Mississippi (Darrow 1993). On one property in the Coastal Plain of South Carolina where visitation to feeding sites was monitored, there was a 25 to 1 rate of visitation by deer during night versus during legal hunting hours (C. Ruth, Unpublished data). This nocturnal movement behavior may be related to increased selectivity of foraging and decreased time spent foraging associated with increased physical condition caused by bait. In any event, when hunters depend on bait to harvest deer, this type of nocturnal movement behavior around bait should be expected to negatively impact hunter success and deer harvest rates.

Deer densities

As the availability of bait moves towards supplemental feeding, reproduction and recruitment can increase creating unnaturally high local deer densities (Ozoga and Verme 1982). Unnaturally high deer densities have been observed in the Coastal Plain of South Carolina. On one 2,837-ha tract, feed consumption increased exponentially ($r = 0.99$) over a 5-year period paralleling the growth in deer density (Ruth 1990). During this 5-year period deer harvest rates also increased exponentially ($r = 0.99$) from 3.7 deer/km² to 15.6 deer/km² (Ruth 1990) and a harvest rate of approximately 20 deer/km² was maintained for a minimum of 5 additional years (C. Ruth, Unpublished data).

A word about deer-vehicle collisions

Deer-vehicle collisions are an issue in South Carolina as they are in most states. Estimates indicate that approximately 1.5 million deer-vehicle collisions occur nationwide annually resulting in approximately \$ 1 billion in damage, 1 million dead deer, 29,000 human injuries, and 211 human deaths (Conover et al. 1995, Conover 1997). In South Carolina, proponents of baiting argue that baiting decreases hunter effort and increases deer harvest rates leading to reduced deer-vehicle collisions.

Although this analysis found no significant differences in humans per deer-vehicle collision, it is interesting to note the following. Human population density in the Piedmont (569 humans/km²) is 33 percent greater than in the Coastal Plain (427 humans/km²). In spite of a higher human population density, humans per deer-vehicle collision were 7 percent less in the Piedmont than in the Coastal Plain. Therefore, not only did the region where baiting takes place exhibit significantly lower deer harvest rates and higher hunter effort, the region exhibited a greater likelihood, though not significantly so, of human being involved in a deer-vehicle collision.

Conclusions

As is the case in most Southeastern states, high deer populations require high annual harvest rates, particularly from the female segment of the population. Proponents of baiting often claim that baiting decreases hunter effort and increases deer harvest rates that will solve problems associated with abundant deer populations. Though counterintuitive for some observers, data from this study suggest a negative, rather than a positive, relationship between baiting and deer harvest rates and hunter effort at the regional level in South Carolina. From a management standpoint, the most important implication is that female harvest rates and female to male harvest ratios were greater in the region where baiting was prohibited. Also, in spite of a higher deer harvest per unit area, annual days hunted per hunter were less in the region where baiting is prohibited than where it is not prohibited.

It is our belief that a combination of factors has created a paradox in which baiting, perhaps more appropriately called feeding in this case, has led to lower harvest rates and increased hunter effort in the Coastal Plain of South Carolina. The most extreme interaction between baiting, hunter success, and deer harvest would involve a point in time when all factors are present; hunter dependence on bait, increased nocturnal behavior by deer around bait and increased deer body condition and densities due to bait. Each of factor eroding hunter effectiveness leading to decreased harvest rates.

We conclude that in the Coastal Plain of South Carolina, these factors are operating because there is substantial evidence that baiting or feeding has negatively impacted deer harvest rates and hunter efficiency. If baiting is the solution to issues associated with abundant deer populations, it is not apparent in the Coastal Plain of South Carolina where baiting has become widespread. Furthermore, the most significant concern of SCDNR Wildlife Management staff is the likelihood that similar interactions would result over time if the prohibition on baiting were eliminated in the Piedmont.

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Table 1. Parameters from South Carolina regions where baiting is prohibited (Piedmont) and not prohibited (Coastal Plain), 2000-2003.

Item	Piedmont LSD means	Coastal Plain LSD means	<i>P</i>	F-value
Total deer harvest (km ²)	6.20	4.65	0.018	22.14
Doe harvest (km ²)	3.13	2.22	0.022	18.95
Buck harvest (km ²)	3.07	2.43	0.014	26.32
Doe:Buck harvest	1.02	0.91	0.048	10.33
Man-days/hunter	17.3	21.7	0.020	20.02
Man-days/deer harvested	8.22	7.78	0.204	2.61
Humans/deer-vehicle collision	1,613	1,503	0.735	0.14