Behavioral Responses of Male White-tailed Deer to Antler Rattling

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Abstract: We observed 111 male white-tailed deer (*Odocoileus virginianus*) responses to four antler rattling sequences performed 171 times during 1992–1995. Thirty-three additional sessions were performed within 200 m of 18 radio-transmittered males during 1994–96. The four sequences, short and quiet ($n = 43$), short and loud ($n = 45$), long and quiet ($n = 43$), and long and loud ($n = 40$), varied by rattling duration and volume. Sequences were randomly chosen and performed near 17 observation towers to test which attracted the greatest number of males. Loud rattling attracted nearly three times as many males as quiet rattling, but duration of rattling did not differ. Greatest response rate was during rut and lowest during prerut. Most responses occurred during the first 10-min rattling segment. Males estimated to be young (1.5 to 2.5 years old) responded more frequently during prerut, middle-aged males (3.5–4.5) during rut, and mature males (5.5+) responded at the greatest rates during postrut. Lower response rates of mature males during rut were likely because they were engaged in courtship of females. Males apparently did not learn to avoid rattling.

Key words: white-tailed deer, *Odocoileus virginianus*, antler rattling

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Male white-tailed deer establish a social hierarchy prior to the breeding season through a series of ritualized dominance displays and threats (Thomas et al. 1965, Brown 1971). Sparring does not involve prior dominance displays or threats and lacks aggression (Goss 1983), but may be the principal method of establishing dominance rank among males (Brown and Hirth 1979). Small-antlered males (≤8 antler points) spar more frequently than large-antlered males and most sparring occurs among males with similar-sized antlers (Michael 1966, Hirth 1973). Sparring begins in September and peaks in October prior to rut and again in late December and January after rut (Brown 1971, Hirth 1973)

Aggressive fights differ from sparring and occur less frequently. Among male white-tailed deer, only 2%–10% of confrontations are classified as aggressive fights (Michael 1966, Brown 1971, Hirth 1973). Aggressive fights typically follow a series of dominance displays and threats. Aggressive fights result from a breakdown in the function of the hierarchal system due to a lack of recognition between males (Brown 1971). Most males have previously sparred with each other and established dominance allowing avoidance of aggressive fights. However, during rut, males were more likely to enter new areas in search of females increasing the likelihood of contact between strange males (Brown 1971). Most aggressive fights occur among larger-antlered (older) males in a contest over females and occur during rut (Michael 1966, Brown 1971, Hirth 1973).

Simulation of sparring or fighting is a common hunting technique used to attract males in many areas of the United States. We measured age class-specific response rates of males to four antler rattling sequences during three periods of the breeding seasons from 1992–1995.

Methods

Experiment One

The initial phase of the study took place at the 3,157-ha Welder Wildlife Refuge in San Patricio County, Texas. Woody vegetation was predominately honey mesquite (*Prosopis glandulosa*) with black brush (*Acacia acacia*), huisache (*A. smallii*), twisted acacia (*A. tortuosa*), and agarito (*Berberis trifoliolata*) in mottes of chaparral (Drawe et al. 1978). The refuge was chosen because of the high deer population, balanced sex and age ratios (Blankenship et al. 1994) and because 17 10-m observation towers dispersed throughout the refuge provided excellent visibility. Deer densi-

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ty at the time of the study was estimated to be 22–31 deer/km^2 (DeYoung et al. 2008).

We determined male response rates to four rattling sequences. Sequences were 30 minutes in length and began with either one (short) or three (long) minutes of rattling followed by seven or nine minutes of silence. This pattern was repeated during the next two 10-min segments. Short and quiet (SQ) sequences included one minute of low volume rattling followed by nine minutes of silence. During quiet sequences elbows were kept against the body to avoid loud antler clashes to simulate two males sparring. Short and loud (SL) sequences were similar to SQ except volume was increased by clashing antlers as hard as possible to simulate fights. In addition, before the rattling began, nearby branches were broken, bark rubbed, and the ground scraped to simulate aggressive fighting. Long and quiet (LQ) sequences included three minutes of low volume rattling followed by seven minutes of silence. Long and loud (LL) sequences were similar to LQ except volume was increased. All rattling sequences were performed by the same two investigators for standardization.

We conducted rattling sequences in random order at randomly chosen towers. Only one sequence was performed at each tower each season. One person performed the rattling upwind of the observer from a clump of brush nearest the tower. The second person observed deer responding and recorded activity with a video camcorder and then on a data sheet. Movements toward the tower by males that became alert after rattling had begun were classified as responses.

Rattling sessions were performed during prerut, rut, and postrut. These periods were determined on the Welder Wildlife Refuge based on reproductive data collected from 943 females during 1961–1992 (Blankenship et al. 1994). All rut rattling sessions were conducted within one week of the mean conception date (22 November). Prerut and postrut were then set as the one-month periods 15–45 days before and after mean conception date. Prerut activity on the Welder Refuge has been reported to last four to six weeks preceding rut (Brown and Hirth 1979).

Ages of responding males were estimated by the observer and reviewed on videotape according to DeYoung et al. (1989) and then placed in one of three age classes. Observers were first trained in estimating age by viewing video of known-age male white-tailed deer.

Experiment Two

The second portion of the study was conducted on the 16,000-ha Faith Ranch in Dimmit and Webb counties, Texas. The ranch is located in the Western Rio Grande Plain region. The gently rolling terrain is dominated by guajillo (*Acacia berlandieri*), blackbrush acacia (*A. rigidula*), guayacan (*Porlieria angustifolia*), and honey mesquite (Gould 1969). Breeding season periods were determined from reproductive data measured on 50 females collected during 1994 (Ruthven et al. 1995). Mean conception date was 24 December.

We had previously attached activity-sensing radio transmitters (Advanced Telemetry Systems, Inc., Isanti, Minnesota) to 48 males throughout the study area. Males were captured using the helicopter drive-net (Beasom et al. 1980) and net gun (DeYoung 1988) techniques, photographed, and ages were estimated according to tooth wear and replacement (Severinghaus 1949). Observers practiced estimating age of free-ranging ear-tagged males ($n = 486$) on the Faith Ranch study area. Estimates were compared to ages indicated by tooth wear and development when males were originally captured.

Eighteen of the 48 males were then located using hand-held telemetry. Males were chosen based on their proximity to a road and were cautiously approached from downwind to a distance estimated to be <200 m. The LL rattling sequence was performed and the male's response monitored with telemetry equipment. If the pulse rate from the signal indicated it became active (Hellickson 2002), and if the signal became stronger, the male was classified as having responded. Visual observations of target males and other males were recorded. Radio-equipped males were then relocated ≥30 minutes after completing the session to measure escape distance and direction.

Results

Experiment One

During 1992–1995, 171 antler rattling sessions were performed and 111 males responded (Table 1). Forty-eight males (43%) were sighted by the person at ground level. Greatest male response rates were to the two sequences incorporating high volume levels (SL and LL), but did not appear to be influenced by rattling length. During prerut, no individual rattling sequence attracted significantly more males, although loud volume sequences combined had greatest response rates. During rut, the loud sequences had the greatest response rates whereas we observed little difference among sequences during postrut.

Response rates were greatest during morning sessions for all sequences except LL, which had greatest rates during afternoon (Table 1). Response rates during rut were greater than responses during prerut and postrut (Table 1). The rut had the greatest rates with ≥one male response per session. During prerut, young males responded at highest rates (Table 2), whereas during the rut, middle-aged males responded in the greatest rates. During postrut, there appeared to be little difference in response rates among age

Table 1. Response rates of male white-tailed deer to four antler rattling sequences (*n* of respondants/sequence) by period of the breeding season and time of day during 1992–1995 at the Welder Wildlife Refuge, San Patricio County, Texas (sample sizes in parentheses).

		Period of breeding season			Time of day			*n* of males responding
Seq[a]	*n*	Prerut	Rut	Postrut	0730–1030	1030–1330	1330–1630	(resp. rate)
SQ	43	0.13 (15)	0.29 (14)	0.43 (14)	0.50 (14)	0.36 (11)	0.06 (18)	12 (0.28)
SL	45	0.38 (16)	1.94 (16)	0.62 (13)	1.61 (19)	0.45 (11)	0.73 (15)	45 (1.00)
LQ	43	0.13 (15)	0.50 (16)	0.67 (12)	0.50 (16)	0.43 (14)	0.23 (13)	18 (0.42)
LL	40	0.57 (14)	1.50 (14)	0.58 (12)	1.00 (16)	0.27 (11)	1.38 (13)	36 (0.90)
Total	171	0.30 (60)	1.07 (60)	0.57 (51)	0.92 (65)	0.38 (47)	0.56 (59)	111 (0.65)

Seq[a] = rattling sequence abbreviations stand for short and quiet (SQ), short and loud (SL), long and quiet (LQ), and long and loud (LL).

classes. Male response rates were greater during the initial 10-minute segment of rattling during loud sequences (Table 3). During quiet sequences, greatest response rates occurred during the second segment. When combining sequences, greatest male response rates occurred following the initial segment.

We observed that response rates generally were greater during rattling sessions performed when winds were light and decreased as wind speed increased. Sixty-seven (60%) of 111 males were first sighted downwind of the observer. Male response rates by tower site varied from 25%–92% (C.V. = 43.3%).

Experiment Two

During 1994–1996, 33 rattling sessions were performed near 18 transmitter-equipped males (Table 4). Response rates tended to be lower during prerut than during rut and postrut. Eleven males were rattled to on ≥2 occasions. In 13 of 14 instances, males responded to rattling during successive sessions. One male responded on all four occasions that a rattling session was performed nearby.

Discussion

Volume of rattling was more important than duration. Seventy-three percent of male responses were to a loud sequence. The only exception occurred during post-rut when response rates were nearly equal among SL, LQ, and LL sequences. Increased response to loud rattling was at least partially due to the greater distances it could be heard. However, males also responded quicker to loud sequences and appeared more aggressive. Males may have become accustomed to sounds of low volume rattling because of the high frequency of sparring during prerut and postrut (Brown 1971, Hirth 1973), reducing their likelihood of response. Also, aggressive fights usually are observed during rut (Brown 1971, Hirth 1973) and are associated with a female nearing estrus (Michael 1966).

Responses were greatest during rut and lowest during prerut in both experiments. Goss (1983) related aggressive fighting in cervids to the seasonal surge in testosterone concentration during rut. He suggested that prerut and postrut peaks in sparring coincided with intermediate levels of testosterone. Previous research has verified the rising production of testosterone during rut and its relation to dominance status (Miller et al. 1987). Fewer responses during prerut and postrut also may be related to the tendency for males to travel in bachelor groups at these times (Brown

Table 2. Response rates of male white-tailed deer to antler rattling (*n* of respondants/sequence) by estimated age class and period of the breeding season during 1992–1995 at the Welder Wildlife Refuge, San Patricio County, Texas (*n* of males responding in parentheses).

Period of breeding season	*n*	Estimated age class 1.5–2.5	3.5–4.5	5.5 +	Total
Prerut	60	0.39 (7)	0.28 (5)	0.33 (6)	0.30 (18)
Rut	60	0.33 (21)	0.48 (31)	0.19 (12)	1.07 (64)
Postrut	51	0.31 (9)	0.34 (10)	0.34 (10)	0.57 (29)
Total	171	0.33 (37)	0.41 (46)	0.25 (28)	0.65 (111)

Table 3. Response rates (*n* of respondants/sequence) of male white-tailed deer to different antler rattling sequences by time segment and volume during 1992–1995 at the Welder Wildlife Refuge, San Patricio County, Texas (*n* of males responding in parentheses).

Time segment[b]	Rattling sequence[a] SQ	SL	LQ	LL	SQ + LQ	SL + LL	Combined
1	0.56 (5)	0.38 (17)	0.28 (5)	0.62 (16)	0.37 (10)	0.46 (33)	0.44 (43)
2	0.11 (1)	0.40 (18)	0.56 (10)	0.15 (4)	0.41 (11)	0.31 (22)	0.34 (33)
3	0.33 (3)	0.22 (10)	0.17 (3)	0.23 (6)	0.22 (6)	0.23 (16)	0.22 (22)
n	43	45	43	40	86	85	17

a. Abbreviations stand for short and quiet (SQ), short and loud (SL), long and quiet (LQ), and long and loud (LL) sequences.
b. Time segment of response for 13 males not recorded.

Table 4. Response rates of radio-transmittered male white-tailed deer (proportion of deer responding) to antler rattling sessions performed within 200 m during different periods of the breeding season and time of day during 1994–1996 at the Faith Ranch, Dimmit and Webb counties, Texas (*n* of time of day sessions performed in parentheses).

Period of breeding season	*n*	Time of day 0730–1030	1030–1330	1330–1630	Total
Prerut	5	0.0 (0)	0.50 (2)	0.33 (3)	0.40
Rut	14	1.00 (5)	0.67 (3)	0.67 (6)	0.79
Postrut	14	0.75 (4)	0.75 (4)	0.83 (6)	0.79
Total	33	0.89 (9)	0.67 (9)	0.67 (15)	0.73

1971). During rut, bachelor groups had disbanded (Brown 1971) and males were seen traveling alone throughout the refuge. Single males observed from towers usually responded to the rattling. This high response rate may have occurred because dominant males were not in the immediate area to discourage subordinates.

Caution should be used in interpreting age class relationships because ages were estimated visually at the Welder Refuge study site. The majority of males that responded during rut peak were identified as young and middle-aged. Low response from mature males likely was because most were actively engaged in chasing or tending females. Hirth (1973) did not observe any males with <8 antler points tending females during 26 observations. He classified 95% of these males as large antlered with ≥8 points. At the Faith Ranch study area the oldest males were less likely to respond to rattling. However, the age structure of the sample was skewed toward older-age males ($x = 6.2$ years) and males ≤3.5 years old ($n = 2$) were under-represented.

During postrut, most young and middle-aged males observed on the refuge had returned to traveling in bachelor groups (Brown 1971). Mature males were typically still engaged in chasing and scent checking females (Brown and Hirth 1979). These single, mature males represented the majority of responses during postrut. According to Blankenship et al. (1994) 75% of females on the refuge are successfully bred during November.

More males responded to morning and afternoon rattling when compared to midday. However, Michael (1966) reported no differences in number of sparring matches observed by hour-of-day. We found no relationships between response rates and temperature, but Michael (1966) observed more matches during below-average temperatures. Most males that responded to our rattling were first sighted downwind from the tower, suggesting that males used the wind to determine what (or who) was producing the sound. Males observed prior to segment one typically circled from their initial position to a position downwind as they approached.

Our results provide evidence that response rates to antler rattling may have utility to index breeding chronology and verify dates for the rut peak. However, observed responses to antler rattling likely will depend on visibility, as well as herd demographics. Additional research is required to evaluate this technique relative to locality, visibility, vegetation type, and herd characteristics.

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