CAPTURE SUCCESS OF WHITE-TAILED DEER IN THE CENTRAL BLACK HILLS, SOUTH DAKOTA

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ABSTRACT

Capture success of white-tailed deer (*Odocoileus virginianus*) can vary based upon trap location, quality and type of bait used, population density, population age/sex characteristics, weather conditions, and deer behavior. Capture and release studies provide useful information regarding size, health, and physical characteristics of populations. The purpose of our study was to evaluate capture success and physical characteristics of white-tailed deer in the central Black Hills of South Dakota. Deer were captured in February and March 1993-1994 in modified Clover traps baited with alfalfa (*Medicago sativa*) hay. Traps were placed in four locations northeast, northwest, and west of Hill City, South Dakota. A subsample (40, 1993; 27, 1994) of captured deer was fitted with radio-transmitters to document mortality. A total of 394 (193, 1993; 201, 1994) deer were captured during the two years of the study. Overall capture success declined ($P = 0.033$) from 67.3% in 1993 to 39.7% in 1994. Comparisons were made for chest girth and hind leg length among the four trapping locations. Capture mortality (5.6%) was similar ($P = 0.482$) over the two years. Winter mortality of radio-collared deer was 20% in 1993 and 18% in 1994. Lowered capture success of deer in the central Black Hills in 1994 may have occurred due to population density reduction, weather conditions, and/or deer behavior.

INTRODUCTION

Capture success of white-tailed deer (*Odocoileus virginianus*) can vary based upon trap location, quality and type of bait used, population density, population age/sex characteristics, weather conditions, geographic region, and deer behavior (Lewis and Farrar, 1968; Mattfeld et al., 1972; Morgan and Dusek, 1992; Naugle et al., in press). Capture and release studies provide useful information regarding size, health, and physical characteristics of populations. Furthermore, information obtained from these studies may allow wildlife managers to estimate survival rates of herds and adjust management practices according to level of winter mortality.

Presently, little information has been recorded on capture success of white-tailed deer in the Black Hills of South Dakota. The purpose of our study was to compare capture success and physical characteristics for white-tailed deer in the central Black Hills.

STUDY AREA

White-tailed deer were captured on winter ranges located northeast, northwest, and west of Hill City, South Dakota. Winter ranges were Horse Creek Burn (44° 00' N, 103° 30' W), Clog-China Gulch (43° 58' N, 103° 32' W), Hill City West-Battle Ax (43° 55' N, 103° 37' W), and Slate Creek (44° 01' N, 103° 38' W). Elevations of the various areas ranged from 1523-1767 m above mean sea level. Land within the study area is managed primarily for timber production, livestock grazing, and deer winter use by the USDA Forest Service, Pactola and Harney Ranger Districts.

Dominant overstory vegetation of the region consists of ponderosa pine (*Pinus ponderosa*) interspersed with small stands of aspen (*Populus tremuloides*) and paper birch (*Betula papyrifera*). Understory vegetation on winter range consists of small, sparsely vegetated, intermittent stands of grass/forb, snowberry (*Symphoricarpos albus*), spiraea (*Spiraea betulifolia*), serviceberry (*Amelanchier alnifolia*), woods rose (*Rosa woodsii*), bearberry (*Arctostaphylos uva-ursi*), and various cherry (*Prunus spp.*) species.

METHODS

White-tailed deer were captured during February and March 1993-1994 using modified, single-gate Clover traps (Clover, 1956) baited with fresh alfalfa (*Medicago sativa*) hay. Traps were placed on level ground near well-used deer trails on known deer winter ranges. All traps were positioned with clear release routes to prevent injury to deer (Rongstaad and McCabe, 1984). The majority of traps were placed behind closed USDA Forest Service roads. Traps placed along open roads were set well away from the road to minimize disturbance to captured animals (Rongstaad and McCabe, 1984). Topographical characteristics (e.g., hills, curves in roads) were used in trap placement to provide easy vehicular access while minimizing stress on trapped animals. Traps were checked each morning.

Upon capture, deer were manually restrained and a breathable bag was placed over the deer's head to minimize stress. Deer ages were estimated based on lower incisor wear (Griffin, unpubl. data). Deer were aged as fawn (0.5 years), yearling (1.5 years), or adult (nearest 0.5 year). Chest girth and lower hind leg length were measured to the nearest 0.5 inch (later converted to cm) using a fabric tape. Chest girth was measured directly behind the front shoulder, and lower hind leg length was measured from the tuber calcis to the top of the hoof (Sauer, 1984). Additionally, all deer were fitted with cattle ear tags that were color coded to area of capture and numbered for individual identification. Sexes were marked in different ears (females right ear, males left ear) for sex identification when numbers were not readable (Griffin et al., in press). In 1993, selected adult and yearling female deer were fitted with radio collars (Telonics Inc., Mesa, Arizona). In 1994, selected adult and yearling male and female deer were fitted with radio collars (Telonics Inc., Mesa, Arizona; Lotek Engineering, Inc. Ontario, Canada). When these procedures were completed, the breathable bag was removed and deer were released into clear escape routes. Capture myopathy was rejected as a cause of winter mortality if deer were alive after a period of seven days following release from traps.

Capture success was calculated as total number of deer captured divided by total trap nights (i.e., total traps checked per day). Data were analyzed using paired t-tests, chi square (Yate's correction for 2x2 table), and analysis of variance. All analyses were performed using SYSTAT (Wilkinson, 1990). Statistical comparisons were considered significant at observed significance levels ≤ 0.05.

RESULTS

Average temperature for trapping dates was 6.2°C in 1993 and 7.6°C in 1994. Total number of deer captured was 394 (193 in 1993, 201 in 1994). Capture success declined ($P = 0.033$) from 67.3% in 1993 to 39.7% in 1994. Capture success comparisons of the four trapping locations ranged from 46.7% to 82.7% in 1993 and from 26.3% to 50.0% in 1994. Estimated age of all captured deer was 3.8 (± 0.2) in 1993 and 4.0 (± 0.3) in 1994. Sex ratio (23 males per 100 females, 1993; 34 males per 100 females, 1994) was similar ($P = 0.211$) across the two years. Likewise, recapture rate was similar ($P = 0.631$) over the two years of the study (12.44%, 1993; 14.93%, 1994). Chest girth of all captured deer was 81.6 cm (± 0.7) in 1993 and 81.1 cm (± 0.8) in 1994 (Table I). Chest girth measurements for age classes in 1993 were 87.0 cm (± 0.4) for adults, 81.4 cm (± 1.0) for yearlings and 68.1 cm (± 0.6) for fawns. Chest girth measurements in 1994 averaged 88.5 cm (± 0.5), 83.1 cm (± 1.1), and 68.4 cm (± 0.5) for adults, yearlings, and fawns, respectively (Table 1). When analysis included area of capture, chest girth was lower in 1993 than 1994 for all age classes in Hill City West ($P = 0.033$) and Slate Creek ($P = 0.003$) (Table 2). Hind leg length for all captured deer in 1993 and 1994 was 38.9 cm (± 0.2) and 38.6 cm (± 0.2), respectively (Table 1). Hind leg length measurements of age classes in 1993 were 40.1 cm (± 0.1) for adults, 39.3 cm (± 0.3) for yearlings and 35.7 cm (± 0.2) for fawns. Hind leg length measurements in 1994 averaged 40.2 cm (± 0.1), 40.0 cm (± 0.4), and 35.7 cm (± 0.2) for adults, yearlings, and fawns, respectively (Table 1). Hind leg length measurements did not differ ($P = 0.459$) across years and area (Table 2). Capture mortality (6.7%, 1993; 4.5%, 1994) did not differ ($P = 0.482$) over the two years of the study. In 1993, 40 female deer were fitted with radio collars. Of these, 20 died before the 1994 trapping season. In 1994, 27 (18 female, 9 male) deer were fitted with radio collars. Winter mortality, January-April, of radio-collared female deer (8 of 40 deer, 20%, 1993; 7 of 38 deer, 18%, 1994) was similar ($P = 1.00$) for the two years.

Table 1. Chest girth (cm ± SE) and hind leg length (cm ± SE) by age class of white-tailed deer in the central Black Hills, South Dakota, 1993-1994.

		Age			
Year	Characteristic	Adult	Yearling	Fawn	Total
1993	Girth	87.0 ± 0.4	81.4 ± 1.0	68.1 ± 0.6	81.6 ± 0.7
1994	Girth	88.5 ± 0.5	83.1 ± 1.1	68.4 ± 0.5	81.1 ± 0.8
1993	Leg	40.1 ± 0.1	39.3 ± 0.3	35.7 ± 0.2	38.9 ± 0.2
1994	Leg	40.2 ± 0.1	40.0 ± 0.4	35.7 ± 0.2	38.6 ± 0.2

Table 2. Chest girth (cm ± SE) and hind leg length (cm ± SE) by year and area of white-tailed deer in the central Black Hills, South Dakota 1993-1994.

Year	Characteristic	Horse Creek	Clog-China Gulch	Hill City West	Slate Creek	Average
1993	Girth	79.8 ± 0.8	80.0 ± 0.8	75.9 ± 1.0	77.5 ± 1.3	78.2 ± 0.5
1994	Girth	80.8 ± 0.8	78.5 ± 0.8	79.0 ± 1.0	82.8 ± 1.5	80.3 ± 0.5
Average	Girth	80.3 ± 0.5	79.2 ± 0.5	77.5 ± 0.8	80.3 ± 1.0	
1993	Leg	38.9 ± 0.3	38.6 ± 0.3	38.9 ± 0.3	38.6 ± 0.5	38.8 ± 0.3
1994	Leg	39.1 ± 0.3	38.9 ± 0.3	38.6 ± 0.3	38.9 ± 0.5	38.9 ± 0.3
Average	Leg	39.0 ± 0.3	38.8 ± 0.3	38.8 ± 0.3	38.8 ± 0.3	

DISCUSSION

Capture success of white-tailed deer may vary based on trap location and quality and type of bait used (Mattfeld et al., 1972; Naugle et al, in press). Therefore, the same trap locations and alfalfa source were used to minimize variation in capture results over the two years. Hence, these variables were not considered important factors relating to the observed variation in capture success across the two years.

Lowered capture success in 1994 could have occurred due to weather conditions. The winter of 1993 was more severe than 1994 with deeper average snow depths (27.7 cm, 1993; 22.4 cm; 1994) and lower average temperatures (6.2 °C, 1993; 7.6 °C, 1994). Similarly, the winter of 1993 had 114 days with at least 2.5 cm of snow on the ground compared with only 52 days in 1994 (NOAA, 1993; 1994). In years with heavy snowfall, deer are forced into areas with high overstory (> 70%), which reduces total snow accumulation and thus allows for easier deer movement while reducing energy costs for locomotion (Parker and Gillingham, 1990). Therefore, an expanded area of use due to low snow cover in 1994 could be associated with decreased capture success. However, all 1993 radio-collared deer returned to their traditional winter ranges, which indicated that concentrations should have been similar across the two years. Although hind leg length, and age and sex distributions were similar across the two years of the study, chest girth measurements for deer on two winter ranges were lower in 1993 than in 1994. Therefore, decreased chest girth may have been related to severity of the winter.

Capture mortality of captured deer was similar over the two years and occurred from various causes. The most common cause of mortality was broken bones, which may be related to the submaintenance condition of deer consuming poor-quality winter diets. Our results suggest that capture myopathy was not a significant problem during our study. Capture mortality was similar across ages between the two years, suggesting that mortality was not more prevalent in the fawn age class.

Winter mortality of radio-collared female deer occurred due to a variety of causes. During 1993, six radio-collared female deer died of natural causes believed to be related to winter severity, one died from predation, and one was struck by a vehicle. During 1994, two radio-collared female deer died from illness/injury related to natural causes, three from predation, and two from unknown causes. Although the overall winter mortality between years was not significantly different, we believe that weather-related mortality from 17 February to 30 April in 1993 (6 of 8 mortalities) was higher than 1 January - 30 April 1994 (2 of 7 mortalities).

Increased harvests in 1993 within the general region of the central Black Hills might have contributed to lower deer numbers wintering in the study area in 1994. Harvest of female deer in the central Black Hills increased over the three-year-period from 272 in 1991 to 1320 in 1993. Conversely, harvest of males for Pennington County was relatively constant for 1991-1992 (1556 and 1695) but declined (1263) in 1993 (McPhillips, 1991; 1992; 1993). This decline in male harvest may have resulted from an increased winter loss of fawns during 1993. However, this decline was not apparent in the age and sex characteristics of captured deer in 1994 compared to 1993.

Because of possible associations among capture success, chest girth, climatic conditions, and harvest rates, information obtained from this study may be useful in estimating winter survival rates and herd densities. Consequently, capture-related information could be useful to wildlife managers when evaluating harvest strategies and modifying hunting regulations.

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