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CHANGES IN MULE DEER SIZE IN UTAH[1]

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ABSTRACT.—Trends in age-specific, eviscerated carcass weights were determined for hunter-harvested yearling and two-year-old buck mule deer. Carcass weights declined over an 11-year period from two areas of similar management, but with independently collected data sets. Carcass weights also declined between the opening and second weekends of the hunt. Management implications are discussed.

Mule deer (*Odocoileus hemionus*) bucks, especially large, mature animals, have sport hunting, economic, and intrinsic values (Wennergren 1968). However, perceptions of a quality hunt or buck vary considerably among hunters as evidenced by the various types of hunts established by state wildlife agencies in response to hunter input. As hunting intensity has augmented and increased the impacts on wildlife populations, and as human population growth has usurped range areas traditionally used by wildlife, game managers have been increasingly pressed to maintain quality programs. Consequently, in Utah either-sex hunting regulations during the 1960s were replaced by buck-only restrictions in the early 1970s to compensate for increasing hunter numbers using a limited resource. Antler restriction and limited-entry hunts have become increasingly common in the 1980s, with motivation for more restrictive regulations coming from hunters and biologists interested in quality hunting in terms of maintaining high numbers of mature, harvestable bucks, and restricting hunter numbers. This paper examines long-term trends of age-specific changes in the size of hunter-harvested mule deer in Utah.

METHODS

STUDY AREAS.—The Daniels Canyon checking station located in north central Utah stopped about 17,000 hunters per year (1975–85), with about 70% of the hunters returning from the Current Creek and Avintaquin deer units. The Blacksmith Fork station in northern Utah checked about 2,700 hunters (1973–83) from a portion of the Cache deer unit, mostly within the Blacksmith Fork drainage. Between 1973 and 1985 both areas had 11-day buck-only hunts, except in 1973 when the area served by the Daniels Canyon station held a three-day either-sex hunt followed by eight days of buck-only hunting. All deer hunts began the Saturday closest to 20 October.

DATA COLLECTION.—Checking station data were collected and reviewed for the two areas. Eviscerated carcass weight, age, and antler tine data were collected at checking stations during most years. Data were collected during the first and/or second weekends of the hunt. Deer were weighed to the nearest .5 kg and field aged as $1^1/_3$, $2^1/_3$, or $3^1/_3+$ years by tooth eruption and wear methodology (Robinette et al. 1957). All antler tines exceeding 2.5 cm (Robinette et al. 1977), but excluding brow tines, were counted on intact antler pairs only at Daniels Canyon.

DATA ANALYSES.—The factors of year, age class, and weekend were initially used for analyzing the carcass weight data (1975–85) from Daniels Canyon. However, because there were many missing three-way cells, and there appeared to be a significant difference between weekends, the data were divided into four sets for analysis: (1) first week, age 1, (2) first week, age 2, (3) second week, age 1, and (4) second week, age 2. Least squares procedures and a two-factor linear model were

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TABLE 1. Deer carcass weights and tine counts from Daniels Canyon and Blacksmith Fork checking stations, Utah (sample sizes in parentheses).

Age (in years)	First weekend		Second weekend			
	1 1/3	2 1/3	1 1/3	2 1/3	1 1/3	2 1/3
Year	Weight[1]	Weight	Weight	Weight	Tines[2,3]	Tines[4]
Daniels Canyon						
67–68	44.9 (19)	57.2 (14)	—	—	—	—
75	45.1 (85)	58.3 (29)	43.7 (42)	56.1 (10)	16.5 (127)	17.9 (39)
76	44.0 (140)	58.5 (38)	43.1 (95)	55.5 (24)	—	—
77	43.8 (38)	59.5 (9)	—	—	—	—
78	42.5 (46)	52.7 (7)	—	—	—	—
79	—	—	41.9 (50)	55.7 (27)	—	—
80	—	—	41.0 (52)	50.6 (2)	44.2 (52)	50.0 (2)
81	—	—	40.6 (104)	51.8 (5)	26.0 (104)	20.0 (5)
82	—	—	42.1 (82)	53.4 (7)	18.3 (82)	57.1 (7)
85	41.1 (59)	52.3 (6)	40.6 (53)	51.9 (10)	33.0 (273)	27.2 (33)
87	41.1 (51)	54.1 (53)	—	—	26.8(1627)	30.2 (69)
Blacksmith Fork						
66	47.2 (33)	63.9 (12)				
73	50.1 (22)	64.8 (11)				
79	44.2 (44)	58.9 (14)				
80	43.0 (45)	60.6 (6)				
81	41.9 (40)	No Data				
83	41.6 (43)	56.7 (6)				
86	44.4 (52)	No Data				
87	42.8 (102)	54.5 (32)				

[1]Eviscerated carcass weight (kg).
[2]A tine is defined as a minimum length of 2.5 cm excluding brow tines.
[3]Percentage of yearling deer with two tines on both antlers combined (spikes).
[4]Percentage of 2 1/3-year-old bucks with four or fewer tines on both antlers combined.

used. Deer aged 3 1/3+ years were not considered in this manuscript because of the potential variation of actual age within the class. The data from Blacksmith Fork (1973–83) were consistently collected on the first weekend. These data were independently analyzed using the same statistical test as a check to the conclusions of the Daniels Canyon analysis.

Antler data from Daniels Canyon were analyzed using chi-square comparisons of tine counts across years. Because the weekend effect was not significant, the data were pooled.

Because of the important implications derived from the data sets, additional, supplementary data were obtained. Two sets of carcass weight data, collected before 1970, but under either-sex hunting regulations, were compared using the 95% confidence intervals to the endpoints of the regression equations. Three sets of recent data were collected after 1985 for data trend verification and were similarly compared.

RESULTS

Carcass weights from Daniels Canyon decreased ($P = .02$) between the first and second weekends. Yearling bucks decreased a mean 2.1% in weight, and two-year-old bucks declined 3.3% between weekends.

Over an 11-year period, trends in carcass weight have been negative at Daniels Canyon (Fig. 1). Between 1975 and 1985 the weight of yearling bucks decreased 8.9% ($P = .03$) and 7.1% ($P = .02$) for the first and second weekends, respectively. Weight in two-year-old bucks decreased 10.1% ($P = .12$) and 7.5% ($P = .03$) for weekends one and two, respectively.

Results of the Blacksmith Fork analysis during a comparable period (1973–83) showed a similar decrease in carcass weight. Weight in yearlings declined 17.0% ($P = .005$) and 12.5% ($P = .04$) in two-year-old bucks.

Tine counts of yearling bucks checked at Daniels Canyon (Table 1) were greater in 1975 than during 1980–85 ($P = .01$). In 1975, 16.5% of the harvested yearling bucks were spikes, whereas the mean percentage of spikes harvested 1980–85 was 30.4%, with three of four years being significantly different

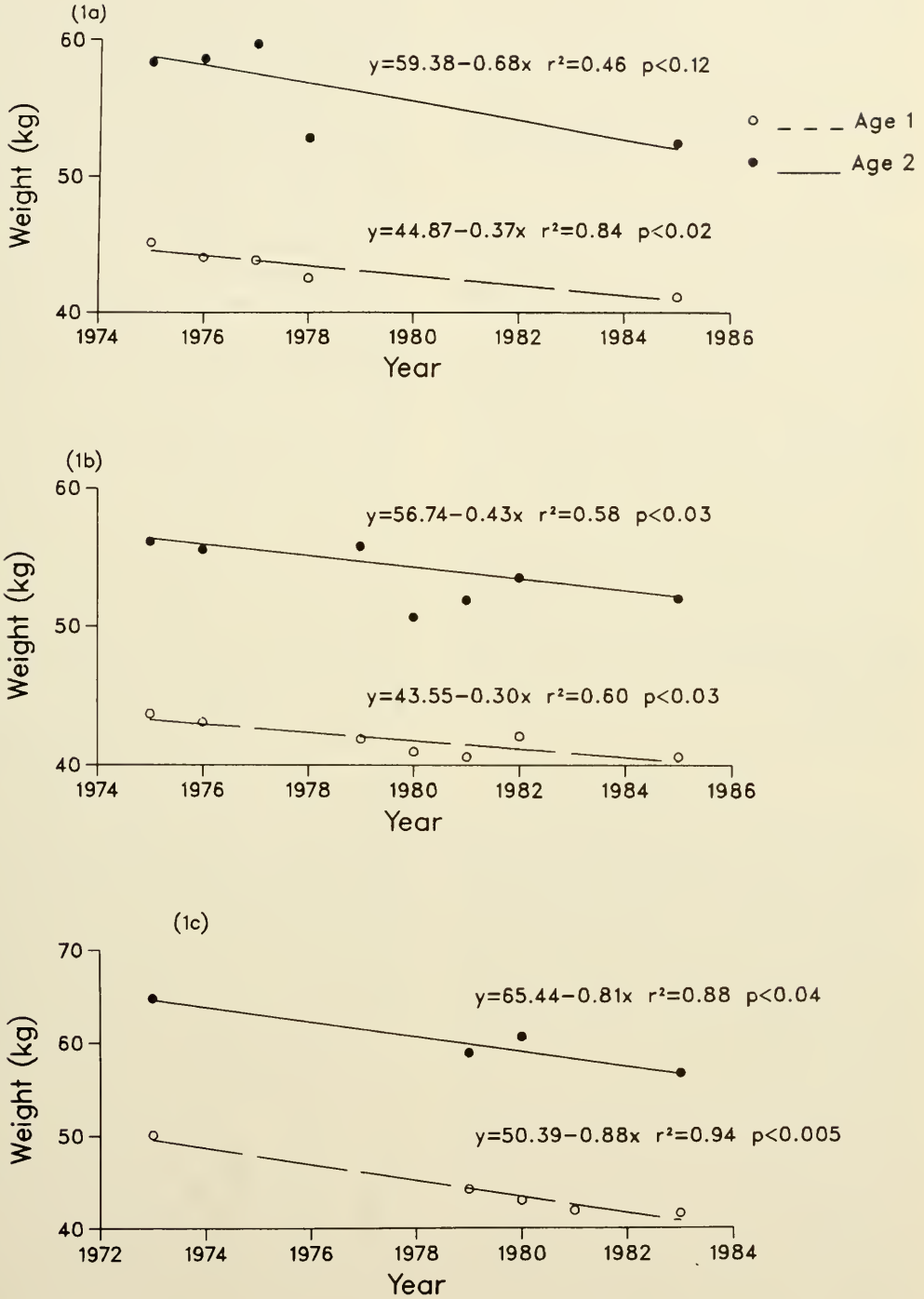

Fig. 1. Decline of mean eviscerated weight of hunter-harvested buck deer aged 1⅓ and 2⅓ years during the first (1a) and second (1b) weekends of the regular Utah deer hunt from Daniels Canyon checking station and during the first weekend from Blacksmith Fork (1c).

from 1975 ($P = .05$). However, significant differences were also found among years from 1980 to 1985 ($P = .01$). Tine counts of two-year-old bucks at Daniels Canyon in 1975 did not differ from combined years 1980–85 ($P = .21$) or among years 1980–85 ($P = .26$). However, 17.9% of bucks in 1975 had four or fewer antler tines, whereas in 1980–85, the mean was 31.9%.

Data collected at Daniels Canyon 1967–68 were combined because of small sample sizes (Table 1). The mean weights for yearling and two-year-old bucks (1967–68) were not different from the 1975 predicted weights. Yearling weights were different from the 1985 value, but two-year-old buck weights were not different. Both yearling and two-year-old buck weights from Daniels Canyon (1987) were not different from the 1985 predicted weights, but were different from those of 1975. Weight data from Blacksmith Fork (1966) were not different from the 1973 weights, but differed from the 1983 weights. The 1986 yearling weights differed from both the 1973 and 1983 predicted weights. Weights for both yearlings and two-year-old bucks in 1987 did not differ from those of 1983, but did differ from the 1973 weights.

DISCUSSION

The decrease in carcass weight between the first and second weekends of the hunt indicates the need for consistent timing of data collection. The data also suggest that physical condition indices (e.g., Austin 1984) collected during the first weekend of the hunt would not be representative of the herd at the hunt's end. A probable cause of the weight loss between weekends is hunter harassment, although other factors, including rutting activity and hunter selection, may also be important. Nonetheless, where overwinter survival is questionable, this degree of weight loss may be important, particularly its impacts on does and fawns.

Reduction in carcass weight and the corresponding, although weaker, reduction in number of antler tines suggest that age-specific deer size has declined in Utah. In our study, and others, weight appears to be the more sensitive index (Kie et al. 1983, Williams and Harmel 1984). Results from Daniels Canyon and Blacksmith Fork show a gradual decline in buck size from the same deer populations over more than a decade. Both areas were under similar management and showed about the same loss in size of deer.

Data collected since 1985 at both Daniels Canyon and Blacksmith Fork supported the findings of reduction in body size, in that mean weights and numbers of antler tines remained low. Data collected previous to 1970 suggest age-specific deer size probably did not decrease before the early 1970s.

A probable consequence of size decline in younger age classes is a parallel reduction in age-specific size of mature bucks. Williams and Harmel (1984) reported changes in number of antler points and live-body weights of 60 pen-reared white-tailed buck deer, fed 16% protein diet *ad libitum*, during ages 1½, 2½, and 3½ years. They found that the number of antler points and the weights at ages 2½ and 3½ years were directly correlated with the number of antler points and weights attained by the same deer at younger ages. The corollary is that weight and antler size of older-aged bucks are also related to yearling characteristics. Consequently, the probability of older bucks being large trophy has likely also declined in Utah.

Regulations of Utah's deer hunt changed from either-sex to buck-only hunts in the 1970s, with 1973–74 being transition years. Because data collected prior to 1970 suggested no age-specific changes in size, attention should be given the potential effects of changing regulations and their effect on buck populations and quality of animals. However, partitioning the important factors potentially responsible for the observed decline was not possible. Nonetheless, several factors should be considered. First, phenotypic changes in deer populations due to hunter selectivity for larger bucks may have occurred. Scribner et al. (1984) demonstrated through modeling that selective removal of spike white-tailed bucks will gradually lower the incidence of spikes in the buck population; conversely, selective removal of nonspike yearlings would increase the incidence of spikes. Second, with increasingly wide buck-to-doe ratios and the lowering of the mean age of the buck population, both of which result from intensive buck-only hunting, a delay in the mean breeding date causing a similar delay in the fawning date may have occurred. In support, Reimers

(1983) showed a significant relationship between a delay in the date of calving and reduced dressed weight of females 2+ years in wild reindeer (*Rangifer*). Third, a density-dependent response to buck-only hunts may have occurred. Buck-only regulations may have allowed population density of females and fawns to increase and, consequently, nutrition limited phenotypic expression of genetic potential. In support, the modest rebound in weight from Blacksmith Fork in 1986 followed a marked population decline due to previously harsh winters (1983–85). McCullough (1979) discussed population growth within finite available resources and demonstrated a decrease in recruitment as carrying capacity was approached. A similar decrease apparently occurs in animal size, as observed for yeld hinds (Clutton-Brock and Albon 1983). Kie et al. (1983) reported reduced body weights and number of antler tines with increased density of white-tailed deer. Finally, climate has been shown to affect fluctuations in deer size on a yearly basis (Robinette et al. 1977), and, consequently, long-term weather trends might also be involved. Additional research is needed to identify the specific factors involved, as well as management alternatives to address the problem.

In summary, eviscerated carcass weight and number of antler tines for yearling and two-year-old buck deer were shown to decrease from 1973 to 1985 in two areas of Utah under buck-only hunting regulations. Although the reduction in size corresponded with changes to buck-only hunting, the effects of individual factors could not be partitioned.

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