Relationship of Birth Date and Physical Development of Yearling White-tailed Deer in Florida

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Abstract: Body mass and antler measurements from yearling, male white-tailed deer (*Odocoileus virginianus*) harvested in pine flatwoods of northwestern Florida were used to test the relationship between estimated birth date and physiological indices. Age, estimated by the degree of third mandibular molar eruption, was related to the body mass and antler development of yearling bucks ($P < 0.001$). Late parturition in this region appears to contribute to poor antler development and low body mass of yearling bucks. The effects of late parturition on the physical development of yearling bucks should be considered when developing and evaluating harvest management strategies in this region.

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The breeding season of white-tailed deer from southern states is more asynchronous than the breeding season in northern states (McDowell 1970). Conception and parturition extends over a 3- to 6-month period in many southeastern states (Lueth 1956, Teer et al. 1965, Roberson and Dennett 1966, Weber 1966, Payne et al. 1967, Wilson and Sealander 1972, Jacobson et al. 1979, Richter and Labisky 1985). In portions of northwestern Florida the parturition period is late summer (August–October) (Richter and Labisky 1985). The effect of late birth on the body mass and antler development of yearling bucks has not been clearly demonstrated in the Southeast. However, Knox et al. (1991) indicated that late birth of deer in South Carolina affected the physical condition of yearlings. Herd condition and harvest

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and habitat management strategies often are evaluated using physiological indices of yearling bucks (Taber 1958, McCullough 1979, Severinghaus and Moen 1983). The effects of late birth on the physiological indices of yearling bucks could have serious management implications in the Southeast.

Compared to white-tailed deer in other forest types of the Southeast, deer from Florida flatwoods characteristically have lower body mass and exhibit poorer antler development (Harlow and Jones 1965*a*). Low forage quality in pine flatwoods (Harlow 1965, Short et al. 1969, Tanner and Terry 1982*a,b;* Wood and Tanner 1985) may be the major cause of low body mass and poor antler development (Shea et al. 1992). However, the late parturition period in northwest Florida also could contribute to poor physical development of yearling bucks. The objective of our study was to determine if antler development and body mass of yearling bucks in northwest Florida were related to estimated birth date as determined by molar eruption.

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Methods

Study Area

Study sites included the Apalachicola Wildlife Management Area (WMA) (2,263 km^2), Edward Ball WMA (135 km^2), G. U. Parker WMA (91 km^2), and the Moore's Pasture unit (177 km^2) of Point Washington WMA. These areas were located within an 85-km radius in Bay, Calhoun, Gulf, Liberty, and Wakulla counties of northwest Florida. Study sites were owned by large timber companies with the exception of the Apalachicola WMA, which was national forest, and a small portion of the Moore's Pasture unit which was state forest. The Florida Game and Fresh Water Fish Commission (GFC) managed deer populations and public hunting on all areas.

Pine flatwoods was the predominant habitat type on all study sites. Flatwoods soil associations comprised 85%, 84%, 86%, and 87% of the areas on the Apalachicola WMA, Edward Ball WMA, G. U. Parker WMA, and Moore's Pasture unit, respectively. Large plantations of slash pine (*Pinus elliottii*), interspersed with titi (*Cliftonia monophylla*) and cypress (*Taxodium* spp.) swamps dominated most areas. However, sand pine (*P. clausa*) and longleaf pine (*P. palustris*) were planted on some well drained sites. Flatwoods had little topographic relief and soils were poorly drained, acidic, sandy loams (Duffie et al. 1984, Abrahamson and Harnett 1990). Wood and Tanner (1985) reported that browse nutrient levels were not significantly different among flatwood soil series in northwest Florida.

We considered the carrying capacity for white-tailed deer to be similar on all sites, based on the parity of soil associations, habitat types, and timber management practices.

Data Collection and Analysis

Biological data and samples, including whole body mass, antler dimensions (i.e., beam length and antler points), and lower mandibles were collected from 300 yearling, male deer harvested on study sites from 1988–90. Legal bucks were required to have 1 or more antlers ≥2.5 cm long. Data were collected by GFC personnel at mandatory check stations or by a roving patrol.

Yearling deer were identified using tooth eruption and attrition (Severinghaus 1949). Relative ages of yearling bucks were calculated by measurement of the degree of eruption of the third molar on the lower mandible (M3). Perpendicular distances (to nearest mm) from the gum-line to the top of each buccal crest (C) on M3 were measured, and the degree of eruption (E) was calculated by summing the measurements ($E = C_1 + C_2 + C_3$). Measurements were taken from 300 mandibles collected during 1988–90.

Statistical analyses were done with the System for Statistics (SYSTAT) software package (Wilkinson 1988). Linear regression analyses were used to test the relationship of E values to main beam length and body mass of yearling bucks. Harvest date (Julian day) was used as a control variable in regression models because differences in tooth eruption were dependent on harvest date. Harvest dates ranged from November through February.

Results

The mean whole mass of 1.5-year-old bucks was 41.5-kg (SE = 0.3, N = 300). The average main beam length of antlers was 11.2-cm (SE = 0.2, N = 298). The mean number of points on antlers of yearlings was 2.5 (SE = 0.04, N = 300). The percentage of spike-antlered yearling bucks harvested was 79.3.

E values for M3 ranged from 0–24 mm. No M3 molars were fully erupted and the 3-cusped fourth milk premolar was replaced in only 1 of 300 mandibles. Linear regression analyses indicated that there was no area ($P = 0.331$) or year ($P = 0.482$) effect on E values. Linear regression identified significant relationships between E values and the main beam length ($R^2 = 0.30$, $P < 0.001$, $N = 298$) and body mass ($R^2 = 0.21$, $P < 0.001$, $N = 300$) of yearling bucks. The prediction equations for beam length and body mass were: beam length = 7875 + 0.349 (E value) and body mass = 75.618 + 1.168 (E value).

Discussion

Severinghaus (1949) reported that the deciduous fourth milk premolar is replaced when deer are approximately 18 months old. Fully exposed permanent premolars and complete eruption of M3 may occur by 19 to 22 months of age (Severinghaus 1949, Sauer 1984). All yearling deer collected between November and February appeared to be <18 months old, based on these criteria.

Although there may be some colinearity between tooth eruption and physical condition, we assumed the degree of eruption of M3 was affected more by date of birth. Shea et al. (1992) reported that the poor range quality of pine flatwoods in northwest Florida was responsible for low body mass and poor antler development of yearling bucks. They reported that physical condition was insensitive to changes in population density. Although data were collected over a 3-year period from 4 study sites, these variables did not effect tooth eruption in our study. These findings suggest that there was no difference in nutritional plane among areas or years. Since all deer came from range of similar quality, differences in physical condition probably are not related to range quality. Because the parturition period has such a wide range in this region (Richter and Labisky 1985), differences in physical condition are most likely caused by differences in age.

Severinghaus (1949) reported that the lower third molar begins to erupt after 12 months and is fully erupted by 20 to 22 months. Deer with more complete eruption of this tooth are most likely older than those with less eruption. Therefore, E value was used as an index to the relative age of yearling deer. Smaller E values were assumed to represent later parturition dates.

The strong relationships between E values and main beam length and mass suggest that birth date affects the physical development of yearling bucks. Although R^2 values were low in both regression models, this was expected since factors other than age also affect the body mass and antler development of yearlings. These relationships suggest that late parturition probably contributes to the low body mass and poor antler development of yearlings in this region. These results are similar to those of Knox et al. (1991) who reported that late birth affected the physical development of yearling bucks in South Carolina. Zwank and Zeno (1986) also reported a relationship between birth date and weight gain. Studies of penned deer also have documented poor antler development of yearlings that are born late in the year (H. A. Jacobson, unpubl. data).

Causey (1990) reported that the weight and antler development of yearling bucks was not related to birth date of captive deer in Alabama. However, he indicated that the extension of these findings to wild deer may be inappropriate because of nutritional deficiencies that may occur in the wild. The nutritional deficiencies of pine flatwoods in our study most likely intensifies the affect of late birth on physical development.

Yearling, white-tailed bucks probably complete antler growth at 12 to 14 months of age, based on the antler cycle (Harlow and Jones 1965*b*, Shea et al. 1990) and parturition period in this region. Body growth often takes precedence over antler development of yearling bucks (French et al. 1956). Antler development may be poor among late born bucks because of a shortened growth period and reduced nutrient availability in late-season forages (Tanner and Terry 1982*b*).

Late parturition probably contributes to the high percentage of spike-antlered yearling bucks in this region. Knox et al. (1991) also reported that the number of antler points of yearlings was related to birth date. The percentage of spike-antlered yearlings found in our study is higher than that reported by Harlow and Jones (1965*a*) for north Florida flatwoods. Although their figures also indicated a high percentage of spike-antlered bucks in the 1.5-year-old age class (60.6%), GFC regulations required legal bucks to have 1 or more antlers at least 12.5 cm long during the study period. In our study 78.2% of spike-antlered yearlings and 65.8% of all yearling bucks had main beam lengths <12.5 cm. Under a 12.5 cm-minimum antler length law, most spike-antlered yearlings would not have been legal to harvest on our study areas. Under current harvest regulations, Harlow and Jones (1965*a*) would probably have had a higher percentage of spike-antlered yearling bucks.

Management Implications

Evaluation of Herd Management.—Many deer managers attempt to improve the habitat and forage quality of pine flatwoods through prescribed burning, herd reduction, agricultural plantings, and supplemental feeding. Biological data on the physiological indices of yearling bucks harvested during the hunting season are used to evaluate herd condition and the effects of habitat management programs. The over-riding effect of late parturition on the physical development of yearling bucks could diminish their effectiveness as a tool in assessing the benefits of management efforts. The effects of management programs on herd condition may be more evident in 2.5-year-old deer. However, the use of 2.5-year-olds for assessing herd health may be limited by low sample size in some areas.

Harvest Age Structure.—Another management implication of the effect of late parturition on antler development of yearlings is obvious in age structures of bucks harvested on dog-hunt areas. Shea and Breault (1989) reported that 2.5-year-old bucks consistently comprised the greatest percentage of the harvest on dog-hunt areas in northwestern Florida, and that yearling bucks comprised the highest percentage of any age class from harvests on still-hunt areas.

Poor antler development of yearling bucks and differences between dog-and still-hunting techniques may contribute to this disparity. Deer chased by dogs often are only visible to the hunter for a short time. Many yearling bucks with poor antler development probably are not recognized as legal deer. Short-antlered spikes probably are more discernible by still-hunters who often observe undisturbed deer for longer periods. The antlers of many bucks may not be long enough to be distinguishable by dog-hunters until the bucks are 2.5 years old. Managers should use caution when interpreting the age structure of harvest data from dog-hunt areas.

Harvest of Spikes.—Harvest strategies for quality deer management often involve selective harvest of spike-antlered bucks (Brothers and Ray 1982). Most quality or trophy deer harvest management strategies have been developed for herds in high quality habitats where the number of spike-antlered yearling bucks is relatively low and are considered inferior. Harmel et al. (1988) reported that subsequent antler development of spike-antlered yearling bucks on high protein diets was less than that of yearlings with branched antlers. They also found that heritability of poor antler development was high for offspring sired by spike-antlered yearlings. However, high incidence of spike-antlered yearlings is common in herds on poor quality or overstocked range (Teer et al. 1965, Brothers and Ray 1982) and where parturition periods occur late in the summer (Knox et al. 1991). Jacobson and White (1985) reported that the number of antler points for yearling was a poor predictor of subsequent antler quality.

The high percentage of spike-antlered yearling bucks in our study appears to be related to poor nutrition (Wood and Tanner 1985, Shea et al. 1992) and late parturition. These factors probably influence antler development of yearlings more than does genetics. Therefore, most spike-antlered yearlings on our study areas probably are not genetically inferior. Although late parturition contributes to poor antler development of yearlings, many late-born bucks may catch up to earlier-born individuals in subsequent years (Kroll 1991, Vanderhoof 1991).

Culling of young bucks may not be appropriate in many areas in northwest Florida because of the effects of late birth and poor nutrition. The preponderance of spike-antlered yearlings in flatwood forests makes selective harvesting in this age class difficult. Excessive culling of spike-antlered yearling bucks in northwest Florida may seriously reduce the mean age of bucks without substantially improving herd antler characteristics.

Harvest strategies that protect spike-antlered bucks may be a simple and effective way to delay the harvest of a high percentage of yearling bucks. However, depending on hunting pressure, this harvest strategy could place excessive pressure on branch-antlered yearlings. Limits on the number of yearling bucks harvested may be more appropriate on some areas.

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