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Author: COOK, R. S.

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Radiotelemetry for Fawn Mortality Studies

R. S. COOK, *Department of Veterinary Science, University of Wisconsin, Madison*[1];
M. WHITE, *Department of Forestry and Conservation, Purdue University, Lafayette*[2];
D. O. TRAINER, *Department of Veterinary Science, University of Wisconsin, Madison;*
W. C. GLAZENER, *Welder Wildlife Foundation, Sinton, Texas*

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ABSTRACT

To establish some of the factors responsible for neonatal fawn mortality in a white-tailed deer (*Odocoileus virginianus*) population on the Welder Wildlife Refuge in South Texas, radio transmitters, constructed as collars, were placed on 34 and 47 fawns, 1 to 12 days of age, during 1965 and 1966, respectively. The collared fawns were relocated almost daily with a receiver and a directional antenna for a minimum of a month, or until death.

Frequent relocation of collared fawns allowed observation of their physical condition and provided fresh carcasses enabling determination of the causes of death. In addition, it was possible to measure movements and study behavior during this normally inaccessible period.

Radiotelemetry techniques and problems encountered during the study are discussed. The utility of radiotelemetry in studies of juvenile mortality, movement, and behavior was amply demonstrated.

INTRODUCTION

Studies of white-tailed deer populations as dynamic entities involve measurement and interpretation of production and loss patterns.[10] Among the factors influencing herd losses, those affecting fawns soon after birth are often of considerable magnitude[5,1,6]. However, the specific causes and times of mortality are not established.

Since 1960, population studies of white-tailed deer on the Rob and Bessie Welder Wildlife Refuge, Sinton, Texas, revealed that high neonatal fawn mortality appeared to be the major factor stabilizing the herd[7,14]. In spite of capturing and marking more than 300 fawns for survival studies from 1960 to 1965, rapid decomposition, destruction by predators, and scavenging of fawn carcasses, as well as difficulty in carcass location due to heavy vegetation, usually prevented determination of the exact time and cause of death.

To better understand the population dynamics of this deer herd the factors involved in the neonatal fawn mortality had to be determined. Radiotelem-

[1] Present address: Department of Zoology, University of Wisconsin-Green Bay, Green Bay, Wisconsin 54302

[2] Present address: School of Forestry and Museum of Vertebrate Zoology, University of California, Berkeley 94720

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etry was utilized to provide a means for daily observation and examination of young fawns, and thereby allow rapid detection and surveillance of morbidity and mortality factors.

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Study area

The study was conducted on approximately 4,000 acres in the center of the 7,800-acre Welder Wildlife Refuge, which is located in the Coastal Bend of South Texas.

The Welder Refuge lies in a transitional zone between the Gulf Prairies and Marshes and the South Texas Plains. Vegetative cover varies from prairie to chaparral[13,2].

The Refuge harbored about 1,500 white-tailed deer *(Odocoileus virginianus)* in the fall of 1965, or more than 100 per square mile[14]. This dense and "healthy" population experienced excellent range conditions during the two-year study.

The coyote *(Canis latrans)* was the only common predator; a minimum of three families (about 20 individuals) inhabited the study area. In addition, bobcats *(Lynx rufus)* were occasionally observed in dense brushland along the watercourses.

MATERIALS AND METHODS

Transmitting Collars: Twenty transmitters were constructed each year as collars to be placed around the necks of fawns. The detailed construction plans followed those of Cochran and Hagen[3] and the circuit was similar to that described by Tester *et al.*[12]

The components were mounted on a small, laminated, fiberglass board, 2- x 14- x 40-mm. A strip of 0.016-inch phosphor bronze, 14- x 130-mm, was riveted to each end of the fiberglass component board. When the two free ends of the bronze strips were bolted together the circular collar formed a circuit and acted as the antenna. One 1.25 v mercury battery (Mallory ZM 12R) was used per collar.

The components of each collar were embedded in an epoxy resin (Stycast 1266, Newark Electronics Corporation, Chicago) with only the two electrodes exposed for battery connection. The Stycast 1266 was light and strong enough to prevent damage by predators. The battery was embedded separately with only a metal solder tab and covered wire exposed. Thus, the battery on a recovered collar could be easily changed and the collar reused. After the battery was attached, the intervening space was filled with DuPont silicone rubber to facilitate wrapping. The entire collar was then wrapped in plastic electrical tape to inhibit corrosion. Average collar weight was approximately 100 g.

All collars were 85 mm in diameter, a size that accommodated fawn growth from birth to approximately 4 months of age. To compensate for the small neck size at time of attachment, foam-rubber strips were loosely taped inside the collars (Fig. 1). These strips reduced collar movement when the fawn was active, prevented the collar from slipping over the head, and were easily compressed to allow neck enlargement.

Three frequencies in the 27,000-mc range were used and variation of the audio pulse rate enabled differentiation between collars on the same frequency whenever necessary.

Receivers: The Johnson Messenger III, all-transistor, crystal-controlled, 11-channel receiver (E. F. Johnson Co., Waseca, Minn.) was utilized during 1966 as another brand of receiver used during 1965 proved to be faulty. Beat-frequency-ocillator (BFO) units were installed in each set. The receivers could transmit as well as receive and were therefore useful for communication when two search parties operated simultaneously.

Receiver power was supplied from the 12-v truck battery when the vehicle was used. While searching on foot, a reachargable 12-v battery module furnished power.

Two types of antennas were used; a 6-foot whip antenna mounted on the truck cab, and a directional loop, hand-held type for determining the exact location of the collared fawn.

Field Procedures: Forty-foot observation towers located strategically throughout the study area were utilized to locate newborn fawns usually detected while nursing.

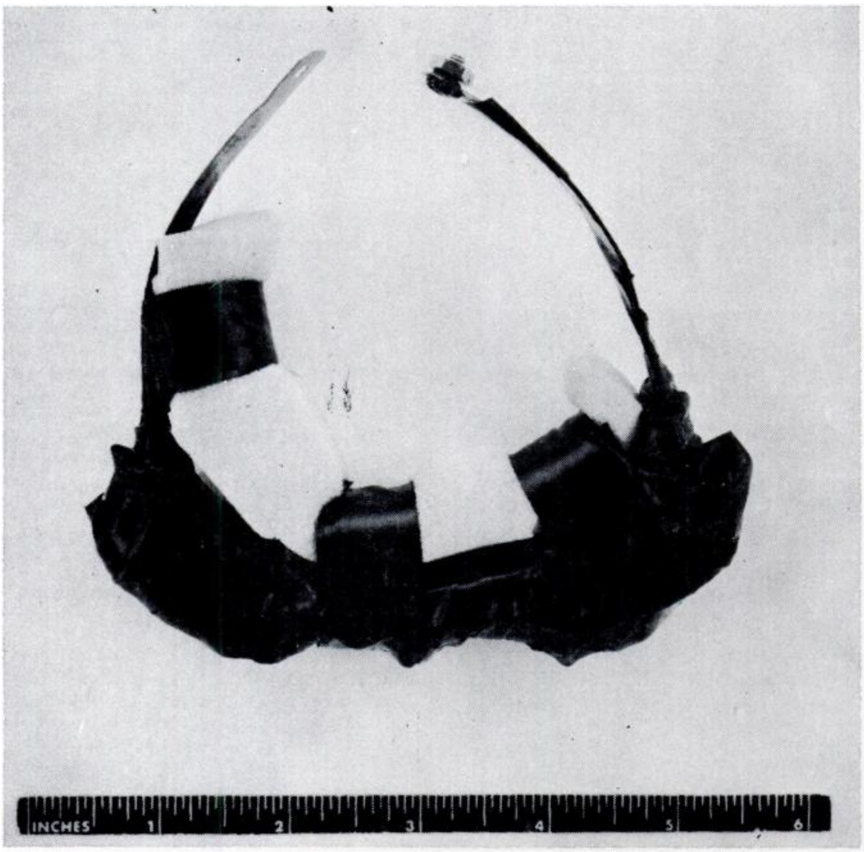

FIGURE 1. *A collar transmitter ready for placing on a fawn, showing foam-rubber strip taped inside to reduce collar movement.*

Captured fawns were marked for individual recognition by ear tagging with colored plastic streamers[8]. Several physical measurements were made on each fawn, and blood and fecal samples were taken for physiological, serological and parasitical studies.

The transmitting collar was then attached, tested, and all exposed portions taped. The fawn was replaced in the bed in which it was found and its location plotted on a map, as was the location of each subsequent observation.

Two 2-man crews relocated fawns at dawn each day to determine the physical status of each animal and to detect dead fawns as soon as possible after death. Each fawn was observed daily for the first month, and then every third day until the batteries expired or the fawn was collected.

Daily relocation efforts for each fawn began at the point where it was last encountered. When a signal was received, the direction was determined and the signal followed with the aid of the directional antenna using a truck for transportation, to within 100 yards of the bedded fawn. The receiver was then connected to a portable battery and the search was concluded on foot.

A daily log was maintained for each fawn and included time of day found, exact location of the bed and a description of the surrounding cover, activity of the fawn, and gross physical condition. Binoculars were useful for identifying individual fawns and in making the examination of gross physical health. Every effort was made not to disturb the bedded fawn and until they were approximately one month old most remained quiet during the approach.

If a fawn was morbid it was left undisturbed, but it was observed more frequently so the carcass could be retrieved and examined as soon as possible after death.

RESULTS

Equipment: The basic equipment employed proved to be dependable and rugged. The collars were fabricated by skilled electronic technicians, and none failed to operate as a result of faulty construction. The use of epoxy-resin embedding material eliminated malfunction due to predator chewing. Average battery life was 136 days.

During 1965, one receiver ceased to function and frequent delays were experienced with the other due to mechanical failures. This emphasized the need for stand-by equipment which was provided in 1966. Fawns could be efficiently captured only during their first 2 weeks of life, and when they were collared it was mandatory to relocate them daily to obtain complete and meaningful data. Stand-by equipment was a small investment compared to the time, funds, data, and effort that could have been lost due to malfunction of the receivers.

The receivers and truck-mounted whip antenna received signals at a distance of 0.50 to 0.75 mile. Thus a strip 1 to 1.5 miles wide could be covered during the initial phase of the daily search.

The BFO's were equipped with on-off switches. This gave the advantage of being able to receive weak signals with the aid of the BFO, but allowed this mechanism to be turned off when the signal was being received clearly, thus eliminating the additional static that often accompanied its use.

Field Problems: Most fawns were generally sedentary until 4-6 weeks of age. At that age, increased fawn mobility created difficulties in locating collared animals. Since the main objective, observation during the first 30 days of life, had been completed this was not of major consequence.

Another factor affecting fawn relocation was that the transmitting collar was directional with a maximum and null, just as was the loop receiving antenna. Therefore, if the fawn was facing the receiver, the null of the collar was towards the receiver and the direction as indicated by the receiving antenna led slightly to the side of the fawn rather than directly to it. As one neared the fawn and moved into the line of maximum transmission, the course turned toward the collar, resulting in a J-shape approach. Since it was important not to disturb the fawn, this J-approach was undesirable. Also, if the fawn watched the approach, its head movements kept the null toward the receiver which resulted in a maze-type approach. Experience eliminated most of these problems.

Mortality factors: All collared fawns which succumbed during the study periods were retrieved, providing carcasses usually less than 12 hours old. In most instances the carcass was in satisfactory condition for a meaningful necropsy.

By reusing some collars, 34 fawns were equipped with radio transmitters in 1965 and 47 in 1966. During 1965, 24 of the 34 collared fawns succumbed and the apparent cause of death was ascertained in 18 of the 24 cases. Six of the 24 carcasses were unmolested and necropsy revealed a variety of causes of death, including disease, starvation, and trauma. Necropsy of the remaining 18 revealed predator involvement. The 1966 season findings were comparable to the first year; 31 of 34 fawn carcasses were retrieved quickly enough to establish cause of death. Predators were involved in 21 of the 31 deaths.

Daily, and in some instances hourly, surveillance provided the opportunity to observe some phenomena not usually seen in wild populations. For instance, one fawn succumbed as the result of the rapid growth of an abscess located in the posterior abdominal wall. The abscess, when first observed, was about golf-ball size. In three days the abscess increased to the size of a volleyball and the fawn was recumbent. The fawn was observed frequently during this period and was regularly nursed by its dam. On the fourth day of intensive surveillance a severe rainstorm occurred which probably added the stress necessary for the death of the fawn as well as prevented our early arrival. The vultures left only the skeleton. However regular observations had documented the events leading to its death. Similar daily observations were documented involving abandonment, starvation and trauma.

Each collar was numbered so when found its bearer was known even if the entire carcass, including the identifying ear-tags, was missing. This provided the age at death of each fawn thereby establishing the period of greatest fawn mortality. Also, daily location of fawns allowed study of their movements, feeding patterns, bed-habitat types and behavior, which will be discussed in subsequent papers.

DISCUSSION

White[14] showed that ear-tagged (marked) Refuge fawns had a slightly higher mortality rate than those that were not captured and marked. The mortality rate of the radio-collared fawns in this study (72%) did not differ from the mortality rate of marked but not collared fawns (64%). Therefore it was concluded that the additional theoretical impediment of the collar transmitter did not increase the mortality rate. This appears logical since the young Refuge fawns are very sedentary during the first few weeks of life[9,4]. By the time fawns were old enough to travel the collar was only a minimal hinderance.

Prior to this study few fresh fawn carcasses suitable for necropsy were available. During this investigation 55 suitable carcasses were studied. Previously one could only speculate as to the predisposing factors contributing to fawn mortality, i.e., whether the deceased had died and been scavenged or if it had been "healthy" and became the victim of a predator. Even when predators devoured so much of the carcass that disease involvement could have been obscured, the regular daily observations made prior to the time of kill documented apparently normal health and activity within 24 hours of the time of death. Consequently, the probability of assigning the cause of death of such a fawn to predation when the primary cause of its death could have been disease was limited to acute infections and was considered to be minimal. Also, necropsy of fresh carcasses designated predator kills did not reveal any pathological lesions suggesting the presence of disease prior to death. These observations could not have been made without the use of radiotelemetry.

The value of this technique in studying juvenile and/or adult mortality, movements, and behavior, especially in populations of limited home range, should increase. Actual mortality rates and causes, age at death, and periods of greatest mortality can be determined. In addition, the use of this technique in locating collared fawns whenever needed will enable more sophisticated studies in such disciplines as physiology where short-ranged bio-medical telemetry equipment can be utilized.

The findings of this study pertaining to the role of disease and predation in juvenile fawn mortality allowed a greater understanding of the overall population dynamics of the Refuge deer herd, and will be discussed in detail in a later paper.

Disadvantages were similar to those encountered while directly observing animals during movement studies,[11] namely a large amount of time is required for the limited number of animals observed and the influence of the observer, and the equipment, on the activities of the observed is unknown. However, radiotelemetry has provided the means whereby deeper insights into neonatal fawn mortality have been obtained.

Future improvements in receiver and antenna efficiency and refinements in the circuitry of transmitting collars, should allow expansion of this approach to gaining more useful knowledge about various segments of many wild populations.

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