OBSERVATION ON INJURIES IN WHITE-TAILED DEER

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ABSTRACT

The frequency of chronic debilitation of white-tailed deer (Odocoileus virginianus) *due to traumatic injuries was estimated from necropsy records on 1,002 animals collected for scientific purposes throughout the southeastern United States. Evidence of previous injury was present in 76 deer (7.6 percent). Percentages of injured deer did not vary significantly according to sex, physical condition, or six-month periods associated with high or low hunting pressure. Incidence of injury increased with age for both sexes but was statistically significant only for does. The cause of most injuries was not determined although 30 percent were related to gunshot or arrow wound. It appears that traumatic injuries due to gunshot or highway collision usually are fatal and result in very little chronic debilitation in the few deer that survive.*

Sport hunting, an important deer management tool, is undergoing increasing public condemnation (Amory 1974, Applegate 1973, 1975). The number of deer suffering from chronic gunshot or arrow wounds presently is a matter of subjective speculation in which overestimation can be made by anti-hunters and underestimation by hunters. The non-fatal effects of other sources of trauma, such as highway collisions, predators, and miscellaneous accidents, also are unknown.

An estimation of the size of this segment of the population would have value to the wildlife manager, since the deer in question could have a lowered reproductive potential and an increased susceptibility to other mortality factors. Additionally, debilitated animals often are considered unsuitable for human consumption and also evoke repulsion or sympathetic emotionalism from the public. The goal of this study was to give insight to these problems through interpretation of necropsy observations made on a large number of white-tailed deer. This study was supported by the Federal Aid in Wildlife Restoration Act (50 Stat. 917).

LITERATURE REVIEW

In general, traumatic injuries of all types are a major mortality factor in white-tailed deer populations. Barick (1969), determined that 98.5 percent of the deer mortality observed by wildlife management personnel was attributed to hunting, poaching, predators, and highway losses. In a study of tagged white-tailed deer in Illinois, 86 percent succumbed to traumatic injuries via hunting, highway collisions, dogs, poaching, or miscellaneous accidents (Hawkins et al. 1970). Seventy-two percent of the non-hunting mortalities in Missouri in 1959 were diagnosed as trauma (Murphy 1959). A compilation of

conservation officer reports indicated 91 percent of the deer found dead in 1948 in West Virginia were killed by various injuries, of which poaching and hunting season wounds comprised 13 and 1 percent, respectively (Ward 1948).

Crippling loss, as treated in the literature, refers to deer *killed but not retrieved,* with death occurring within a short period after the hunt. Table 1 provides numerous crippling loss estimates varying from "negligible" to 175 percent of the legal harvest. The most common method of study was to search selected areas or transects for wounded deer or carcasses after the hunt. Highest values (Whitlock and Eberhardt 1956, DeBoer 1957) were obtained in northern areas when the carcass counts were conducted in late winter. Abandonment of illegal deer is included in figures for buck only hunting. The highest losses for either sex hunting was from a hunt in which participants were not allowed to move more than 100 yards from their stands (Roseberry et al. 1969). A comparison of the effectiveness of three hunting weapons on a limited number of deer resulted in a 50 percent loss for archery, a 26 percent loss for buckshot, and a 7 percent loss for shotgun slugs (Downing 1971). In other studies, a 10 percent crippling loss was attributed to bowhunting (DeBoer 1958) and an 8.9 percent wounding incidence by bowhunters was reported by Garland (1972).

In contrast to mortal wounding, observations on nonmortal wounds have been much less common. Roseberry et al. (1969) found that about 3 percent of deer examined at checking stations had been wounded previously. Dechert (1967) concluded that mortality due to crippling was 95 to 100 percent, as he observed few deer with old wounds in the hunter harvest. Observations of lame mule deer (*Odocoileus hemionus*) ranged from 0.5 to 1.3 percent after hunts in Utah and Nevada (Robinette 1947).

Highway mortality has been rated the "second deadliest deerslayer" by Burgin (1964), who calculated that road-kills were responsible for 17 percent of the annual mortality in New York as compared to 46 percent by hunting. Numbers of deer killed in highway collisions were as large as 18 percent of Wisconsin's 1967 hunter harvest (McCaffery 1973), 19 percent of the 1969 harvest in Pennsylvania (USDI 1970, Bellis and Graves 1971), and 33 percent of the 1963 harvest in Ohio (Nixon 1965). Highway mortality apparently is

Table 1. Reported crippling losses in deer due to hunting with firearms.

Authority	*Date*	*Crippling loss % of legal harvest*
Costley	1948	42[a]
		25[b]
Creed and Kubisiak	1973	7[b]
DeBoer	1957	175[a]
	1958	44[c]
Dechert	1967	19[b]
Downing	1971	19[b]
Hardin and Roseberry	1975	20[b]
Holsworth	1973	5[b]
Krefting et al.	1955	"negligible"[b]
Robinette	1947	18[b]
Roseberry et al.	1969	33[b]
Sanders	1939	29[a]
Schofield	1960	"low for legal bucks" "high for illegal does and fawns"[a]
Van Etten et al.	1965	10-15[b]
Whitlock and Eberhardt	1956	79[a]

[a]Bucks only.
[b]Either sex.
[c]One antlerless permit for each party of four hunters.

seasonal, with highest losses in the fall and second highest in the spring (Bellis and Graves 1971, Puglisi et al. 1974). Deer-car accidents resulted in death of the deer in 92 percent of the cases in southern Michigan (Allen and McCullough 1976).

Infrequent reports have been made of predation by coyotes (White 1973), coydogs (Jackson et al. 1973), and bobcats (Matson 1948, Petraborg and Gunvalson 1962, Corbett et al. 1971). Of great controversy, however, is the significance of the domestic dog as a deer predator. Although the popular literature of a decade ago often attributed high deer losses to uncontrolled dogs in the Southeast (Bowers 1953, Ward 1954, Giles 1960, Morrison 1968), scientific studies have not verified this. Radio-equipped deer chased by trained deerhounds have been caught or killed only in a few instances involving debilitated deer in mountainous terrain (Marchinton et at. 1970, Corbett et al. 1971, Sweeney et al. 1971). Segelquist et al. (1969) observed that heavily parasitized deer apparently were more susceptible to predation by dogs. Deliberate dog harassment of deer in Missouri (Progulske and Baskett 1958) and Virginia (Gavitt et al. 1974) did not result in capture or mortality. Radio-telemetry studies of feral dogs in Alabama indicated that deer were not a prey species (Scott and Causey 1973).

METHODS

From July 1961, through July 1975, detailed necropsy examinations were conducted on white-tailed deer collected for parasitologic surveys, herd health evaluations, or mortality investigations. Deer for these studies were obtained from wild populations by shooting at night, or rarely, box-trapping. Deer were collected in a nonselective manner except for a few occasions when lame deer were deliberately removed from a group of animals sighted together. Animals originated from areas throughout the southeastern United States (Fig. 1), which were representative of a wide variety of habitat types, population levels, hunting

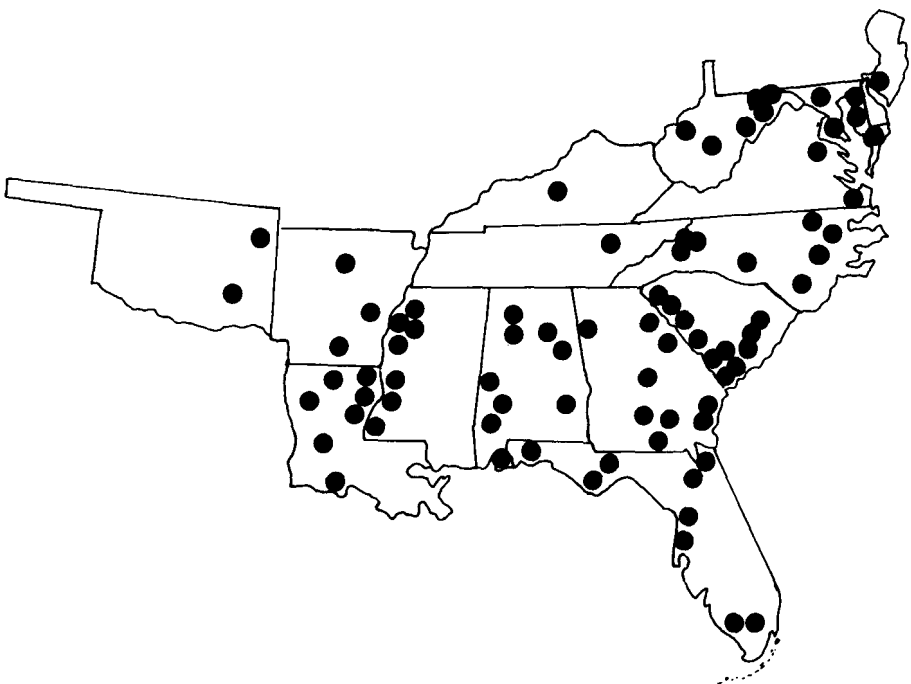

Figure 1. Collection sites for white-tailed deer examined for injuries.

practices, and wildlife management techniques. Individual deer which were submitted to the diagnostic laboratory for clinical and necropsy examinations were not included in the study.

Gross examination included external inspection, skinning, opening of the body cavities, and removal and separation of the viscera. Examination of the head entailed removal of the eyes, opening the nasal sinuses, and inspection of the brain and cranial meninges. Age was determined by tooth eruption and attrition (Severinghaus 1949). Physical condition was rated excellent if the animal had massive fat reserves at the base of the tail, over the loins and surrounding the kidney and heart. Deer were rated in good condition if there were moderate fat deposits in the aforementioned areas, whereas animals in fair condition had only traces of fat. Deer were considered in poor condition when they did not have body fat and were emaciated as indicated by generalized muscle atrophy. Data were tested by the chi-square method.

RESULTS

Necropsy records revealed that 76 of 1,002 (7.6 percent) deer examined had evidence of previous traumatic injury. Of these, 62 had single injury, 11 were injured in two separate body regions, and 3 had injuries in three locations. Seventeen instances were recorded for superficial wounds involving skin and/or subcutis. Deep soft tissue injuries were found in 23 instances and skeletal injuries were most numerous with 53 observations. Injuries were located most frequently in the legs and chest as compared to the abdomen, head, and neck (Table 2). Five deer had lost a forelimb distal to the metacarpus.

Shrapnel was recovered from 20 animals and was categorized as follows: buckshot (11), 22 caliber rimfire bullet (3), bullet fragments (2), birdshot (2), and arrowhead (2). In addition, three gunshot wounds without shrapnel and three wounds caused by arrowheads were observed. Seven deer had multiple fractures of the ribs suggestive of a collision-type

Table 2. Types of traumatic injuries and body regions affected in 76 injured white-tailed deer.[a]

	Type of injury			
Region injured	*Superficial*	*Deep soft tissue*	*Skeletal*	*All types*
Head	0	2	5	7
Neck	2	1	0	3
Chest	4	7	13	24
Abdomen	1	9	0	10
Foreleg	5	2	17	24
Hindleg	5	2	15	22
Leg (unspecified)	0	0	3	3

[a]Eleven deer had two injuries and three deer had three injuries

Table 3. Physical condition of white-tailed deer in relation to evidence of previous injury.[a]

Physical Condition	*Examined*	*Injured*	*% of group injured*
Excellent	56	4	7.1
Good	396	32	8.1
Fair	440	33	7.5
Poor	46	5	10.9

[a]Sixty-four deer in the study were not appraised for physical condition.

injury. One deer examined had an abscess surrounding a large thorn in the front leg. Multiple linear abrasions, attributed to fighting during rut, were noted in one adult buck. In approximately half of the cases, however, the cause of the injury was uncertain.

Physical condition and evidence of previous injury were statistically independent factors ($P>0.05$), although deer in poor condition had a slightly higher percentage of injuries (Table 3). The incidence of injured deer did not vary significantly ($P>0.05$) when grouped by sex or six-month periods associated with high or low hunting pressure (Table 4). Does 2.5 years or older had a greater percentage of injury than younger females ($P<0.05$). Injuries tended to increase with age for bucks but differences were not statistically significant (Table 5).

DISCUSSION

The primary collection method used in this study was night hunting, which may have been slightly biased against the selection of debilitated deer, since telemetry studies indicate that these animals usually are less active (Marchinton and Jeter 1966). Counteracting this factor, however, is the increased likelihood that a debilitated deer would be a more cooperative target for shooting when seen.

Many injuries were reflected by indistinct scars or fracture calluses, which were impossible to classify to cause. Wounds inflicted by gunshot or arrow were easiest to assess, since shrapnel usually was found. Of the 20 deer carrying shrapnel, one-fourth probably represented illegal activity through use of 22 caliber rimfire ammunition or birdshot. The incidence of chronic injuries in the population without regard to sex or hunting season suggests that many wounds were produced by etiologies less selective and seasonal than hunting. Highway trauma was probably a considerable factor although it

Table 4. Incidence of traumatic injury in white-tailed deer compared for six-month periods of high and low hunting pressure in the southeastern United States.

Sex	*High hunting pressure (Sept.-Feb.)*	*Low hunting pressure (Mar.-Aug.)*
Bucks		
examined	138	168
injured	13(9.4%)	11(6.5%)
Does		
examined	281	415
injured	20(7.1%)	32(7.7%)
Both sexes		
examined	419	583
injured	33(7.9%)	43(7.4%)

Table 5. Incidence of traumatic injury in different age groups of male and female white-tailed deer in the southeastern United States.[a]

Age Class (yrs.)	*Buck*		*Does*	
	examined	*injured*	*examined*	*injured*
0.5-1.0	164	11(6.7%)	159	4(2.5%)
1.5-2.0	88	7(7.9%)	134	8(6.0%)
2.5+	53	6(11.3%)	403	40(9.9%)

[a]Age was not determined for one deer in this study.

also may be seasonal and sex biased if extrapolation is made from highway mortality studies (Jahn 1959, Murphy 1959, Nixon 1965, Bellis and Graves 1971, Puglisi et al. 1974).

The salient finding of this study was that deer bearing evidence of previous injury, regardless of cause, represented a small percentage of those examined. Traumatic injuries inflicted by gunshot or highway collision, which are the most frequent types observed, apparently are characterized by high mortality. The few deer which survive injury do not become debilitated, as evidenced by the fact that deer in poor physical condition comprised only 6.6 percent of all injured animals. Thus, long-term suffering resultant to traumatic injury probably affects very few white-tailed deer.

LITERATURE CITED

Allen, R. E., and D. R. McCullough. 1976. Deer-car accidents in southern Michigan. J. Wildl. Manage. 40(2):317-325.

Amory, C. 1974. Man Kind? Dell Publishing Co., New York. 367 pp.

Applegate, J. E. 1973. Some factors associated with attitude toward deer hunting in New Jersey residents. Trans. N. Am. Wildl. Conf. 38:267-273.

_____. 1975. Attitudes toward deer hunting in New Jersey: a second look. Wildl. Soc. Bull. 3(1):3-6.

Barick, F. B. 1969. Deer predation in North Carolina and other southeastern states. Proc. White-tailed Deer in the Southern Forest Habitat Symp., U. S. For. Serv., Southern For. Exp. Stn., Nacogdoches, Texas. pp. 25-31.

Bellis, E. D., and H. B. Graves. 1971. Deer mortality on a Pennsylvania interstate highway. J. Wildl. Mange. 35(2):232-237

Bowers, R. R. 1953. The free-running dog menace. Virginia Wildl. 14(10):5-7.

Burgin, B. E. 1964. Second deadliest deerslayer—the automobile. [N.Y.] Conservationist 19(2):2-3.

Corbett, R. L., R. L. Marchinton, and C. E. Hill. 1971. Preliminary study of the effects of dogs on radio-equipped deer in mountainous habitat. Proc. Southeastern Assoc. Game and Fish Commissioners 25:69-77.

Costley, R. J. 1948. Crippling losses among mule deer in Utah. Trans. N. Am. Wildl. Conf. 13:451-458.

Creed, W. A., and J. F. Kubisiak. 1973. Experimental deer hunt at Sandhill. Wisconsin Conserv. Bull. 38(4):24-26.

DeBoer, S. G. 1957. Waste in the woods. Wisconsin Conserv. Bull. 22(10):10-15.

_____. 1958. Less waste in the woods. Wisconsin Conserv. Bull. 23(10):13-17.

Dechert, J. A. 1967. The effects of overpopulation and hunting on the Fort Knox deer herd. Proc. Southeastern Assoc. Game and Fish Commissioners 21:15-23.

Downing, R. L. 1971. Comparison of crippling losses of white-tailed deer caused by archery, buckshot and shotgun slugs. Proc. Southeastern Assoc. Game and Fish Commissioners 25:77-82.

Garland, L. E. 1972. Bow hunting for deer in Vermont. Some characteristics of the hunter, the hunt, and the harvest. Vermont Fish Game Dept. 19pp.

Gavitt, J. D., R. L. Downing, and B. S. McGinnes. 1974. Effect of dogs on deer reproduction in Virginia. Proc. Southeastern Assoc. Game and Fish Commissioners 28:532-539.

Giles, R. H., Jr. 1960. The free-running dog. Virginia Wildl. 21(6):6-7.

Hardin, J. W., and J. L. Roseberry. 1975. Estimates of unreported loss resulting from a special deer hunt on Crab Orchard National Wildlife Refuge. Proc. Southeastern Assoc. Game and Fish Commissioners 29:*in press.*

Hawkins, R. E., W. D. Klimstra, and D. C. Autry. 1970. Significant mortality factors of deer on Crab Orchard National Wildlife Refuge. Trans. Illinois State Acad. Sci. 63(2):202-206.

Holsworth, W. N. 1973. Hunting efficiency and white-tailed deer density. J. Wildl. Manage. 37(3):336-342.

Jackson, L. W., R. Monson, and L. A. Raville. 1973. Observations of wild canids chasing deer. New York Fish Game J. 20(2):168-169.
Jahn, L. R. 1959. Highway mortality as an index of deer-population change. J. Wildl. Manage. 23(2):187-197.
Krefting, L. W., A. B. Erickson, and V. E. Gunvalson. 1955. Results of controlled deer hunts on the Tamarac National Wildlife Refuge. J. Wildl. Manage. 19(3):346-352.
McCaffery, K. R. 1973. Road-kills show trends in Wisconsin deer populations. J. Wildl. Manage. 37(2):212-216.
Marchinton, R. L., A. S. Johnson, J. R. Sweeney, and J. M. Sweeney. 1970. Legal hunting of white-tailed deer with dogs: biology, sociology, and management. Proc. Southeastern Assoc. Game and Fish Commissioners 24:74-89.
Marchinton, R. L. and L. K. Jeter. 1966. Telemetric study of deer movement-ecology in the Southeast. Proc. Southeastern Assoc. Game and Fish Commissioners 20:189-206.
Matson, J. R. 1948. Cats kill deer. J. Mammal. 29(1):69-70.
Morrison, J. 1968. Hounds of hell. Georgia Game and Fish 3(12):13-19.
Murphy, D. A. 1959. Cause of death—accidental. Missouri Conserv. 20(9):1-3.
Nixon, C. M. 1965. The relationship between the annual accidental deer kill and the legal harvest in Ohio. Game Research in Ohio 3:137-152.
Petraborg, W. H., and V. E. Gunvalson. 1962. Observations on bobcat mortality and bobcat predation on deer. J. Mammal. 43(3):430-431.
Progulske, D. R., and T. S. Baskett. 1958. Mobility of Missouri deer and their harassment by dogs. J. Wildl. Manage. 22(2):184-192.
Puglisi, M. J., J. S. Lindzey, and E. D. Bellis. 1974. Factors associated with highway mortality of white-tailed deer. J. Wildl. Manage. 38(4):799-807.
Robinette, W. L. 1947. Deer mortality from gunshot wounds. USDI, Fish and Wildl. Serv., Wildl. Leaf. 295, Chicago 54, Ill. 8pp.
Roseberry, J. L., D. C. Autry, W. D. Klimstra, and L. A. Mehrhoft. 1969. A controlled deer hunt on Crab Orchard National Wildlife Refuge. J. Wildl. Manage. 33(4):791-795.
Sanders, R. D. 1939. Results of a study of the harvesting of whitetail deer in the Chequamegon National Forest. Trans. N. Am. Wildl. Conf. 4:549-553.
Schofield, R. Q. 1960. Determining hunting season waste of deer by following fox trails. J. Wildl. Manage. 24(3):342-344.
Scott, M. D., and K. Causey. 1973. Ecology of feral dogs in Alabama. J. Wildl. Manage. 37(3):253-265.
Segelquist, C. A., F. D. Ward, and R. G. Leonard. 1969. Habitat-deer relations in two Ozark enclosures. J. Wildl. Manage. 33(3):511-520.
Severinghaus, C. W. 1949. Tooth development and wear as criteria of age in white-tailed deer. J. Wildl. Manage. 13(2):195-216.
Sweeney, J. R., R. L. Marchinton, and J. M. Sweeney. 1971. Responses of radio-monitored white-tailed deer chased by hunting dogs. J. Wildl. Manage. 35(4):707-716.
United States Department of the Interior. 1970. Big game inventory for 1969. Wild. Leafl. 492. U. S. Fish Wildl. Serv., Bur. Sport Fish. and Wildl., Washington, D. C. 4pp.
Van Etten, R. E., D. F. Switzenberg, and L. Eberhardt. 1965. Controlled deer hunting in a square-mile enclosure. J. Wildl. Manage. 29(1):59-73.
Ward, L. 1954. What's it going to be, deer or dogs in southern West Virginia? West Virginia Conserv. 18(6):3-5.
Ward, L. W. 1948. Decline in deer mortalities. West Virginia Conserv. 12(7):9-10.
White, M. 1973. Description of remains of deer fawns killed by coyotes. J. Mammal. 54(1):291-293.
Whitlock, S. C., and L. Eberhardt. 1956. Large-scale dead deer surveys: methods, results and management implications. Trans. N. Am. Wildl. Conf. 21:555-566.