BEHAVIOR OF WHITETAIL DOES AND FAWNS DURING THE PARTURITION PERIOD

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Abstract: Fourteen adult whitetail deer (*Odocoileus virginianus*) does were captured (10 in 1976 and 4 in 1977) and fitted with radio transmitters. Eight of the 14 survived through at least 1 parturition period with properly functioning collars. Eleven fawns of the radio-collared does and 37 other fawns were captured soon after birth, radio-collared, released and monitored regularly. Four other does marked with ear streamers supplemented data from radio-collared deer. Some does shifted or reduced use of established home ranges just before parturition and separated themselves from conspecifics, usually by moving to the edge or outside of their established home range. Does remained near the birth site for approximately 24 hours and then moved away with their fawns. Distance between sibling fawns and distance between does and their fawns increased the first 8 days postpartum. Physical description and characteristic behavior of does are described during prepartum, birth, postpartum, and after loss of fawns.

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An understanding of behavior is essential to any study of population ecology. Knowledge of mobility, territory, and social organization are required to understand changes in natality, mortality, density, and structure of a population (Dasmann and Taber 1956:143). The fawning season is a significant yet poorly understood time in the life of whitetail deer (Downing and McGinnes 1969, Townsend and Bailey 1975). This paper describes behavior of whitetail does during prepartum and parturition, and behavior of does and fawns during postpartum. The approximately 3-month "parturition period" referred to in this paper is defined by Fraser (1968) as a sequence including prepartum, birth, and postpartum activities.

Social interactions within a particular group of animals are significantly influenced by the density of the population (Odum 1971). Much of the published data about social behavior of whitetail deer has been derived from studies of relatively dense populations of 23 to 76 deer per km^2 (Thomas et al. 1965, Hawkins and Klimstra 1970, Hirth 1977). In contrast, this paper describes behavior of deer in a population of 6 to 10 per km^2 (Gene Stout 1977, unpublished report, Division of Fish and Wildlife, Fort Sill Military Reservation; Garner et al. 1976), 0.14 to 0.5 the density of the studies cited in the previous sentence.

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STUDY AREA

The general study area is in the Wichita Mountains of Comanche County, southwestern Oklahoma. Wichita Mountains National Wildlife Refuge (WMNWR) and FSMR contain most of the mountains; portions of the refuge and reservation were used as specific study sites. The topography varies from nearly level prairies to rocky slopes exceeding 20%, with maximum elevations of 755 m, rising 427 m above the surrounding plains.

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Mixed grass species characterize the prairie which is the principal habitat type. Closed canopy woodland is found primarily near creek bottoms and along fracture lines on rockly slopes where soils are sandy or gravelly. Upland trees are predominantly post oak (*Quercus stellata*) and blackjack oak (*Q. marilandica*); trees common in bottomlands are elm (*Ulmus americana*), hackberry (*Celtis* spp.), and post oak. A savannah woodland, intermediate between prairie and dense woods, is also common.

Deer of the Wichita Mountains are a prairie subspecies, the Texas whitetail (*O. v. texanus*). Fawn survival is low (Bartush 1978, Garner et al. 1976) on the study area; fawn:doe ratios in late fall have ranged from 14-45:100 (1974-1977). Garner et al. (1976) stated that over 90% of the fawn mortality in 1974 and 1975 was due to predation by coyotes (*Canis latrans*) and bobcats (*Lynx rufus*). High fawn mortality caused by these same predators continued through the 2 years of this study (Bartush 1978).

METHODS

Field work occurred from February 1976 to October 1977. Adult deer were captured during January and February of 1976 and 1977 using box traps with cottonseed bait. Fawns were captured by hand as soon as possible after birth. Deer were fitted with radio collars and released at the capture site. Radio collars were manufactured by Wildlife Materials Inc., Carbondale, Illinois[a]. AVM model LA12 portable receivers and hand-held, 4-element yagi antennae (AVM Instrument Co., Champaign, Illinois) were used to monitor transmitter signals.

Fourteen adult does were captured (10 in 1976 and 4 in 1977); 8 survived through at least 1 parturition period with properly functioning collars. Four additional does, marked with ear streamers, also provided an opportunity to collect behavior data. Movements of radio-collared does were monitored at approximately 2-week intervals during fall, winter, and early spring. Attempts were made to observe these animals during each relocation effort. Beginning on 15 May of 1976 and 1977, monitoring efforts were intensified; does were located 2 or more times per week to gather information on prepartum activities and to increase the chances of finding their fawns before they became too large to catch.

Does observed within 48 hours before parturition had enlarged udders and distended abdomens. Various observers of penned deer have noted an enlargement of the dam's udder from 2 weeks to 2 days before parturition (Golley 1957, Townsend and Bailey 1975). When evidences of these later physical stages of pregnancy and behavior characteristic of parturient does were observed, we attempted to make several radio triangulations daily in order to find the fawning site. Knowledge of behavior of does during postpartum (Downing and McGinnes 1969, White et al. 1972) also enabled researchers to identify does that had fawned.

Decreased distention of the abdomen, a well-developed udder with rather clean, pink-colored teats, and a swollen, red, and sometimes slightly bleeding vulva were characteristic of a doe that had recently given birth. Blood and/or a watery discharge from the vulva of does sometimes continues for some hours after the fawns are delivered. On 2 occasions does were frightened from a bedsite and small patches of blood and watery discharge were found. Intensive observations of the vicinity of 1 of these bedsites led to the capture, 6 hours later, of twin fawns approximately 24 hours old.

Before capture, fawns were located using 2 principal methods. First, does were observed from high vantage points (mountains and observation towers) by use of binoculars and spotting scopes. Whenever field workers saw a specific fawn for the first time, it was usually observed until it bedded down and then an attempt was made to

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capture it in the manner described by Garner et al. (1976). The second method of finding fawns involved carefully observing the doe in an attempt to estimate the approximate time she would give, or had given, birth. From that estimate the general fawning area could sometimes be determined, thereby facilitating finding the fawn(s).

Forty-eight fawns were captured, radio-tagged, and released; 11 were from transmittered does and 6 from the does marked with ear streamers. Six pairs of fawns from unmarked does were tagged; 4 of these pairs were captured at their birth sites.

Radio-tagged fawns and their radio-collared dams were located daily by triangulation or by triangulation and observation of the animal. Precautions were used when triangulating because of the severe deflection of high-frequency signals in the rocky terrain; short distance triangulations from 50 to 250 m were used. Descriptions of behavior and movements of deer, social groupings, weather conditions, and habitat use were recorded. Intraspecific and interspecific aggressive behaviors of deer were noted using the posture terminology of Thomas et al. (1965).

Locations of deer were plotted on overlays of large-scale aerial photos to determine movement. The modified-minimum-area technique was used to delineate home range boundary (Harvey and Barbour 1965), and areas were measured with a compensating polar planimeter.

RESULTS AND DISCUSSION

Prepartum

Prepartum was characterized by changes in home range (Table 1) of some does. After 1 April 1976, does Y_1 and R moved to areas which contained very little of their previously established home ranges. In 1977, doe R again moved to the prepartum area utilized the previous year. Does Y_2, 0, and Wh_2 appeared to move to areas outside of their established home ranges, but only 5 triangulations of each animal were made between the month of capture (February) and 1 April, and a shift in home range could not be positively confirmed. Doe Wh_1 reduced her home range during parturition periods in 1976 and 1977. Does LB_1 and LB_2 appeared to use the same home range in winter and during the parturition period but these data were incomplete (Table 1) because the precise time of fawning was not determined.

Does with known home ranges moved to an edge of or outside their home range just before parturition. This movement by the radio-collared does was confirmed in 4 of the 5 times when their fawns were captured at the birth site. Fawns of 4 other marked does were captured or seen soon after birth, but the precise fawning site was not identified. Two of these 4 probable fawning areas were at the edge of the respective doe's home range.

Decreased home range and/or movements by whitetail does seem characteristic of prepartum (Hawkins and Klimstra 1970, Miller 1970, Sparrowe and Springer 1970). Dasmann and Taber (1956:153) documented seasonal shifts in areas utilized by nonmigratory Columbian blacktail deer (*O. hemionus columbianus*) and postulated that the movement may be a response to daily or seasonal changes in quantity or quality of elements essential to the animal.

Size of doe groups declined during the fawning period from an average of 3.9 individuals the second week of May to 1.5 by 11 June (Fig. 1). Haugen and Speake (1957), Halford and Alldredge (1975), and Townsend and Bailey (1975) postulated that penned deer attempt to isolate themselves from other deer or disturbances prior to fawn drop. In our study each marked doe isolated herself from other deer 24 to 48 hours before parturition. Another behavior change noted in the days immediately preceding parturition was an increase in the frequency of aggressive actions of pregnant does toward conspecifics (Fig. 2).

Behavior and social relationships observed in deer during prepartum in the Wichita Mountains were similar to those reported in other studies. Hawkins and Klimstra (1970) and Hirth (1977) 'mentioned a decrease in doe herd size in the fawning season.

Intraspecific aggression was also believed to be at least partially responsible for the decline in average number of individuals within doe groups (Dasmann and Taber 1956).

Table 1. Yearly and prepartum home range (ha), and home range changes of radio-collared does in the Wichita Mountains, Oklahoma, 1976 and 1977.

Doe identification and year	*Home range in ha and (number of relocations)*			*% Prepartum home range within winter/fall home range*
	Annual	*Winter/fall (Jan. - Mar., Sept. - Dec.)*	*1 April to parturition*	
1976				
Y_1	54.7 (41)	18.1 (16)	21.7 (13)	12
R	40.9 (45)	17.3 (19)	29.5 (14)	2
LB_1	69.5 (36)	13.8 (13)	I[a]	
Wh_1	44.4 (49)	31.2 (18)	18.7 (16)	100
LB_2	61.4 (43)	21.7 (10)	I[a]	
1977				
Y_2	23.4 (23)	10.5 (8)	5.2 (10)	0
R	30.5 (47)	9.4 (12)	2.3 (11)	0
0	64.1 (46)	12.3 (8)	9.6 (9)	0
Wh_2	41.9 (80)	10.2 (7)	4.3 (8)	0
Wh_1	41.4 (28)	14.2 (12)	3.5 (10)	100

[a]Home range calculation incomplete through prepartum period.

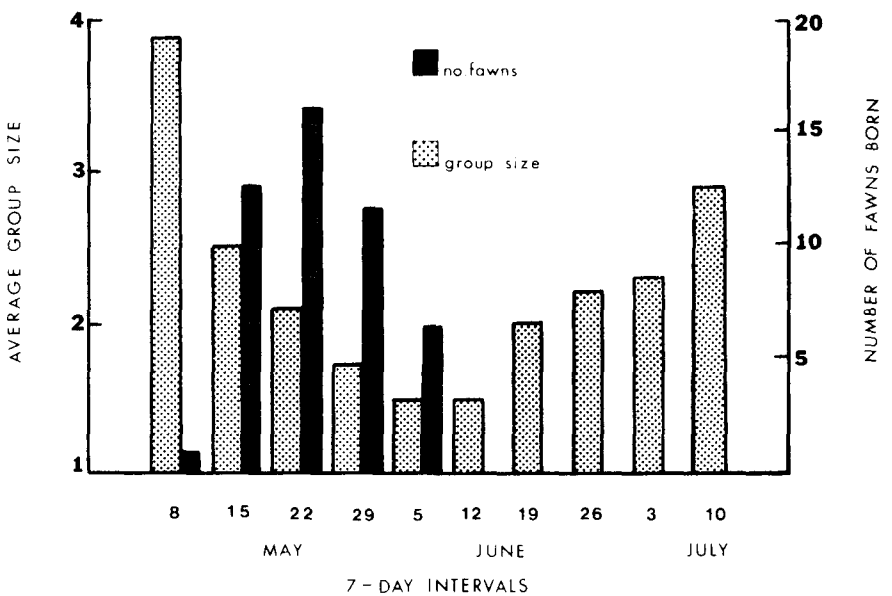

Fig. 1. Average size of doe groups and estimated birth date of 48 fawns, listed in 7-day intervals, Wichita Mountains, Oklahoma, 1976 and 1977. Numbers listed on the abscissa represent the first date of each interval.

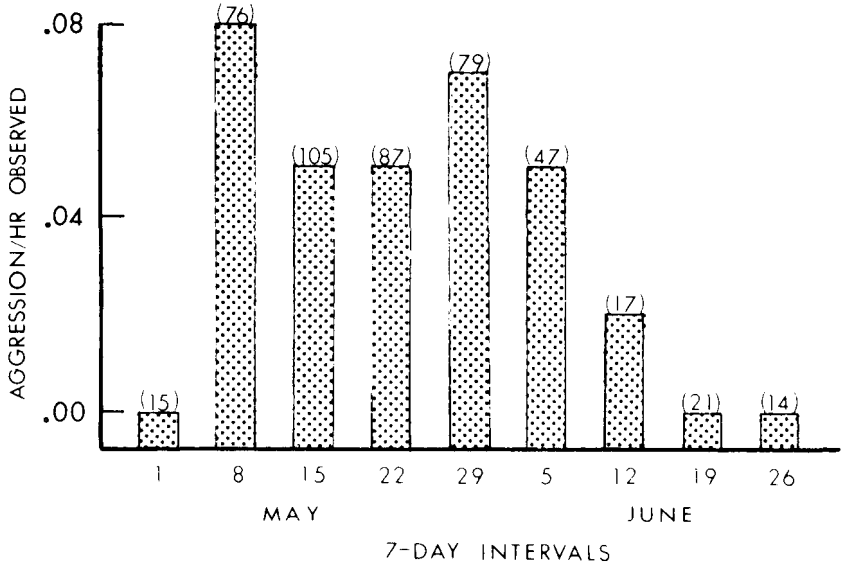

Fig. 2. Occurrence of aggressive behavior recorded within doe groups at the Wichita Mountains, Oklahoma, 1976 and 1977. Numbers listed on the abscissa represent the first date of each interval. Numbers in parentheses are observation hours during interval.

Interspecific aggression between does and elk (*Cervus canadensis*) and between deer and coyotes was evident during the parturition period. We observed 2 instances of direct aggression between does and elk, though deer seemed to avoid elk on WMNWR (Waldrip 1977:48) as has been noted in other areas (Kramer 1973). On 10 May 1976 a cow elk was observed pursuing a young doe, and on 30 May 1976 a doe, with a well-developed udder, was seen chasing a cow elk. On 9 occasions, between 25 May and 30 June, does were seen pursuing and striking coyotes. Such interactions between coyotes and deer were not observed outside the parturition period. Does which had fawned exhibited the most aggressive response towards predators. Interspecific and intraspecific aggression by does increased simultaneously during the parturition period and this behavior seemed to reflect the strong maternal instinct of the does. Michael (1967) and Garner (1976) described similar interactions between deer and predators.

Birth

Judging from her behavior for 105 minutes and the condition of her fawns at capture, doe 0 was observed giving birth. She was bedded 500 m from the observer in dense native prairie grasses 0.75 to 1 m in height, which prevented a clear view of the birth sequence. Twice she arose, walked in a small circle, then lay down; these movements are similar to birth activities described in other studies (Haugen and Speake 1957, Miller 1965, Halford and Alldredge 1975, Townsend and Bailey 1975).

Doe 0 was approached at dusk and she ran when researchers were 15 m away. The bedsite was a flattened, circular area of matted grass, 1 m in diameter, containing spots of blood and small pieces of afterbirth. Two fawns were in the bedsite; 1 was dry, the other had a small portion of moist and matted hair on its hindquarters. The birth sites in this study resembled 1 used by a black-tailed doe (Miller 1965).

Judging from their physical condition, 3 other pairs of twin fawns were captured within 24 hours postpartum at the birth site. Each fawning site was similar in size and

appearance to the fawning bedsite of doe 0. In all 3 cases the siblings, although not always on the birth site (but within 10 m), were less than 3 m apart and docile. The dams stayed nearby while fawns were marked.

Marked does exhibited some fidelity to fawning areas. In 1977, fawning areas of 5 does were less than 300 m from fawning sites they used in 1976. Fawns (1 in 1976 and 2 in 1977) of a sixth doe were captured within the area where she had been captured as a fawn in 1974. Dasmann and Taber (1956) mentioned that black-tailed deer might show fidelity to preferred or traditional fawning areas.

During this study, 5 known and 4 probable fawning sites were located in a specific habitat type; 3 other possible fawning areas were near an ecotone, where the exact parturition spot and specific habitat could not be precisely determined. Among the 9 known or probable fawning sites, 5 were in open prairie, 3 were in savanna woodland, and 1 was in closed canopy woodland with a dense understory. Dasmann and Taber (1956) mentioned that black-tailed deer sought dense cover in which to give birth to their fawns. Use of dense vegetation and the secretive nature of deer are suggested as reasons why does are seen less in the summer (Hawkins and Klimstra 1970:410, Sparrowe and Springer 1970:427) than at other seasons. Judging from the habitat used for parturition in the Wichita Mountains, does did not seek the most dense woody cover available for fawning, even though such cover was to be found within the home ranges of all marked does. Does frequently chose dense prairie vegetation as parturition sites and this may be a characteristic behavior of prairie subspecies of deer. The does' wariness and reduced home range appeared to be reasons that they were seen less frequently during and just after parturition.

Postpartum

In the 24 hours postpartum, does Wh_1, Wh_2, 0, and R remained less than 100 m from their fawns. Does were less likely to run when approached by a researcher in the first few days postpartum, ran only a short distance, or flattened against the ground in a manner resembling the prostrate position of young fawns (Michael 1964, Miller 1965). The latter behavior occurred especially when a does's fawn(s), less than 3 weeks old, was nearby. By 3 weeks postpartum this hiding behavior was not observed among the dams. Florida Key deer also remained with their fawns almost 100% of the time within 24 hours postpartum (Hardin et al. 1976).

Does and their fawns left the natal bedsites approximately 24 hours after parturition. At this time, siblings began bedding separately, 15 to 260 m apart (x 112, Fig 3a). Distance between siblings and between siblings and dam generally increased through the first 8-9 days of age but began an erratic decline during the next 9 days (Fig. 3). Spatial relationships between individual fawns and their dams were extremely variable. As examples, 1 fawn was never located more than 300 m from the doe during the first month postpartum; another fawn was located 500 to 700 m from its dam the first 10 days after birth. Generally, the distances between does and their fawns were less than 200 m. Downing and McGinnes (1969:712) and White et al. (1972) reported a similar separation of siblings.

The areas utilized by the does were small for the 21 days postpartum (Table 2), but then began to increase. Home range size of the neonatal fawns appears similar to that used by the dam in the first 2 or 3 weeks postpartum. Garner and Morrison (1977) and Bartush (1978) noted that the home range of fawns in the Wichita Mountains continued to increase as the fawns grew older. In south Texas, the length of activity periods tended to increase as fawns grew older (Jackson et al. 1972).

Daily movement of fawns appeared to be influenced by disturbance factors. The daily movements of all radio-collared fawns were greater in the first 3 days after capture than in the fourth to sixth days postcapture (t-test, $P < 0.1$; Table 3). Daily movements were also affected by predators. One member of each of 4 sets of radio-tagged twins was killed by predators. Three of the surviving fawns moved to an area outside of their

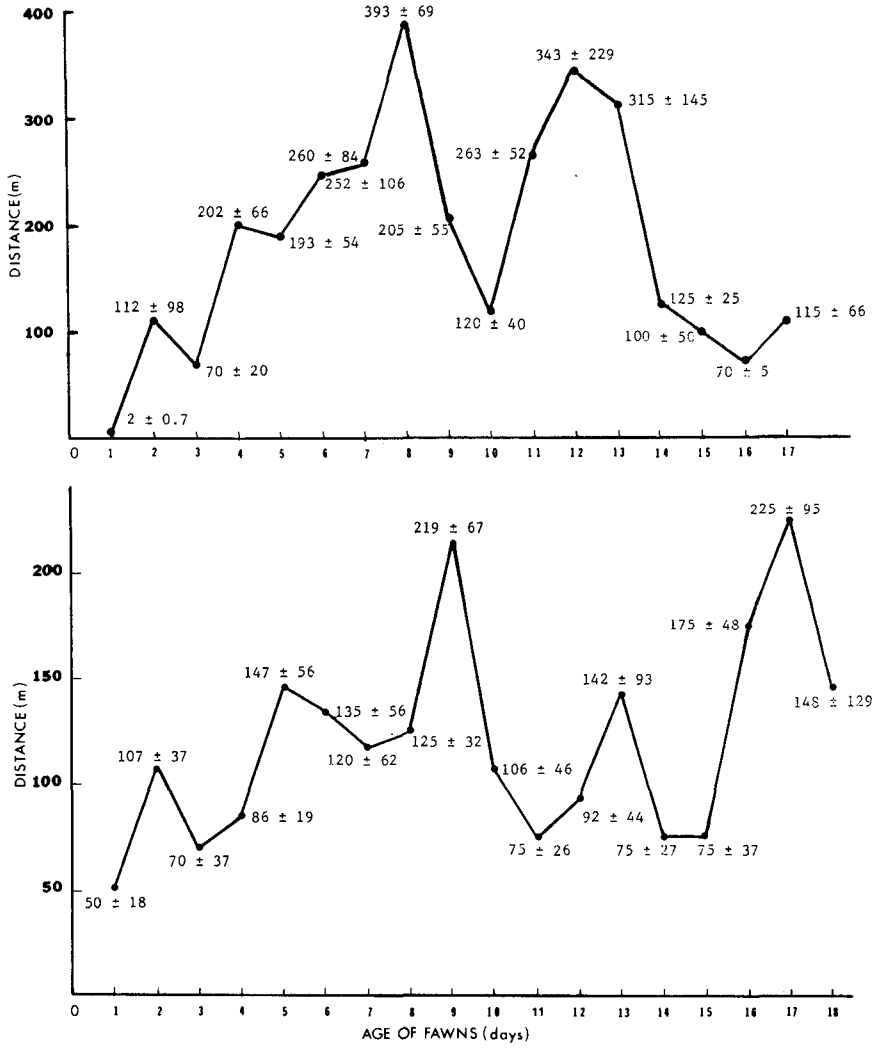

Fig. 3. Average distance (m) ± SE between sibling fawns from 1 to 17 days of age (a, upper illustration), and average distance (m) ± SE between radio-collared does and their fawns from 1-18 days postpartum (b, lower illustration, Wichita Mountains, Oklahoma, 1976 and 1977.

established home range within 24 hours after death of their siblings; the fourth sibling was killed by predators less than 24 hours after its siblings was killed. Two of the 3 sibs that moved out of their home range were killed by predators the second day after the death of their sibling. The only surviving sibling, which by then had returned to the previously established home range, was killed by a coyote 8 days after its twin died.

The movement of siblings, after the death of their respective twins, was presumably a response by the doe to the death of her other fawn. The association between a doe and her

Table 2. Home range (ha) of 11 fawns and their 7 dams in the first 2 to 3 weeks postpartum, Wichita Mountains, Oklahoma, 1976 and 1977.

Doe	*Fawn(s) age at capture (days)*	*Doe home range*	*Fawn(s) home range and (days survived)*	
1976				
Y_1	2	1.8	1.1 (13)	
LB_1	7	1.3	0.6 (6)	
Wh_1	1	2.1	5.4 (14)	2.6 (13)
LB_2	6	4.0	0.5 (10)	
1977				
R	1	2.5	3.9 (21+)	3.1 (19)
0	1	5.7	5.1 (21+)	< 1 (3)
Wh_2	1	3.1	2.3 (21+)	< (2)

Table 3. Average daily movement ± SE for male and female fawns at 1-3 and 4-6 days postcapture, Wichita Mountains, Oklahoma.

Sex	*Sample size*	*Mean daily movement ± SE (m)*
1-3 days postcapture	41	166.9 ± 20.6
M	22	198.4 ± 31.6
F	19	130.5 ± 23.5
4-6 days postcapture	41	130.6 ± 16.1
M	22	163.2 ± 27.4
F	19	92.8 ± 8.4

fawns is the strongest social bond of whitetail deer (Hawkins and Klimstra 1970). A significant disturbance such as violent death of a fawn changes the normal behavior pattern in the primary association. Garner and Morrison (1977) described fawn home ranges in the Wichita Mountains as being significantly larger than those reported in Illinois (Kjos and Montgomery 1969) and eastern Oklahoma (Logan 1972), and suggested 1 reason might be the more open terrain. The high level of predation on fawns causes movement of surviving siblings, and thus was another factor causing larger home ranges. The increased activity of these surviving siblings may have also increased the chance that they would be killed by predators.

Changes in behavior of the does were observed after death of their fawns. Does were observed in the general area of their fawn's last bedsite prior to death, exhibiting what could be described as searching behavior. One radio-collared doe was observed searching in a distinct area 3 different times (ranging from about 20 minutes to just over 60 minutes) during an 8-hour period. Between searches this doe intermittently drank, ate, or bedded for short periods. As the researchers approached the doe ran a short distance, but remained nearby as we searched the area. At 1 spot where the doe had searched intensively, bone fragments, hair, blood, and hooves of a fawn were found. These remains appeared fresh and were similar to descriptions by White (1973) and Garner et al. (1976) of fawn remains after consumption by a predator. Does observed searching appeared restless and exhibited various activities (grooming, feeding, etc.) for brief periods but repeatedly returned to the searching behavior.

The udder and teats of does that had recently lost their fawns were swollen. On 2 separate occasions individual does were observed that appeared to be in pain; they walked slowly, with hind legs stiffened, and often licked their swollen udders. Radio-collared does remained isolated from other deer for at least 3 days after their fawns died. Between 3 and 6 days after loss of their fawns, these does began feeding and resting with other adult deer. Such an association with other adults was never observed among does whose fawns were alive and less than 3 weeks old.

After losing her fawn to predators, doe LB_1 was observed for 3 days. On the third day her udder was swollen and she began feeding and resting with other does; thus, we assumed she had no surviving twin fawn. Approximately 3 weeks later (after 4 additional observations of this doe) LB_1 was seen nursing a young fawn and they remained together throughout the duration of the summer. In the matriarchal social organization (Hawkins and Klimstra 1970) older does normally are the dominant individuals within a given family group. Hersher et al. (1963) described more subordinate goats as the most likely to adopt kids. Since doe LB_1 was 2 years old (probably subordinate in the adult doe group) and showed all signs of having lost her fawn(s), it appears that she adopted the fawn. McGinnes and Downing (1970) also reported the adoption of a fawn that had been abandoned by its mother.

Adult doe groups were increasingly common in WMNWR as summer progressed (Fig. 1), in contrast to populations with high fawn survival (Hawkins and Klimstra 1970, Hirth 1977), but similar to areas experiencing low survival of fawns (Hirth 1977). Group size began to increase in late June. Relocation and observations of radio-collared or marked does revealed that stable groups of adult does were common from midsummer through early spring. After death of their fawns, does joined with members of the herd associated with before parturition. Because of the low annual recruitment of fawns, the doe and fawn(s) social group described by Hawkins and Klimstra (1970) as commonly seen in summer was not the group most characteristic of WMNWR. Related adult doe groups were the more prevalent social groupings in this study area during postpartum. Only small numbers of does and fawns incorporated into these adult social units during mid- and late summer months.

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