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TITLE: Population Dynamics of White-tailed Deer in the Big Cypress National Preserve

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EXECUTIVE SUMMARY

A large-scale, 3-year research investigation of white-tailed deer (*Odocoileus virginianus*) populations in the prairie/tree island habitat of the Big Cypress National Preserve (hunted site--Stairsteps) and the Everglades National Park (protected site--upper Shark River Slough) was initiated in 1989 to elucidate the biological potential of the herds as (1) a food resource (prey base) for the endangered Florida panther (*Felis concolor coryi*), and (2) a recreational resource for sport hunting. To this end, 64 deer (14 fawns, 7 yearlings, and 43 adults) were captured by helicopter netgunning (0.55 helicopter hours per captured animal) and radio-instrumented in 1989. Sixty-three animals were subsequently radio-located, by fixed-wing aircraft, a total of 1,869 times from the time of capture through 31 December 1989; visual sightings of the radio-instrumented deer were recorded for 576 (31%) of the radio-locations. Thirty-seven (59%) of the 63 radio-instrumented deer were "alive and transmitting" as of 31 December 1989.

Survival rates, using Kaplan-Meier "staggered entry" procedures, were calculated by age/sex cohorts and study site. Survival rates by age/sex cohorts were: fawns (n=14), 0.4017 [9 months, Apr-Dec]; yearling males (n=3), 1.000 [8 months, May-Dec]; yearling females (n=4), 1.000 [8 months, May-Dec]; adult males (n=16), 0.6188 [9 months, May-Dec]; and adult females (n=26), 0.7161 [9 months, Apr-Dec]. Age and sex ignored, the survival rate of deer in the hunted herd (0.7387, n=18) was modestly higher than that in the protected herd (0.6220, n=22). However, the survival rate of adult females in the hunted herd (1.000, n=5) was nearly double that in the nonhunted herd (0.5533, n=11). Age, sex, and site ignored, the survival rate of deer in the BCNP/ENP for the 9 months, April-December 1989, was 0.6601, n=63). Of 20 recorded deaths,

4 (20%) were attributed to bobcat (*Felis rufus*) predation, 4 (20%) to legal hunting (males only), 3 (15%) to illegal hunting (poaching), and 9 (45%) to undetermined causes; however, the majority of the latter deaths occurred principally during the wet season--July, August, and September, which tentatively suggests the involvement of stress-related factors. There were no deaths in the yearling age cohort, and only a single death attributable to any factor other than legal hunting or poaching in the adult male cohort.

Twenty-four (96%) of 25 adult females captured in 1989 produced at least a single fawn. The litter sizes for 14 fecund females were: singletons, 12 (86%); and twins, 2 (14%). Minimum calculated litter size was 1.14 fawns per fecund female.

Home range sizes (km^2) by age/sex cohorts, calculated by minimum convex polygon procedures, for the 7-months, June-December 1989, were: fawn females ($n=3$), 2.31; fawn males ($n=9$), 3.85; yearling females ($n=4$), 4.17; yearling males ($n=3$), 5.19; adult females ($n=26$), 4.01; and adult males ($n=16$), 7.51. Thus, males exhibited larger home ranges than females among all age cohorts. Mean home range size among all age/sex cohorts, except the adult male cohort, was constricted during the wet season (June-September) and expanded during the dry season (October-December). Adult males exhibited home ranges during the wet season (coincident with the rutting season) that were 2-fold greater than during the dry season. Home ranges of both adult males and adult females in the hunted herd (Camp 107) increased 2-fold in size between the pre hunting (June-August) and hunting (September-December) seasons, whereas home ranges of adults in the nonhunted herd (Glades) either remained relatively unchanged or declined between the pre hunting and hunting seasons.

Spatial pattern analyses revealed that tree islands, including hardwood hammocks and willow heads, comprised about 3% of the BCNP/ENP study site. Tree island density averaged 9.6 islands/ km^2 ; 89% of the tree islands were ≤ 0.5 ha in size. Tree islands on the BCNP/ENP study site increased notably in density and decreased slightly in size along a northwest-southeast gradient.

Deer appeared to utilize habitats in the BCNP/ENP disproportionately to their availability; to illustrate, 41% of the radio-located deer were associated with tree islands, which comprised only 3% of the land area. Deer used tree islands ≥ 0.5 ha in size more frequently than expected on the basis of availability. Females used open habitats (prairie) more frequently than males, and males used habitats offering concealment (tree islands) more frequently than females.

In summary, recruitment to the BCNP/ENP herd appears to be depressed by the relatively low survival of fawns, which is related to (1) documented predation by bobcats, and (2) suspected stress-related causes associated with the rainy season of late summer. Also, the survival of adult females in the nonhunted Glades herd was relatively low in 1989. The most notable finding to date has been the documented predation by bobcats on adult deer as well as fawns. Preliminarily, the bobcat has emerged as the key predator impacting the natural regulation of deer abundance in the BCNP/ENP.

RESEARCH GOALS

This research study is designed to elucidate selected population characteristics of white-tailed deer in the Big Cypress National Preserve (BCNP)/Everglades National Park (ENP) for the purpose of determining the biological potential of the herd as (1) a food resource (prey base) for the endangered Florida panther, and (2) a recreational resource for sport hunting.

BACKGROUND

This research investigation initially was scheduled to be conducted in the Monument Unit (now Corn Dance and Turner River units) of BCNP; the specific siting of the study area was to be contingent, in part, on the presence of panther activity in the locality. Efforts by the NPS to capture panthers in the Monument Unit during late winter/spring 1989 were unsuccessful; in fact, evidence of panther activity in the Monument Unit was sparse. However, a sub-adult male Florida panther (No. 33) was captured and radio-instrumented in the Stairsteps Unit (near Lostmans Pines) of BCNP in late February. Furthermore, a second sub-adult male Florida panther (No. 16), radio-instrumented in ENP, established temporary residence in the Stairsteps Unit (near Dr. Tiger Hammock) in March. The presence of these two panthers in the Stairsteps Units prompted a revisitation of the specific sites to be selected for the proposed research on white-tailed deer. Inasmuch as the prairie/tree island habitat also supported a relatively high density of deer (1988: 2.4-4.8 deer/km² [Schortemeyer et al. 1989]), it was considered an appropriate site on which to investigate the potential dependence of the Florida panther on the deer as a prey species (Goal 1). As a consequence, the deer study initially was sited in the prairie/tree island complex of the Stairsteps Unit of BCNP. Further, inasmuch as the impact of sport hunting on deer in BCNP is destined to become a critical issue if deer do constitute a major food source of panthers, it was considered prudent to measure the impact of sport hunting on the deer herd in BCNP (Goal 2). To this end, the study site was extended (by contract agreement) into the adjacent and contiguous prairie/tree island habitat of ENP, where sport hunting is prohibited. The expansion of the project from the Stairsteps Unit of BCNP, where sport hunting of deer (and other game species) is permitted annually, into the adjacent ENP, where hunting is prohibited totally, provides the unique opportunity to evaluate the impacts of hunting on a deer herd that occupies a contiguous habitat embraced by the common denominators of hydroperiod and time.

THE STUDY AREA

BCNP consists of approximately 240,000 ha of primarily cypress (*Taxodium distichum*), pine (*Pinus elliottii* var. *densa*), and marsh communities in southwest Florida. The climate of the region is driven by both tropical and temperate influences. Mean annual temperature is 23 C (74 F); mean monthly temperatures range from 14 C (57 F) in January to 28 C (83 F) in August (Duever et al. 1986). Mean annual rainfall for the region is 1,360 mm (53.54 inches) (Duever et al. 1986). The region has a distinct dry winter season (Nov-Apr) and a wet summer season (May-Oct). Generally, precipitation that falls during the wet season is insufficient to compensate for the annual water loss; hence, mild to severe drought conditions are not uncommon in BCNP/ENP. In this respect, 1989 was characterized by a modestly severe drought.

Topographically, the Big Cypress region is nearly flat, with a slight sloping (< 1 foot per mile [Duever et al. 1986]) toward the south and west. Within the 640,000 ha watershed of the Big Cypress Swamp, the sheet flow of water is southwest--toward the Ten Thousand Islands and Gulf of Mexico. In the wet season, the sheet flow inundates the low topographic plain; in the dry season, only sloughs are characterized by standing water.

The project study area is located within the contiguous wet prairie/mixed hardwood hammock (termed prairie/tree island in this report) habitat type that extends from Stairsteps Unit of BCNP southward into ENP. Encompassing about 200km², the area (excluding the "west Steps" site, which initially was included in the study site) is bounded on the north by Dr. Tiger Hammock, on the west by Lostmans Slough, on the east by the BCNP/ENP boundary, and on the south by Shark River Slough (Fig. 1). Within this study region, 3 subsites--Camp 107, Boundary, and Glades, were designated; these subsites reflected those localities in which efforts were made to concentrate subsamples (pods) of radio-instrumented deer.

The study area is comprised of 2 principal habitat types: wet prairie (prairie) and mixed hardwood hammock (tree island). Duever et al. (1986) define wet prairie as that vegetation community characterized by 50-150 days of water inundation per year. Common plants of the wet prairie include maidencane (*Panicum hemitomon*), sand cordgrass (*Spartina bakeri*), sawgrass (*Cladium jamaicense*), muhly grass (*Muhlenbergia* spp.), beak rush (*Rhynchospora* spp.), spike rush (*Eleocharis* spp.), white water-lily (*Nymphaea odorata*), flag (*Sagittaria lancifolia*), and pickerel weed (*Pontederia lanceolata*) (Loveless 1959, Duever et al. 1986). The mixed hardwood hammocks or tree islands, found on slightly elevated bedrock sites in the wet prairie, are characterized by a usually elongated shape, northeast-southwest orientation (axis), variable size (0.01-100.0 ha), closed dome canopy (<20 m in height), and shallow and short-term inundation, if any, by water. These hammocks contain a mixture of tropical and temperate plants (Long 1974). Common tree species include wax myrtle (*Myrica cerifera*), dahoon holly (*Ilex cassine*), willow (*Salix caroliniana*), redbay (*Persea borbonia*), elderberry (*Sambucus simpsonii*), cabbage palmetto (*Sabal palmetto*), strangler fig (*Ficus aurea*), and coco plum (*Chrysobalanus icaco*)--the latter being very susceptible to foliar damage by freezing temperatures e.g., December 1989 (Loveless 1959, Duever et al. 1986). The ground cover in the hammocks often is dominated by royal fern (*Osmunda regalis*), but also includes swamp fern (*Blechnum serrulatum*), blood-berry (*Rivina humilis*), greenbriar (*Smilax* spp.), and aster (*Aster carolinensis*) (Loveless 1959, Wade et al. 1980).

SPECIFIC OBJECTIVES: PHASE I (1989)

Specific objectives for the initial phase of the study on the population ecology of deer in the BCPN/ENP included: (1) the development of a research study design; (2) the evaluation of methods for capturing free-ranging deer for radio-instrumentation and obtainment of physical/morphological measurements, and (3) the development and implementation of methods for documenting mortality, recruitment, spatial distribution, and habitat availability and use.

RESEARCH DESIGN

The study design for the conduct of research on the population ecology of the BCPN/ENP deer herd centered on the use of radio-telemetry procedures as the most feasible means for evaluating mortality, recruitment, spatial distribution, and habitat use. The study design was predicated on two basic assumptions: (1) deer could be captured in sufficient numbers; and (2) radio-instrumented animals could be monitored accurately from fixed-wing aircraft (the latter dictated by the lack or near lack of access to the study site for the conduct of ground monitoring). Despite the uncertainty of successful procedures for capturing deer, a sample of 40 radio-instrumented deer (30 adults/yearlings and 10 fawns) was established as the goal for the initial year of study (1989).

METHODS

Capture Procedures

White-tailed deer were captured exclusively by helicopter-netgunning (Barrett et al. 1982), a technique recently used successfully to capture deer in "open" habitats in south Florida (Smith et al. 1988, 1989; Land 1987, 1989). The netgun (CODA Enterprises, Inc., Mesa, AZ), powered by a .308 caliber blank, deploys a 12 x 12-ft² mesh net from 4 barrels via 4 cylindrical stainless-steel cylinder projectiles; the net, prior to deployment, is contained within a canister that is cradled within the spread of the 4 projectile barrels. The net is fired (forward and down) from the helicopter on deer (running) under pursuit; the net is normally deployed from an above-ground height of 3-4 m. The helicopter pursuit of any individual deer was restricted to a maximum of 3

minutes; if the deer was not captured within 3 minutes, the pursuit was terminated. (Note: Most deer were captured within 2 minutes after the initiation of pursuit.)

All captured deer were immediately blindfolded, physically restrained in the net, and then immobilized by securing the front and hind legs together with cord. Biological data recorded from each deer included: sex; age (Severinghaus 1949); neck and chest circumference (cm); hind foot and total body length (cm); body weight (kg); antler measurements for males--points (right and left), beam circumference (mm), inside antler spread (cm), and beam length (cm); pregnancy/lactation status for females; tail-fat condition index (Stockle et al. 1978); and ectoparasite index. Blood smears (thick and thin) were also collected from fawns for subsequent blood parasite analyses. Each deer was marked with numbered No. 49 monel ear tags in both right and left ears, and a radio-transmitter/collar (150-152 MHz frequency range), equipped with motion-sensitive activity (2X signal pulse) and mortality (4X signal pulse) modes (Wildlife Materials, Inc., Carbondale, IL). Processing time averaged about 20 minutes per animal (for a 2-person team), after which time the deer was released at the capture site.

Radio-telemetry Monitoring

The relatively remote location of the study area (a portion being in the Everglades, where ground access is prohibited), the seasonally fluctuating hydroperiod, and the areal expanse of the study area essentially limit the obtainment of radio-locations of instrumented deer to aerial telemetric monitoring (by fixed-wing aircraft), which, in turn, restricts the location-monitoring to daylight hours. Given these logistical restrictions, a biological-clock regime was designed to obtain unbiased daylight monitoring data. To this end, the daylight hours were subdivided into 4 distinct periods: sunrise to 2 hours post-sunrise; 2 hours post-sunrise to mid-day; mid-day to 2 hours pre-sunset; and 2 hour pre-sunset to sunset. Accordingly, each radio-instrumented deer is located once each 5-day period, which yields 72 radio-locations per surviving animal per year; all radio-locations for any given animal are equally divided among the 4 discrete daytime monitoring periods. Additionally, all radio-instrumented deer are monitored with respect to mortality on every radio-location flight, which equates to a minimum of 4 times every 5 days.

Each radio(deer)-location is sketched on a notepad, using topographic features, during the flight, and supplemented by the following information: date/time; habitat, including distance to, type and size of nearest tree island; behavioral activity; associations with other deer when applicable; and transmitter-signal characteristics (1X, 2X, or 4X pulse). Immediately after the completion of each flight, the sketched locations are verified by satellite photographs (scale = 1:26,000) of the study area, and then plotted on Universal Transverse Mercator (UTM) maps to obtain empirical x and y coordinates. The coordinates for each radio-location are then both recorded on a data sheet and logged into a computer file.

Home range sizes presented in this report were calculated by the minimum convex-polygon method (Mohr 1947), using the MCPAAL computer software program.

Mortality

All radio-instrumented deer for which death was indicated by the emittance of the transmitter-mortality signal (4X pulse) were investigated upon occurrence (fixed-wing flight). This airborne investigation generally isolated one of 3 outcomes: (1) a false-mortality signal, which was usually detected by "buzzing" the site of radio-location, thereby disturbing the deer and reactivating the normal activity switch (1X pulse); (2) sighting the carcass of the dead radio-instrumented animal; or (3) failure to either sight the dead radio-instrumented animal or to verify a false-mortality signal. In the latter 2 instances, efforts were made to reach the site as soon as possible by helicopter (ENP) or by either helicopter, airboat, or 4-wheel ATVs (BCNP) to verify

death, and if verified, to determine cause and time of death as well as to recover the carcass, pending the usefulness of its condition, for subsequent necropsy.

Survival estimates of radio-instrumented deer were derived by the product-limit estimator procedure (Kaplan and Meier 1958), modified to allow for the staggered entry of new radio-instrumented animals that were added to the sample population as the study progressed in calendar time (Pollock et al. 1989).

Habitat

The size, spatial distribution, and areal extent of tree islands was measured for purposes of determining their importance as habitat for deer. To this end, tree islands were separated into 2 community-types--hardwood hammocks and willow heads.

The sample area included the extent of the study area that encompassed the 3 major pods of radio-instrumented deer--Camp 107 (BCNP), Boundary (BCNP/ENP), and Glades (ENP). The sample design consisted of a total of 30, 4 km² quadrats contained within 3, 2 km-wide, 24 km-long transects, oriented on a north-south axis. The 5 northernmost quadrats and 5 southernmost quadrats in each transect constituted the sample units for the BCNP (north) and ENP (south), respectively. Thus, 15, 4 km² quadrats were sampled in BCNP, and 15 in ENP. Transect and quadrat boundaries were outlined on topographic maps, and then transferred to aerial photographs (date: March 1984). A scale of 1:26,200 was calculated by comparing the distance between landmarks on a topographic map of known scale (1:24,000) with that measured on the aerial photographs (Avery 1977).

Field observations indicated that a high proportion of the tree islands were < 0.1 ha in size. Accordingly, a grid of 0.1 ha-sized units, 1.2 mm x 1.2 mm, was used to construct a master grid. Tree island size was measured within each quadrat by overlaying the aerial photographs with the master grid. (Note: Measurements were not recorded from the outer edge of the aerial photographs to minimize the effects of optical distortion [Lee 1941].) However, a proofing of the master grid revealed that the individual grid-squares measured 0.16 ha rather than 0.10 ha. Islands that measured < 1 grid-square, but $\geq$ 0.5 grid-square, were recorded as 1 grid-square, or 0.16 ha; islands that measured < 0.5 grid-square were recorded as < 0.5 grid-square, or < 0.08 ha. This classification system allowed the separation of tree islands into 7 size-classes: < 0.10 ha; 0.11-0.50 ha; 0.50-1.00 ha; 1.01-3.00 ha; 3.01-5.00 ha; 5.01-10.00 ha; and >10.00 ha.

The distribution of tree islands was evaluated by Spatial Pattern Analysis (Blocked-Quadrat Variance Method/Two-Term Local Quadrat Variance Method/Paired-Quadrat Variance Method) (Ludwig and Reynolds 1988). SPA utilizes changes in block size and quadrat spacing to detect underlying patterns in community structure.

RESULTS/DISCUSSION

Capture Success/Study Sample

Sixty-five individual deer were captured by helicopter netgunning during 36.0 h of helicopter time expended on portions of 9 days during March, April, May, June and August 1989 (Tables 1 and 2). Eighty-one percent (65) of the 80 deer pursued were captured; notably, capture efficiency increased as the capture team gained in proficiency--40% in March, 56% in April, and 100% in May, June, and August. The amount of helicopter time expended per capture (inclusive of travel time) averaged 0.55 h per deer. Capture-time per deer declined also as the capture team gained experience, as was reflected by means of 0.74 h (44 minutes) per non-selective capture during March and April and 0.49 h (29 minutes) per selective capture in May, June, and August (Table 2).

Only 2 (3%) of the 65 deer captured died as a result of the capture process; 1 adult female was fatally injured during capture, and 1 adult female (BC8920) died from probable capture myopathy (Chalmers and Barrett 1982) 7 days after capture. Thus, the study herd of radio-instrumented deer in 1989 included 63 animals, 37 (59%) of which were alive and transmitting a radio-signal as of 31 December 1989.

The radio-instrumented sample of 63 deer was distributed about equally between BCNP and ENP, with 8 being located in the Steps pod, 18 in the Camp 107 pod, 15 in the Boundary pod, and 22 in the Glades pod (Table 3).

Age and Sex Structure

The age/sex structure of the 63 deer in the study herd included 29 males (16 adults, 3 yearlings, and 10 fawns) and 34 females (26 adults, 4 yearlings, and 4 fawns). The selective capture of deer employed in the study during 1989 precluded an unbiased analysis of the sex and age structure of the sample. However, the age structure of the adult female component of the herd should not reflect capture bias, and, thus, merits evaluation. The unverified age profile among 27 adult (≥ 2 years in age) females was: 2 years = 22%; 3 years = 37%; and ≥ 4 years = 41%. Comparatively, the age profile among 143 adult females from 5 disjunct herds in Florida was: 2½ years = 30%; 3½ years = 25%; and $\geq 4½$ years = 45% (Richter and Labisky 1985). These data preliminarily suggest that the BCNP/ENP deer herd, specifically females, may have some skewness toward deer ≥ 3 years in age.

Survival/Mortality

Survival rates were derived from the radio-instrumented herd using the product-limit estimator procedure (Kaplan and Meier 1958), modified to allow for the "staggered entry" of radio-instrumented individuals added to the sample during the course of the investigation (Pollock et al. 1989) (Tables 4-13). Survival rates by age/sex cohorts were: fawns (n=14), 0.4017 [9 months, Apr-Dec]; yearling males (n=3), 1.000 [8 months, May-Dec]; yearling females (n=4), 1.000 [8 months, May-Dec]; adult males (n=16), 0.6188 [8 months, May-Dec]; and adult females (n=26), 0.7161 [9 months, Apr-Dec] (Tables 4-7). Notably, there were no deaths in the yearling cohort during the 8-months, May-December. Further, there was only a single death within the adult male cohort during the 8-months, May-December, that was attributable to factors other than legal hunting or poaching (Table 14); yet, man-induced losses (hunting and poaching) resulted in the removal of 31% of the adult males from the sample in the 8-month period (Table 7). These partial-year survival rates of deer for this BCNP/ENP herd are notably less, except for yearlings, than those annual survival rates reported for the radio-instrumented East Everglades herd (nonhunted) in 1987 and 1988 by Smith et al. (1989): fawns = 80% (n=20); yearlings = 65% (n=11); adult males = 84% (n=12); adults females = 84% (n=23).

The survival of fawns, sex ignored, was 0.4017 for the 9-months, April-December; this survival rate was modestly higher than the 9-month rate of 25% reported for radio-instrumented fawns in South Carolina (Epstein et al. 1983), but notably less than the annual rate of 80% reported in the East Everglades (Smith et al. 1989). Of the 7 documented deaths of radio-instrumented fawns, 3 were attributable to bobcat predation (Table 14); the predation, however, did not occur until the fawns had reached ≥ 5 months in age. Noteworthy is that the death of 1 fawn (BC8911) occurred when its mother (BC8910) embarked on an excursion of several days duration from the established doe/fawn home range during the rut in late July. (Note: The annual survival rate of fawns in the BCNP/ENP for the 12 months, April 1989-March 1990, was 0.2001; this annual rate preliminarily suggests that fawn mortality may be a depressant to recruitment.)

A indirect measure of fawn mortality was derived from radio-instrumented adult females (≥ 2 years) that were either accompanied by fawns and/or exhibited lactation at the time of capture. These observations revealed that of 23 radio-instrumented does that gave birth to at least a single fawn in 1989, 17 were still accompanied by a fawn(s) on 30 June, which implies a crude fawn survival rate of 74%; however, the fawn(s) of only 5 of 18 of these females were alive on 31 December, which suggests a crude survival rate of 28% (Table 15). These findings, as well as those from radio-instrumented fawns (Table 14), suggest that fawn mortality may be higher among older fawns than among younger fawns--which is contrary to that reported for fawns in coastal South Carolina (Epstein et al. 1985) and in the East Everglades (Smith et al. 1989).

Age and sex ignored, the survival rate of deer in the hunted herd (Camp 107 = 0.7387, Table 8) was higher than that in the nonhunted herd (Glades = 0.6220, Table 11); this difference was manifest even though radio-instrumented deer in the hunted herd were subjected to a 9-month mortality period in contrast to a 7-month mortality period in the nonhunted herd. Interestingly, the survival of deer in the Boundary herd, which was located on the BCNP/ENP boundary and, thus, subjected to partial hunting, had the lowest survival rate (0.5728, Table 9) of the four delineated herds. In contrast, the Steps herd, which also was located along the BCNP/ENP boundary and subjected to partial hunting, exhibited a survival rate (0.6666, Table 10) exceeded only by that in the Camp 107 herd. Notably, however, the survival rate of adult females in the hunted herd (Camp 107 = 1.000) was nearly double that in the nonhunted herd (Glades = 0.5533) (Table 12).

Age, sex, and location ignored, the survival rate of the entire radio-instrumented herd of deer on the BCNP/ENP study site for the 9-months, April-December 1989, was 0.6601 (Table 13). This rate of survival was less than the annual survival rates of radio-instrumented deer, 0.721 for 1987-88 and 0.751 for 1988-89, at Bear Island (BCNP) (Land 1989).

Of 20 recorded deaths (Table 14), 4 (20%) were attributed to bobcat predation, 4 (20%) to legal hunting (males only), 3 (15%) to illegal hunting (poaching), and 9 (45%) to undetermined causes; however, 6 of the latter deaths occurred during the wet season--July (3), August (2), and September (1), which tentatively suggests the involvement of malnutrition/stress factors. Notably, no deaths in the radio-instrumented herd occurred prior to July 12, even though there were as many as 53 animals at risk.

Reproductive Phenology

Loveless (1959) reported that breeding activity in the Everglades deer herd occurs throughout the year, but is most prevalent in August, September, and October. This schedule of breeding is supported by the findings of Richter and Labisky (1985), who reported a median breeding date of 8 August (range = 83 days) for the nearby herd on Rotenberger Wildlife Management Area. Therefore, the median date of fawning in BCNP/ENP, using the standard gestation period of 200 days (Cheatum and Morton 1946, Haugen and Davenport 1950, Haugen 1959), would occur about

24 February. Thus, fawning in the BCNP/ENP occurs principally in February, March, and April, and is synchronized with the dry season (Richter and Labisky 1985, Smith et al. 1989, this study).

Productivity

Twenty-four (96%) of 25 adult females captured in 1989 gave birth to at least a single fawn (Table 15); only 1 adult female was barren. The frequency of litter sizes (albeit minimum), ascertained at capture or by subsequent radio-locations, for 14 does was: singletons, 12 (86%); and twins, 2 (14%). These litters equate to a minimum productivity rate of 1.14 fawns per fecund adult female, which is very similar to the number of fetuses per pregnant doe reported for other Florida deer herds--1.30 (Harlow and Jones 1965) and 1.28 (Richter and Labisky 1985). Thus, the prevalence of pregnancy and litter size, and resultant productivity, in the BCNP/ENP herd appears to be in concert with that observed throughout Florida. Nonetheless, the productivity of deer in Florida is substantially less than that reported for herds not only in the South but also throughout eastern North America (Richter and Labisky 1985).

Although Loveless (1959) observed that twinning was not uncommon in the Everglades--particularly in dry years, Smith (1989) reported the occurrence of only singleton fawns in the East Everglades (Taylor Slough) in 1987 and 1988. However, multiple litters appear to be relatively common in the BCNP/ENP study area (Forrester and Wright 1989, Table 15). (Note: In addition to the multiple litters reported in Table 15, 3 litters of triplets and ≥ 4 litters of twins were observed during capture flights in BCNP/ENP during April and May 1989.)

Spatial Distributions: Home Ranges and Movements

Home range sizes (km^2) by age/sex cohorts, calculated by minimum convex polygon procedures, for the 7-months, June-December 1989, were: fawn females ($n=3$), 2.31; fawn males ($n=9$), 3.85; yearling females ($n=4$), 4.17; yearling males ($n=3$), 5.19; adult females ($n=26$), 4.01; and adult males ($n=16$), 7.51 (Table 16). Thus, males exhibited larger home ranges than females among all age cohorts.

Mean home range size among all age/sex cohorts, except the adult male cohort, was constricted during the wet season (June-September) and the pre hunting season (June-August) and expanded during the dry season (October-December) and the hunting season (September-December) (Table 17). Noteworthy is that the greatest enlargement of home ranges between these summer and fall periods occurred among female fawns (>2-fold increase) and yearling males (>3-fold increase). Adults males exhibited home ranges during the summer wet season that were about 2-fold greater than those exhibited during the subsequent fall months; these large home ranges during the wet period were likely a reflection of the rutting season, which peaks in August.

A comparison of home ranges of adults between the Camp 107 (hunted) and Glades (nonhunted) areas revealed that (1) home ranges of both males and females were smaller in the nonhunted herd than in the hunted herd (possibly a reflection of different population densities) and (2) home ranges of both males and females doubled in size in the hunted herd between the pre hunting- and hunting-season periods whereas those in the nonhunted herd either remained relatively unchanged or declined between the pre hunt and hunt periods (Table 18). Preliminarily, the latter finding points to increased movement activity resulting from the disturbance associated with hunting.

Familial Units/Associations

Eight distinct familial units, involving 20 radio-instrumented deer, were derived by the selective capture of individuals in 1989 (Table 19). Death or transmitter-loss had altered the composition of 7 of the 8 familial units by 31 December 1989. One familial unit, consisting a mother/fawn, was eliminated by the death of both family members in September.

Habitat Distribution and Size of Tree Islands

Spatial pattern analyses revealed a substantive variance in the density and size of tree islands, including both hardwood hammocks and willow heads, along both north (BCNP)-south (ENP) and west-east axes (Table 20). The overall density of tree islands ($n=1,145$) on the study area was 9.6 islands/km². The frequencies of tree islands by size class were: ≤ 0.1 ha = 51%; $>0.1-0.5$ ha = 38%; $>0.5-1.0$ ha = 6%; $>1.0-3.0$ ha = 4%; >3.0 ha = 1%. Thus, small tree islands were most prevalent, with 89% of the islands being <0.5 ha in size. Despite the landscape conspicuousness of tree islands in this prairie ecosystem, tree islands occupied only approximately 3% of the land area.

The density of tree islands along the north-south gradient was 7.5 islands/km² in the north (BCNP) and 11.6 islands/km² in the south (ENP), whereas the density of tree islands on the west-east gradient was 6.8, 9.8 and 12.1 islands/km² in the west, central, and east transects, respectively. The frequency of small tree islands (≤ 0.5 ha) was slightly greater in the south (91%) than in the north (85%), but nearly equivalent in the west (90%), central (86%), and east (87%). Thus, in general, tree islands on the BCNP/ENP study site increased notably in density and decreased slightly in size along a northwest-southeast gradient.

Habitat Use

Preliminarily, deer appear to utilize habitats in the BCNP/ENP disproportionate to their availability (Table 21). Eighty-one percent of the radio-located deer were associated with 2 habitats, prairie and tree islands, which accounted for 40% and 41% of observed use, respectively. The disproportionately high use by deer of tree islands, which constitute only about 3% of the study area, strongly corroborates the observation of Loveless (1959:21) that "Tree islands are the key to an understanding of the ecology of Everglades deer ..."

Deer also exhibited a sex-related difference in their use of habitat (Table 21). Females utilized open habitats (prairie) more frequently than males, and males utilized habitats offering concealment (tree islands) more frequently than females.

Deer did not use tree islands of different sizes with respect to their availability (Table 22). Although 89% of the tree islands were included in size classes ≤ 0.5 ha (Table 20), only 42% of the radio-instrumented deer were located within and 58% nearby (within 50 m) these small islands. This preliminary analysis suggests that deer may use larger islands (≥ 0.5 ha) more than expected on the basis of their availability.

Interestingly, deer associated with small islands (≤ 0.5 ha) were located more frequently nearby the island than within the island, whereas those associated with larger islands were located within the island more frequently than nearby the island (Table 22). The latter observations indicate that deer may use the smaller islands for escape cover while foraging and the larger islands for daytime resting cover.

ASSESSMENT

Preliminarily, productivity of the BCNP/ENP deer herd in 1989 appeared to be equivalent to that documented in other Florida herds. However, recruitment to the herd appeared to be depressed by the relatively low survival of fawns, which was related to (1) documented predation by bobcats, and (2) suspected stress-related factors associated with the rainy season of late summer. Also, the survival of adult females in the nonhunted Glades herd was relatively low (0.5333) for the 7-month period, June-December 1989. Home range analyses suggested that hunter-activity in the hunted Camp 107 herd exacerbated movements of deer during the hunting season, the impact of which has not been documented. The most significant finding to date has been the documented predation by bobcats on adult deer as well as on fawns. Thus, the bobcat has emerged as a predator that potentially plays a key role in the natural regulation of population abundance in the BCNP/ENP deer herd. Accordingly, it is recommended that a radio-telemetry study of bobcats be initiated, and conducted concurrently with the deer study, for the purpose of evaluating this unique predator-prey relationship in the Everglades system.

1990 UPDATE

Fifty-one deer, including 34 fawns, were captured and radio-instrumented during January-April 1990. Eleven radio-instrumented deer were lost to "natural causes" during the 5-months, January-May; the causes of death were: bobcat predation, 7; panther predation, 1; and undetermined, 3. As of 31 May 1990, the extant radio-instrumented herd of deer on BCNP/ENP study site totalled 70 animals..

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DATE OF REPORT: 31 May 1990

Table 1. Statistics on deer captured by helicopter netgun and radio-instrumented on Big Cypress National Preserve/Everglades National Park, Florida, March-December, 1989. Number of available transmitter-days and number of radio-locations are presented for each deer from date of capture through 31 December, 1989.

Deer ID	Capture date	Capture location: Loran coordinates	Sex	Age at capture (yrs)	Body weight (kg)	Radio frequency (collar-type) ^a	Transmitter-days/ 31 Dec 89 ^b	Radio-locations/ 31 Dec 89	Capture comments
BC8901	28 Mar 89	2541.7/8056.9(C) ^c	M	Fawn	4.5	151.806 (B)	269(M:21 Dec)	48(12) ^d	Fawn w/doe
BC8902	28 Mar 89	2540.2/8057.8(C)	F	>4	40.0	151.902 (F)	278	44(14)	Pregnant
BC8903	05 Apr 89	2544.0/8057.2(C)	M	Fawn	11.3	151.845 (B)	270	41(09)	Fawn w/doe
BC8904	05 Apr 89	2542.1/8057.1(C)	F	>4	35.8	151.853 (F)	270	39(14)	Lactating
BC8905	05 Apr 89	2542.3/8057.0(C)	F	1	31.3	151.863 (F)	270	40(04)	Neither pregnant nor lactating
BC8906	05 Apr 89	2539.9/8058.9(B)	F	>3	39.9	151.873 (F)	270	37(03)	Lactating
BC8907	05 Apr 89	2540.0/8059.2(B)	M	2	34.5	151.748 (E)	260(M:21 Dec)	45(06)	
BC8908	05 Apr 89	2544.2/8055.7(C)	F	>2	34.0	151.931 (F)	270	41(19)	Lactating, w/fawn
BC8909	05 Apr 89	2543.6/8057.3(C)	M	Fawn	15.4	151.825 (B)	139(C:22 Aug)	18(06)	Twin fawns w/doe
BC8910	05 Apr 89	2541.9/8103.2(S)	F	>3	36.3	151.950 (F)	270	39(07)	Doe of fawn BC8911
BC8911	05 Apr 89	2541.9/8103.2(S)	M	Fawn	11.8	151.885 (B)	111(M:25 Jul)	09(02)	Fawn of doe BC8910
BC8912	06 Apr 89	2547.2/8103.4(S)	M	3	43.5	151.836 (E)	213(M:05 Nov)	24(06)	6-point
BC8913	06 Apr 89	2546.1/8056.3(C)	M	3	43.5	151.794 (E)	214(C:06 Nov)	30(01)	7-point
BC8914	06 Apr 89	2541.7/8057.2(B)	F	3	35.8	151.916 (F)	269	39(10)	Lactating
BC8915	06 Apr 89	2540.8/8057.8(B)	M	2	43.1	151.971 (E)	232(M:25 Nov)	32(11)	Fork-horn
BC8916	06 Apr 89	2540.4/8059.6(B)	F	1	28.1	151.940 (F)	269	38(06)	Neither pregnant nor lactating
BC8917	06 Apr 89	2541.5/8058.0(C)	M	1	28.1	151.880 (E)	269	41(23)	Spike
BC8918	10 May 89	2532.4/8056.9(G)	F	5 ^e	42.2	151.909 (F)	64(M:13 Jul)	08(02)	Lactating
BC8919	10 May 89	2532.5/8057.5(G)	F	>4	35.4	151.955 (F)	235	39(28)	Lactating
BC8920	10 May 89	2531.7/8056.9(G)	F	3 ^e	30.8	151.965 (F)	7(M:17 May)		Lactating; died (capture myopathy), 17 May 89
BC8921	10 May 89	2532.5/8057.0(G)	F	>3	41.7	151.985 (F)	235	38(12)	Lactating
BC8922	10 May 89	2539.5/8058.1(B)	F	<3	40.8	151.998 (F)	235	38(15)	Doe (lactating) w/fawn

Table 1. Continued, 2 of 3.

Deer ID	Capture date	Capture location: Loran coordinates	Sex	Age at capture (yrs)	Body weight (kg)	Radio frequency (collar-type) ^a	Transmitter-days/ 31 Dec 89 ^b	Radio-locations/ 31 Dec 89	Capture comments
BC8923	10 May 89	2539.5/8100.7(B)	M	1	24.9	151.920(E)	235	36(13)	Spike
BC8924	10 May 89	2539.8/8100.5(B)	M	Fawn	13.6	151.813(B)	79(C:28 Jul)	07(00)	
BC8925	10 May 89	2532.7/8056.0(G)	M	4/5	54.5	151.730(E)	235	37(10)	8-point
BC8926	10 May 89	2532.5/8053.1(G)	F	>4	37.6	150.976(F)	235	39(12)	Lactating
BC8927	10 May 89	2535.4/8054.4(G)	M	4	51.7	151.761(F)	235	38(10)	8-point
BC8928	11 May 89	2533.4/8055.8(G)	M	Fawn	9.5	151.830(B)	178(M:05 Nov)	28(07)	Fawn w/doe
BC8929	11 May 89	2532.8/8055.7(G)	M	Fawn	7.8	151.857(B)	121(M:10 Sep)	15(02)	Fawn of doe BC8930
BC8930	11 May 89	2532.8/8055.7(G)	F	4 ^e	27.2	151.065(F)	132(M:20 Sep)	13(07)	Doe of fawn BC8929
BC8931	11 May 89	2531.6/8055.6(G)	F	3 ^e	27.2	151.651(F)	145(M:03 Oct)	22(05)	Doe w/fawn
BC8932	11 May 89	2530.6/8054.9(G)	M	Fawn	11.3	151.867(B)	82(M:01 Aug)	10(05)	
BC8933	11 May 89	2532.1/8052.7(G)	M	3/4	63.5	151.775(E)	234	39(13)	10-point
BC8934	11 May 89	2531.9/8053.8(G)	M	>5	65.8	151.890(E)	234	38(07)	9-point
BC8935	11 May 89	2541.1/8057.4(S)	F	Fawn	11.8	151.896(B)	228(M:25 Dec)	39(25)	Fawn w/doe and yearling
BC8936	11 May 89	2542.0/8103.4(S)	M	1	31.3	151.710(E)	234	40(16)	Spike
BC8937	11 May 89	2543.2/8106.1(S)	F	2	35.8	151.736(F)	211(C:08 Dec)	31(02)	Not lactating
BC8938	11 May 89	2544.9/8105.2(S)	F	5 ^e	33.1	151.757(F)	90(M:09 Aug)	14(04)	Lactating
BC8939	11 May 89	2544.3/8108.0(S)	F	1	29.0	151.781(F)	234	36(07)	Not lactating
BC8940	28 Jun 89	2545.7/8056.9(C)	M	3	52.6	151.596(E)	147(M:22 Nov)	28(09)	Fork-horn
BC8941	28 Jun 89	2543.4/8057.0(C)	F	>5	38.1	151.692(F)	186	38(12)	Doe of fawn BC8909
BC8942	28 Jun 89	2543.8/8055.7(C)	F	Fawn	20.0	151.699(B)	47(C:14 Aug)	12(03)	Fawn w/doe
BC8943	28 Jun 89	2530.6/8055.3(G)	F	4 ^e	37.2	151.679(F)	88(M:25 Sep)	17(12)	
BC8944	28 Jun 89	2533.9/8050.0(G)	M	Fawn	21.8	151.542(E)	186	33(10)	Triplet fawns
BC8945	28 Jun 89	2533.4/8055.1(G)	F	>3	30.8	151.671(F)	186	34(27)	Doe of fawn BC8928
BC8946	28 Jun 89	2533.9/8055.5(G)	M	>3	49.9	151.531(E)	186	34(09)	5-point
BC8947	28 Jun 89	2542.0/8103.3(S)	F	2/3	30.4	151.960(F)	186	33(07)	Doe (lactating) w/doe BC8910 and fawn

Table 1. Continued, 3 of 3.

Deer ID	Capture date	Capture location: Loran coordinates	Sex	Age at Capture (yrs)	Body weight (kg)	Radio frequency (collar-type) ^a	Transmitter-days/ 31 Dec 89 ^b	Radio-locations/ 31 Dec 89	Capture comments
BC8948	28 Jun 89	2542.2/8057.8(C)	M	Fawn	12.7	151.500(B)	127(C:02 Nov)	28 (01)	Twin fawn of doe BC8904
BC8949	28 Jun 89	2545.1/8054.7(C)	M	2/3	41.7	151.522(E)	123(M:29 Oct)	24 (11)	Fork-horn
BC8950	29 Jun 89	2543.8/8057.9(C)	F	Fawn	19.5	151.554(B)	185	38 (07)	
BC8951	29 Jun 89	2539.4/8057.9(B)	F	Fawn	12.2	151.452(B)	14(M:12 Jul)	03 (01)	Fawn of doe BC8922
BC8952	29 Jun 89	2534.6/8053.0(G)	M	3	42.2	151.512(E)	185	34 (08)	8-point
BC8953	29 Jun 89	2536.6/8050.2(G)	F	>3	34.9	151.663(F)	185	32 (06)	
BC8954	29 Jun 89	2536.8/8055.6(B)	F	5 ^c	38.1	151.664(F)	121(M:28 Oct)	24 (16)	Lactating
BC8955	14 Aug 89	2543.4/8056.4(C)	F	2½	38.6	151.635(F)	139	27 (07)	Doe (estrus) w/fawn BC8909
BC8956	14 Aug 89	2543.3/8057.0(C)	M	2½	34.9	151.490(E)	139	28 (05)	Spike (hard)
BC8957	14 Aug 89	2542.6/8058.7(C)	M	5½	68.0	151.482(E)	77(M:30 Oct)	14 (02)	11-point hard
BC8958	14 Aug 89	2541.0/8056.9(B)	F	3½	37.6	151.623(F)	139	26 (05)	Doe (estrus) w/doe BC8914
BC8959	14 Aug 89	2536.7/8054.8(B)	F	2½	34.0	151.590(F)	139	27 (21)	Doe (estrus) w/doe BC8954
BC8960	14 Aug 89	2536.1/8054.2(B)	M	3½	44.4	151.471(F)	139	25 (10)	6-point (hard)
BC8961	14 Aug 89	2530.8/8052.6(G)	M	3½	65.8	151.387(E)	139	27 (01)	8-point (hard)
BC8962	14 Aug 89	2531.2/8054.9(G)	F	1½	25.9	151.965(E)	139	27 (14)	Estrus (attended by 6-point male)
BC8963	14 Aug 89	2530.6/8052.8(G)	F	2½	34.9	151.579(F)	139	27 (11)	Recent lactation; estrus
BC8964	14 Aug 89	2533.2/8053.0(G)	F	5½ ^c	39.9	151.569(F)	88(M:10 Nov)	19 (06)	Still lactating

^aCollar-type: B = breakaway fawn collar; F = fixed, permanent collar; E = expandable, permanent collar.^bNumber of transmitter days from capture through 31 December 1989, except for animals that died (M) or were censored (C) due to transmitter/collar failure.^cLocation-units: C=Camp 107; S=Steps; B=Boundary; and G=Glades.^dNumerals within parentheses denote number of radio-locations for which animal was sighted.^eAged by examination of wear and replacement of teeth at time of mortality; age back-calculated to time of capture.

Table 2. Efficiency of capturing white-tailed deer by helicopter netgunning, Big Cypress National Preserve/Everglades National Park, March-December 1989.

Dates	Capture efficiency			Technique efficiency		Capture-time efficiency	
	Number of deer for which capture was attempted	Number of deer captured	Percentage captured	Number of netgun attempts (shots)	Percentage shooting efficiency	Hours of helicopter time	Helicopter hours/captured deer
28/29 Mar	5	2	40	6	33	1.50	0.75 ^a
05/06 Apr	27	15	56	40	38	11.00	0.73 ^a
10/11 May	22	22	100	28	79	9.00	0.41 ^a
28/29 Jun	16	16	100	18	89	10.20	0.64 ^b
14 Aug	10	10	100	14	71	4.30	0.43 ^b
Total/mean	80	65	81	106	61	36.00	0.55

^aNon-selective capture of individuals.

^bSelective capture of individuals, i.e., efforts were made to capture only (1) individuals related to previously radio-instrumented deer and (2) antlered males.

Table 3. Age and sex of white-tailed deer captured by helicopter netgunning, Big Cypress National Preserve/Everglades National Park, March-December 1989.

Location-unit or pod	Number of deer captured						Total
	Adults		Yearlings		Fawns		
	M	F	M	F	M	F	
Steps	1	4	1	1	1	0	8
Camp 107	5	6 ^a	1	1	4	2	19
Boundary	4	6	1	1	1	2	15
Glades	6	12 ^b	0	1	4	0	23
Total	16	28	3	4	10	4	65 ^c

^aIncludes 1 adult doe injured (dispatched) during capture operations.

^bIncludes 1 adult doe captured and radio-instrumented that subsequently died from probable capture myopathy.

^cThirty-seven radio-instrumented individuals were alive/transmitting as of 31 December 1989.

Table 4. Survival rate of radio-instrumented fawn white-tailed deer, sex ignored, in the Big Cypress National Preserve/Everglades National Park, April-December, 1989. Survival rate derived from the product-limit estimator procedure (Kaplan and Meier 1958), modified to allow for the "staggered" entry of radio-instrumented animals captured during the course of the study (Pollock et al. 1989).

Month	Number at risk (r_i)	Number of deaths (d_i)	Number censored ^a	Number added	Survival (S_i)
Mar	0	0	0	1	N/A
Apr	1	0	0	3	1.0000
May	4	0	0	5	1.0000
Jun	9	0	0	5	1.0000
Jul	14	2	1	0	0.8571
Aug	11	1	2	0	0.7791
Sep	8	1	0	0	0.6818
Oct	7	0	0	0	0.6818
Nov	7	1	1	0	0.5844
Dec	5	2	0	0	0.3506

^aNumber of deer for which radio-transmitter failed or transmitter signal was "lost" because of sudden dispersal from study site.

Table 5. Survival rate of radio-instrumented yearling white-tailed deer, sex ignored, in the Big Cypress National Preserve/Everglades National Park, May-December, 1989. Survival rate derived from the product-limit estimator procedure (Kaplan and Meier 1958), modified to allow for the "staggered" entry of radio-instrumented animals captured during the course of the study (Pollock et al. 1989)

Month	Number at risk (r_i)	Number of deaths (d_i)	Number censored ^a	Number added	Survival (S_i)
Apr	0	0	0	3	N/A
May	3	0	0	3	1.0000
Jun	6	0	0	0	1.0000
Jul	6	0	0	0	1.0000
Aug	6	0	0	1	1.0000
Sep	7	0	0	0	1.0000
Oct	7	0	0	0	1.0000
Nov	7	0	0	0	1.0000
Dec	7	0	0	0	1.0000

^aNumber of deer for which radio-transmitter failed or transmitter signal was "lost" because of sudden dispersal from study site.

Table 6. Survival rate of radio-instrumented adult female (> 2 years) white-tailed deer in the Big Cypress National Preserve/Everglades National Park, April-December, 1989. Survival rate derived from the product-limit estimator procedure (Kaplan and Meier 1958), modified to allow for the "staggered" entry of radio-instrumented animals captured during the course of the study (Pollock et al. 1989).

Month	Number at risk (r_i)	Number of deaths (d_i)	Number censored ^a	Number added	Survival (S_i)
Mar	0	0	0	1	N/A
Apr	1	0	0	5	1.0000
May	6	0	0	9	1.0000
Jun	15	0	0	6	1.0000
Jul	21	1	0	0	0.9523
Aug	20	1	0	5	0.9047
Sep	24	2	0	0	0.8292
Oct	22	2	0	0	0.7338
Nov	20	1	0	0	0.7161
Dec	19	0	1	0	0.7161

^aNumber of deer for which radio-transmitter failed or transmitter signal was "lost" because of sudden dispersal from study site.

Table 7. Survival rate of radio-instrumented adult male (>2 years) white-tailed deer in the Big Cypress National Preserve/Everglades National Park, May-December, 1989. Survival rate derived from the product-limit estimator procedure (Kaplan and Meier 1958), modified to allow for the "staggered" entry of radio-instrumented animals captured during the course of the study (Pollock et al. 1989).

Month	Number at risk (r_i)	Number of deaths (d_i)	Number censored ^a	Number added	Survival (S_i)
Apr	0	0	0	4	N/A
May	4	0	0	4	1.0000
Jun	8	0	0	4	1.0000
Jul	12	0	0	0	1.0000
Aug	12	0	0	4	1.0000
Sep	16	0	0	0	1.0000
Oct	16	2(2) ^b	0	0	0.8750
Nov	14	3(3)	1	0	0.6875
Dec	10	1	0	0	0.6188

^aNumber of deer for which radio-transmitter failed or transmitter signal was "lost" because of sudden dispersal from study site.

^bNumerals within parentheses denote number of deer killed legally or illegally by hunters

Table 8. Survival rate of radio-instrumented white-tailed deer, age and sex ignored, in the Camp 107 location-unit (hunted), Big Cypress National Preserve, April-December, 1989. Survival rate derived from the product-limit estimator procedure (Kaplan and Meier 1958), modified to allow for the "staggered" entry of radio-instrumented animals captured during the course of the study (Pollock et al. 1989).

Month	Number at risk (r_i)	Number of deaths (d_i)	Number censored ^a	Number added	Survival (S_i)
Mar	0	0	0	2	N/A
Apr	2	0	0	7	1.0000
May	9	0	0	0	1.0000
Jun	9	0	0	6	1.0000
Jul	15	0	0	0	1.0000
Aug	15	0	2	3	1.0000
Sep	16	0	0	0	1.0000
Oct	16	2(2) ^b	0	0	0.8750
Nov	14	1(1)	2	0	0.8125
Dec	11	1	0	0	0.7387

^aNumber of deer for which radio-transmitter failed or transmitter signal was "lost" because of sudden dispersal from study site.

^bNumerals within parentheses denote number of deer killed legally by hunters.

Table 9. Survival rate of radio-instrumented white-tailed deer, age and sex ignored, in the Boundary location-unit (hunted/nonhunted), Big Cypress National Preserve/Everglades National Park, May - December, 1989. Survival rate derived from the product-limit estimator procedure (Kaplan and Meier 1958), modified to allow for the "staggered" entry of radio-instrumented animals captured during the course of the study (Pollock et al. 1989).

Month	Number at risk (r_j)	Number of deaths (d_j)	Number censored	Number added	Survival (S_j)
Apr	0	0	0	5	N/A
May	5	0	0	3	1.0000
Jun	8	0	0	2	1.0000
Jul	10	1	1	0	0.9000
Aug	8	0	0	3	0.9000
Sep	11	0	0	0	0.9000
Oct	11	1 ^b	0	0	0.8182
Nov	10	1 ^b	0	0	0.7364
Dec	9	2	0	0	0.5728

^aNumber of deer for which radio-transmitter failed or transmitter signal was "lost" because of sudden dispersal from study site.

^bDeer poached (female in October, male in November).

Table 10. Survival rates of radio-instrumented white-tailed deer, age and sex ignored, in the Steps location-unit (hunted), Big Cypress National Preserve, May-December, 1989. Survival rate derived from the product-limit estimator procedure (Kaplan and Meier 1958), modified to allow for the "staggered" entry of radio-instrumented animals captured during the course of the study (Pollock et al. 1989).

Month	Number at risk (r_i)	Number of deaths (d_i)	Number censored ^a	Number added	Survival (S_i)
Apr	0	0	0	3	N/A
May	3	0	0	5	1.0000
Jun	8	0	0	1	1.0000
Jul	9	1	0	0	0.8889
Aug	8	1	0	0	0.7778
Sep	7	0	0	0	0.7778
Oct	7	0	0	0	0.7778
Nov	7	1(1) ^b	0	0	0.6666
Dec	6	0	1	0	0.6666

^aNumber of deer for which radio-transmitter failed or transmitter signal was "lost" because of sudden dispersal from study site.

^bNumerals within parentheses denote number of deer killed legally by hunters.

Table 11. Survival rate of radio-instrumented white-tailed deer, age and sex ignored, in the Glades location-unit (nonhunted), Everglades National Park, June-December, 1989. Survival rate derived from the product-limit estimator procedure (Kaplan and Meier 1958), modified to allow for the "staggered" entry of radio-instrumented animals captured during the course of the study (Pollock et al. 1989).

Month	Number at risk (r_i)	Number of deaths (d_i)	Number censored ^a	Number added	Survival (S_i)
May	0	0	0	12	N/A
Jun	12	0	0	6	1.0000
Jul	18	1	0	0	0.9444
Aug	17	1	0	4	0.8885
Sep	20	3 ^b	0	0	0.7552
Oct	17	1	0	0	0.7108
Nov	16	2	0	0	0.6220
Dec	14	0	0	0	0.6220

^aNumber of deer for which radio-transmitter failed or transmitter signal was "lost" because of sudden dispersal from study site.

^bIncludes one female that was poached.

Table 12. Comparative survival rates of radio-instrumented adult female (> 2 years) white-tailed deer in the Camp 107 (hunted) and Glades (nonhunted) location-units, Big Cypress National Preserve/Everglades National Park, June-December, 1989. Survival rates derived from the product-limit estimator procedure (Kaplan and Meier 1958), modified to allow for the "staggered" entry of radio-instrumented animals captured during the course of the study (Pollock et al. 1989).

Month	Number at risk (r_i)	Number of deaths (d_i)	Number censored ^a	Number added	Survival (S_i)
Camp 107					
Jun	3	0	0	1	1.0000
Jul	4	0	0	0	1.0000
Aug	4	0	0	1	1.0000
Sep	5	0	0	0	1.0000
Oct	5	0	0	0	1.0000
Nov	5	0	0	0	1.0000
Dec	5	0	0	0	1.0000
Glades					
Jun	6	0	0	3	1.0000
Jul	9	1	0	0	0.8899
Aug	8	0	0	2	0.8899
Sep	10	2	0	0	0.7111
Oct	8	1	0	0	0.6222
Nov	7	1	0	0	0.5333
Dec	6	0	0	0	0.5333

^aNumber of deer for which radio-transmitter failed or transmitter signal was "lost" because of sudden dispersal from study site.

Table 13. Survival rate of radio-instrumented deer, including all age and sex cohorts, in the Big Cypress National Preserve/Everglades National Park, April-December, 1989. Survival rate derived from the product-limit estimator procedure (Kaplan and Meier 1958), modified to allow for the "staggered" entry of radio-instrumented animals captured during the course of the study (Pollock et al. 1989).

Month	Number at risk (r_i)	Number of deaths (d_i)	Number censored ^a	Number added	Survival (S_i)
Mar	0	0	0	2	N/A
Apr	2	0	0	15	1.0000
May	17	0	0	21	1.0000
Jun	38	0	0	15	1.0000
Jul	53	3	1	0	0.9434
Aug	49	2	1	10	0.9049
Sep	56	3	0	0	0.8564
Oct	53	4	0	0	0.7917
Nov	49	5	2	0	0.7109
Dec	42	3	2	0	0.6601

^aNumber of deer for which radio-transmitter failed or transmitter signal was "lost" because of sudden dispersal from study site.

Table 14. Causes of death of radio-instrumented white-tailed deer, Big Cypress National Preserve/Everglades National Park, 1989.

ID ^a	Sex	Age ^b (years)	Location	Date of death	Habitat	Probable cause of death
BC8920	F	3	Glades	17 May	PR	Capture myopathy
BC8951	F	Fawn	Boundary	12 Jul	PR	Unknown
BC8918	F	5	Glades	13 Jul	HH	Unknown
BC8911	M	Fawn	Steps	25 Jul	PI	Unknown
BC8932	M	Fawn	Glades	01 Aug	PR	Unknown
BC8938	F	5	Steps	09 Aug	CY	Unknown
BC8929	M	Fawn	Glades	10 Sep	HH	Bobcat predation
BC8930	F	4	Glades	20 Sep	PR	Unknown
BC8943	F	4	Glades	25 Sep	HH	Poaching ^d
BC8931	F	3	Glades	03 Oct	HH	Bobcat predation ^d
BC8954	F	5	Boundary	28 Oct	PR	Poaching
BC8949	M	2/3	Camp 107	29 Oct	HH	Legal kill
BC8957	M	5½	Camp 107	30 Oct	HH	Legal kill
BC8912	M	3	Steps	05 Nov	PI	Legal kill
BC8928	M	Fawn	Glades	05 Nov	PR	Bobcat predation
BC8964	F	5½	Glades	10 Nov	PR	Unknown
BC8940	M	3	Camp 107	22 Nov	PR	Legal kill
BC8915	M	2	Boundary	25 Nov	PR	Poaching
BC8901	M	Fawn	Camp 107	21 Dec	PR	Bobcat predation
BC8907	M	2	Boundary	21 Dec	HH	Unknown
BC8935	F	Fawn	Boundary	25 Dec	PR	Unknown

^aCapture number.

^bAge (years) at capture.

^cHabitat: prairie (PR), hardwood hammock (HH), pine island (PI), cypress (CY), sawgrass (SG).

^dNecropsy indicated emaciated condition.

Table 15. Crude productivity of 27 radio-instrumented adult (≥ 2 years) female white-tailed deer in 1989, and probable survival of their fawn(s) through December 31 1989, Big Cypress National Preserve/Everglades National Park

ID (Radio-frequency)	Capture date	Production of fawn(s) ^a	Supplemental information	Survival of fawn(s) ^b	
				30 Jun 89	31 Dec 89
BC8902 (151.902)	28 Mar 89	Yes		Yes	Unknown ^c
BC8904 (151.853)	05 Apr 89	Yes	Twins, including male BC8948 (censored, 02 Nov 89)	Yes	Yes
BC8906 (151.873)	05 Apr 89	Yes	Singleton male, BC9075	Yes	Yes
BC8908 (151.931)	05 Apr 89	Yes	Singleton	Yes	Unknown
BC8910 (151.950)	05 Apr 89	Yes	Singleton male, BC8911 (died, 25 Jul 89)	Yes	No
BC8914 (151.916)	06 Apr 89	Yes		No	No
BC8918 (151.909) ^d	10 May 89	Yes		No	No
BC8919 (151.955)	10 May 89	Yes		No	No
BC8920 (151.965) ^d	10 May 89	Yes		Unknown	Unknown
BC8921 (151.985)	10 May 89	Yes		No	No
BC8922 (151.998)	10 May 89	Yes	Singleton female, BC8951 (died, 25 Jul 89)	Yes	No
BC8926 (151.976)	10 May 89	Yes	Singleton	Yes	Yes
BC8930 (150.065) ^d	10 May 89	Yes	Singleton male, BC8929 (died, 10 Sep 89)	Yes	No
BC8931 (151.651) ^d	11 May 89	Yes		No	No
BC8937 (151.736)	11 May 89	No	Barren female	N/A	N/A
BC8938 (151.757) ^d	11 May 89	Yes		No	No
BC8941 (151.692)	28 Jun 89	Yes	Twins, including male BC8909 (censored, 22 Aug 89)	Yes	Unknown
BC8943 (151.679) ^d	28 Jun 89	Yes		Yes	Unknown
BC8945 (151.671)	28 Jun 89	Yes	Singleton male, BC8928 (died, 05 Nov 89)	Yes	No

Table 15. Continued, 2 of 2.

ID (Radio-frequency)	Capture date	Production of fawn(s) ^a	Supplemental information	Survival of fawn(s) ^b	
				30 Jun 89	31 Dec 89
BC8947 (151.960)	28 Jun 89	Yes	Singleton	Yes	No
BC8953 (151.663)	29 Jun 89	Yes	Singleton	Yes	No
BC8954 (151.644) ^d	29 Jun 89	Yes	Singleton	Yes	No
BC8955 (151.635)	14 Aug 89	Yes		Yes	No
BC8958 (151.623)	14 Aug 89	Unknown	Nonlactating; in estrus		
BC8959 (151.590)	14 Aug 89	Unknown	Nonlactating; in estrus		
BC8963 (151.579)	14 Aug 89	Yes	Singleton	Yes	Yes
BC8964 (151.569) ^d	14 Aug 89	Yes		Yes	Unknown

^aProduction of fawn(s) as evidenced by lactation of doe at time of capture and or observation of fawn with doe at time of capture or during subsequent radio-locations of doe.

^bSurvival of fawns is based on either known death of radio-instrumented fawn(s), or absence of fawn(s) as evidenced by repeated observations of radio-instrumented does known to have produced fawns.

^cThe designation of "Unknown" in this column denotes lack of confirmation of fawn survival, but implies probable death of fawn(s). Survival of fawns is maximum in that the frequency of twin/triplet births is unknown, and minimum in that some radio-instrumented does may have

^ehad fawns that were not observed during radio-location efforts.

^dFemales that died (see Table 14).

Table 16. Mean home range sizes (km²), as determined by the minimum convex polygon method (Mohr 1947), of radio-instrumented white-tailed deer captured on Big Cypress National Preserve/Everglades National Park, Florida, March-December, 1989. Home ranges are presented only for individuals with 9 or more radio-locations.

	Fawns	Yearlings	Adults
Females	2.31(0.80-3.93) ^{3a}	4.17(1.06-9.85) ⁴	4.01(0.28-23.19 ^b) ²⁶
Males	3.85(0.41-8.90) ⁹	5.19(1.67-11.72 ^c) ³	7.51(1.39-43.73 ^d) ¹⁶

^aSuperscripted numerals denote sample size.

^bExcluding BC8904, mean home range size = 3.24km².

^cControl burn caused BC8917 to expand home range.

^dExcluding BC8927, mean home range size = 5.10km².

Table 17. Mean home range sizes (km²), as determined by minimum convex polygon method (Mohr 1947), of radio-instrumented white-tailed deer captured on Big Cypress National Preserve/Everglades National Park, Florida. Four predetermined "seasons" have been chosen, spanning the period 1 June-31 December, 1989.

	Rain season 1 Jun-30 Sep	Dry season 1 Oct-31 Dec	Prehunt season 1 Jun-31 Aug	Hunting season 1 Sep-31 Dec
FAWNS				
Females	0.96(0.33-1.74) ^{3a}	2.05(1.87-2.23) ²	0.71(0.30-1.03) ³	2.64(1.90-3.38) ²
Males	2.31(0.61-6.66) ^{b,c}	2.94(0.11-8.32) ⁵	1.83(0.44-3.78) ⁶	3.33(0.80-8.87) ⁵
YEARLINGS				
Females	1.85(0.34-3.65) ⁴	2.74(0.68-8.08) ⁴	2.27(1.00-3.56) ³	2.89(0.88-8.28) ⁴
Males	1.14(0.50-1.81) ³	4.58(0.75-11.72) ³	1.05(0.35-1.80) ³	4.59(0.75-11.72) ³
ADULTS				
Females	2.23(0.29-7.83) ²⁵	2.94(0.22-20.20) ²⁰	2.08(0.28-6.73) ²⁰	3.24(0.23-20.20) ²¹
Males	6.09(0.48-41.70) ¹⁶	2.78(0.26-11.43) ¹²	6.61(0.56-41.44) ¹²	3.73(0.36-12.37) ¹⁶

^aSuperscripted numerals denote sample size.

^bExcluding BC8948, mean home range size = 0.69km².

^cExcluding BC8905, mean home range size = 0.96km².

^dExcluding BC8905, mean home range size = 1.09km².

^eExcluding BC8917, mean home range size = 1.01km².

^fExcluding BC8917, mean home range size = 1.02km².

^gExcluding BC8904, mean home range size = 2.03km².

^hExcluding BC8904, mean home range size = 2.39km².

ⁱExcluding BC8927, and BC8949, mean home range size = 2.79km².

^jExcluding BC8927, mean home range size = 2.00km².

^kExcluding BC8927 and BC8949, mean home range size = 2.12km².

Table 18. A comparison of pre hunting and hunting-season mean home range sizes (km²), as determined by the minimum convex polygon method (Mohr 1947), of radio-instrumented white-tailed deer in 3 different "pods" on Big Cypress National Preserve\Everglades National Park, Florida, 1 June-31 December 1989. Home ranges are presented only for individuals with 9 or more radio-locations.

	CAMP 107		BOUNDARY		GLADES	
	Prehunt 1 Jun-31 Aug	Hunt 1 Sep-31 Dec	Prehunt 1 Jun-31 Aug	Hunt 1 Sep-31 Dec	Prehunt 1 Jun-31 Aug	Hunt 1 Sep-31 Dec
FAWNS						
Females	0.55 ^{2a} (0.30-0.80)	1.90 ¹	1.03 ¹	3.38 ¹	-.---	-.---
Males	2.11 ⁴ (0.63-3.78)	2.26 ³ (0.80-5.03)	-.---	-.---	1.55 ⁴ (0.44-3.08)	4.93 ² (0.99-8.87)
YEARLINGS						
Females	2.25 ¹	8.28 ¹	3.56 ¹	0.88 ¹	-.---	1.01 ¹
Males	0.35 ¹	11.72 ¹	1.01 ¹	1.29 ¹	-.---	-.---
ADULTS						
Females	2.35 ⁴ (0.64-4.7)	8.17 ⁵ (3.54-20.20 ^b)	1.16 ⁴ (0.56-1.81)	2.64 ⁶ (0.60-4.65)	2.58 ⁸ (0.40-6.73 ^c)	1.01 ⁷ (0.23-3.76 ^d)
Males	6.97 ³ (2.01-16.68 ^e)	4.40 ³ (1.49-7.97)	16.34 ³ (3.04-41.44 ^f)	5.52 ⁴ (1.92-12.37 ^g)	1.25 ⁵ (0.56-2.49)	2.20 ⁶ (0.36-7.05 ^h)

^aSuperscripted numerals denote sample size.

^bExcluding BC8904, mean home range size = 5.18km².

^cExcluding BC8953, mean home range size = 1.99km².

^dExcluding BC8945, mean home range size = 0.55km².

^eExcluding BC8949, mean home range size = 2.11km².

^fExcluding BC8927, mean home range size = 3.79km².

^gExcluding BC8927, mean home range size = 3.23km².

^hExcluding BC8946, mean home range size = 1.23km².

Table 19. Familial units consisting of two or more radio-instrumented deer, Big Cypress National Preserve/Everglades National Park, 1989.^a

Family unit	Location-unit or pod	Age/sex composition (Deer ID)	Relationships	Status, 31 Dec 1990
1	Steps	Adult [>3 yrs] female (BC8910) Adult [2/3 yrs] female (BC8947) Yearling male (BC8936) Fawn male (BC8911)	Female BC8910 is matriarch; yearling BC8936 and fawn BC8911 are progeny of BC8910; female BC8947 also observed with fawn (unmarked).	Fawn BC8911 died 25 Jul 89.
2	Camp 107	Adult [>5 yrs] female (BC8941) Fawn male (BC8909) Adult [2½ yrs] female (BC8955)	Mother (BC8941)/fawn (BC8909); other members possibly include a doe (BC8955) and fawn (unmarked).	Fawn BC8909 censored 22 Aug 89.
3	Camp 107	Adult [>4 yrs] female (BC8904) Yearling female (BC8905) Fawn male (BC8948)	Mother/yearling/fawn (twins); associated with 2 additional does (unmarked).	Fawn BC8948 censored 02 Nov 89.
4	Boundary	Adult [>3 yrs] female (BC8922) Fawn female (BC8951)	Mother/fawn.	Fawn BC8951 died 13 Jul 90.
5	Boundary	Adult [>3 yrs] female (BC8914) Adult [>3½ yrs] female (BC8958)	Unknown; associated with 2 additional doe/fawn units.	Unchanged.
6	Boundary	Adult [5 yrs] female (BC8954) Adult [2½ yrs] female (BC8959)	Female BC8954 possibly mother of female BC8959; associated with 2 additional does.	Female BC8954 died 28 Oct 89.
7	Glades	Adult [>4 yrs] female (BC8930) Fawn male (BC8929)	Mother/fawn.	Female BC8930 died 20 Sep 90; fawn BC8929 died 09 Sep 89.
8	Glades	Adult [>3 yrs] female (BC8945) Fawn male (BC8928)	Mother/fawn (possibly triplets).	Fawn BC8928 died 05 Nov 89.

^a Familial units potentially derivable from deer captured in 1989 include deer associated with the following radio-instrumented animals: BC8916 (yearling female); BC8919 (adult female); BC8922 (adult female); BC8926 (adult female); BC8959 (adult female); BC8962 (yearling female); and BC8963 (adult female).

Table 20. Frequency (%) and density (number/km²) of tree islands, by size class, within the study area in Big Cypress National Preserve/Everglades National Park, 1989.

Size Class	Big Cypress ^a (North)			Everglades ^a (South)		
	West	Central	East	West	Central	East
Frequency (%)						
<0.1	39.5	48.0	46.8	36.6	53.7	62.9
0.1-0.5	49.2	33.3	38.7	54.8	37.3	26.5
0.5-1.0	7.9	9.8	8.1	3.2	4.9	5.4
1.0-3.0	2.8	5.9	5.8	3.2	3.1	4.2
3.0-5.0	0	2.0	0	1.1	0.3	0.6
5.0-10.0	0	1.0	0	1.1	0.7	0.3
>10.0	0.6	0	0.6	0	0	0
Density (no./km ²)						
<0.1	3.5	2.5	4.1	1.7	7.7	9.9
0.1-0.5	4.4	1.7	3.4	2.9	5.4	4.2
0.5-1.0	0.7	0.5	0.7	0.2	0.7	0.9
1.0-3.0	0.3	0.3	0.5	0.2	0.5	0.7
3.0-5.0	0	0.1	0	0.1	0.1	0.1
5.0-10.0	0	0.1	0	0.1	0.1	0.1
>10.0	0.1	0	0.1	0	0	0
Total	8.9	5.1	8.6	4.7	14.4	15.7

^aEach sample unit (West, Central, East) in both the BCNP (North) and ENP (South) contained 20 km², i.e., 5, 4 km² sample quadrats.

Table 21. Proportionate use of different habitat types ^a by radio instrumented white-tailed deer, age ignored, Big Cypress National Preserve/Everglades National Park, June-December 1989.

Sex/ area	N ^b	Radio locations	Percentage use of habitats					
			PR	TI	SG	CY	PI	MG
Females								
BCNP	16	520	38	35	9	7	9	1
ENP	18	498	51	32	12	4	0	2
Males								
BCNP	14	411	36	44	6	7	7	0
ENP	15	440	35	55	9	0	0	1
Total/mean	63	1869	40	41	9	5	4	1

^aHabitats: PR= prairie; TI= tree islands (hardwood hammocks and willow heads); SG= sawgrass; CY= cypress; PI= Pine; MG= mangrove.

^bNumber of radio-instrumented deer.

Table 22. Proportionate use of tree islands of different sizes by radio-instrumented white-tailed deer, age ignored, Big Cypress Preserve/Everglades National Park, June-December 1989.^a

Sex/ area	Percentage use of tree islands (by island size)									
	<u>≤ 0.5 ha</u>		<u>0.5-1.5 ha</u>		<u>1.5-5.0 ha</u>		<u>5.0-10.0 ha</u>		<u>≥ 10.0 ha</u>	
	W ^b	N ^b	W	N	W	N	W	N	W	N
Females										
BCNP	56	61	35	27	3	6	1	0	5	6
ENP	44	56	25	22	13	12	1	1	17	8
Males										
BCNP	37	46	27	33	13	10	1	2	22	10
ENP	32	67	45	22	19	7	2	3	2	0

^aSee Table 21 for sample size of deer and numbers of radio-locations.

^bLocation of deer: W= within tree island; N= near (within 50 m) of tree island.

Appendix 1. Individual home range sizes (km²), as determined by the minimum convex polygon method (Mohr 1947), of radio-instrumented white-tailed deer captured on Big Cypress National Preserve/Everglades National Park, Florida, April-December, 1989.

Deer ID	Rain season 1 Jun-30 Sep	Dry season 1 Oct-31 Dec	Prehunt season 1 Jun-31 Aug	Hunting season 1 Sep-31 Dec	Entire study 1 Apr-31 Dec
BC8901(FM) ^a	0.88(22) ^b	0.74(19)	0.63(16)	0.80(25)	1.89(48)
BC8902(AF)	3.02(23)	3.54(17)	3.02(17)	3.54(23)	4.71(44)
BC8903(FM)	1.26(21)	4.86(19)	1.09(15)	5.03(25)	7.14(41)
BC8904(AF)	7.83(21)	20.20(17)	4.70(15)	20.20(23)	23.19(39)
BC8905(YF)	2.27(22)	8.08(17)	2.25(16)	8.28(23)	9.85(40)
BC8906(AF)	0.70(19)	0.60(17)	0.70(13)	0.60(23)	1.06(37)
BC8907(AM)	4.92(20)	2.90(21)	3.04(14)	5.25(27)	6.81(45)
BC8908(AF)	2.29(22)	5.44(18)	1.06(16)	6.95(24)	8.36(41)
BC8909(FM)	2.92(16)	----- ^c	2.92(16)	-----	3.43(18)
BC8910(AF)	4.05(20)	0.46(17)	3.91(15)	2.19(22)	4.64(39)
BC8911(FM)	-----	-----	-----	-----	0.41(9)
BC8912(AM)	3.65(18)	-----	3.19(13)	2.39(10)	3.76(24)
BC8913(AM)	2.78(20)	-----	2.01(14)	2.10(14)	5.27(30)
BC8914(AF)	1.95(20)	4.51(17)	1.81(14)	4.65(23)	5.32(39)
BC8915(AM)	5.12(20)	1.20(11)	4.55(13)	2.53(18)	6.15(32)
BC8916(YF)	3.65(20)	0.68(17)	3.56(14)	0.88(23)	3.99(38)
BC8917(YM)	0.50(21)	11.72(20)	0.35(15)	11.72(26)	11.72(41)
BC8918(AF)	-----	-----	-----	-----	-----
BC8919(AF)	2.05(21)	0.49(18)	2.05(16)	0.55(23)	2.05(39)
BC8920(AF)	-----	-----	-----	-----	-----
BC8921(AF)	1.02(20)	0.52(18)	1.02(15)	0.54(23)	1.36(38)
BC8922(AF)	0.80(20)	1.12(17)	0.56(14)	1.12(23)	1.69(38)
BC8923(YM)	1.11(19)	1.28(17)	1.01(13)	1.29(23)	1.67(36)
BC8924(FM)	-----	-----	-----	-----	----- (7)
BC8925(AM)	1.96(19)	0.80(18)	1.64(14)	1.37(23)	1.99(37)
BC8926(AF)	0.48(20)	0.33(18)	0.40(15)	0.33(23)	0.72(39)
BC8927(AM)	41.70(20)	11.43(17)	41.44(14)	12.37(23)	43.73(38)
BC8928(FM)	3.46(19)	0.69(9)	3.08(14)	0.99(14)	3.46(28)
BC8929(FM)	1.38(15)	-----	1.38(12)	-----	1.38(15)
BC8930(AF)	1.42(13)	-----	1.36(9)	-----	1.42(13)
BC8931(AF)	2.95(20)	-----	2.75(15)	-----	3.05(22)
BC8932(FM)	1.31(9)	-----	1.31(9)	-----	1.32(10)
BC8933(AM)	0.65(21)	1.17(18)	0.56(16)	1.19(23)	1.39(39)
BC8934(AM)	0.72(20)	0.28(18)	0.60(15)	0.36(23)	1.46(38)

Appendix 1. Continued, 2 of 2.

Deer ID	Rain season 1 Jun-30 Sep	Dry season 1 Oct-31 Dec	Prehunt season 1 Jun-31 Aug	Hunting season 1 Sep-31 Dec	Entire study 1 Apr-31 Dec
BC8935(F)	1.74(21)	2.23(17)	1.03(15)	3.38(23)	3.93(39)
BC8936(YM)	1.81(23)	0.75(17)	1.80(18)	0.75(22)	2.19(40)
BC8937(AF)	2.54(19)	0.22(12)	2.50(14)	0.27(17)	2.73(31)
BC8938(AF)	0.28(12)	-----	0.28(12)	-----	0.28(14)
BC8939(YF)	1.12(19)	1.34(17)	1.00(14)	1.39(22)	1.80(36)
BC8940(AM)	2.34(17)	1.47(11)	2.22(11)	1.49(16)	3.97(28)
BC8941(AF)	1.52(17)	6.08(21)	0.64(11)	6.08(27)	6.14(38)
BC8942(FF)	0.80(12)	-----	0.80(12)	-----	0.80(12)
BC8943(AF)	4.70(17)	-----	3.50(11)	-----	4.70(17)
BC8944(FM)	0.61(16)	8.32(17)	0.44(10)	8.87(23)	8.90(33)
BC8945(AF)	3.02(16)	3.65(18)	2.81(11)	3.76(23)	5.36(34)
BC8946(AM)	5.31(16)	4.71(18)	2.49(11)	7.05(23)	7.49(34)
BC8947(AF)	0.41(16)	1.77(17)	0.32(11)	1.85(22)	1.85(33)
BC8948(FM)	6.66(18)	0.11(10)	3.78(12)	0.94(16)	6.69(28)
BC8949(AM)	16.68(17)	-----	16.68(11)	3.18(13)	16.68(24)
BC8950(FF)	0.33(16)	1.87(22)	0.30(10)	1.90(28)	2.20(38)
BC8951(FF)	-----	-----	-----	-----	----- ⁽³⁾
BC8952(AM)	1.20(16)	1.89(18)	0.94(11)	1.92(23)	1.98(34)
BC8953(AF)	6.73(15)	0.22(17)	6.73(9)	0.23(23)	6.73(32)
BC8954(AF)	5.35(18)	-----	1.57(12)	3.59(12)	5.46(24)
BC8955(AF)	0.29(9)	3.59(18)	-----	4.06(24)	4.06(27)
BC8956(AM)	0.47(9)	6.18(19)	-----	7.25(25)	7.25(28)
BC8957(AM)	8.65(9)	-----	-----	7.97(11)	8.97(14)
BC8958(AF)	0.39(9)	1.44(17)	-----	1.68(23)	1.68(26)
BC8959(AF)	0.98(9)	3.62(18)	-----	4.18(24)	4.18(27)
BC8960(AM)	0.48(9)	1.12(16)	-----	1.92(22)	1.92(25)
BC8961(AM)	0.88(9)	0.26(18)	-----	1.33(23)	1.41(27)
BC8962(YF)	0.34(9)	0.86(18)	-----	1.01(23)	1.06(27)
BC8963(AF)	0.38(9)	0.61(18)	-----	0.89(23)	0.93(27)
BC8964(AF)	0.49(9)	0.44(10)	-----	0.76(15)	0.81(19)

^aAge/sex designation: F = fawn, Y = yearling, and A = adult; M = male, F = female.

^bNumerals within parentheses denote number of radio-locations used in calculating home range.

^cDashes denote individuals for which less than 9 radio-locations were available for calculation of mean home range.

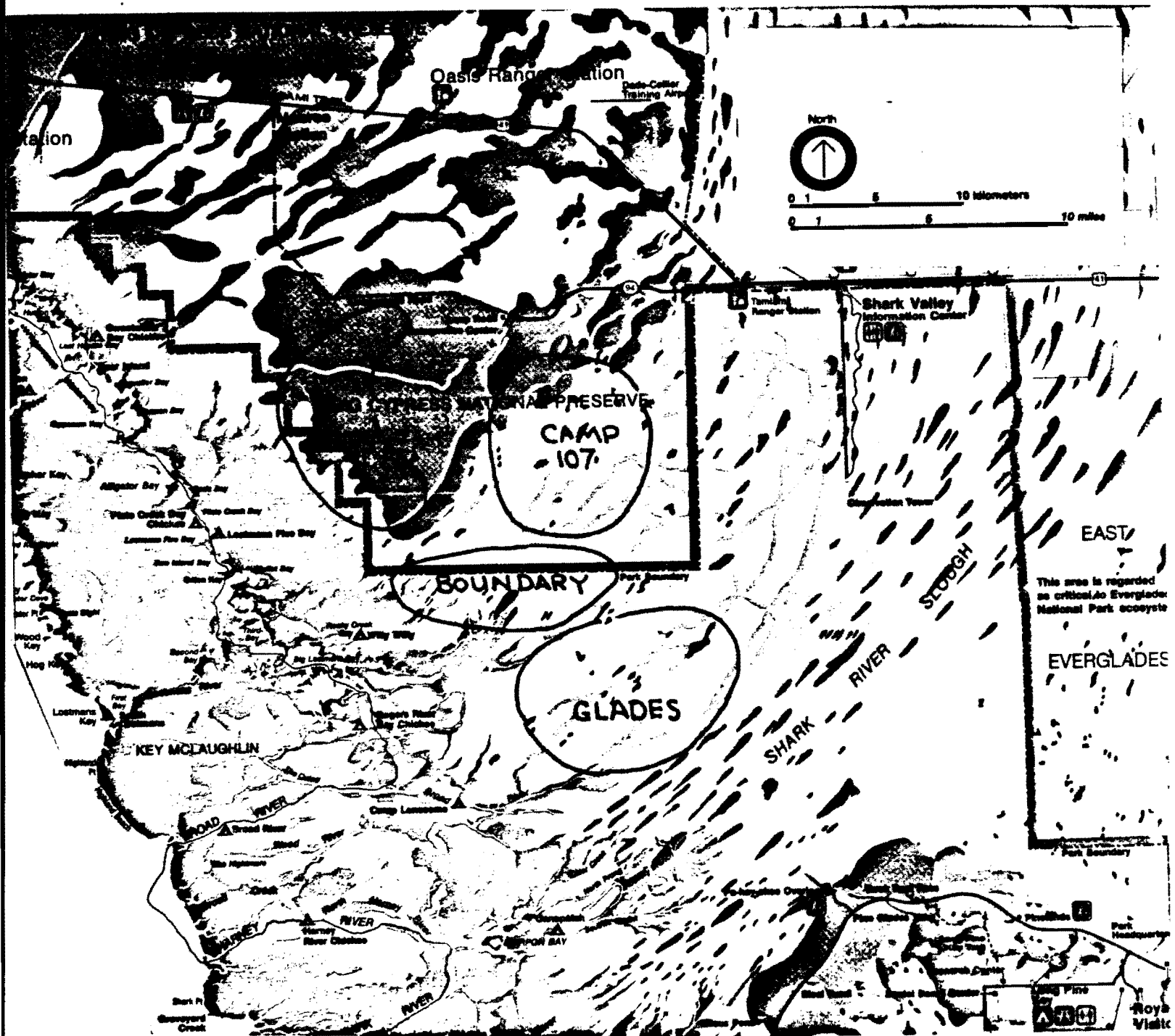


Figure 1. Depiction of the 4 location-units (Steps, Camp 107, Boundary, Glades), within Big Cypress National Preserve/Everglades National Park, in which white-tailed deer were captured, radio-instrumented, and monitored during 1989.