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## Movement, Habitat Use and Denning of Opossums in the Georgia Piedmont

**ABSTRACT:** Opossum (*Didelphis virginiana*) movements, habitat use and denning habits were studied in the lower Georgia Piedmont during spring, summer and early autumn. Five adult females and two adult males were radio-tracked. Daily movements of males averaged significantly farther ( $P < 0.001$ ) than females, but movements of females seemed more variable. Movements were almost entirely nocturnal. Ranges were somewhat oval in shape. Most foraging occurred along small flowing or intermittent streams. Dens were often associated with stump holes in upland pine habitats. They were normally used only 1 night at a time, with distance between dens on successive days averaging 254 m.

### INTRODUCTION

The opossum (*Didelphis virginiana*) is the only marsupial found in North America. Its abundance in Georgia is illustrated by the large number that are taken during the trapping seasons and those observed as "road kills." Presently available information on movement parameters and denning habits is inadequate for a basic understanding of the general ecology of opossums in the Southeast. The primary objectives of this study were (1) determination of opossum ranges; (2) location and description of dens; (3) determination of activity patterns, and (4) delineation of habitat types used for denning and food-gathering activities.

### METHODS

The 6075-ha study area is located in the Georgia Piedmont, primarily on the B. F. Grant Memorial Forest near Eatonton. Approximately three-fourths of the area is forested, mostly in pure pine or pine-hardwood stands. Ten percent is in improved pasture (486 ha) and cultivated land (121 ha). Both intermittent and permanent streams are present and bottomland hardwoods occupy approximately 15% of the area. Average yearly rainfall is approximately 130 cm, with the largest percentage occurring in late winter and midsummer. Mean temperature ranges from 6-9 C in January to 23-25 C in July.

Opossums were captured in double-doored, collapsible live traps. Sardines were used as bait and a commercial fox lure provided scent. Traps generally were placed along streams or in trails leading to bottomland habitat. After capture, animals were sexed and aged (Petrides, 1949).

Five adult females and two adult males were equipped with 110-g, pulsed-signal transmitter collars (Dav-Tron, Minneapolis, Minn.) that were bolted on. Frequencies ranged from 27.555 to 27.670 MHz with 0.015 MHz intervals between channels. Operating time of the collars ranged from 13-78 days with detection distances varying between 0.64-0.97 km. Radio locations ( $N = 1114$ ) were obtained by triangulation during portions of the spring, summer and autumn 1974. A total of 94 diel periods, in which data were obtained at 2-hr intervals, were recorded. These data were plotted on maps and range sizes were calculated using the modified minimum area method (Harvey and Barbour, 1965), with additional movement parameters as described by Marchinton (1969). Dens were located by triangulation. Number of days of use, den type (underground, ground-level or arboreal) and surrounding habitat were recorded for each. (For more details, see Allen, 1977.)

### RESULTS AND DISCUSSION

*Home range.* — Burt (1943) designated home range as "that area traversed by the individual in its normal activities of food gathering, mating and caring for young." We used home range to denote the area of activity determined by radio-tracking. Because opossums were not tracked throughout an annual cycle, these probably are not maximum home range sizes. Home range sizes varied from 7.2-94.4 ha, with female ranges being smaller than males' (Table 1). The smallest range (7.2 ha) was recorded for an adult female (AF4) during the autumn when dogwood (*Cornus florida*) berries, wild grapes (*Vitis* spp.) and insects were abundant. Den sites and dense cover were found in close proximity to food, water and travel lanes.

Four other adult females, (AF1, AF2, AF3 and AF5) were radio-tracked in the spring. All four females possessed pouch-young when captured. The two instrumented adult males had an average home range size of 78.1 ha.

There is a general trend for home range size to increase with the length of observation (Gil-

TABLE 1. — Summary of range parameters and daily movements and distance between dens of seven opossums radio-tracked during 1974 in the Georgia Piedmont

Animal	Study period	Number of locations	Modified Minimum range (ha)	24-hour tracking periods	Distance between dens	
					Minimum total distance (m)	mean (m)
AF1	3/04-5/15/74	272	43.9	23	1241.1	317.3
AF2	3/02-3/30/74	129	36.0	9	1568.5	256.5
AF3	3/23-4/24/74	96	8.0	9	664.2	127.0
AF4	9/12-10/22/74	110	7.2	8	566.9	107.8
AF5	5/17-5/31/74	70	15.7	7	1091.5	155.9
Female average			22.2		1026.4	192.9
AM4	6/29-10/09/74	266	94.4	26	1341.7	428.3
AM5	9/18-11/07/74	171	61.8	12	1215.0	386.9
Male average			78.1		1278.3	407.6
Overall average			38.1		1098.4	254.2

lette, 1980). Data on modified minimum range and number of locations (Table 1) from this study support this contention.

Home ranges were somewhat oval, with streams appearing to have some influence; however, they were not restricted to areas along streams. Males and females had average modified minimum range length-to-width ratios, based on major and minor axis lengths, of 1.48:1 and 1.74:1, respectively. These findings were the reverse of those reported by Gillette (1980) for Wisconsin opossums, where the larger male home ranges were more elongated.

*Activity cycles.*—Opossums were active primarily during hours of darkness. They left their dens at dusk or immediately thereafter and entered them shortly after first light. Only once was an animal observed leaving its den prior to twilight.

Linear movement during each 2-hr period was used as an indicator of relative activity. The pooled activity cycles for each sex are presented in Figure 1. Animals moved approximately the same amount in spring and summer even though periods of darkness were much shorter during summer.

Females were most active between 2000 and 2200 hr. They became progressively less active until around 0700 hr, at which time a smaller activity peak was recorded. Their two most active periods were the 2-hr intervals after leaving and before entering their dens.

Males had three peaks of activity with the largest between 2200 and 2400 hr. This type of activity cycle probably resulted when an animal was foraging in two or more distinct areas with greatest activity being recorded as it moved from one area to another.

*Daily movement.*—Most daily movements by radio-equipped opossums could best be described as erratic, although linear or circular patterns were occasionally noted. These erratic movements were probably associated with feeding activities. Opossums moved slightly more than 254 m between dens (Table 1), but males traveled significantly more ( $P < 0.001$ ) than females. Average minimum total distance moved during diel periods and distances between ex-

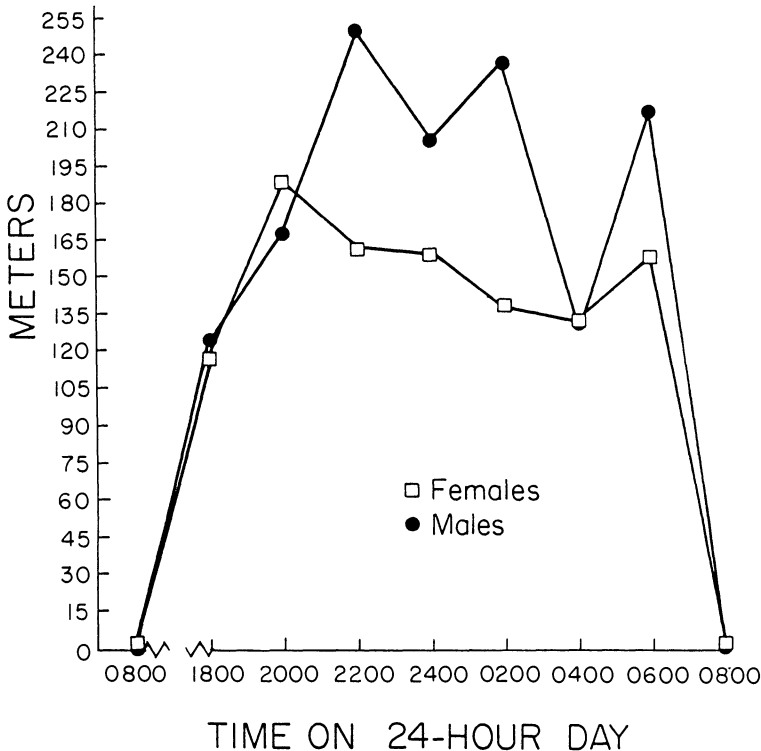


Fig. 1.—Pooled activity cycles of male and female opossums radio-tracked during 1974 in the Georgia Piedmont

treme locations recorded during diel periods of males also were significantly greater ( $P < 0.001$ ) than those of females. However, an adult female (AF2) had the largest single and average minimum total distance (3030.9 and 1568.5 m, respectively).

Daily movements in our study ( $\bar{X} = 1098.4$  m) were larger than have been previously reported. Two studies in Illinois, in which recaptures were used to determine distances moved, indicated means of 228.0 (Holmes and Sanderson, 1965) and 830.3 m (Verts, 1963). A radiotelemetry study in Kansas (Fitch and Shirer, 1970) revealed daily movements from 9-620 m except for a single movement of 681 m, believed to be a sally outside the home range. Gillette (1980) reported that nightly foraging by male and female opossums between 1 April and 30 November averaged 946 and 413 m, respectively, in Wisconsin.

*Habitats used for foraging.*—Moist areas along small flowing or intermittent streams were favored for foraging. Insects and fruits, found in abundance within these areas, are considered to be staples in the diet of opossums (Reynolds, 1945; Fitch and Sandidge, 1953; Wood, 1954; Hamilton, 1958). During the summer, blackberries (*Rubus* spp.) were especially common near moist areas along the edges of natural openings and young pine plantations.

A cornfield was included in two opossum ranges; however, only a relatively few locations were recorded within its boundaries. Three of these occurred when the corn was nearing maturity, but in each instance the animal moved rapidly through the field. A pasture of fescue grass 15-23 cm in height was within the ranges of a male and female. Even though both animals could have reduced travel time between foraging areas by crossing the pasture, only a small number of tracking locations occurred in it. These two examples suggest that Georgia opossums seldom utilize fields and pastures for foraging. This may be partially due to the lack of cover in fields.

*Denning habits.*—Eighty-five dens were examined during the study. Approximately 90% ( $N = 76$ ) of these were in upland pine areas, whereas upland hardwoods contained only about 9% ( $N = 8$ ). One den was found in an old field which was near both upland pine and hardwood areas. The high occurrence of dens in upland pine was consistent with its availability, for upland pine and upland hardwood types occupy approximately 90 and 10%, respectively, of the entire forested area. Also numerous potential den sites occurred in these upland pine areas.

Each den was categorized as underground, ground-level, or arboreal and also was characterized according to structure. The largest number ( $N = 47$ ) of dens was underground, and almost 60% of these were stump holes, where stumps had either rotted or burned out. This figure may reflect the availability of this den type rather than a particular preference, because the combination of timber harvesting and prescribed burning had resulted in their abundance.

Ground-level dens ( $N = 31$ ), second in number, were mostly in blackberry thickets and windrows. Particularly favored were blackberry thickets in 3- to 10-year-old pine plantations or windrows consisting of logs and debris overgrown with honeysuckle (*Lonicera japonica*) and blackberry. The latter were usually at the edge of two habitat types with travel lanes and foraging areas in close proximity.

Arboreal dens ( $N = 7$ ) included dead snags and leaf nests; the latter were probably constructed by squirrels and later used by opossums. Ranging from 4-6 m above the ground, three dens were located in the forks of tree limbs and two were in vines extending from the ground to treetops.

In a study in Kansas, Fitch and Shirer (1970) reported the use of a number of different den types, ranging from old houses, brush piles, hollow trees and logs, to the most often used type, those found in limestone outcrops and gullies.

Opossums usually moved to different dens on successive days. Only one adult female (AF4) used the same den for as long as 4 days in succession, and three opossums (AF1, AF3 and AM5) used a den for 3 days in a row. Mean distances between dens were 407.6 and 192.9 m, respectively, for males and females (Table 1). The most probable reason for an animal rarely using a den for more than 1 day prior to moving was the abundance of potential den sites on the area.

Georgia opossums use a wide variety of den types, probably based on availability. The daily movement, as revealed by radio-tracking, was greater than has been reported for opossums from other geographic locations. Home range estimates were larger for males than for females, as has been reported elsewhere. Finally, the opportunistic nature of the foraging habits, as seen in our study, is consistent with reports in the literature, and exemplifies the extreme adaptability of opossums.

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