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MOVEMENT PATTERNS AND HOME RANGE IN THE COMMON OPOSSUM (*DIDELPHIS MARSUPIALIS*)

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A description of the manner in which animals use space, especially with respect to others of the same species, is a necessary prerequisite for understanding such diverse aspects of their autecology as population dynamics, genetic structure, foraging pattern, and social system (Brown and Orians, 1970). In recent years, advances in radiotelemetric technology have vastly improved the potential for detailed examination of animal space use, and as this technology becomes widely implemented, new insights into mammalian ecology should emerge.

The genus *Didelphis* is one of the most widespread genera in the New World, extending from southern Canada to central Argentina (Gardner, 1973; Hunsaker, 1977). Although numerous studies (Fitch and Sandidge, 1953; Lay, 1942; Reynolds, 1945; Verts, 1963; Wiseman and Hendrickson, 1950), including some using radiotelemetry (Allen et al., 1985; Fitch and Shirer, 1970; Gillette, 1980; Pippitt, 1976), have described movement patterns for the Virginia opossum (*Didelphis virginiana*), there exist no equivalent studies of its putative ancestral species, the common opossum, *D. marsupialis* (Gardner, 1973). There are a few estimates of home range size or distances moved (August, 1984; Fleming, 1972; O'Connell, 1979), but these all come from trapping data gathered on small grids during surveys focusing on mammals much smaller than *Didelphis*. Consequently, the authors of these published figures have cautioned that they may be serious underestimates. Only Telford et al. (1979), in a mark-recapture study of the role of *D. marsupialis* as a reservoir of the parasite *Trypanosoma cruzi*, have focused solely on this species.

In this paper we examine aspects of space use by the common opossum using radiotelemetric data and compare our observations with previous observations derived only from trapping data.

We initiated our continuing study of *D. marsupialis* in 1982–83 at Hato Masaguaral, a working cattle ranch, 45 km south of Calabozo (8°33'N, 67°37'W) in the central Venezuelan savanna (*llanos*). The ranch owner, Sr. Tomás Blohm, has maintained Hato Masaguaral as a wildlife sanctuary for over 35 years, therefore fire and hunting pressures have been minimal. Open grasslands with scattered palms and low stature forest are the dominant habitats. Detailed vegetational descriptions of the area are available in Troth (1979).

Though temperature is relatively invariant (average daily maxima and minima vary less than 5°C throughout the year—Troth, 1979), the climate of the *llanos* is strongly seasonal in precipitation. There are four dry months (December–March), six wet months (May–October), and two transitional months (April and November) (Troth, 1979). Yearly rainfall is about 1,480 mm, with nearly all precipitation occurring during the wet season, at which time flooding is common in low lying areas.

In addition to the present study, both O'Connell (1979) and August (1984) examined movement patterns of *D. marsupialis* at Hato Masaguaral. In order that we might assess the extent of change in opossum density between study years, we set up a trapping grid of the same size (4 ha) they both used, and at the same location used by O'Connell. Live traps (46 × 15 × 15 cm) were placed on the ground at each of our 49 trapping stations (set 28.5 m apart). Each trap was baited with sardines and set on two consecutive nights per month for three successive months (February–April).

After realizing that the above grid was too small to cover even a single individual's home range, we established a larger (20 ha) grid which consisted of 47 traps (75–100 m apart) that were set on two consecutive nights per month for one year.

All adult opossums trapped on this second grid (5 females and 3 males) were fitted with radio collars and tracked for 3 to 11 months to provide estimates of movement patterns and home range size. Radio-collared animals were located at daytime rest sites at least twice per week, and on at least one night per month they were located every 2 h between 1800 and 0600 h. We continued monitoring our radio-collared opossums until they died, at which time we recovered the collars and attempted to ascertain the cause of death. We estimated home range sizes in all instances by the minimum convex polygon method (Mohr, 1947).

Estimates of opossum density and home range size on our 4 ha grid are remarkably similar to those derived from earlier studies on Hato Masaguaral. Our density estimate, based on the minimum number

TABLE 1.—*Type of dens used by D. marsupialis as a function of season.*

Den type	Den use (%)	
	Dry season (n = 247)	Wet season (n = 341)
Palm/fig tree	32	8
Underground	35	64
Tree cavity	27	25
Leaf nest/vines	4	2
On ground	2	1

known to be alive on the grid, was 1.0–2.0/ha, and from trapping data home range size was estimated to be 0.30 ha. By comparison, O'Connell (1979) estimated density and home range size were 0.25–2.75/ha and 0.27 ha, respectively, whereas the estimates by August (1984) were 0.25–2.50/ha and 0.20 ha, respectively. This suggests that ecological conditions for the opossum were very similar for our study and previous work on the same site. Therefore discrepancies between our findings and those of previous investigators probably do not result from gross differences in population levels.

Like its North American congener, *D. marsupialis* is essentially nocturnal. During our all-night radio tracking censuses opossums usually emerged from their dens within an hour after sunset. There was a gradually decreasing level of activity throughout the night. About 75 percent (34/45) of our records show opossum activity between 1900 and 2000 h, and activity remained high until 0200 h. Between 0200 and 0300 h, about 60 percent (22/36) of our records showed activity, and by 0400 h many animals were inactive and already occupying their daytime rest sites.

There were no statistical differences between males and females in type of den used as rest sites; however, there was a significant ($\chi^2 = 72.5$, $P < 0.0001$) seasonal effect when data for the sexes were pooled (Table 1). Opossums spent fewer days in palm/fig trees and more days underground during the wet season, although underground dens were the favored den type in both seasons. Males changed dens significantly more often than females ($P < 0.05$), (Mann-Whitney U test). Seventy-five percent of male den occupancies ($n = 109$) were for one day only, whereas only 32 percent of female den occupancies ($n = 101$) were for a single day. Mean male den occupancy was 1.5 days (range = 1–7); female mean was 5.1 days (range = 1–35). Prolonged use of some dens by females was associated with times when young were left in dens and females returned there to feed them.

Our nighttime tracking data on three adult females and two adult males (Table 2) show that both sexes traveled an average of 1 km per night, and males traveled significantly farther ($t = 2.732$, $d.f. = 52$, $P < 0.01$). Because of our assumption that travel between fixes was in a straight line, these calculations of nightly movement are doubtless significant underestimates.

Female home range sizes did not differ significantly ($P > 0.05$) between wet and dry seasons (Table 2). Seasonal ranges of each individual overlapped extensively, as shown by the small size difference between ranges in each season, and the cumulative range. No overlap between ranges of individual females was

TABLE 2.—*Home range size of D. marsupialis and minimum distances traveled during nightly forays.*

Animal	No.	Home range size (ha)			Months tracked	Distances traveled (m)	
		Dry season	Wet season	Cumulative		\bar{X} (range)	No. of nights tracked
Male	10	165.0 (50)	—	165.0 (50)	3	1,345 (1,200–1,650)	5
	14	53.0 (45)	—	53.0 (45)	3	—	
	52	150.0 (82)	—	150.0 (82)	3	1,398 (900–3,058)	7
	Mean	122.7 \pm 60.8		122.7 \pm 60.8		1,376 \pm 566	
Female	09	11.9 (88)	10.3 (148)	14.2 (236)	11	964 (650–1,350)	17
	54	7.2 (63)	5.9 (42)	8.7 (105)	5	—	
	71	5.3 (42)	—	5.3 (42)	3	—	
	74	21.2 (54)	24.1 (149)	26.9 (203)	8	1,161 (826–2,176)	18
	87	10.7 (42)	12.5 (89)	15.2 (131)	3	823 (375–1,200)	7
Mean	11.3 \pm 6.2	13.2 \pm 7.8	16.3 \pm 8.2		1,025 \pm 331		

Mean home range size and distance traveled are presented as $\pm SD$. Number of radio locations used in home range determination is in parentheses.

observed in the dry season for four radio-collared animals occupying adjacent ranges. However, during the wet season, three female ranges overlapped at a temporarily abundant food source (viz. fruiting mango and guava trees).

Male home ranges were more than 10 times as large as female ranges during the dry season (Table 2). Unfortunately, we were unable to accumulate data on wet season male ranges because all our radio-collared males died before the onset of the wet season. During the dry season, when adult female ranges did not overlap, there was extensive overlap in male ranges.

We do not feel that the high mortality rate to which our radio-collared opossums were subject is unusual. Neither sex appears to be very long-lived. On the basis of tooth wear all study animals were about one year old when first radio collared; none survived to two years of age. Five of eight (63%) were dead after being tracked for only 3 months, and only one survived for as long as 11 months (Table 2). Our continuing demographic study of *D. marsupialis* confirms this pattern of very high adult mortality.

It is apparent that previous figures for distances moved and home range size for *D. marsupialis* were severe underestimates. Whereas the previously recorded longest single move for *D. marsupialis* was 651 m (Telford et al., 1979) we found that the animals traveled on average at least 1 km per night and probably considerably more. Previous home range estimates varied from 0.20 ha (August, 1984) to 2.5 ha (Telford et al., 1979). Our estimates based on radio tracking ranged from 6 to 50 times greater than the largest previous report, depending upon opossum gender. This points up the difficulty of assessing home range sizes from gridtrapping data alone. Our 4 ha grid yielded a home range estimate of 0.3 ha, and calculations even from our larger 20 ha grid still suggested a home range size of only 4.7 ± 1.8 ha (SD) for the three females whose ranges overlapped it.

Our home range figures for *D. marsupialis* are comparable to those available for its slightly larger congener, *D. virginiana* (Gardner, 1973). Virginia opossum home ranges have been estimated as small as 4.7 ha (Lay, 1942) and as large as 254 ha (Fitch and Shirer, 1970). As is the case for the common opossum, home range estimates for the Virginia opossum are much larger when data are acquired via radio tracking, as opposed to trapping (Allen et al., 1985; Fitch and Shirer, 1970; Gillette, 1980). Gillette (1980) and Allen et al. (1985) found, as we did, that males tend to occupy larger ranges, although Fitch and Shirer (1970) reported that male and female ranges were almost identical. Allen et al. (1985) also observed, as we did, that males traveled farther than females on a nightly basis.

We failed to observe home range shifts, or the nomadism that has often been mentioned as characteristic of *D. virginiana* (Fitch and Sandidge, 1953; Fitch and Shirer, 1970; Hunsaker, 1977) and other didelphids (Charles-Dominique, 1983; Fleming, 1972; Hunsaker, 1977; O'Connell, 1979). Females stayed in well-defined home ranges and one was tracked for 11 months, spanning two breeding seasons; she occupied essentially the same range for the duration. In our continuing studies, we have now radio collared many additional females, all of which show the same pattern. Once a female breeds in an area, she tends to remain there. One male that we tracked showed what could have been interpreted as a range shift. He used an area of about 50 ha in the first month and an entirely new area during the second month; however, during the third month he returned to his original area. Therefore the shift was temporary. Our observations of nonshifting home ranges are supported by the data of Telford et al. (1979), who trapped individuals of both sexes repeatedly in the same area for over one year.

No didelphids have been reported to defend a territory (Charles-Dominique, 1983; Hunsaker, 1977), although we feel our observation of exclusive home range use by females for at least part of the year, and exclusive use of much of the home range all year, is suggestive. It is unclear whether such exclusive use is maintained by active defense or mutual avoidance, and we have no direct observations bearing on that fact. However, the possibility must at least be entertained that previous generalizations about space use in this family were premature.

Male home ranges overlap one another extensively, and each overlaps the ranges of several females. Such a spatial arrangement allows extensive direct male competition for mates and might result in a polygynous mating system. Most adult males trapped during the breeding season show wounds on the head and shoulders which may be from combat with other males. Captive male *D. virginiana* are known to be fiercely aggressive toward one another (Gardner, 1982; McManus, 1970).

In conclusion, we have documented much more extended use of space in *D. marsupialis* than has hitherto been reported. Our findings also contrast in some ways with what is known about *D. virginiana*. Extrapolations from data on that one species might be invalid for the other two species in the genus.

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