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DENSITY ESTIMATES OF THE VIRGINIA OPOSSUM (MARSUPIALIA: DIDELPHIDAE) IN WESTERN TENNESSEE

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ABSTRACT

Population density of the Virginia opossum *(Didelphis virginiana)* was studied at four sites in western Tennessee using trapping procedures. Population estimates, based on removal data, ranged from one opossum per 11.9 ha to one per 111.7 ha. Greatest densities were found in habitats associated with permanent water; lowest abundance was in a loblolly pine–hardwood, upland forest. Calculated densities were within the range of intermediate to low when compared to previous estimates for the species.

INTRODUCTION

The Virginia opossum, *Didelphis virginiana,* has been the subject of many biologic investigations. McManus (1974), Hunsaker (1977), and Gardner (1982) summarized much of this literature. Among questions in need of additional study are those that relate to population density. Density values for *Didelphis virginiana* have most recently been summarized by Hunsaker (1977) and Gardner (1982). Although methodology differed among previous studies, a wide range of estimates is evident. Approximations of abundance vary in different habitat types and between geographic regions. Because of such variability, density estimates derived in some areas may not be representative of the species in others. At present, population density of the opossum has been investigated at only a few sites in the southeastern United States, and, with the exception of Leberg et al. (1983), no estimates are available for the species in Tennessee. Additional investigations are needed in these less studied areas to more completely understand the natural history of the opossum throughout its range. The purpose of the present study was to examine winter density of *D. virginiana* in western Tennessee.

STUDY AREA

Opossum densities were assessed at four sites in western Tennessee. Site 1 was on the Ames Plantation (a private farm) in Fayette Co., 12 km north of LaGrange. It was a mixed loblolly pine *(Pinus taeda)*–hardwood, upland forest. Dominant hardwoods with diameter breast height of 10–20 cm were hickories (*Carya* spp.) and white and black oaks *(Quercus* spp.*)*. Topography consisted of gently rolling hills, and water was confined to temporary streams.

Site 2 was a bottomland, hardwood forest on the Ames Plantation in Fayette Co., 10 km north of LaGrange. It was dominated by medium-sized sweetgum *(Liquidambur styraciflua)*, maples *(Acer* spp.), and oaks. Terrain was flat. Several large streams (North Fork of the Wolf River and its tributaries) transversed the area, and beaver ponds were common; these provided permanent water.

Site 3 was on Shiloh National Military Park in Hardin Co., 5 km north of Shiloh. It was a bottomland, hardwood forest dominated by sweetgum, green ash *(Fraxinum pennsylvanica),* water tupelo *(Nyssa aquatica),* and silver maple *(Acer saccharinum).* A soybean field covered 16% of the area. Topography was generally flat, and permanent water was provided by several streams (Owl Creek and its tributaries) and beaver ponds.

Site 4, also on Shiloh National Military Park (Hardin Co., 5 km northeast of Shiloh), was an upland, hardwood forest adjacent to the Tennessee River. The overstory consisted of white and black oaks, sweetgum, and juniper on ridge tops and beech *(Fagus grandifolia)* and yellow poplar *(Liriodendron tulipifera)* in hollows. Several large agricultural fields and mowed areas comprised 10–15% of the area. Topography consisted of alternating ridge tops and hollows with steep slopes, and small tributaries (many temporary) of the Tennessee River were present in most hollows.

MATERIALS AND METHODS

Animals were captured with Havahart or folding Tomahawk live traps. On sites 1 and 2, opossums were removed from the site following capture at the request of Ames Plantation personnel; there was concern of possible impact of opossums on the nesting success of bobwhite quail *(Colinus virginianus)*. On sites 3 and 4, opossums were tagged in both ears (using style 4–41 rabbit ear tags from the National Band and Tag Co.) and released after capture. Policy at Shiloh National Military Park prohibited the removal of animals from the area. However, subsequent recaptures on sites 3 and 4 were not used in the analysis; therefore, opossums were functionally removed from these sites as they were captured. To reduce variation in capture probabilities, trapping was conducted only during winter. The trapping design for each site is given in Table 1. Tree branches were piled along the sides and backs of traps to prevent animals from robbing bait from the outside. Fish was used as bait.

Table 1. Description of trapping schemes used in a study of opossum *(Didelphis virginiana)* densities at four sites in western Tennessee.

Trapping Site[a]	Days	Inclusive trapping dates	Grid config.[b]
1	21	3–24 March 84	8 × 8
2	15	3–28 March 84	5 × 10
3	21	28 Dec. 83–17 Jan. 84	8 × 8
4	27	28 Dec. 83–30 Jan. 84	9 × 9

[a] See text for explanation of site numbers.

[b] Traps were spaced 200 m apart on all grids.

Population sizes, based on removal data, were estimated using the constant removal estimator of the variation due to behavior model (M_b) from the CAPTURE program of White et al. (1978). Following Wilson and Anderson (1985), a strip one-half the average maximum distance moved between recaptures (as determined on sites 3 and 4) was added to the perimeter of each trapping grid to provide a total area of effect. Density estimates were derived by dividing the total area of effect by the estimated population size.

RESULTS AND DISCUSSION

Estimates of density ranged from one opossum per 11.9 ha to one per 111.7 ha (Table 2). Highest density occurred in a bottomland, hardwood forest associated with permanent streams (site 3); however, other water associated sites (2 and 4) had relatively similar densities. Lowest density was in a loblolly pine–hardwood, upland forest (site 1) without a nearby source of permanent water. Our value for site 1 is among the lower estimates reported for the species. Estimates for the other sites were similar to the one opossum per 15.6 ha reported by Leberg et al. (1983) for an upland area planted in loblolly pine in western Tennessee. Density values calculated for sites 2–4 were somewhat intermediate to most recorded appraisals. The highest density reported in the literature for opossums was one per 0.4 ha (Holmes and Sanderson, 1965). Estimates ranged as low as zero in a spring estimate reported by Stout and Sonenshine (1974). Population densities of one per 1.1 to 25.9 ha were more typical (Hunsaker, 1977; Gardner, 1982; Leberg et al., 1983).

Table 2. Estimates of opossum *(D. virginiana)* density at four sites in western Tennessee.

Site[a]	n[b]	N[c]	Size (ha)[d]	Total grid (animals/ha)	Density 95% CI[e]
1	3	3	335.1	1/111.7	74.6–217.0
2	17	17	274.3	1/13.5	16.1–19.9
3	19	21	250.1	1/11.9	8.7–18.8
4	18	23	397.5	1/17.9	11.0–48.1

[a] See text for explanation of site numbers.

[b] Total number of individuals captured on each grid.

[c] Number of animals estimated on each grid.

[d] Size of each grid plus area of effect.

[e] CI refers to confidence interval.

Ecologic factors directly related to the population abundance of *D. virginiana* have not been studied in detail. However, as seen in the present study, water associated habitats are usually linked to higher opossum density. Small streams and ponds provided a source of year round water at the upland site in western Tennessee studied by Leberg et al. (1986). The presence of permanent water differentiates this site from our site 1 and probably accounts for the difference in density estimates in the otherwise similar habitats. Lay (1942) found that the location of open water seemed to determine the distribution and number of opossums that remained on his study area, and Sandridge (1953) indicated that the greatest distance between any den and a source of drinking water was about 366 m. Moist areas along small streams, either flowing or intermittent, were reported by Allen et al. (1985) as favorable habitat for opossum foraging. Additionally, Reynolds (1945) suggested that the proximity to water was

likely an important factor to suitable opossum range. Other studies (see McManus, 1974; Gardner,1982) have noted the importance of water to opossums.

Because of varying methodologies among studies and numerous factors (both biotic and abiotic) that influence catchability, comparisons of density estimates among investigations are at best generalizations. Wiseman and Hendrickson (1950), Hunsaker (1977), and Moore and Kennedy (1985) have pointed out some of the difficulties in estimating population density based on trapping records. Nevertheless, such comparisons do allow overviews that contribute to the understanding of species over their ranges. For the opossum, studies throughout the distribution suggest that water associated habitats support higher densities. However, among and within habitat types, population densities commonly vary. Therfore, a knowledge of the population structure at the local level appears critical in order to completely understand the natural history of the species.

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