Opossum Demography and Scent-Station Visitation in Western Tennessee

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Abstract: Removal trapping was used to study opossum (*Didelphis virginiana*) demography at an upland site in western Tennessee during March 1983. Monthly differences in scent-station visitation were assessed at 5 western Tennessee localities, representing upland and lowland habitats, from April 1982 to May 1983. A density of 1 opossum/15.6 ha was determined using removal trapping. Yearlings made up 64% of the 14 animals captured. Adult and pouch-young sex ratios were approximately 100:100. Mean litter size was 8.8 young. Monthly differences in scent-station visitation were found in lowland habitat ($P = 0.02$) but not in upland habitat ($P = 0.38$).

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Several density estimates of opossum (*Didelphis virginiana*) populations have been determined using a variety of techniques (Lay 1942, Wiseman and Hendrickson 1950, Fitch and Sandridge 1953, Sanderson 1961, Verts 1963, Holmes and Sanderson 1965, VanDruff 1971, Conner et al. 1983). Capture-recapture methods have frequently been applied to census opossum populations, but often the species may violate assumptions associated with these techniques. For example, Petrides (1949), Sanderson (1961), and Llewellyn and Dale (1964) indicated that the species may violate the assumption of equal catchability. Additionally, capture-recapture and other studies, over prolonged periods of time, may be troubled by turnover and seasonal changes in movements. Lay (1942), Petrides (1949), and others have noted high mortality and low longevity in opossum populations. Home ranges for opossum are quite fluid, especially in the summer and early fall (Gillette 1980). Therefore, short-term removal studies of opossum density (during

seasons when population structure is generally more stable) may avoid some of the biases associated with long-term capture-recapture studies.

The use of scent-station transects as a means of determining population trends of furbearers has increased in recent years (Conner et al. 1983). However, opossum populations in Tennessee and other areas of the southeastern United States have yet to be assessed in this manner. The purposes of the present study were to: (1) obtain a density estimate and other demographic information from an opossum population in western Tennessee using removal trapping over a short-term study period, and (2) assess monthly variation in opossum scent-station visitation in lowland and upland habitat types in western Tennessee.

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Methods

The study was conducted in portions of 6 western Tennessee counties. The removal trapping site was located 9.6 km south of Brownsville in Haywood County on the Hatchie National Wildlife Refuge. This upland site encompassed approximately 108 ha with 70% of the area covered by pole-size loblolly pine (*Pinus taeda*) interspersed with scattered stands of mature hardwoods. Dominant hardwoods were primarily oak (*Quercus* sp.) and hickory (*Carya* sp.). The understory was commonly dominated by honeysuckle (*Lonicera* sp.) and greenbrier (*Smilax* sp.). Several ponds (total surface area of 11 ha), 2 small streams, old fields, and croplands covered the remainder of the site. Principal cultivated crops were corn and milo while unidentified grasses and forbs dominated old fields. Terrain was gently rolling hills (elevations of 98 to 113 m) which were in proximity to extensive bottomlands associated with the Hatchie National Scenic River.

Removal trapping was conducted from 8 to 19 March 1983 utilizing 40 Tomahawk live traps in a 10×4 grid (total area trapped = 160 ha). Traps were spaced at approximately 200 m intervals, with actual trap placement taking advantage of nearby terrain to maximize chances of capture. Sticks were piled along the sides and back of traps to prevent animals from removing bait from the outside. Bait, added daily, consisted of sardines or fish.

Captured opossums were sexed, and standard measurements of total length, tail length, hind foot length, and external ear length were recorded.

Tooth wear and replacement were used to age specimens (Petrides 1949). Pouch young were counted and aged, and average dates of parturition and mating were approximated for each litter according to Petrides (1949). Skins, skeletal material, and internal organs were saved for future analysis.

In order to provide a more accurate estimate of density, a 202-m wide strip was added to the perimeter of the trapping area to include the total area of effect. Area of effect is difficult to determine, and little standardized methodology exists for this task. The added strip in the present study was half the average winter foraging distance of male and female opossums on nights in which the sunset temperature was above 0° C as determined from the data of Gillette (1980). These temperature conditions closely approximate those of the present study, and the area added to the grid appeared to provide a reasonable total area of effect (218 ha).

Eight scent-station lines were established in upland habitat and 7 in bottomlands. Most upland areas were characterized by oak-hickory forest while bottomlands were typically dominated by beech (*Fagus grandifolia*), elm (*Ulmus americana*), hackberry (*Celtis occidentalis*) and cottonwood (*Populus deltoides*).

Scent-station lines were monitored monthly from April 1982 to May 1983 when weather and water levels permitted. Since part of the transect on Hatchie National Wildlife Refuge occurred on the trapping site and since removal of animals would influence levels of visitation, this scent-station line was discontinued after March.

Each transect was 3.2 km in length and consisted of 10 stations. Each station was comprised of a circle of sifted sand, 1 m in diameter, with a centrally-placed cottonball (attached to the top of an immersed applicator stick) saturated with a scent. Several scents (bobcat urine, fox urine, coyote urine, and fatty acid scent, FAS) were used initially, but, after a few sampling periods of no apparent differences in visitation rates to stations receiving different scent treatments, bobcat urine was used exclusively. If the stick or cottonball was displaced and no opossum tracks were present, the station was considered inoperable. An index for each line was calculated by dividing the number of stations receiving opossum visits by the number of operable stations and multiplying this value by 1,000 (Linhart and Knowlton 1975).

Chi-square analysis was used to test for deviations from an equal sex ratio. Analysis of variance procedures of the Biomedical Computer Program (Dixon et al. 1981) and Statistical Package of the Social Sciences (Nie et al. 1975) were used to assess habitat and monthly differences in the arcsine transformed visitation rates.

Results

A total of 14 opossums (4 males and 10 females) were removed in 12 days of trapping (Fig. 1). Adults constituted 36% ($N = 5$) of the cap-

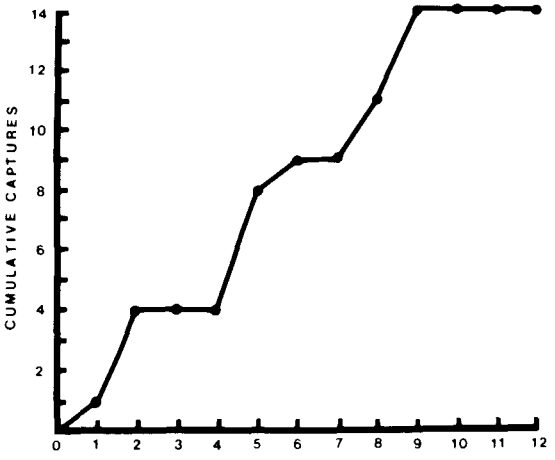

Figure 1. Daily cumulative captures of opossums from a trapping site on the Hatchie National Wildlife Refuge in Haywood County, Tennessee, during March 1983.

tures while yearlings represented 64% ($N = 9$). Minimum opossum density on the trapping site was estimated as 1 animal/15.6 ha.

All 10 females had litters in their pouches, totaling 88 young. Of the young which could be sexed, 47 were males and 33 were females. Sex ratios of adult ($X^2 = 2.57$) or juvenile ($X^2 = 2.45$) opossums did not differ significantly ($P > 0.05$) from 100 : 100. Mean litter size was 8.8 with a range of 3 to 13. Litters were 6 to 39 days old. Nine litters had estimated birth dates of 1 to 11 February and conception dates of 18 to 29 January. A considerably less developed litter was born approximately 3 March and conceived about 18 February.

The mean scent-station visitation index across all months was 191 in upland habitat and 226 in bottomland (Fig. 2). The mean monthly index for bottomland habitat was higher than for upland in July ($P = 0.02$) and October ($P = 0.08$); no other differences in monthly values were found between habitats ($P = 0.92$ to 0.23). There were no significant differences in mean indices between months in upland transects ($P = 0.38$), but differences did occur in the bottomland transects ($P = 0.02$). Mean bottomland indices for July and October were higher than those for December and June ($P < 0.05$).

Discussion

The density of 1 opossum/15.6 ha in the present study is within the range of densities previously recorded for the species. Reported spring estimates include 1 opossum/9.9 ha in Florida (Conner et al. 1983) and 1/42.9 ha in Iowa (Wiseman and Hendrickson 1950). Summer and fall

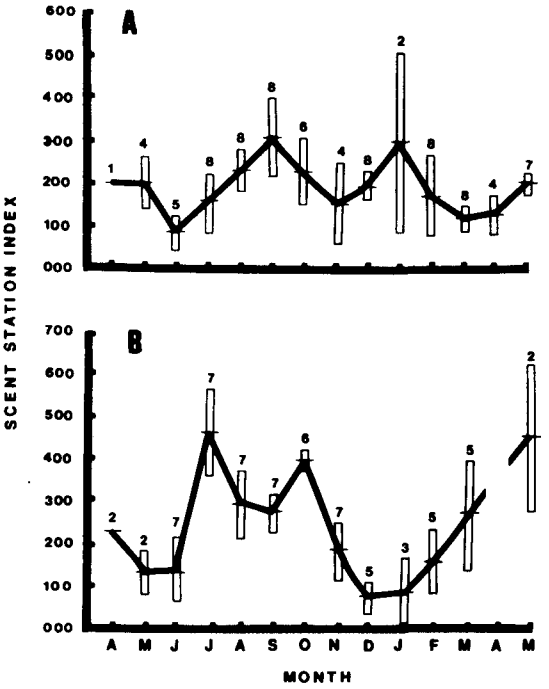

Figure 2. Monthly scent-station indices of opossum visitation in upland (A) and bottomland (B) habitats of western Tennessee from April 1982 to May 1983. Bars represent standard errors and numbers above bars are the number of scent-station lines monitored that month.

density estimates include 1 opossum/0.86 to 1.1 ha (Sanderson 1961, Holmes and Sanderson 1965) and 1/25.9 ha (Verts 1963) for Illinois, 1/1.6 ha for Texas (Lay 1942), 1/7.0 ha for New York (VanDruff 1971), and 1/12.1 ha for Kansas (Fitch and Sandridge 1953). Summer and fall densities are generally higher than spring values reflecting, at least partially, the high reproductive potential of opossums (Petrides 1949). Additionally, summer and early fall density estimates may be inflated by high levels of dispersal occurring in opossum populations during these seasons (Gillette 1980). Gillette (1980) also pointed out that opossum home ranges were smallest and more stable in the winter and that little or no dispersal occurred during this season. In the present study, effects of immigration and emigration were probably minimal due to the short duration and timing of the trapping period. No captures were made during the last 3 trapping nights. The minimum nightly temperatures for this period were 5.6° to 14.0° C, which were suitable for opossum movement outside the den (Fitch and Shire 1970). Thus, the duration seemed to be adequate for removing most indi-

viduals from the study site. A 2-day period early in the trapping effort in which no captures were made was probably due to a change in temperature (Fig. 1). The minimum nightly temperature dropped from 2.2° C on the second night of trapping to −0.5° C on the following night. Fitch and Shire (1970) and Gillette (1980) have reported reduced opossum activity during periods of cold weather and dropping temperatures.

The carrying capacity of various habitats is important when comparing different density estimates. Verts (1963) and Llewellyn and Dale (1964) considered forested bottomlands and shorelines as the best opossum habitat, cultivated fields and open shorelines the poorest, and dry upland forest as intermediate. Densities ranging from 1 opossum/0.86 ha in bottomland habitat (Sanderson 1961) to 1/42.9 ha in an area under 97% cultivation (Wiseman and Hendrickson 1950) have been reported. Considering the above criteria, the upland pine-hardwood forest, interspersed with fields and ponds, of the present study would be expected to support higher densities than cultivated areas but lower than those found in lowland forests. Results of our study fit this model. Overall, considering the habitat and season, the use of short-term, intensive trapping appears to be a viable means of sampling opossum populations.

Present results agree with previous studies (Petrides 1949, Sanderson 1961, VanDruff 1971) in indicating an approximate 100 : 100 sex ratio in both adult and pouch young opossums. The percentage of yearlings found in the present study is lower than the 75% to 86% reported for summer and fall populations (Petrides 1949, Sanderson 1961, Llewellyn and Dale 1964, VanDruff 1971). In comparison with values given by Tyndale-Biscoe and Mackenzie (1976), our mean litter size of 8.8 is one of the largest reported at Tennessee's latitude. This large litter size, combined with the fact that all of the captured females were carrying young, indicated a highly productive population.

The mean opossum scent-station index values of 191 for upland habitat and 226 for bottomland habitat are higher than those reported in other southeastern studies (44 in Alabama, Summer and Hill 1980; 28 in Louisiana, Morrison et al. 1981; 70 and 121 in Florida, Conner et al. 1983). Explanations for differences in visitation rates across geographic areas are unclear. However, habitat no doubt plays an important role. Higher visitation could be expected in areas of more desirable habitat (bottomlands) than in regions of lesser quality (uplands). This was generally the case in the present study. Differences in visitation between habitat types were greatest in July and October. Since these months had visitation rates among the highest for both habitats, July and October would appear to be good choices for sampling periods if transects were to be conducted in only 1 or 2 months annually.

Much is yet to be learned concerning scent-station transects in the Southeast. However, results of the present study suggest that the technique is sensitive to the 2 habitat types studied and that it presents favorable pros-

pects as a means for providing a measure of opossum population trends. Additional studies are needed in order to more fully understand scent-station visitation by opossums and other furbearers.

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