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Robert K. Rose
Old Dominion University, rrose@odu.edu

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Range Extension for the Dismal Swamp Southern Bog Lemming, *Synaptomys cooperi helaletes*, in Eastern Virginia

Robert K. Rose

Department of Biological Sciences
Old Dominion University
Norfolk, Virginia 23529-0266
brose@odu.edu

ABSTRACT

The distribution of the Dismal Swamp Southern Bog Lemming is extended to include three counties west of the Dismal Swamp in southeastern Virginia, long considered its only location in the state. Evidence of lemmings was detected at 10 of 27 survey sites, and confirmed by trapping at three of five sites, all dominated by herbaceous vegetation.

Key words: range extension, southern bog lemming, *Synaptomys cooperi*.

INTRODUCTION

Synaptomys cooperi helaletes, the Dismal Swamp Southern Bog Lemming, was discovered in the Great Dismal Swamp of southeastern Virginia in 1895 and named by C. H. Merriam (1896) as a new species of rodent. In a revision of the genus, the distinct population from the Swamp was reduced to subspecies status (Howell, 1927) and later revisions, including Wetzel (1955), have affirmed that decision. This taxon is now considered to be one of seven subspecies and among the four subspecies that occur as isolated populations (Wilson & Ruff, 1996). No specimens of *S. c. helaletes* were collected for the next 85 years despite efforts by several investigators, including Handley (1979a, b), who speculated on the possible extinction of the Dismal Swamp population. In the early years of Virginia's protected species program, the Southern Bog Lemming was classified as "status undetermined" because it was unclear whether populations existed (Handley, 1979b).

Then, in late winter 1980, Rose (1981) collected 13 specimens of the Southern Bog Lemming (hereafter 'lemming') with pitfall traps from three locations in the northwestern section of the Great Dismal Swamp National Wildlife Refuge, confirming that the population was extant. Later pitfall trapping (Everton, 1985; Padgett, 1991) revealed its presence in several locations in the Refuge and also well beyond its boundaries (see review in Rose, 2006). Information gathered in the 1980s allowed this taxon to be removed from consideration for possible state listing in 1989 (Handley, 1991). Webster and his colleagues (1992) found lemmings in a few locations in the Coastal Plain of North Carolina, raising the possibility that the species might range more widely in Virginia also. Rose (2005) reported its presence at eight of 14 survey locations in Isle of Wight County, which lies more than 30 km from the western boundary of the Refuge.

The Southern Bog Lemming is a small (<30 g) rodent in the subfamily Arvicolinae (formerly Microtinae) of the Family Muridae. Arvicoline rodents are characterized by chunky bodies, dense fur, and short ears and tails. Other arvicolines in eastern Virginia are the Meadow Vole (*Microtus pennsylvanicus*) and Woodland or Pine Vole (*Pitymys pinetorum*). All arvicolines are herbivorous, eating mostly the stems and leaves of grasses, plus some forbs and lesser amounts of other plant material. *Synaptomys* differs from other local arvicolines by having grooved upper incisors and it differs from the more common Meadow Vole by having a much shorter tail; the lemming's tail is about as long as the hind foot whereas the Meadow Vole's tail is twice as long as the hind foot. Southern Bog Lemmings have squarish noses, brownish grizzled dorsal fur, and gray belly fur. Two morphological features, grooved incisors and short tail, help distinguish Southern Bog Lemmings from other short-

tailed rodents. Woodland Voles have equally short tails but lack grooved incisors.

The presence of lemmings can be detected in the field because they produce bright green feces (Burt, 1928), a unique feature among rodents in eastern North America. The causes of the green feces are unknown but may be related to the unusual spiral-shaped caecum in the digestive tract of *Synaptomys*. Besides being green in color and ca. 2 mm long, lemming droppings are sausage-like, being rounded on both ends whereas the feces of the Meadow Vole are brownish-black and tapered on one end. Other rodents in grassy habitat have larger or smaller droppings.

When herbivorous rodents eat grasses or other monocots, often their principal food, they leave small piles of cuttings, each usually about 2-3 cm long and with diagonal cuts at the ends. Meadow Voles make and maintain runways, the thoroughfares on which they travel as they conduct their daily activities. Woodland Voles confine most of their foraging activities to the shallow (3-4 cm) burrows they construct (Smolen, 1981). It is unclear whether lemmings make runways or burrows, but at least in eastern Virginia their presence is most often related to wet herbaceous habitats, often characterized by the presence of sphagnum (*Sphagnum* spp.) or other mosses and to obligate wetland plants such as soft rushes (*Juncus* spp.), sedges (*Carex* spp.), wool grass (*Scirpus cyperinus*), and giant plume grass (*Erianthus giganteus*) (Rose, pers. obs.).

The purpose of my study was to search for the presence of lemmings in three Virginia counties west of the known distribution, namely in Surry, Sussex, and Southampton counties. The western boundaries of these counties lie 130-155 km (75-85 miles) west of Norfolk and about 100-115 km west of the Refuge. If the known distribution extends well beyond the Refuge, *Synaptomys cooperi helaletes* populations are secure.

MATERIALS AND METHODS

In previous field studies in eastern Virginia, pitfall traps often were used to confirm the presence of lemmings at locations where the habitat was suitable (Rose, 2006). However, sites where lemmings are found often are too wet for the use of pitfall traps because the hygroscopic pressure of water pushes the traps out of the ground when the water table is near the surface, as often happens in eastern Virginia during winter. The alternative method I used was to visit potential habitats in the three counties and search for the green feces indicating the presence of lemmings. At five sites where feces were detected, I used live traps baited with mixed seeds in January and February, 2011, in an attempt to confirm the presence of lemmings. Southern Bog Lemmings are difficult to capture using live traps (e.g., Rose & Stankavich, 2008), but they are most trappable in winter.

The habitats most commonly associated with the presence of lemmings are dominated by grasses and other herbaceous vegetation. I made my searches at sites near where roadways intersect with powerline rights-of-way (ROWs), habitats that often are dominated by such plants. Using county maps, I identified 13 locations in Surry County, 31 locations in Sussex County, and 22 locations in Southampton County where powerlines intersect public roads. A few more locations now exist because of the new Thrasher-Suffolk line that Dominion Virginia Power is currently constructing from Hopewell to Suffolk, Virginia. Most of the powerline ROWs were those of Dominion Virginia Power radiating from their Surry generating station, located on the James River in eastern Surry County. Most ROWs had two adjacent towers and were 60-70 m wide, providing linear habitat often bordered by farmland or forest.

At each site dominated by grassy vegetation, I spent 1-3 hours looking for the runways and cuttings characteristic of arvicoline rodents, and for the green feces associated with the presence of lemmings. At many places where a road intersected with a powerline, the ROW was under cultivation, had unsuitable shrubby or forested vegetation, or was posted against trespassing. I made searches only at sites where grassy vegetation dominated and the land was not posted.

RESULTS

I spent 14 days driving 2,361 miles to examine 27 potential sites for the presence of lemmings (Table 1). Seven sites were in Surry County (723 km^2), 11 in Sussex County (1276 km^2), and nine in Southampton County (1553 km^2). These values are roughly proportional to the number of road crossings of powerline ROWs, and similar to the miles of ROW in each county.

I found evidence of lemmings (green feces) at 10 of the 27 survey sites, including two locations in Surry County and four locations each in Sussex and Southampton counties (Table 1; Fig. 1). I set live traps at five of the most promising sites (i.e., those with numerous cuttings and green feces) and captured one or two lemmings at three of these sites, thus confirming that the green feces were accurate in predicting the presence of lemmings. (Voucher specimens are in the Old Dominion University collection.) At the other two sites, I caught only Meadow Voles or Hispid Cotton Rats (*Sigmodon hispidus*) during the time I trapped. I caught lemmings at two locations in extreme south-

Table 1. GPS coordinates associated with the 27 locations where searches were made for Dismal Swamp Southern Bog Lemmings (SBL) and a brief summary of survey results. "no" in the last column means that evidence of SBL was not detected at that site.

Surry County, Virginia, with elevations from 68 to 114 feet (21 to 35 m)					
Site 6	N37º	05.995'	W76º	42.099'	green feces, no SBL in traps
Site 7	N37º	08.573'	W76º	41.830'	no; vole cuttings and a nest
Site 1	N37º	05.084'	W76º	43.529'	no; Cotton Rat cuttings
Site 19	N37º	05.024'	W76º	45.506'	green feces, no trapping
Site 20	N37º	03.160'	W76º	46.872'	no; Meadow Voles only
Site 21	N37º	01.883'	W76º	52.801'	no; area probably too small and adjacent to forested swamp
Site 2	N37º	07.138'	W76º	51.890'	no; Meadow Voles only
Site 3	N37º	10.693'	W76º	56.444'	sphagnum, but no feces
Site 4	N37º	12.217'	W76º	59.312'	no; Cotton Rats only
Sussex County, with elevations from 72 to 177 feet (22 to 54 m)					
Site 8	N37º	02.489'	W77º	04.143'	no; area probably too small
Site 5	N37º	04.380'	W77º	09.414'	green feces, only Meadow Voles in traps
Site 11	N37º	02.040'	W77º	17.120'	no cuttings or feces
Site 12	N37º	02.685'	W77º	17.019'	no; area probably too dry and recently mowed for hay
Site 13	N37º	01.991'	W77º	09.215'	green feces, no trapping
Site 14	N37º	00.828'	W77º	03.934'	no; area disturbed
Site 15	N36º	59.492	W77º	01.821'	caught 1 SBL
Site 24	N36º	54.596'	W77º	29.444'	no cuttings or feces
Site 25	N36º	53.876'	W77º	29.793'	green feces, no trapping
Site 26	N36º	51.814'	W77º	30.835'	no; Cotton Rats only (?)
Site 27	N36º	53.821'	W77º	32.574'	no cuttings in small area
Southampton County, with elevations from 11 to 93 feet (3.5 to 28 m)					
Site 22	N36º	54.051'	W76º	54.174'	no cuttings in cattails
Site 23	N36º	53.932'	W76º	54.726'	no; habitat disturbed by recent construction
Site 18	N36º	34.884'	W77º	14.279'	caught 1 SBL+ 1 Meadow Vole
Site 17	N36º	38.397'	W77º	04.871'	1 green feces and cuttings, no trapping
Site 16	N36º	38.772'	W77º	02.998'	caught 2 SBL
Site 9	N36º	39.395'	W76º	59.214'	no cuttings or feces
Site 10	N36º	39.520'	W76º	58.326'	green feces, no trapping

western Southampton County (sites 16 and 18 between Boykins and Branchville) and at one location (site 15) in western Sussex County, about two miles (4 km) from the Prince George County line and within 20 miles (32 km) of Petersburg, Virginia. All locations were near the western boundaries of these counties, suggesting that lemmings might be present even farther to the west.

DISCUSSION

All 27 survey sites were dominated by herbaceous vegetation, mostly grasses, and saturated soils usually were present on the site or nearby. The presence of lemmings sometimes was associated with standing water on the site, often with sphagnum moss, panic grasses (*Panicum* spp.), and wool and giant plume grasses present. In the wettest sites, soft rushes (*Juncus effusus* and *J. tenuis*) also were present, and at site 16, where the piles of cuttings and green feces were especially numerous, soft rushes were the most prominent type of plant being cut and eaten. My searches in other grassy vegetation on slightly drier locations at site 16 detected few or no cuttings or droppings, indicating that, in mid-winter at least, lemmings were relying heavily on green soft rushes for food. At the 10 sites where I found bright green feces, piles of green cuttings were present, suggesting that this was the food being consumed. Lemmings were not cutting the standing dead vegetation that often was much more abundant at this (winter) season.

At the other two sites (#15 and 18) where I caught lemmings, there was little sphagnum moss, no wool grass or soft rushes, and little standing water. The grasses at these sites were dominated by little bluestem (*Schizachyrium scoparius*) and panic grasses, and a few tree seedlings were present also, indicating somewhat drier conditions.

Each of the counties that I surveyed has numerous swamps, often with slow-moving blackwater streams flowing through them (each county map has many

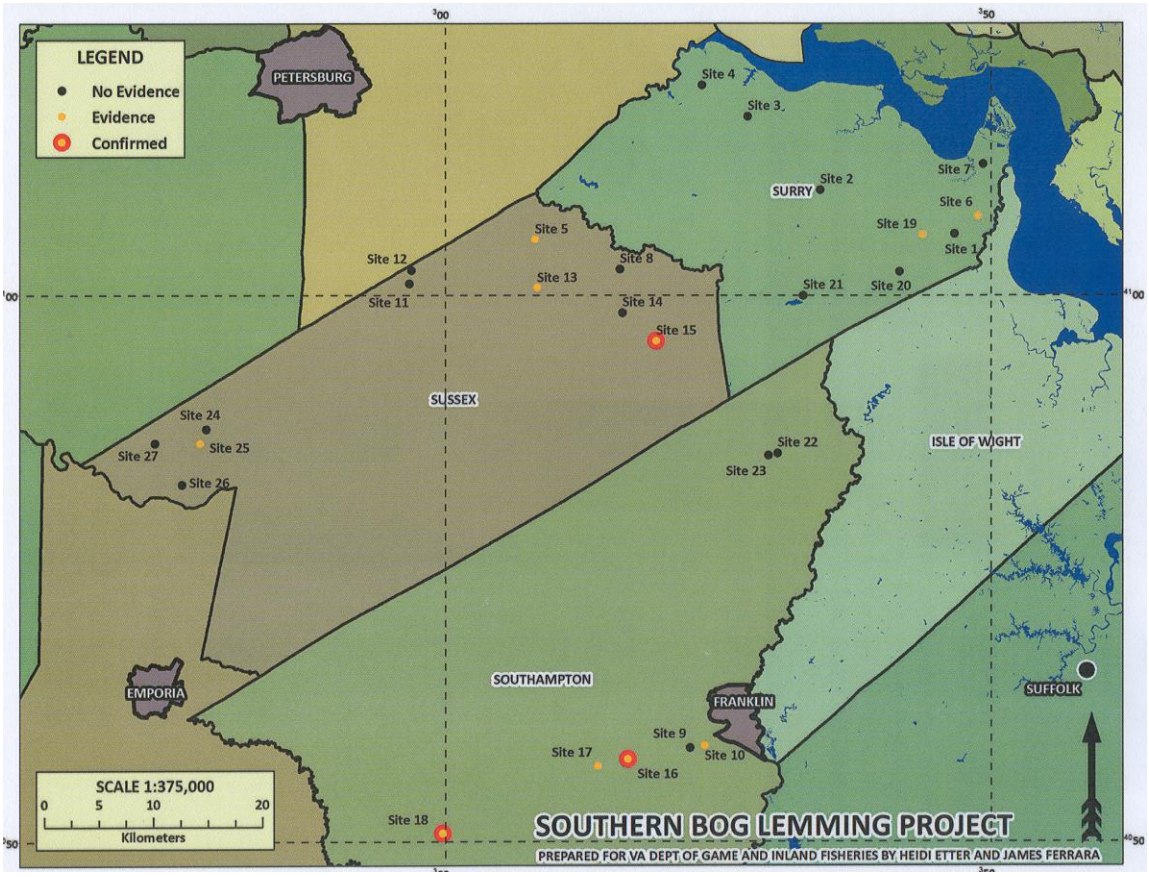

Fig. 1. Map of Surry, Sussex, and Southampton counties in southeastern Virginia showing the 27 sampling locations (powerlines at road crossings) and results of surveys for Dismal Swamp Southern Bog Lemmings.

named swamps [Surry (n=13), Sussex (n=17), and Southampton (n=9)] and countless miles of associated streams). Such swamps are present even in western Sussex County where the countryside is rolling and mean sea level elevations approached 200 feet (61 m) in some places. These conditions can produce marshes dominated by panic, wool, giant plume, and other grasses tolerant of persistently saturated soils. Sphagnum and other mosses often were present too. In these damp or wet conditions, lemmings and/or meadow voles often are present as the dominant herbivorous rodents.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this field study, Dismal Swamp Southern Bog Lemmings (*Synaptomys cooperi helaletes*) are known to occur at multiple locations in each county. Besides the locations that I documented, many more places, including powerlines distant from road crossings, probably support populations of lemmings. In addition, each county has many streamside and larger marshes associated with meandering slow-moving streams that may harbor bog lemmings.

With the addition of these three counties, the total area of known distribution of lemmings in eastern Virginia is increased to 6,996 km^2 (3,701 mi^2), which includes the cities of Virginia Beach, Chesapeake, and Suffolk, and Isle of Wight County, as reported previously (Rose, 2006), and now the counties of Surry, Sussex, and Southampton. I suspect that the next counties to the west (Prince George, Dinwiddie, and Greensville) also harbor populations of lemmings in appropriate habitat, as described in this report. It is now clear that the Dismal Swamp subspecies of the Southern Bog Lemming is not restricted in distribution to the Great Dismal Swamp, as was once believed, but has a much broader range to the west, at least south of the James River, extending to within about 30 km of Petersburg.

In light of this new information on the much greater area of distribution, I believe *S. c. helaletes* has a sufficiently broad range in Virginia such that its

populations can be considered secure. Part of the justification for this belief is that the habitat used by Southern Bog Lemmings is low-lying, often boggy land adjacent to meandering streams that is not likely to be developed beyond its present state, now mostly farmland. Furthermore, logging operations in these rural counties do not pose a threat either, because after clearing, these tracts often provide suitable habitat for lemmings for several years, and, of course, the powerline ROWs will continue to serve as habitat in many places, potentially providing corridors for lemmings to establish new populations. Thus, the habitats in which lemmings now are found are likely to continue to be present in comparable quality and number for the foreseeable future. The major threats remain in the cities of Virginia Beach, Chesapeake, and Suffolk, where development continues apace in upland sites, sometimes degrading or shrinking nearby wetlands and other low-lying habitat that might harbor lemmings.

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