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Additional Records of the Rock Vole, *Microtus chrotorrhinus* (Miller) (Mammalia: Rodentia: Muridae), in Virginia.

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The southern Appalachian mountains support a rich small mammal fauna, with representatives that are typical of boreal climes often existing in sympatry with species associated with southern regions (Guilday, 1971). The rock vole, *Microtus chrotorrhinus*, is a boreal rodent whose geographic distribution extends from eastern Canada south along the Appalachians to North Carolina and Tennessee (Kirkland & Jannett, 1982). *Microtus chrotorrhinus* typically inhabits moist, rocky habitats within this region, although clearcuts and disturbed habitats may also be utilized. Southern populations are considered disjunct (Kirkland & Jannett, 1982), and may be adversely affected by natural and anthropogenic habitat fragmentation and destruction (Handley & Gordon, 1980; Pagels, 1990). The relatively low reproductive output of *M. chrotorrhinus* (Handley, 1980), which also tends to decrease in southern areas (Kirkland & Jannett, 1982), may also contribute to smaller populations with increased sensitivity to perturbation and local extinction. The rock vole, listed as state endangered (Handley & Pagels, 1991), was previously known in Virginia from only a single locality in Bath County at an elevation of 1036 m (Pagels, 1990). Here we report an additional record for Bath County and a new record from Highland County.

Voles were collected as part of a larger, ongoing small mammal study of 353 sampling sites within the George Washington and Jefferson National Forests. An effort was made to sample all habitat types present in the study area according to their abundance in the landscape, *e.g.*, if xeric oak habitats constituted 50% of the entire study region, then 50% of the sampling sites were in xeric oak habitat. At each site, small mammals were sampled using eight Sherman live traps (8 x 9 x 23 cm) and one Tomahawk live trap (21 x 21 x 62 cm). A pitfall array consisting of three 0.5 l pitfalls connected to a central 0.5 l pitfall with a 0.3 m high drift fence of aluminum screening was also installed within each site (Type 1B of Handley & Kalko, 1993). Live traps were baited with rolled oats scented with peanut butter or peanut oil, and pitfalls were filled with 5 cm of water during sampling. There were 69 trapnights (TN) of effort at the Highland County site from 28 May to 1 June 1997. The Bath county site was live-trapped for 69 TN followed by 65 TN with Museum Special traps in early summer 1996, and was live-trapped again for 69 TN in early summer 1997. The increased effort at the Bath county site resulted from its inclusion in 30 sites that were used to examine the efficacy of our trapping protocol and seasonal fluctuations in small mammal abundance. Specimens of *M. chrotorrhinus* were found dead in Sherman live traps and were deposited in the Virginia Commonwealth University

Mammal Collection (VCU # 12378 and 14034, Bath County specimens; VCU # 14031 and 14032, Highland County specimens).

Two individuals of *Microtus chrotorrhinus* were captured near the upper reservoir of the Bath County Hydroelectric Plant at approximately 1,021 m elevation. Two others were taken at a site in Highland County in Kent Simmons Hollow at an elevation of 976 m. All captured rock voles were adult females with visible mammae. The new records for Bath and Highland counties are 1.4 km north and 3.9 km northeast, respectively, of the original Bath County site (Pagels, 1990). Both sites were in riparian habitats with steep slopes (28^0 at Bath County site, 31^0 at Highland County site). Sites were characterized by abundant vegetation, moss, talus- and rock-laden slopes typical of *M. chrotorrhinus* habitat (Kirkland & Jannett, 1982). Rock or talus at the sites ranged in size from < 0.2 m to > 1 m, and woody debris was abundant at each site. Herbaceous growth was prevalent at both sites and consisted primarily of stinging nettle (*Urtica dioica*) and jewelweed (*Impatiens* spp.).

Woody tree species present at the sites were typical of rock vole habitat as found in the region (Kirkland, 1977; Pagels, 1990). Canopy tree species with diameter at breast height (dbh) > 10 cm in decreasing abundance at the Bath county site were American basswood (*Tilia americana*), yellow birch (*Betula alleghaniensis*), and a single standing dead tree (snag). Mean dbh of canopy trees was 37.8 ± 4.7 cm (n = 10). Subcanopy and shrub species in decreasing abundance at the site were witch hazel *(Hamamelis virginiana*), sugar maple (*Acer saccharum*), mountain maple (*Acer spicatum*), honeysuckle *(Lonicera* spp.), basswood, and white ash (*Fraxinus americana*). Canopy tree species at the Highland County site consisted of basswood, snags, slippery elm (*Ulmus rubra*), striped maple (*Acer pensylvanicum*), white ash, and cucumber magnolia (*Magnolia acuminata*). Subcanopy and shrub species at the site were mountain maple, honeysuckle, mountain laurel (*Kalmia latifolia*), hornbeam (*Ostrya virginiana*), sugar maple, and hickory (*Carya* spp). Mean dbh of canopy trees was 20.7 ± 2.4 cm (n = 17). Tree communities at both sites were > 120 years old (U.S. Forest Service Continuous Inventory of Stand Condition data).

Other small mammals captured at the Bath County site were the southern red-backed vole (*Clethrionomys gapperi*) (19), the cloudland deer mouse (*Peromyscus maniculatus*) (6), the eastern chipmunk (*Tamias striatus*) (4), the northern short-tailed shrew (*Blarina brevicauda*) (2), the masked shrew (*Sorex cinereus*) (2), the white-footed mouse (*Peromyscus leucopus*) (1), the smoky shrew (*Sorex fumeus*) (1), and the pygmy shrew (*Sorex hoyi*) (1). Small mammals captured at the Highland County site were *P. maniculatus* (6), *S. fumeus* (6), *B. brevicauda* (2), *C. gapperi* (2), the woodland jumping mouse (*Napaeozapus insignis*) (2), *S. cinereus* (1), and *P. leucopus* (1). These species, especially *C. gapperi*, have been found in sympatry with *Microtus chrotorrhinus* (Martin, 1971; Timm *et al*., 1977; Kirkland & Jannett, 1982; Pagels, 1990).

The occurrence of rock voles at only two of 353 sampling sites supports the contention of other researchers (Kirkland, 1977; Pagels, 1990; Handley & Pagels, 1991) that *Microtus chrotorrhinus* populations in the area exist in relative isolation. The relatively narrow niche breadth of *M. chrotorrhinus* may explain this distribution to some extent (Clough, 1987), although the true nature of the ecological restriction of this species is not fully understood (Kirkland & Jannett, 1982). The capture of only two individuals during 203 TN of effort at the Bath county site suggests that low abundance was common even in suitable habitat in the study area, in concurrence with the findings of French & Crowell (1985) and Guilday (1971). Genetic studies suggest that the range of *M. chrotorrhinus* may not be so fragmented in more northern regions (Kilpatrick & Crowell, 1985). However, if genetic exchange occurs among populations in the study region, immigration-enhanced heterozygosity (Kilpatrick & Crowell, 1985) may be offset by inbreeding and relatively low reproductive output (Handley & Gordon, 1980).

Whether the distribution of *Microtus chrotorrhinus* in the study area is limited by suitable habitat is unknown. Although we did not find this species at some sites in apparently suitable habitat, this must be interpreted with caution. Because our sampling protocol examined habitats in relation to their abundance, relatively few sites suitable for *M. chrotorrhinus* were sampled due to the rarity of such biotopes in the southern Appalachian landscape. As such, the presence of optimal habitat may be of concern for the conservation of this species, but the ability of the rock vole to successfully colonize other suitable habitats must also be considered. The presence of presumably viable populations of *M. chrotorrhinus* in West Virginia (Kirkland, 1977) suggests that source populations exist for recolonization of suitable habitat in the study region (Pagels, 1990). Proximity to these populations (approximately 33 km) may explain the presence of *M. chrotorrhinus* at these new sites and its absence at other apparently suitable habitats that are more distant from potential source populations. The highly managed landscape of the southern Appalachians may contain

few suitable dispersal corridors and thus movement of *M. chrotorrhinus* into potential habitats may be restricted (Anderson & Danielson, 1997; Rosenberg *et al*., 1997). Additionally, the presence of adequate corridors may provide stability to apparently small populations that are likely to become locally extinct by random processes alone (Rosenberg et al., 1997). Maintenance of viable, genetically diverse populations of *Microtus chrotorrhinus* in the study area is contingent upon management decisions that minimize alteration of existing habitat and promote suitable dispersal corridors within the landscape.

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