Notes on Distribution and Habitats of *Sorex* and *Microsorex* (Insectivora: Soricidae) in Kentucky

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ABSTRACT.— New distributional information on long-tailed shrews in Kentucky is presented. *Sorex fumeus*, *S. cinereus*, *S. longirostris*, and *Microsorex hoyi* are shown to be more widespread in the state than previously thought. Two apparently isolated populations of *M. hoyi* occur. Habitat information and a key to Kentucky Soricidae are included.

INTRODUCTION

Of the eight species of long-tailed shrews (genera *Sorex* and *Microsorex*) shown by Junge and Hoffman (1981) to occur in the eastern United States, only three—*Sorex longirostris* Bachman, *Sorex cinereus* Kerr, and *Sorex fumeus* Miller—were reported from Kentucky by Barbour and Davis (1974). Caldwell (1980) additionally documented the presence in the state of *Sorex dispar* Batchelder and *Microsorex hoyi* (Baird), bringing the number of long-tailed species to five. Additional distributional information were reported for *Sorex longirostris* and *Sorex fumeus* by Bryan (1979), and for *Sorex cinereus* by French (1978). A sixth species, the Water Shrew, *Sorex palustris* Richardson, may yet be discovered in the higher elevations of eastern Kentucky.

This paper updates the known ranges in the state for each species of long-tailed shrew (Figs. 1A-E). Figure 1F shows counties where pitfalls have been placed. We also present a key to the species of Soricidae in Kentucky (including short-tailed species), and habitat and ecological information. Exact locality data are available from the authors upon request. Catalogued specimens are deposited in the collections of the Kentucky Nature Preserves Commission, the Division of Environmental Analysis, the University of Kentucky vertebrate museum, and the personal collections of the authors.

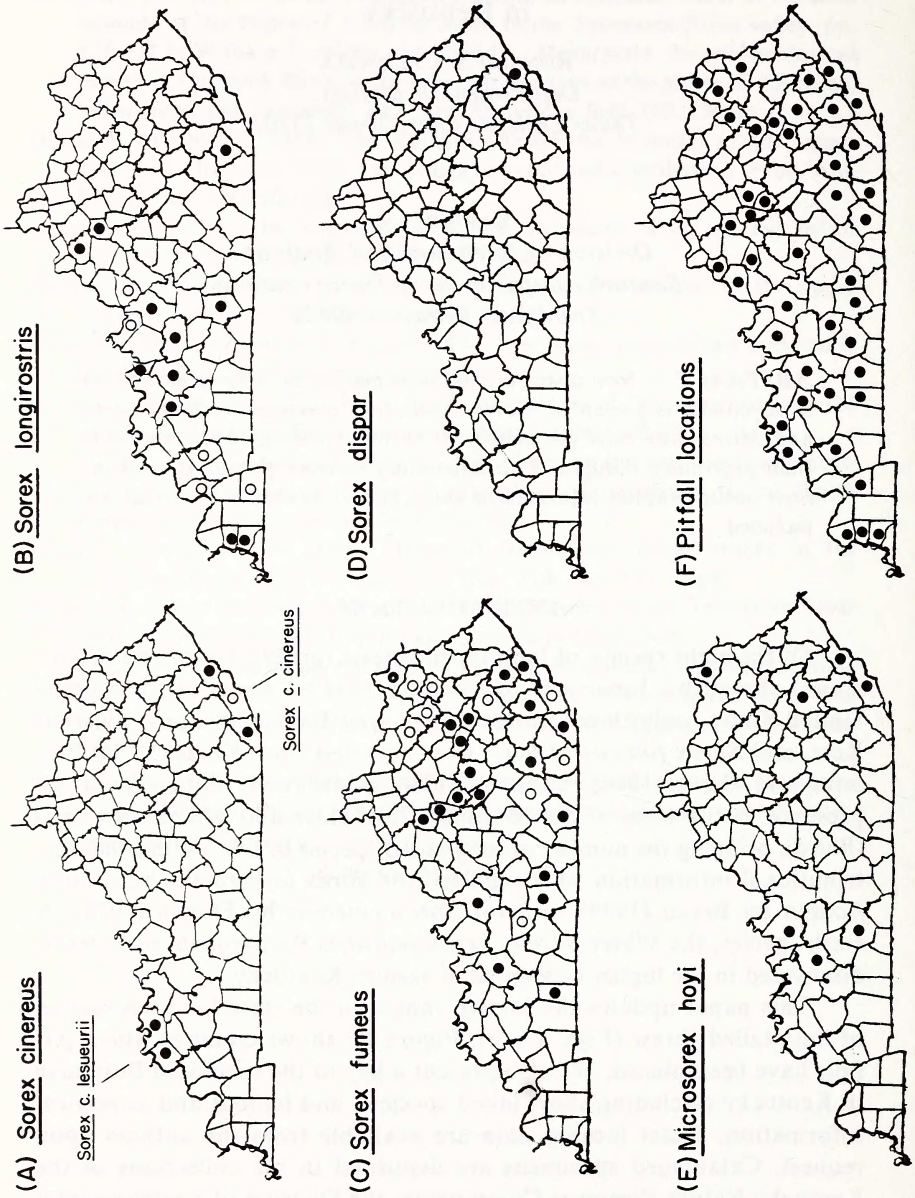


Fig. 1. County records of long-tailed shrews known to occur in Kentucky, and pitfall locations. Open circles are records from Barbour and Davis (1974), closed circles are additional recent records.

METHODS AND MATERIALS

Both standard snap-back mouse traps and pitfall traps were used to capture shrews, usually with 5 to 20 pitfall traps and 30 to 300 snap-traps in suitable habitat. Snap-traps were removed after one to three nights, but pitfalls often remained in place at each locality for 3 to 10 months.

Many researchers have commented on the effectiveness of pitfall traps for capturing *Sorex* (Briese and Smith 1974; Brown 1967; Hudson and Solf 1959; Rose 1980; Wolfe and Esher 1981; and others). In this study, several sizes of pitfall cans were often used. Number 10 cans (153 mm opening) were preferred, but smaller sizes were also used. The top of each can was positioned just below the surface of the ground, and leaves were placed around the lip to present a more natural environment. As was suggested by MacLeod and Lethiecq (1963) water was added to some cans to prevent shrews from escaping. Brown (1967) gave suggestions for setting pitfalls in talus.

RESULTS AND DISCUSSION

Annotated List

Sorex cinereus Kerr, Masked Shrew — North of Kentucky, the masked shrew is common in many habitats (Buckner 1966; Getz 1961), but Kentucky specimens have all been taken in woodlands. Two subspecies occur in the state (Fig. 1A). *Sorex c. cinereus* occurs in the eastern mountains. *Sorex c. lesueurii* Duvernoy was first found in Henderson County, in a floodplain forest along the Ohio River (French 1978). More recently it was taken in similar habitat along the Ohio River in Union County (Floyd Scott, unpubl. data), and along the Green River in Henderson County about 11 km from its confluence with the Ohio River. Specimens were collected in floodplain forests beside fallen logs and other large debris. Eastern Kentucky specimens (*S. c. cinereus*) were taken along rockfaces close to small order streams and seepages in mesic woodlands at higher elevations (above 500 msl).

Sorex longirostris Bachman, Southeastern Shrew — French (1980) stated that the favored habitats of *Sorex longirostris* in Alabama are grassy freshwater marshes with rotting logs, and along river floodplains dominated by hardwood forest. However, he noted that collections in other states were made in many habitats, such as upland old-fields, dry sandy areas, and pine plantations. In Kentucky this species often inhabits wet weedfields. However, one specimen was collected within 1 m of the water's edge on a Kentucky River rockbar with no vegetative cover. We have also taken it in riparian forests that annually flood along the Kentucky River in Franklin County, and along East Fork Lynn Camp

Creek in Knox County (Fig. 1B). The Knox County specimen is the first record of this shrew in the Eastern Coal Field (elevation 326 msl). We also have a specimen from the edge of the Inner Bluegrass on the Franklin-Scott County line. We have found it most frequently in bottomland hardwoods of the Mississippi Embayment, in the same cans with the small short-tailed shrew, *Blarina carolinensis.*

Sorex fumeus Miller, Smoky Shrew — This is the most common long-tailed shrew in the Eastern Coal Field (Fig. 1C). The series of smoky shrews taken by Bailey (1933) at Mammoth Cave National Park, Edmonson County, was once thought to represent a disjunct population (Blair et al. 1968). However, our recent records support the hypothesis of Barbour and Davis (1974) that these animals are "probably distributed across southern Kentucky where suitable habitat is available". We collected smoky shrews across the Mississippian Plateau west to Todd County. In addition, they have been collected along the wooded corridor of the Kentucky River north to Franklin County, and probably occur in other counties of central and north-central Kentucky. The western limit of the species' range is as yet undetermined.

The species is usually found in relatively mature mesic forests with deep organic litter (Hamilton 1940). Along the Kentucky River in northern Franklin County it is the most abundant shrew in the forest above the five-year floodplain. Individuals seldom move into the annually inundated riparian forest of cottonwood, silver maple, and sycamore, where *Blarina brevicauda* is the most common shrew. In rich mesic forest we have taken as many as 15 smoky shrews in 2 cans left in place for 5 days. We recently took a smoky shrew in a wooded ravine in Hardin County over upper Mississippian limestone in what was thought to be the Kentucky "Barrens" (Dicken 1935).

Sorex dispar Batchelder, Long-Tailed Shrew — *Sorex dispar* was taken at only two localities, both woods at high elevations on Pine Mountain (Fig. 1D). Here specimens were captured beside logs in water-filled pitfall traps, and along wet rockfaces in snap-traps. Wet, moss-covered rockfaces, and cool, shaded talus slopes at high elevations, are the preferred habitats. *Sorex dispar* should be sought at additional sites on Pine, Cumberland, and Big Black mountains in Pike, Letcher, Harlan, and Bell counties.

Microsorex hoyi (Baird), Pygmy Shrew — Pygmy shrews are the smallest mammals endemic to North America. Diersing (1980) revised the pygmy shrews and reduced *Microsorex* to subgeneric status. The taxonomic status of this shrew in Kentucky is currently under investigation by Caldwell and Smith. Long (1972a,b; 1974) considered the pygmy shrew to be a boreal animal restricted in the southern parts of its range

to the higher elevations of the Appalachian Mountains, with extensions along riparian corridors draining the high slopes. There is, however, a recent record from Wabash County in southern Illinois (see Diersing 1980). North of Kentucky the pygmy shrew has been reported from a variety of habitats, including bluegrass pasture, mature woodland, marsh, and brushland (Long 1972b), often where two habitats are in close proximity (Brown 1967; Spencer and Pettus 1966).

Barbour and Davis (1974) noted that there was a specimen from the state with no locality data in the University of Kentucky collection. Caldwell (1980) reported the first Kentucky pygmy shrews with specific locality information. These were taken at elevations above 600 msl in Harlan and Letcher counties (Fig. 1E). The habitat was cool, mesic forests in the terraces of small streams where rock outcrops, boulders, and fallen logs were numerous. We recently collected this shrew in riparian woodlands at low elevations. In eastern Kentucky, two were taken in a narrow wooded corridor adjacent to cropland along the Little Sandy River, Greenup County (elevation 150 msl). Another was collected along Sinking Creek in west-central Kentucky, Breckinridge County. It was found in a similar narrow (5-10 m) wooded corridor next to a cornfield. At both locations, typical stream border trees such as sycamore, silver maple, box elder, and river birch were the dominant species. The soil in these riparian habitats was sandy, and periodic flooding had prevented accumulation of a deep layer of organic litter. Tree stumps, logs, and brushpiles provided cover. We also collected pygmy shrews in rich mesophytic forests with a well-developed litter layer in Ohio County along the Rough River, and in northwestern Warren County on the edge of the Dripping Springs Escarpment. The overstory of these mature forest habitats was dominated by beech, sugar maple, and yellow poplar. Soils were loamy in texture and were not periodically flooded. The species was collected in both xeric and mesic hardwood forest by biologists from the Department of Forestry at the University of Kentucky's Robinson Forest, Breathitt County (J. Moriarty and W. McComb, pers. comm.).

Sorex palustris Richardson, Water Shrew — This shrew has not been taken in Kentucky in Recent times although it occurred here during the Pleistocene (Guilday, et al. 1971). However, the species has been taken in the highlands of Southern Appalachia to the east and south of Kentucky (Conaway and Pfitzer 1952; Hooper 1942; Pagels and Tate 1976; Whitaker, et al. 1975). It is still possible that an isolated population of the species may be found in the state.

Species Associations

We found several Kentucky sites inhabited by more than one spe-

cies of shrews. Five species, including four long-tailed species, were taken in the talus slopes and rich mesic woodland at Bad Branch Falls, Letcher County. These were *Sorex dispar, S. fumeus, S. cinereus, Microsorex hoyi*, and *Blarina brevicauda*. This is the greatest number of shrew species known from a single location in Kentucky. We also collected *S. fumeus* and *S. longirostris* in the same pitfall traps in hardwood forest in Barren County. Both species were also collected with *M. hoyi* in a mesic forest in Ohio County (Western Coal Field).

The three smallest species of long-tailed shrews in Kentucky — *Sorex cinereus*, *S. longirostris* and *Microsorex hoyi* — are now known from riparian areas within the Western Coal Field. *Microsorex hoyi* and *S. cinereus* have been collected together in the Eastern Coal Field (Harlan and Letcher counties). *Sorex longirostris* and *S. cinereus* have yet to be found together in Kentucky. Where they occur sympatrically in southern Indiana, *S. cinereus* occupies lowland sites and *S. longirostris* occurs primarily in upland habitats (T. French, pers. comm.; Hamilton and Whitaker 1979). Rose (1980) reported that *S. cinereus* occurred more often in forests while *S. longirostris* was captured more frequently in old-fields.

KEY TO THE SORICIDAE OF KENTUCKY

To facilitate a more complete knowledge of soricid distribution within the state, the following eclectic key is presented to aid collectors. General references that can be used in conjunction with the key are Burt and Grossenheider (1976); Hall (1981); Jackson (1928); Whitaker (1968, 1980); and Junge and Hoffman (1981).

1a. Less than 5 unicuspids visible from the side, or if 5, the third and fifth greatly reduced (Figs. 2A, B, C); medial tine (Fig. 2F) of first upper incisor present or absent 2

1b. Five unicuspids visible from side, fifth may be very reduced; medial tine present 4

2a. Three or four unicuspids visible from the side (Figs. 2A, B); upper incisors not possessing medial tine 3

2b. Unicuspids 3 and 5 greatly reduced, may not be readily apparent in side view (Fig. 2C); fifth unicuspid peglike, third unicuspid platelike; medial tine of upper incisors well developed (Fig. 2F) ..... *Microsorex hoyi*

3a. Three unicuspids visible in side view (Fig. 2A); fourth unicuspid hidden from view; total number of teeth 30 ..... *Cryptotis parva*

3b. Four unicuspids visible in side view (Fig. 2B); first and second upper unicuspids large, third and fourth smaller and subequal; total number of teeth 32 ..... (*Blarina*) 8

4a. Total length usually greater than 140 mm; fringe of hairs between toes; maxillary breadth 6.0 mm or greater ..... *Sorex palustris*

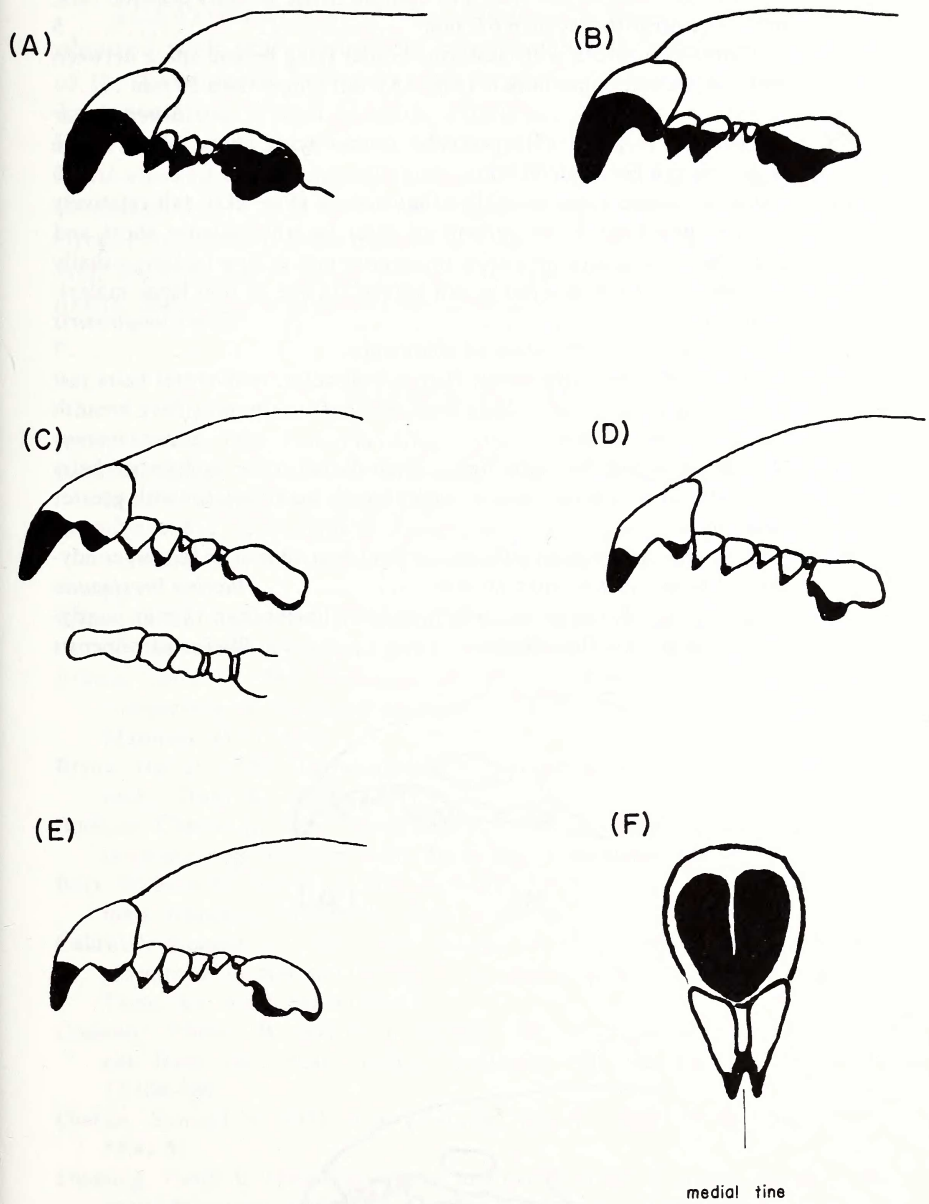


Fig. 2. Dental characters of Kentucky Soricidae. A, *Cryptotis parva*. B, *Blarina*. C, *Microsorex hoyi*, with first unicuspid shown on occlusional view. D, *Sorex longirostris*. E, *Sorex cinereus*. F, medial tine of genera *Sorex* and *Microsorex*.

4b. Total length usually less than 140 mm; no fringe of hairs between toes; maxillary breadth less than 6.0 mm 5

5a. Infraorbital foramen with posterior border lying behind space between first and second upper molars (Fig. 3A); tail longer than 50 mm ..... *Sorex dispar*

5b. Infraorbital foramen with posterior border lying ahead of the space (Fig. 3B); tail less than 50 mm 6

6a. Third unicuspid usually smaller than fourth (Fig. 2D); tail relatively shorter, generally 32-38 percent of total length; rostrum short and wide; length of posterior palate to anterior end of first incisors usually less than twice the greatest width across outside of first large molariform tooth ..... *Sorex longirostris*

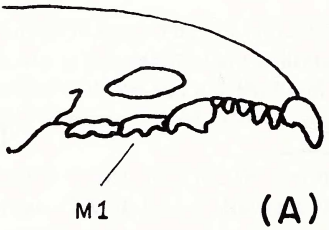
6b. Not with above combination of characters 7

7a. Ventral color distinctly lighter than dorsal color; midventral hairs just anterior to axillary region light from midshaft to tip; maxillary breadth narrower than 4.6 mm ..... *Sorex cinereus*

7b. Ventral color not distinctly lighter than dorsal color; midventral hairs just anterior to axillary region dark tipped; maxillary breadth greater than 4.6 mm ..... *Sorex fumeus*

8a. Total length greater than 105 mm, or hind foot 13 mm or longer; condylobasal length greater than 20 mm ..... *Blarina brevicauda*

8b. Total length 105 mm or less, and hind foot shorter than 13 mm; condylobasal length less than 20 mm ..... *Blarina carolinensis*



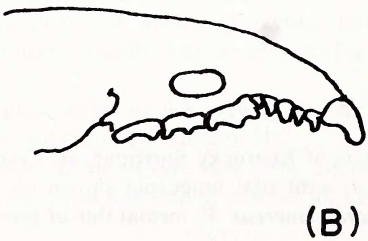


Fig. 3. Infraorbital foramen position. A, *Sorex dispar;* B, *Sorex fumeus.* Ml is first molar.

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LITERATURE CITED

Bailey, Vernon. 1933. Cave life of Kentucky. Am. Midl. Nat. *14*:385-635.

Barbour, Roger W., and W. H. Davis. 1974. Mammals of Kentucky. Univ. Press Kentucky, Lexington. 322 pp.

Blair, W. Frank, A. P. Blair, P. Brodkorb, F. R. Cagle and G. A. Moore. 1968. Vertebrates of the United States. McGraw-Hill Book Co., New York. 616 pp.

Briese, Linda A., and M. H. Smith. 1974. Seasonal abundance and movement of nine species of small mammals. J. Mammal. *55*:615-629.

Brown, Larry N. 1967. Ecological distribution of six species of shrews and comparison of sampling methods in the central Rocky Mountains. J. Mammal. *48*:617-623.

Bryan, Hal D. 1979. The occurrence of two species of shrews in central Kentucky. Trans. Ky. Acad. Sci.*40*:41-42.

Buckner, Charles H. 1966. Populations and ecological relationships of shrews in tamarack bogs in southeastern Manitoba. J. Mammal. *47*:191-194.

Burt, William H., and R. P. Grossenheider. 1976. A Field Guide to the Mammals. Houghton Mifflin Co., Boston. 289 pp.

Caldwell, Ronald S. 1980. First records of *Sorex dispar* and *Microsorex thompsoni* in Kentucky with distributional notes on associated species. Trans. Ky. Acad. Sci. *41*:46-47.

Conaway, Clinton H., and D. W. Pfitzer. 1952. *Sorex palustris* and *Sorex dispar* from the Great Smoky Mountains National Park. J. Mammal. *33*:106-108.

Dicken, Samuel N. 1935. The Kentucky Barrens. Bull. Geogr. Soc. Phila. *33*:42-51.

Diersing, Victor E. 1980. Systematics and evolution of the pygmy shrews (subgenus *Microsorex*) of North America. J. Mammal. *61*:76-101.

French, Thomas W. 1978. First record of the masked shrew in western Kentucky. Trans. Ky. Acad. Sci. *39*:78-79.

———. 1980. Natural history of the southeastern shrew, *Sorex longirostris* Bachman. Am. Midl. Nat. *104*:13-31.

Getz, Lowell L. 1961. Factors influencing the local distribution of shrews. Am. Midl. Nat. *65*:67-88.

Guilday, John E., H. W. Hamilton and A. D. McGrady. 1971. The Welsh Cave peccaries (*Platygonus*) and associated fauna, Kentucky Pleistocene. Ann. Carnegie Mus. *43*:249-320.

Hall, E. Raymond. 1981. The Mammals of North America. John Wiley and Sons, New York. 2 vols. 1181 pp.

Hamilton, William Jr., Jr. 1940. The biology of the smoky shrew (*Sorex fumeus fumeus* Miller). Zoologica *25*:473-492.

_____, and J. O. Whitaker, Jr., 1979. Mammals of the Eastern United States. Cornell Univ. Press, Ithaca. 346 pp.

Hooper, Emmett T. 1942. The water shrew (*Sorex palustris*) of the southern Allegheny Mountains. Occas. Pap. Mus. Zool. Univ. Mich. 463:1-4.

Hudson, G. E., and J. D. Solf. 1959. Control of small mammals with sunken can pitfalls. J. Mammal. *40*:455-457.

Jackson, Hartley H. T. 1928. A taxonomic review of the American long-tailed shrews (genera *Sorex* and *Microsorex*). N. Am. Fauna 51. 238 pp.

Junge, J. A., and R. S. Hoffman. 1981. An annotated key to the long-tailed shrews (genus *Sorex*) of the United States and Canada, with notes on middle American *Sorex*. Occas. Pap. Mus. Nat. Hist. Univ. Kans. *94*:1-48.

Long, Charles A. 1972 a. Taxonomic revision of the mammalian genus *Microsorex* Coues. Trans. Kans. Acad. Sci. *74*:181-196.

_____. 1972b. Notes on the habitat preference and reproduction in pigmy shrews, *Microsorex*. Can. Field-Nat. *86*:155-160.

_____. 1974. *Microsorex hoyi* and *Microsorex thompsoni*. Mamm. Species *33*:1-4.

MacLeod, C. F., and J. L. Lethiecq. 1963. A comparison of two trapping procedures for *Sorex cinereus*. J. Mammal. *44*:227-278.

Pagels, John R., and C. M. Tate. 1976. Shrews (Insectivora: Soricidae) of the Paddy Knob-Little Back Creek area of western Virginia. Va. J. Sci. *27*:202-203.

Rose, Robert K. 1980. The southeastern shrew, *Sorex longirostris*, in southern Indiana. J. Mammal. *61*:162-164.

Spencer, Albert W., and D. Pettus. 1966. Habitat preference of five sympatric species of long-tailed shrews. Ecology *47*:677-683.

Whitaker, John O., Jr. 1968. Key to the vertebrates of the eastern United States excluding birds. Burgess Publ. Co., Minneapolis. 256 pp.

_____. 1980. The Audubon Society Field Guide to North American Mammals. Chanticleer Press, New York. 745 pp.

_____, G. S. Jones and D. D. Pascal, Jr. 1975. Notes on the mammals of the Fires Creek area, Nantahala Mountains, North Carolina, including their ectoparasites. J Elisha Mitchell Sci. Soc. *91*:13-17.

Wolfe, James L., and R. J. Esher. 1981. Relative abundance of the southeastern shrew. J. Mammal. *62*:649-650.

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