

*Microsorex hoyi* and *Microsorex thompsoni*. By Charles A. Long

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***Microsorex Coues, 1877***  
Pigmy Shrews

*Microsorex* Coues, 1877:646. Type species *Sorex hoyi* Baird, 1858, by original designation. The opinion on generic status published by Coues was an opinion of Baird.

**CONTEXT AND CONTENT.** Order Insectivora, Family Soricidae, Subfamily Soricinae. The genus *Microsorex* was originally distinguished by a dental formula later shown to be erroneous, but these shrews have diagnostic characters (see below). Pigmy shrews could be referred to *Sorex* in order to emphasize close relationship and resemblance. The name *Microsorex* suggests this strong similarity to *Sorex*. Long (1972a) recognized two Recent species belonging to *Microsorex*, but this view needs further study in critical areas. The species are *M. hoyi* and *M. thompsoni*; the account of the latter immediately follows that of *hoyi* treated below.

**DIAGNOSIS.** Dental formula is i 3/1, c 1/1, p 3/1, m 3/3, total 32. Upper unicuspidate teeth are crowded, only three ordinarily visible from the side. The fifth is a minute peg, and the third an anteroposteriorly compressed disk. The second unicuspidate tooth usually bears a distinct accessory cusp, and such a cusp has been reported on the first as well. The dentary is short and stout.

***Microsorex hoyi* (Baird, 1858)**  
Hoy's Pigmy Shrew

*Sorex hoyi* Baird, 1858:32. Type locality Racine, Wisconsin.  
*Sorex (Microsorex) eximius* Osgood, 1901:71. Type locality Tyonek, Cook Inlet, Alaska.  
*Sorex (Microsorex) alnorum* Preble, 1902:72. Type locality Robinson Portage, Oxford Lake, Manitoba.

**CONTEXT AND CONTENT.** Context noted in generic account above. Five subspecies are presently recognized (Long, 1972a) as follows:

- M. h. hoyi* (Baird, 1858:32), see above (*interjectus* Jackson a synonym).
- M. h. eximius* (Osgood, 1901:71), see above.
- M. h. alnorum* (Preble, 1902:71), see above.
- M. h. washingtoni* Jackson, 1925:125. Type locality Loon Lake, Stevens Co., Washington.
- M. h. montanus* Brown, 1966:50. Type locality "Trail's Divide Pond, ¼ mile S of Univ. Wyoming Summer Science Camp on State Highway 130, 16 mi. WJ Centennial, Albany Co., Wyoming."

**DIAGNOSIS.** Where *M. hoyi* approaches *M. thompsoni* (in the Great Lakes region) the former is decidedly larger, less grayish, has a less flattened cranium (ratio of cranial breadth to depth usually less than 1.7 in old adults), and possesses larger teeth.

**GENERAL CHARACTERS.** Weight is only 2.2 to 6 g. The pelage is reddish brown (especially in summer) or grayish brown above, paler on the sides (especially in winter), and whitish, grayish, or rusty gray on the venter (Long, 1972a; Jackson, 1928). Some females maintain grayish pelages into the summer, especially in *M. h. montanus*. Molt was observed in *M. h. alnorum* on 8 July, 25 July, and 30 July. It occurred in *M. h. hoyi* in August, perhaps also in spring (summary in Long, 1972a). External measurements (listed by Long, 1972a) varied from 67 to 98 in total length, 25 to 34 in length of tail, and 8.5 to 11.5 mm in length of hind foot. Cranial length usually (in young adult shrews) is 16 mm or more, except in *washingtoni* and *montanus* of the Rocky Mountains (Long, 1972a). An adult drawn from life is shown in Figure 1.

**DISTRIBUTION.** The geographic range is mapped in Figure 4. Important fossil occurrences (Long, 1972a) reveal an earlier distribution fringing the moraines of the Kansan period.

*Microsorex hoyi* occurs from Hudson Bay to the northern shores of the Great Lakes, onto the Gaspé Peninsula, and southward into central Wisconsin and westward to the Pacific Ocean. An isolated alpine subspecies occurs in southern Wyoming and northern Colorado. The habitats are usually boreal, but extensions away from boreal habitats along riparian routes are usual except in *M. h. montanus* (Long, 1972a).

**FOSSIL RECORD.** As summarized by Long (1972a), the fossil and subfossil sites of *Microsorex* include the Irvingtonian (middle or early Pleistocene, remains named *Microsorex pratensis*, Hibbard, 1958); Conard Fissure of Arkansas (late Pleistocene, remains named *M. minutus*, B. Brown, 1908); Munroe County cave deposits, Illinois (possibly Recent, Parmalee and Munyer, 1966); Crankshaft Cave, Missouri (late Pleistocene or early Recent, Parmalee et al., 1969), and Little Box Elder Cave, Wyoming (late Pleistocene or early Recent, *M. hoyi*, Anderson, 1968).

**FORM.** The skull and dentitions (see figures 2 and 3) were figured and described by Miller (1895) and Jackson (1928). The post-cranial skeleton resembles that of *Sorex cinereus*, except the humerus is smaller, has a simple winglike deltoid process, a small, straight medial epicondyle, and an elongate pointed deltoid process (Long, 1972a). Mastology of *M. h. montanus* and lateral glands of males (see below) were described by Preble (1908), Long (1972a), Schmidt, (1931), and Harper (1961:34). Dryden and Conaway (1970) described "anal tonsils" in *Microsorex*, probably *M. h. washingtoni*.

**FUNCTION.** The rarity of *Microsorex* reduces the opportunity for physiological study. Buckner (1964:260) reported some information from a single individual (*M. h. hoyi*, weight 3.5 g, from Manitoba). Oxygen consumption was higher per unit of body weight than in other shrews, 16,700 mm<sup>3</sup>/g/hr (11,200 to 25,400). Carbon dioxide production was high, as in other shrews (14,200 mm<sup>3</sup>/g/hr). The respiratory quotient (ratio of above two values) was 0.85, close to that recorded for other shrews. Protein metabolism indicated by urinary nitrogen (micro-Kjeldahl test) was quite high (1.02 mg/g body weight/hr) as in *Sorex cinereus* (0.87 mg). Heat production was calculated as 6670 calories for one day, and a minimal metabolic rate of 4500 cal/d was determined. Finally, the basal metabolic rate was deduced as 1900 cal/d, identical to that of *Sorex cinereus* and less than that of *S. arcticus* and *Blarina brevicauda*.

Prince (1940) reported that a pigmy shrew ate 11.1 g of mouse meat from some time on 13 August to some time on 15



FIGURE 1. Drawing of living *Microsorex hoyi* by P. F. Wright. Courtesy of John Paradiso and the Johns Hopkins Press.

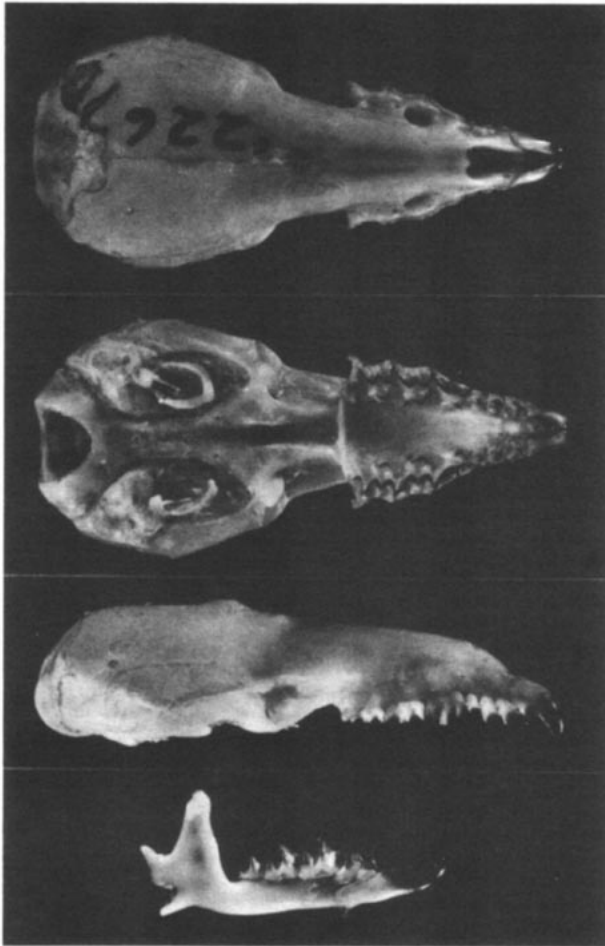


FIGURE 2. Skull of *Microsorex hoyi eximius* (AMNH 22670, a male from Moose Camp, Alaska) shown, from top to bottom in dorsal, ventral, and lateral view. Right mandible at bottom, part of the slender angular process is missing. Photographs by Arthur Singer, Department of Photography, American Museum of Natural History.

August. The weight of food items partly eaten during 10 days totaled 107.5 g.

**ONTOGENY AND REPRODUCTION.** Nothing is known of copulation or gestation in *Microsorex*, and little is known concerning embryo counts, litter size, number of litters per year, and breeding season. Long (1972b) summarized literature records and reported some new data: in *M. h. hoyi* from Iowa, seven embryos (in one horn), 6.7 mm long, July; eight embryos, 19 July. One specimen from Millston, Wisconsin,



FIGURE 3. Drawings of partial dentitions in *Microsorex hoyi*. Left, anterior teeth in occlusal and lateral views showing compressed third unicuspidate tooth and peglike fifth unicuspid. Second unicuspid is numbered. Right, second right upper "unicuspidate" tooth viewed from the posterior showing secondary internal cusp (arrow). After Miller (1895) and Jackson (1928).

sin, was lactating on 28 July. Of 22 *Microsorex* from Chippewa Lake, northern Wisconsin, none was pregnant although one was lactating (6 August), and some were young of the year. In *M. h. eximius*, a female was lactating on 19 August. In *M. h. washingtoni*, one female from Montana was pregnant (three embryos) on 9 August, another was lactating then. A specimen of *M. h. montanus* from Colorado was pregnant (five embryos) on 17 July, and another was lactating on 26 August. A juvenile was taken in Wyoming on 30 July. Thus, the scanty records suggest that litter size is greater, as would be expected, in the larger, northern *hoyi* than in the small, southern *washingtoni* and *montanus*. Although Hamilton (1943) suggested that pigmy shrews have several litters in spring and summer, there is no evidence of more than one litter, especially in *M. h. hoyi*. This may account for the low densities of *Microsorex* in comparison to the relative abundance of other shrews. The duration of the breeding season may be the same as the season of lateral glands in males. Schmidt (1931) stated that they secrete a viscous, odoriferous substance. Long (1972a) reported glands visible in skins of *hoyi* in June through August, in *eximius* in April, and in *alnorum* in July. The young attain nearly adult size by winter (Long, 1972b). Two age classes are usually present, the classes are especially distinct in *M. h. alnorum*, and the older shrews have shorter, more flattened skulls. Their teeth are worn conspicuously, and in some, especially in *alnorum*, the anterior upper incisors wear and rotate ventrally, so that a root is often partly exposed (Long, 1972a).

**ECOLOGY.** Spencer and Pettus (1966) made an excellent, quantitative study on the ecology of *M. h. montanus* in Colorado. Long (1972b) summarized the descriptions of numerous habitats mentioned in mammalogical literature, reviewed data from numerous specimen labels, and studied communities in Wisconsin. Apparently *M. hoyi* prefers boreal habitats where dry and wet soils are found together. In spring *Microsorex* occurs in swamps and marshes, but in late summer it was taken more frequently on dry soils, usually of adjoining uplands. Prince (1941) took *M. h. alnorum* in a dry grassy clearing and on the dry shore of a lake. *M. h. montanus* prefers wet-dry habitat, along the shores of alpine bogs (Spencer and Pettus, 1966; see also Brown, 1967). Other inhabited wet situations include marshes and riparian areas (Buckner, 1966; Quimby, 1943; Long, 1972b; and many others). *Microsorex* is also often found in disturbed habitats undergoing succession such as sandy blowouts, cut-over forest, flooded areas, even cultivated land (Long, 1972b, and others). Some interesting indicators include seral plants such as birch, aspen, jack pine, blackberry, and raspberry. Some indicators of arid soils are oak, hazelnut, and jack pine (Long, 1972b). Numerous boreal and some nonboreal vertebrate associates were listed by Long (1972b) and others. Parasites include the flea *Stenoponia americana* (Buckner and Blasko, 1969), unidentified mites, one small tick (*Ixodes* sp.) and intestinal hymenolepidid tapeworms (unpublished data). The only records of natural predation to my knowledge are by *Thamnophis* (Cahn, 1937) and "*Buteo delawarensis*" (Long, 1972b). Domestic cats occasionally catch pigmy shrews (Long, 1970). Foods of captive pigmy shrews include larchfly larvae, grasshoppers, houseflies, crane flies, beetles, carrion of *Sorex cinereus*, *Peromyscus leucopus*, *Clethrionomys gapperi*, and another *Microsorex* (Prince, 1940; see also Goodwin, 1924). A den (burrow) of *M. hoyi* was described by Cahn (1937), who stated that pigmy shrews live under logs or in the roots of old stumps, and that the tiny runways lead all about the "crannies" of the stump.

The rarity of pigmy shrews in collections may result from a lower reproductive rate (see above) or from difficulties in trapping them, according to Prince (1941), who was the first to catch pigmy shrews with water or can traps. Manville (1949) recorded a population density of 0.52/ha in upper Michigan. Spencer and Pettus (1966) and Long (1972b) provided some data on seasonal, annual, and relative abundance.

**BEHAVIOR.** Pigmy shrews are active throughout the year, and have been trapped on snow and in runways in it (Long, 1972b; Dice, 1921). They are taken during either night or day (Harper, 1961; Koford, 1938; Long, 1972b). Reproductive and territorial behavior are unknown. Comments on a captive pigmy shrew include such descriptions of behavior as the following: swimming; making repeatedly a nest of cotton with openings at opposite ends; continuing activity (tail held straight out from the body with slight upward curve); climbing and walking upside down on the wire top of the cage; hanging by hind limbs only "monkey fashion"; bounding as high as 110 mm; violent quivering and immediate dash to cover when disturbed; constant moving of the snout, "sniffing"; sleeping

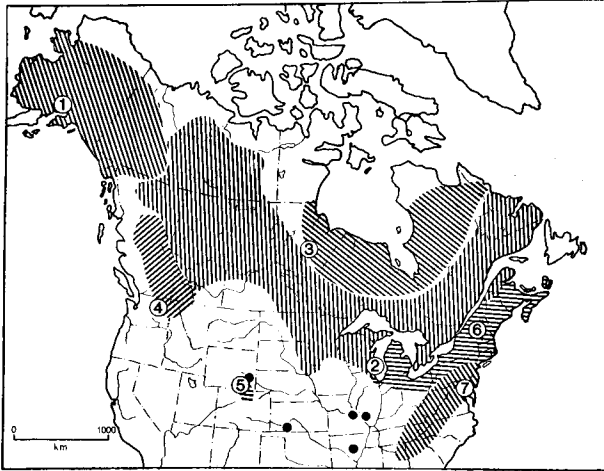


FIGURE 4. Geographic range of *Microsorex hoyi* and *M. thompsoni*. Subspecies are: 1, *M. h. eximius*; 2, *M. h. hoyi*; 3, *M. h. alnorum*; 4, *M. h. washingtoni*; 5, *M. h. montanus*; 6, *M. t. thompsoni*; 7, *M. t. winnemana*. Black dots show fossil sites, and the numerals are placed at the type localities.

once (afternoon) with limbs drawn under the body and head and tail curled alongside; audible short, sharp squeaking when frightened or disturbed; and defecating randomly in location and regularly in time. During defecation the forelegs were set low, the hind limbs "braced," and the tail and posterior body held high. The shrew frequently inserted its snout in water but did not drink. Green shoots of grass were never eaten. While feeding on biscuit the captive pigmy shrew sat back on its hind legs, in the manner of a squirrel, holding the food between the forefeet (Prince, 1940).

**REMARKS.** *Microsorex thompsoni* has been separated from *M. hoyi* (Long, 1972a) on the basis of differences observed in two areas of parapatry (Gaspé Peninsula, southern Wisconsin). The minute, western shrews known as *montanus* were assigned to *M. hoyi* because they resemble *M. h. washingtoni* in size and are closest to this subspecies geographically. *M. h. alnorum* has not been shown to intergrade with any adjacent subspecies, although some specimens referred to *hoyi* may be intergrades (Long, 1972a). The shrews of the subspecies *M. h. montanus* are among the smallest mammals in the world, about the size of *M. thompsoni winnemana*. The arctic *M. h. alnorum* frequently exceeds 6 g.

### *Microsorex thompsoni* (Baird, 1858) Thompson's Pigmy Shrew

*Sorex thompsoni* Baird, 1858:34, pl. 27. Lectotype chosen by Lyon and Osgood (1909) from the locality of Burlington, Chittenden Co., Vermont. Baird had described *thompsoni* from specimens from Zanesville, Ohio; Halifax, Nova Scotia; and the type locality.

*Microsorex winnemana* Preble, 1910:101. Type locality Bank of Potomac River, near Stubblefield Falls, 4 mi. below Great Falls, Fairfax Co., Virginia.

**CONTEXT AND CONTENT.** Context noted in generic context above. Two subspecies are presently recognized (Long, 1972a) as follows:

- M. t. thompsoni* (Baird, 1858:34), see above.
- M. t. winnemana* Preble, 1910:101, see above.

**DIAGNOSIS.** See diagnostic comparisons with *M. hoyi* above.

**GENERAL CHARACTERS.** Same as for *M. hoyi*.

**DISTRIBUTION AND FOSSIL RECORD.** *M. thompsoni* ranges (figure 4) from the Gaspé Peninsula to southern Wisconsin, southward of the Great Lakes, and extends southward along the Allegheny-Appalachian mountain chain into northern Georgia (Wharton, 1968). *M. thompsoni* as such has no fossil record, but see fossil records of its relatives within the genus under *M. hoyi* above.

**FORM, FUNCTION, AND ONTOGENY.** Aside from descriptions of the skull and teeth (Jackson, 1928; Baird,

1858; Long, 1972a) and long tail in Georgian *winnemana* (Long, 1972a), nothing is known of function and form. Two specimens of *M. thompsoni* were lactating and probably lactating, respectively, on 2 July and 13 June (Long, 1972b). Long mentioned lateral glands in *winnemana* as late as September. Jackson (1928:202) mentioned molt in a female over the posterior two-thirds of its back on 28 April, and another had acquired fresh pelage by 17 May.

**ECOLOGY.** *M. t. thompsoni* and *M. t. winnemana* are often found in wet or closely mingled wet and dry habitats and occasionally occupy dry habitats, although these are ordinarily within 100 yards of water (Long, 1972b). Miller (1964) reported *M. t. thompsoni* from subclimax beech-maple forest having small clearings with sugar and mountain maple, chokecherry, *Viburnum*, sedges, and ferns. Manville (1942) took the species in heavy spruce and pine bordering a lake. Heinrich (1953) took it on a mountain associated with moss mats under low, creeping, dwarfed spruce. Preble (1910) reported *winnemana* from a wet situation along the Potomac River, but shrews from Alta Vista, Virginia (dry wooded land, about 100 m from running water), Berwyn, Maryland (dry hillside at some distance from water), and northern hardwood forest of northern Georgia (steep, rocky exposure, 100 m from a stream) all occurred in dryer places. Some of these were cut-over areas (see Long, 1972b). The specimen from Maryland was found on January 24 within a "decayed heart of a dead chestnut tree" and the Virginia holotype was taken on 24 April also from within a fallen tree. Miller (1964) reported two shrews of *thompsoni* from a single 300-pace trapline, and his closest captures were 30 m apart, the maximum distance 114 m. He also mentioned foods identified from stomach contents as lepidopteran larvae, coleopteran larvae and adults, dipteran adults, and other unidentified insects.

**BEHAVIOR.** Nothing is known except recorded observations on captive shrews. Jackson (1961) mentioned a "weak, high-pitched, rolling purr" in a shrew from southern Wisconsin later assigned to *M. thompsoni* (see Long, 1972a). Saunders (1929) mentioned the kangaroo-like stance on the hind limbs, reported also in *M. hoyi* (see above). He described "a combination of whispering and whistling infinitely high on the musical scale." He also mentioned a strong "musk."

**REMARKS.** See account of *M. hoyi* above. *M. t. winnemana* is the smallest shrew in North America, perhaps in the world (Jackson, 1928), although *M. hoyi montanus* is approximately the same size. Jackson (1928) listed one specimen of *winnemana* as weighing 2.1 g, and Long (1972a) reported specimens labelled 2.2 g.

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