

## Quaternary Remains of the Spotted Skunk, *Spilogale putorius*, in Indiana

RONALD L. RICHARDS,  
Indiana State Museum and Historic Sites  
202 North Alabama Street  
Indianapolis, Indiana 46204

### Introduction

There is no physical evidence (skin or skull) of a live spotted skunk (*Spilogale putorius*) in Indiana. However, "civet cats" were known to fur dealers in extreme southwestern Indiana prior to about 1922. Evermann and Butler (5) suggested that the spotted skunk might occur in Indiana, and Hahn (9) reported the trapping of a "civet cat" between Bicknell and Bruceville in Knox County. He also cited a fur dealer from Vincennes who had obtained a few "civet cats" with "several curved white stripes and spots on the body" from the southern part of the State. Hahn also related that a St. Louis fur dealer had received a few civet cat skins from Indiana.

Lyon (15) noted three occurrences of the animal in the Mount Vernon, Posey Co. area, one of which (Lynn Township) he regarded as the best documented observation of the skunk in Indiana to date. Lyon also noted that some authors had listed the spotted skunk for Indiana (eg. Howell (12) for Posey Co. and Cory (4) for southern Indiana) without presenting any evidence. Mumford (16) summarized previous reports and Mumford and Whitaker (17), in treating only extant fauna, excluded the spotted skunk.

It appears that the spotted skunk was a rare inhabitant of at least extreme southwestern Indiana in historic times and is now extirpated from the state. The spotted skunk presently occurs no nearer to Indiana than Missouri on the west, and Tennessee and eastern Kentucky on the south.

The spotted skunk inhabits prairies and brushy or sparsely wooded areas (3, 14). It is an agile climber and in eastern Kentucky is found among the cliffs and rocks in the rugged terrain where it usually dens in crevices at the base of a cliff or among boulders (2). It is a common cave fossil within its modern range in Missouri (21, 24, 25).

In 1958 a left dentary of *S. putorius* was recovered from a woodrat den in Sullivan's Cave, Lawrence County, Indiana (1), demonstrating that the animal once had a wider distribution in Indiana. More recent references to spotted skunk include remains from south-central Indiana caves (26, 29, 31, 32) and the Pleistocene occurrence of the animal in the Harrodsburg Crevice fauna of Monroe County (23).

### Descriptive Paleozoology

Most *S. putorius* remains were associated with rather extensive faunas. The species that were extinct, extralocal (occurring out of their modern range), or extirpated (exterminated within Indiana) are listed in Table 1. All references to a locality or any of its fauna are cited. Abbreviations: B.P., Before Present (1950 A.D.); MNI, minimum number of individuals; L, R, left, right; C, c, M, m, upper and lower canines and molars respectively; cm, centimeter; mm, millimeter; m, meter.

Remains of at least 25 individuals are known from 9 localities in Monroe, Lawrence and Harrison Counties (Figure 1).

1. Freeman's Pit, Monroe County, Indiana. *OCCURRENCE*: Bones occurred in the upper 30 cm. of a 60 cm. deep laminated silt/clay deposit in a corner alcove of the entrance room of the 29.6 m. (97 foot) deep pit. Bones of other individuals were found in the silty sediments of a small chamber ("Attic") located off the

TABLE 1. Important Associations on Indiana *Spilogile putorius* bone localities.<sup>1</sup>

	FP	HC	IR	SC	CCC	KLC	PPC	FMW
	Ledge Floor							
Extinct:								
<i>Dasyus bellus</i> , Beautiful Armadillo				X				
<i>Canis</i> cf. <i>C. dirus</i> , Dire Wolf		X						
<i>Smilodon fatalis</i> , Sabertooth		X						
<i>Panthera onca augusta</i> , Pleistocene Jaguar		X						
<i>Equus</i> cf. <i>E. complicatus</i> , Pleistocene Horse		X						
<i>Mylohyus</i> sp., Long-nosed Peccary			X					
<i>Platygonus</i> cf. <i>P. vetus</i> (= <i>P. cf. cumberlandensis</i> ), Leidy's Peccary		X						
Extralocal:								
<i>Parascalops breweri</i> , Hairy-tailed Mole		X			X			
<i>Spermophilus tridecemlineatus</i> , Thirteen-lined Ground Squirrel				X				
<i>Geomys</i> cf. <i>G. bursarius</i> , Plains Pocket Gopher		X		X				
<i>Oryzomys plaustris</i> , Rice Rat							X	
<i>Neotoma floridana</i> , Eastern Woodrat	X	X	X	X	X	X	X	(local) X
<i>Clethrionomys gapperi</i> , Boreal Red-backed Vole					X			
<i>Phenacomys</i> cf. <i>P. intermedius</i> , Heather Vole					X			
Extirpated:								
<i>Ectopistes migratorius</i> , Passenger Pigeon							X	
<i>Erethizon dorsatum</i> , Porcupine	X			X	X	X		
<i>Ursus americanus</i> , Black Bear		X		X		X		X
<i>Cervus elaphus</i> , Wapiti				X <sup>3</sup>		X		

1. FP, Freeman's Pit, Monroe Co.; HC, Harrodsburg Crevice, Monroe Co.; IR, Indun Rockshelter, Monroe Co.; SC, Sullivan's Cave, Lawrence Co. (note ledge and floor deposits); CCC, Carcass Crypt Cave, Lawrence Co.; KLC, King Leo Cave, Harrison Co.; PPC, Passenger Pigeon Cave, Harrison Co.; FMW, Fair-to-Middlin Well, Harrison, Co.

2. Nomenclature of Kurten and Anderson (14).

3. Noted by Bader and Hall (1) only.

main room some 18.3 m. above the cave floor. **MATERIALS:** 2 complete, 1 fragmented skulls; 2L, 3R additional maxillae; 11L (2 are small fragments), 9R dentaries; 4L, 4R fragmented scapulae; 4L, 8R humeri; 5L, 5R ulnae; 3L, 8R radii, 5L, 7R fragmented innominates; 6L, 6R femora; 4L, 5R fragmented tibiae; 3L, 4R calcanea; 3L, 3R astragali (MNI = 11). "Attic": RC; Lc; skull fragment; 2LM<sup>1</sup> and 2LM<sup>2</sup> (MNI = 2). **COMMENTS:** A radiocarbon date of 2,315 ± 65 years B.P. was determined for the base of deposits containing *S. putorius* (30). **PUBLISHED RECORDS:** (26, 30, 31).

2. Harrodsburg Crevice, Monroe County, Indiana. **OCCURRENCE:** Remains from an "undisturbed mass of bone embedded in a beige clay-limestone, detritus-travertine matrix" (23) from the floor deposit of a collapsed, filled in cave sectioned during highway construction. **MATERIALS:** L humerus, distal end (MNI = 1). **COMMENTS:** A warmer and drier-than-present short-grass prairie/forest edge environment of Sangamonian (last interglacial) age was proposed for the fauna. **PUBLISHED RECORDS:** (18, 23, 36).
3. Indun Rockshelter, Monroe County, Indiana. **OCCURRENCE:** Remains recovered from Levels 1 and 2 in sediments of a sandstone shelter. **MATERIALS:** L radius



FIGURE 1. Modern (lettered), fossil and subfossil (numbered) localities for the Spotted Skunk, *Spilogale putorius*, in Indiana. A. Knox County (Hahn, 1909). B. Posey County (Lyon, 1936). 1. Freeman's Pit, Monroe County. 2. Harrodsburg Crevice, Monroe County. 3. Indun Rockshelter, Monroe County. 4. Sullivan's Cave, Lawrence County. 5. Carcass Crypt Cave, Lawrence County. 6. King Leo Cave, Harrison County. 7. Passenger Pigeon Cave, Harrison County. 8. N. Jim Cave, Harrison County. 9. Fair-to-Middlin Well (pit), Harrison County.

and L ulna, proximal section (MNI = 1). **COMMENTS:** Because a fauna ranging in age from Late Pleistocene to modern age was mixed in the disturbed deposit any associations are unclear. **PUBLISHED RECORDS:** None.

4. Sullivan's Cave, Lawrence Co., Indiana. **OCCURRENCE:** Bones recovered from sediments of an ancient woodrat den on a ledge a couple meters above the cave floor and within a 23 cm. deep sand, gravel and organic silt deposit in a floor channel below and adjacent to the ledge some 600 m. inside the cave. **MATERIALS:** "Ledge:" L dentary (collected by Bader and Hall in 1958); RC; L, R c; LM1; Rm3; L radius (collected by author in same deposit in 1971). "Floor:" RM2 from upper 8 cm. of sediment. RM2 collected in gravelly sediments below this. (MNI = 3). **COMMENTS:** Temporal association of the fauna is unclear. Further excavation will be undertaken. **PUBLISHED RECORDS:** (1, 26, 31).
5. Carcass Crypt Cave, Lawrence County, Indiana. **OCCURRENCE:** Bones found in the upper 5 cm. of carbon-rich silt/clay in floor deposits ca. 25.9 m. inside the pit cave (21.6 m. entrance drop). A calcaneum had been transported by a woodrat to a cache 2.4 m. off the floor of the room. **MATERIALS:** Complete skull; R dentary; R innominate; L ulna; 2L, 1R femora; 2L, 1R tibiae; R calcaneum (MNI = 2). **COMMENTS:** Much of the fauna, primarily of deciduous woodlands,

- is believed to be of Holocene age, though no C-14 dates are available. *PUBLISHED RECORDS*: (26, 28, 31).
6. King Leo Cave, Harrison Co., Indiana. *OCCURRENCE*: Bones occurred in the upper 23 cm. of a ca. 33 cm. deep sand/silt deposit in a small passageway perhaps 6 m. from the top of the 19.8 m. (65 foot deep) pit entrance. *MATERIALS*: L dentary; LM1; RM2; R humerus (MNI = 1). *PUBLISHED RECORDS*: (30).
  7. Passenger Pigeon Cave, Harrison Co., Indiana. *OCCURRENCE*: Bone recovered from within the top 30 cm. of a loose, dusty silt deposit a couple meters inside a shallow shelter-like limestone cave on an Ohio River bluff. *MATERIALS*: RM1 in maxilla section; R dentary, rodent gnawed (MNI = 1). *PUBLISHED RECORDS*: (27). *COMMENTS*: The teeth are of large size (Table 2); identification is tentative (skunk *cf. Spilogale putorius*).
  8. N. Jim Cave, Harrison Co., Indiana. *OCCURRENCE*: Bone found in winnowed gravely sediments on surface, ca. 21 m. inside pit cave (10.7 meter deep pit). *MATERIALS*: Dentary (MNI = 1). *COMMENTS*: Isolated dentary with most of the dentition was identified by author in the field, and later lost in transit to the lab. *PUBLISHED RECORDS*: (26).
  9. Fair-to-Middlin Well (Pit), Harrison County, Indiana. *OCCURRENCE*: Skull noted in gravely sediments on surface associated with bear skeleton in a water washed area at corner of room below the 27.4 m. (90 foot) entrance drop. *MATERIALS*: Complete skull; L dentary; L, R humeri; L, R innominates; R femur; L, R tibiae (MNI = 2). *PUBLISHED RECORDS*: (32).

The complete *S. putorius* skulls are illustrated in Figure 2. Measurements are given in Table 2.

The Indun Rockshelter remains are on file at the Glenn A. Black Laboratory of Archaeology, Bloomington, Indiana, the Fair-to-Middlin Well bones are at the Indiana State Museum, Indianapolis, and the Harrodsburg Crevice remains are at the Dept. of Anthropology, University of Tennessee, Knoxville. All other remains, largely from undescribed faunas, are presently on file with the author.

### Discussion

Two subspecies of *S. putorius* are present in eastern United States (exclusive of Florida), the easterly *S. putorius putorius* and westerly *S. p. interrupta*; both intergrade in the southern part of their ranges (35). Though the largest cranial measurements are of *S. p. putorius* from Hale Co., Alabama, the slightly larger of the two subspecies, the great overlap in size makes subspecific separation of individual fossils difficult (35). The Indiana material (Harrodsburg Crevice bone not examined) was of relatively large size, with some dimensions (especially toothrow lengths) similar to those from Hale Co., Alabama. This suggests that *S. p. putorius*, the subspecies typically indicated for Indiana (10, 35), is represented by the Indiana fossils. Van Gelder (1959) notes that average cranial measurements of *S. putorius* are in general larger in the northern part of its range. Existing metric data, however, is difficult to utilize in interpreting fossil gradients of size, as measurable skulls are not commonly recovered from fossil localities, and there is a lack of published postcranial measurements. For this reason selected measurements of Indiana *S. putorius* have been presented (Table 2). *S. putorius* displays a sexual dimorphism in size with male crania 5% to 9% larger than those of females in various measurements (35). This dimorphism is apparent in especially the Indiana postcranial material.

Several species of extralocal and some extinct mammals have been associated with *S. putorius* on the Indiana fossil localities (Table 1). This suggests that environmental conditions at that time were different than today. None of the localities (except, perhaps

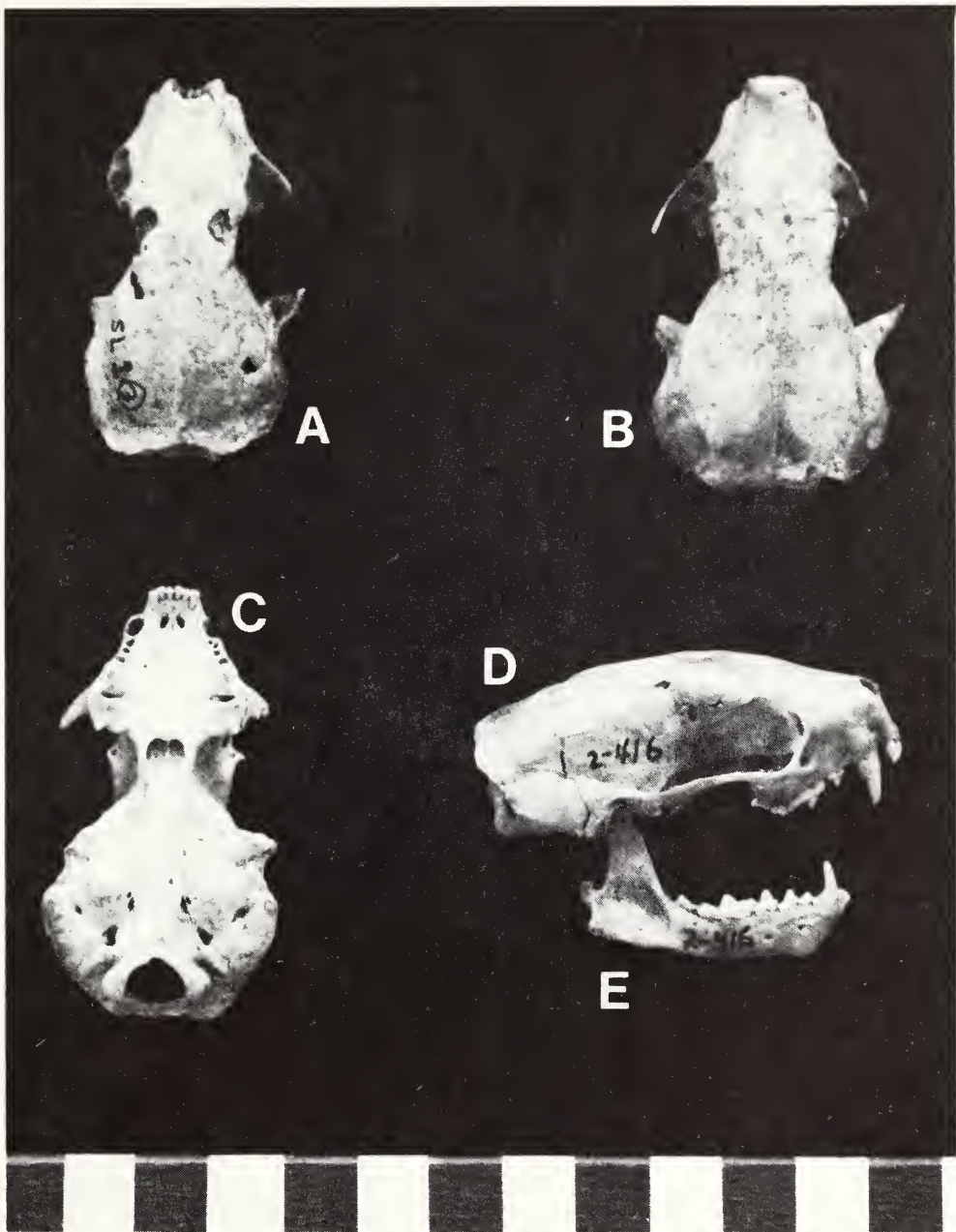


FIGURE 2. Complete skulls of the Spotted Skunk, *Spilogale putorius*, recovered from Indiana pit caves. A. Freeman's Pit, Monroe County (dorsal view). B. Fair-to-Middlin Well, Harrison County (dorsal view). C. Freeman's Pit, Monroe County (palatal view). D. Carcass Crypt Cave, Lawrence County (right lateral view). E. Right dentary, Carcass Crypt Cave, Lawrence County (labial view). Scale in centimeters.

Sullivan's Cave) appear to have full-glacial boreal faunas. All Indiana *S. putorius* remains have been found in interglacial (Harrodsburg Crevice), very late glacial (?Sullivan's Cave), or post-glacial deposits. The most common extralocal associates are the Woodrat, Plains Pocket Gopher and Hairy-tailed Mole, with the Thirteen-lined Ground Squirrel, Rice Rat, Red-backed and Heather Voles at one locality each. Excepting the Hairy-tailed Mole, Red-



<b>HUMERUS</b>										
Greatest length	43.4	41.3-45.0	8	—	—	43.0	42.9-43.0	2	—	—
Proximal width (in plane of distal end)	9.76	8.62-10.51	7	—	—	9.65	9.33-9.96	2	—	—
Distal width	11.4	10.46-12.74	10	—	—	11.8	11.3-12.2	2	—	—
<b>ULNA</b>										
Greatest length	42.6	41.3-43.8	3	42.6	—	1	—	—	—	INDUN Rockshelter
Anteroposterior length from inside of semilunar notch to Margo dorsalis	3.27	2.76-3.68	9	3.09	—	1	—	—	—	3.20
<b>RADIUS</b>										
Greatest length	34.5	33.4-35.4	5	—	—	—	—	—	—	33.2
Greatest diameter of proximal end	4.83	4.12-5.21	6	—	—	—	—	—	—	4.56
Greatest diameter of distal end	6.53	6.24-6.87	6	—	—	—	—	—	—	6.12
<b>INNOMINATE</b>										
Ilium, least dorsoventral width	5.28	4.85-5.78	8	4.88	—	1	5.21	5.18-5.24	2	—
Ischium, least dorsoventral width	5.72	5.18-5.95	5	5.23	—	1	5.44	5.37-5.51	2	—
<b>FEMUR</b>										
Greatest length	48.6	46.5-50.3	5	45.5	45.3-45.7	2	48.4	—	1	—
Proximal width	13.0	11.5-14.2	7	12.4	12.1-12.6	3	12.9	—	1	—
Distal width	8.9	8.8-9.0	2	9.85	9.8-9.9	2	10.30	—	1	—
<b>TIBIA</b>										
Greatest length	48.5	—	1	50.5	47.6-52.2	3	48.3	46.9-49.7	2	—
Proximal width, perpendicular to plane of posterior margin	9.78	8.84-10.85	4	9.82	9.43-10.02	3	10.02	—	1	—
Distal width, perpendicular to flattened plane of posterior edge	7.02	6.46-7.73	8	7.56	7.11-7.78	3	7.24	—	1	—
<b>CALCANEUM</b>										
Greatest length, normal to long axis	12.7	11.5-13.5	7	13.5	—	1	—	—	—	—
<b>ASTRAGALUS</b>										
Greatest anteroposterior length, normal to posterior edge	8.54	7.65-9.13	6	—	—	—	—	—	—	—

backed and Heather Voles, all are southern or western in distribution today, and the Plains Pocket Gopher and Thirteen-lined Ground Squirrel are indicative of open vegetation and well-developed soils. *Geomys* in particular once had a much more extensive range in Illinois, Indiana, Kentucky and Tennessee which Parmalee and Klippel (22) suggest indicates drier conditions than today with extensive prairies or open parklands throughout the region. The Hairy-tailed Mole, Red-backed and Heather Voles suggest cooler, more mesic conditions. Most of the associates, however, including the reptiles and amphibians, are within their modern range. Graham (letter, November 15, 1984) suggests that the presence of western species in "eastern" faunas indicates an "environmental mosaic, with patches of open vegetation and well developed soils," that could be created by a slight change in climate or edaphic conditions.

The Illinois records of *Spilogale putorius* are similar to those in Indiana. There is one unreliable observation for 1910 in southeast Illinois (11), and two Holocene bone localities. The Modoc Rock Shelter, Randolph County, produced extralocal Plains Pocket Gopher remains and bones of at least 9 Spotted Skunks from the 4500-6500 B.P. levels (20). Meyer Cave, Monroe County, Illinois had an extensive fauna with northern, southern and western extralocals that included the Plains Pocket Gopher and 25 Spotted Skunks. The presence of the western animals was thought to have dated from the post-Wisconsinan Xerothermic Interval, characterized by a warm, dry climate (19). At that time the ranges of forest animals are thought to have been fragmented and the ranges of grassland, forest-edge and aridity-tolerant forest animals shifted eastward (33, 34).

Guilday *et al.* (8) in discussing the "Prairie Peninsula," noted that the evidence for a late-glacial eastern movement of western species was much stronger than that for the hypothesized Xerothermic Interval thousands of years later.

The assignment of western extralocal species in a fossil fauna to either of these two periods should be undertaken with caution and in context with the entire fauna. This is true of the Sullivan's Cave, Indiana fauna.

Graham (7) and King and Graham (13) suggested that each species responds to environmental change individually, with its distribution controlled by the interaction of many variables such as habitat type, competitive advantage, and physiological tolerances interfacing with climatic parameters. Climatic reconstructions based solely upon modern temperature and humidity extremes in the distribution of a species without regard to other limiting factors could be oversimplified. Until limiting factors are better known for modern species, it will be difficult to speculate upon the cause of many range extensions. It seems productive at present to establish a chronology of common faunal associates, making inferences from particular species with better known limiting factors. The common extralocal associates of *S. putorius* tend to be southern and western species, and *Geomys* in particular suggests more extensive tracts of open vegetation. This accords well with interglacial, late-glacial and postglacial range extensions of the spotted skunk. The Late Pleistocene in general is thought to have been more equable than at present, with greater overlapping of many presently separated animal ranges (6).

As indicated by the Freeman's Pit, Monroe County, Indiana Radiocarbon date of  $2,315 \pm 65$  years B.P., the spotted skunk was still present in south-central Indiana, long before the Caucasoid settlement of the region when its extirpation from the lower Wabash Valley was recorded. The lack of historic accounts from south-central Indiana where its bones are common suggest that it had been undergoing a general range reduction since at least 2300 years ago, in response to environmental change.

#### Acknowledgments

Russel W. Graham, Illinois State Museum, kindly reviewed this manuscript, and made



helpful notation on range limiting factors of western species. Dave Rieger and Donald B. Haddix produced Figures 1 and 2 respectively, and Deborah Randolph, Indiana State Museum, typed the manuscript. A thanks is extended to cavers too numerous to name for help in the field recovery of specimens.

#### Literature Cited

1. Bader, R.S. and J.S. Hall. 1960. Mammalian remains from an Indiana cave. *J. Mammal.*, 41:111-112.
2. Barbour, R.W. and W.H. Davis. 1974. *Mammals of Kentucky*. The University Press of Kentucky. 322 p.
3. Burt, W.H. and R.P. Grossenheider. 1964. *A field guide to the mammals*. Houghton Mifflin Co. Boston 284 p.
4. Cory, C.B. 1912. The mammals of Illinois and Wisconsin. *Field Mus. Nat. Hist. Publ.* 153, Zool. Ser. Vol. 11, 505 p.
5. Evermann, B.W. and A.W. Butler. 1894. Preliminary list of Indiana mammals. *Proc. Indiana Acad. Sci. for 1893*: 124-139.
6. Graham, R.W. 1976. Late Wisconsin mammalian faunas and environmental gradients of the eastern United States. *Paleobiology*, 2 (4): 343-350.
7. Graham, R.W. 1984. Paleoenvironmental implications of the Quaternary distribution of the Eastern Chipmunk (*Tamias striatus*) in central Texas. *Quat. Res.* 21:111-114.
8. Guilday, J.E., P.S. Martin and A.D. McCrady. 1964. New Paris No. 4: A Pleistocene cave deposit in Bedford County, Pennsylvania. *Natl. Speleol. Soc. Bull.*, Vol. 26(4):121-194.
9. Hahn, W.L. 1909. The mammals of Indiana. *Indiana Dept. Geol. Nat. Res.* 33rd Ann. Rept., 1908. p. 417-654 and 659-664.
10. Hall, E.R. 1981. *The mammals of North America*. John Wiley and Sons. New York, 2 vols. 1181 p.
11. Hoffmeister, D.F. and C.O. Mohr. 1972. *Fieldbook of Illinois mammals*. Dover Publications, Inc., New York. 233 p.
12. Howell, A.H. 1910. Notes of the mammals of the middle Mississippi Valley, with description of a new Woodrat. *Proc. Biol. Soc. Washington*. Vol. 22:23-24.
13. King, F.B. and R.W. Graham. 1981. Effects of ecological and paleoecological patterns on subsistence and paleoenvironmental reconstructions. *American Antiquity*, Vol. 46(1):128-142.
14. Kurten, B. and E. Anderson. 1980. *Pleistocene mammals of North America*. Columbia University Press. New York. 442 p.
15. Lyon, M.W., Jr. 1936. Mammals of Indiana. *Amer. Midl. Natur.*, 17(1): 1-384.
16. Mumford, R.E. 1969. Distribution of the mammals of Indiana. *Indiana Acad. Sci. Monogr.* 1. Indianapolis, 114 p.
17. Mumford, R.E. and J.O. Whitaker, Jr. 1982. *Mammals of Indiana*. Indiana Univ. Press, Bloomington. 537 p.
18. Munson, P.J., P.W. Parmalee and J.E. Guilday. 1980. Additional comments on the Pleistocene mammalian fauna of Harrodsburg Crevice, Monroe County, Indiana. *Nat'l Speleol. Soc. Bull.* 42:78-79.
19. Parmalee, P.W. 1967. A recent cave bone deposit in southwestern Illinois. *Nat'l. Speleol. Soc. Bull.* 29(4):119-147.
20. Parmalee, P.W. and D.F. Hoffmeister. 1957. Archaeozoological evidence of the spotted skunk in Illinois. *J. Mammal.* 38(2):261.
21. Parmalee, P.W. and K.W. Jacobson. 1959. Vertebrate remains from a Missouri cave. *J. Mammal.* 40(3):401-405.

22. Parmalee, P.W. and W.E. Klippel. 1981. A late Pleistocene population of the Pocket Gopher, *Geomys cf. busarius*, in the Nashville Basin, Tennessee. J. Mammal., 62(4):831-835.
23. Parmalee, P.W., P.J. Munson and J.E. Guilday. 1978. The Pleistocene mammalian fauna of Harrodsburg Crevice, Monroe County, Indiana. Nat'l Speleol. Soc. Bull. 40(2):64-75.
24. Parmalee, P.W. and R.D. Oesch. 1972. Pleistocene and Recent faunas from the Brynjulfson Caves, Missouri. Illinois State Mus. Rept. Inv. No. 25, 52 p.
25. Parmalee, P.W., R.D. Oesch and J.E. Guilday. 1969. Pleistocene and Recent vertebrate faunas from Crankshaft Cave, Missouri. Illinois State Mus. Rept. Inv. No. 14, 37 p.
26. Richards, R.L. 1972. The woodrat in Indiana: Recent fossils. Proc. Indiana Acad. Sci. 81:370-375.
27. Richards, R.L. 1980. Rice Rat (*Oryzomys cf. palustris*) remains from southern Indiana caves. Proc. Indiana Acad. Sci., 89:425-431.
28. Richards, R.L. 1981. Vertebrate remains from Carcass Crypt Cave, Lawrence County, Indiana. Proc. Indiana Acad. Sci., 90:442.
29. Richards, R.L. 1982. Hairy-tailed Mole (*Parascalops breweri*) remains from south-central Indiana caves. Proc. Indiana Acad. Sci., 91:613-617.
30. Richards, R.L. 1983. Quaternary records of the Pygmy and Smoky Shrews from southern Indiana caves. Proc. Indiana Acad. Sci., 92:507-521.
31. Richards, R.L. 1984. The Pleistocene Vertebrate collection of the Indiana State Museum, with a list of the extinct and extralocal Pleistocene vertebrates of Indiana. Proc. Indiana Acad. Sci., 93:483-504.
32. Richards, R.L. 1984. It's the pits: explorer discovers black bear bones. Outdoor Indiana, vol. 49 (7):25-27. October.
33. Smith, P.W. 1957. An analysis of post-Wisconsin biogeography of the prairie peninsula region based on distributional phenomena among terrestrial vertebrate populations. Ecology, 38(2):205-218.
34. Smith, P.W. 1965. Recent adjustments in animal ranges. pp. 633-642 in: H.E. Wright, Jr. and D.G. Frey, (eds.), The Quaternary of the United States, Princeton Univ. Press.
35. Van Gelder, R.G. 1959. A taxonomic revision of the spotted skunks (Genus *Spilogale*). Bull. Amer. Mus. Nat. Hist., 117(5):233-392.
36. Volz, S.A. 1977. Preliminary report on a Late Pleistocene death-trap fauna from Monroe County, Indiana. Proc. Indiana Acad. Sci., 86:293-307.