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Spilogale putorius.

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Spilogale Gray, 1865

Spilogale Gray, 1865:150. Type species *Mephitis interrupta* Rafinesque.

CONTEXT AND CONTENT. Order Carnivora, Family Mustelidae, Subfamily Mephitinae (Jones et al., 1992). Hall and Kelson (1959) originally recognized four species: *S. putorius, S. gracilis, S. pygmaea,* and *S. angustifrons.* Following Van Gelder's (1959) revision of the genus, Hall (1981) recognized two species, *S. putorius* and *S. pygmaea.* However, Jones et al. (1992) treated *S. putorius* and *S. gracilis* as distinct species, based on geographic and reproductive isolation (Mead, 1968*b*). Wozencraft (1993) considered *S. putorius* and *S. gracilis* to be synonymous, but commented on Mead's (1968b) argument for recognizing each as distinct species and *S. putorius leucoparia* as a possible third species. This account reviews spotted skunks occurring in the central and eastern United States, from the Great Plains eastward, that were recognized as *S. putorius* by Jones et al. (1992). The following key to species of *Spilogale* is derived from Van Gelder (1959), Mead (1968*a, b*), and Teska et al. (1981):

1. Size small, total length <300 mm and tail <90 mm; skull small and narrow, basilar length <38 mm and mastoid breadth <23.5 mm; nasal patch connected to shoulder stripes; forefeet and hind feet white dorsally; dorsal stripes not interrupted; gestation period 41–53 days ... *S. pygmaea*
   Size small to large, total length >300 mm, or if less, tail >90 mm; skull small to large, but if basilar length <38 mm, then mastoid breadth >23.5 mm; nasal patch not connected to shoulder stripes; forefeet and hind feet not completely white dorsally; dorsal stripes interrupted posteriorly ... 2
2. Gestation period 50–65 days; parturition usually occurring in late May and June; geographic range in Northern Hemisphere east of the Continental Divide and extending south into northeastern Mexico ... *S. putorius*
   Gestation period 210–230 days with delayed implantation; parturition usually occurring in April, geographic range west of Continental Divide and south into Nicaragua and Costa Rica ... *S. gracilis*

Spilogale putorius (Linnaeus, 1758)

Eastern Spotted Skunk

[*Viverra*] *Putorius* Linnaeus, 1758:44. Type locality "South Carolina."

Viverra Mapurita Müller, 1776:32. Based on "*Le Zorille*" of Buffon.

Viverra Zorilla Schreber, 1776:445. Based on "*Le Zorille*" of Buffon.

Must[*ela*] *putida* Cuvier, 1798:116. A substitute name for *Viverra putorius* Linnaeus (1758).

Viverra Striata Shaw, 1800:387. Based in part on *Viverra putorius* Linnaeus (1758).

Mephitis bicolor Gray, 1837:581. Based on a spotted skunk from North America.

Mephitis interrupta Rafinesque, 1820. Type locality "Louisiana" [territory]. Restricted to Upper Missouri river valley by Lichtenstein (1838:281).

Mephitis quaterlinearis Winans 1859, in a [?Kansas] newspaper. Not seen, cited in Coues, 1877, pp. 239,240.

Spilogale ringens Merriam, 1890:9. Type locality "Greensborough, Hale Co., Alabama."

Spilogale indianola Merriam, 1890:10. Type locality "Indianola, Matagorda Bay, Texas."

Spilogale ambarvalis Bangs, 1898:222. Type locality "Oak Lodge, opposite Micco, Brevard Co., Florida."

CONTEXT AND CONTENT. Context same as for genus. Three subspecies of the eastern spotted skunk are recognized.

S. p. ambarvalis Bangs, 1898. see above.

S. p. interrupta Rafinesque, 1820. see above (*indianola* Merriam and *quaterlinearis* Winans are synonyms).

S. p. putorius Linnaeus 1758. see above (*mapurita, zorilla, putida, striata, bicolor,* and *ringens* Merriam are synonyms).

DIAGNOSIS. *S. putorius* is distinguished from *S. gracilis* by having a gestation period of 50–65 days with no known period of delayed implantation (Mead 1968*a*) and 64 chromosomes (Hsu and Mead, 1969); *gracilis* has a gestation period of 210–230 days, accompanied by delayed implantation (Mead 1968*b*), and 60 chromosomes (Hsu and Mead, 1969). Unlike *S. pygmaea*, dorsal stripes of *S. putorius* are not continuous from the nose to the rump (Van Gelder, 1959).

GENERAL CHARACTERS. Eastern spotted skunks have fine, dense fur and an elongated weasel-shaped body. Limb posture is plantigrade and the body is carried low to the ground (Fig. 1). There are five toes on all feet (Van Gelder, 1959). The slightly curved claws of the forefeet of *S. putorius*, like other members of

FIG. 1. Photograph of *Spilogale putorius ambarvalis*, in handstand posture. Provided by Kevin Dawn Ward.

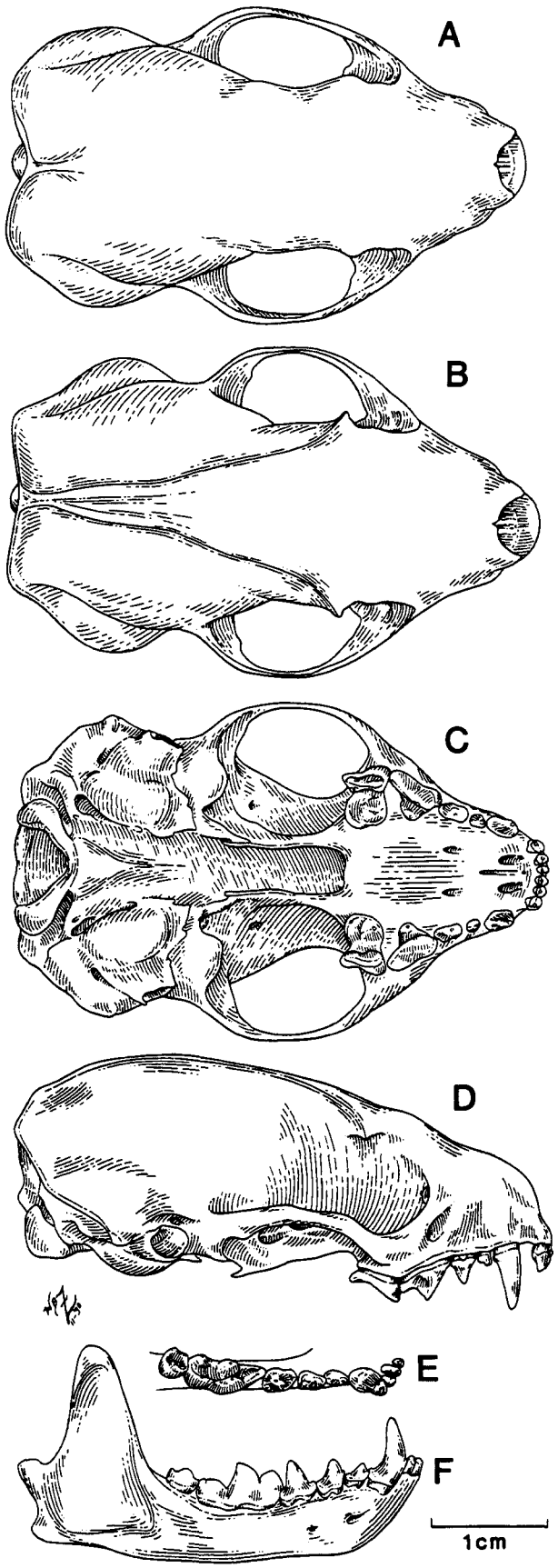

FIG. 2. Dorsal view of female (A) and male (B) skull of adult *Spilogale putorius*. Ventral view of male skull (C). Side view of male skull (D). Dorsal (E) and lateral (F) view of mandible. Female, number UF14379, and male, composite of numbers UF180 and UF14378, Florida Museum of Natural History. Greatest length of skull is 4.7 cm. Drawn by Wendy Zomlefer.

the genus, are about 7 mm long, a little more than twice the length of claws of the hind feet (Van Gelder, 1959). The feet of *Spilogale* may be less specialized for digging and more specialized for climbing than those of *Mephitis* or *Conepatus* because the plantar pads are more distinctly subdivided into four lobes and the carpal and metatarsal pads are more reduced (Pocock, 1921). Means (in mm, ranges in parentheses) and sample sizes (n) for external measurements for male *S. p. putorius* from Alabama are: total length, 519.44 (463–596), $n = 9$; length of tail, 201.67 (193–211), $n = 6$; length of hindfoot, 47.00 (43–51), $n = 10$ (Van Gelder, 1959). The respective measurements for females are 465.00 (403–470), $n = 8$; 182.00 (165–193), $n = 3$; and 43.88 (39–47), $n = 8$ (Van Gelder, 1959). Ears of four male and two female *S. p. putorius* from Louisiana averaged 18 and 23 mm, respectively (Lowery, 1974). Tail length is the most variable morphometric character of adult eastern spotted skunks (Van Gelder, 1959).

Body mass ($\pm SD$) of 94 male and 38 female *S. p. ambarvalis* from Florida averaged 399 ± 112 g and 283 ± 39 g, respectively (Ehrhart, 1974). In Florida, males weighed 13% more during the cooler months of October–May than during the June–September hot period (Kinlaw, 1990).

The rostrum is nearly straight in some individuals (Van Gelder, 1959) so that the skull appears flattened in dorsal profile (Hall and Kelson, 1959). Means (in mm), ranges, and sample sizes (n) for cranial measurements of male and female (in parentheses) *S. p. putorius* are: basilar length, 51.95, 49.6–54.5, $n = 10$ (49.11, 47.6–50.0, $n = 7$); condylobasal length, 58.85, 56.3–61.9, $n = 10$ (55.61, 55.0–56.4, $n = 7$); occipitonasal length, 53.35, 50.5–55.0, $n = 10$ (51.19, 50.3–52.5, $n = 8$); zygomatic breadth, 36.25, 34.9–37.8, $n = 7$ (34.00, 33.1–34.8, $n = 6$); mastoid breadth, 31.85, 30.1–34.2, $n = 10$ (30.39, 28.7–31.4, $n = 7$); interorbital breadth, 15.70, 14.4–16.9, $n = 10$ (15.31, 14.1–15.8, $n = 8$); postorbital breadth, 15.10, 13.8–15.5, $n = 10$, (14.46, 13.3–15.5, $n = 7$); palatilar length, 21.11, 19.6–22.7, $n = 11$ (20.19, 19.0–20.8, $n = 8$); postpalatal length, 31.05, 29.4–32.1, $n = 10$ (29.04, 28.7–29.7, $n = 7$); cranium height, 18.45, 17.8–19.6, $n = 10$ (17.89, 16.2–18.4, $n = 7$); length of toothrow, 18.84, 17.3–20.5, $n = 11$ (17.97, 17.3–18.6, $n = 9$—Van Gelder, 1959). The least variable of these cranial measurements are palatilar length, condylobasal length, height of cranium, length of toothrow, and occipitonasal length (Van Gelder, 1959). Extensive lists of skull and body measurements and skull drawings for subspecies can be found in Van Gelder (1959); skull photographs of subspecies can be compared in Howell (1906).

External measurements for male eastern spotted skunks are about 8% larger than females; the greatest differences are in length of head and body and length of hind foot. Like other members of the genus, skulls of males are about 7% larger, have more widely spread zygomatic arches, and show greater development of sagittal and lambdoidal crests than those of females (Fig. 2; Van Gelder, 1959). Eastern spotted skunks show a north-south gradation in total length, with *S. p. ambarvalis* in the south ranging from 311–421 mm and *S. p. putorius* in the north ranging from 453–610 mm (Van Gelder, 1959).

Bacula of adult *S. p. interrupta* weigh from 5.0 to 8.5 mg and are longer and more recurved than those of *S. gracilis latifrons* (Mead, 1967). Bacula of *S. putorius* have a small hollow core (Mead, 1970). Females have six to 10 teats, usually two pectoral pairs, one abdominal pair, and one inguinal pair (Howell, 1906).

The dental formula for *S. putorius* is i 3/3, c 1/1, p 3/3, m 1/2, total 34. The anteriormost premolar always is small and occasionally is absent (Van Gelder, 1959).

The jet-black pelage of *Spilogale putorius* and other *Spilogale* is marked by a white triangular nose patch and four to six broken white body stripes (Fig. 1) in an infinitely varying pattern (Van Gelder, 1959). The dorsal stripes parallel the vertebral column and extend from the back of the head posteriorly to the outer edges of the tail, joining at the tip. The shoulder stripes parallel the dorsal stripes, extend over the shoulders, and may continue anteriorly across the ears to join across the face. The lateral stripes extend from the toes of the forefeet posteriorly past the end of the shoulder stripes and then curve dorsad. Individuals may have several vertical stripes

connecting the dorsal and lateral stripes; stripes are divided into a pattern of spots in *S. p. interrupta* (Van Gelder, 1959). There are small white spots in front of each ear. Photographic comparisons of the pelts of different subspecies can be found in Howell (1906).

Eye lens mass is the variable most useful in distinguishing between juveniles, subadults, and adults. Obliteration of cranial sutures is the next best index for determining age (Mead, 1967).

DISTRIBUTION. *Spilogale putorius* has a very localized distribution within its range (Seton, 1929) and is less uniformly distributed than *Mephitis* (Howell, 1906). Eastern spotted skunks range from south-central Pennsylvania down the Appalachian chain to Florida, west to the Continental Divide, and south to Tamaulipas, Mexico (Fig. 3). The range in Florida extends as far south as Ft. Myers (Hamilton, 1941).

Increases in geographic range of eastern spotted skunks in the Great Plains may be correlated with increases in the amount of land devoted to agriculture, because agricultural practices provide outbuildings as shelter and encourage commensal house-mice (*Mus musculus*) that serve as a prey base (Choate et al., 1974). By the 1940s, eastern spotted skunks were reported in North Dakota, Wisconsin, and Minnesota, areas in which they had not previously occurred (Van Gelder, 1959).

S. putorius interrupta and *S. gracilis gracilis* both range into the Black Mesa area in western Oklahoma but are ecologically separated (Dalquest et al., 1990), with *gracilis* inhabiting the rimrock and *interrupta* occurring along the Cimarron River (Van Gelder, 1959). Both subspecies meet in Laramie Co., Wyoming, without intergradation (Armstrong, 1972). Patton (1974) captured three skunks he identified as *S. p. interrupta* along with 21 *S. g. gracilis* in Reeves Co., western Texas. These two species are sympatric in the Hill country of eastern Texas (Schmidly, 1984).

FOSSIL RECORD. The earliest representative of the genus *Spilogale* is *Spilogale rexroadi*, from the late Pliocene of Kansas and Texas. It was approximately the size of *S. pygmaea*, regarded as the most primitive living spotted skunk (Van Gelder, 1959). *S. rexroadi* had a more trenchant dentition than extant species and probably had more predaceous habits (Kurtén and Anderson, 1980). This skunk was probably ancestral to later species and is considered to be the most primitive member of the genus (Dalquest, 1972; Hibbard, 1941; Kurtén and Anderson, 1980). The place of origin may have been central Mexico (Van Gelder, 1959).

The stratigraphic range of *S. putorius* extends from pre-Nebraskan (early Blancan) to Recent, and early representatives were slightly smaller than extant eastern spotted skunks living in the same area (Kurtén and Anderson, 1980). The north-south gradation in size of modern species also is evident in Pleistocene samples (Kurtén and Anderson, 1980). Webb (1974) documented 11 sites in Florida at which fossils of *S. putorius* were found, the earliest being the late Blancan period. These often are found in association with fossilized owl (Strigiformes) pellets (G. S. Morgan, pers. comm.).

Spilogale and *Mephitis* may have diverged from a common semiarboreal ancestor. Behavioral and fossil evidence suggest that selective pressures favored increased activity and arboreality in *Spilogale* (Zeiner, 1975).

FORM AND FUNCTION. The fur of eastern spotted skunks, like other members of the genus *Spilogale*, is finer and denser than that of *Mephitis* or *Conepatus* (Zeiner, 1975). The warning effect of the striking pelage is emphasized by the dramatic moving handstand. The pelage also may serve a cryptic function, because it is virtually impossible to distinguish *S. putorius* in moonlight shadows (Crabb, 1948; Seton, 1929).

The many small pads on the soles of the feet of eastern spotted skunks probably assist in climbing. Although not as specialized for digging as *Mephitis* or *Conepatus*, the longer front claws assist *Spilogale* in climbing and digging, allowing it to hunt in both arboreal and subterranean habitats. Eastern spotted skunks also use these longer claws to hold prey while making a killing bite (Ziener, 1975). The elongated but small body enables this weasel-like mustelid to pursue prey down smaller burrows than *Mephitis* or other larger-bodied skunks.

The carnassial P4 is proportionately longer in *Spilogale* than *Mephitis* or *Conepatus* (Van Gelder, 1959), an adaptation correlated with the inclusion of more meat in the diet (Selko, 1937). The ears are proportionately larger than the ears of *Mephitis* or *Conepatus*

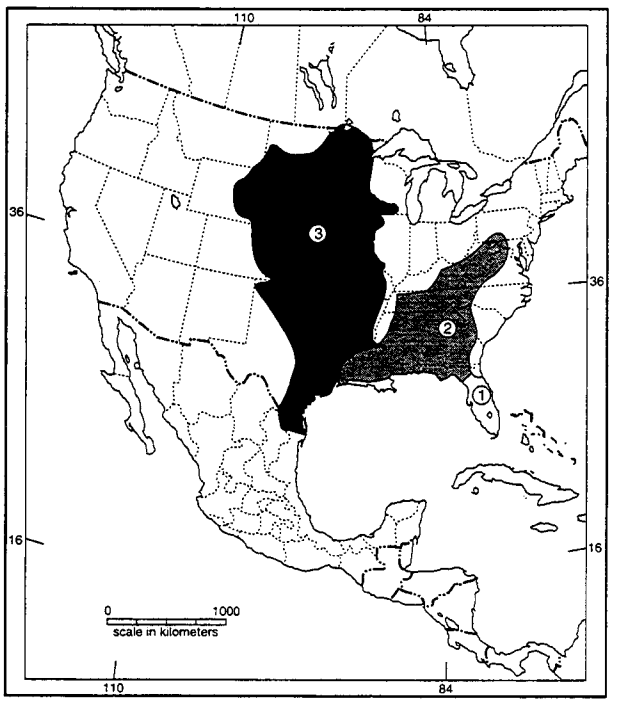

FIG. 3. Distribution of *S. putorius:* 1, *S. p. ambarvalis*; 2, *S. p. putorius*; 3, *S. p. interrupta*; Redrawn from Hall (1981), with modifications from Barbour and Davis (1974), Hoffmeister (1989), Mumford and Whitaker (1982), Schmidly (1984), and Webster et al. (1985). Drawn by John Wollinca.

(Van Gelder, 1959), perhaps to assist in heat loss or to detect movements of small mammals.

In behavioral tests between male and female eastern spotted skunks, fights were common and males rubbed their bellies and perineal regions against the cages (Zeiner, 1975) as if they were scent marking. However, physical examination of captive animals failed to locate glandular areas (Zeiner, 1975).

The paired anal glands open through nipples hidden just within the anus, and musk is discharged when the nipples protrude as the tail is raised over the back (Crabb, 1948). The musk sprayed by eastern spotted skunks and other *Spilogale* is reported to be more pungent (Hall and Kelson, 1959) than that of striped skunks (*Mephitis mephitis*). If sprayed directly in the eyes, musk causes irritation and temporary vision impairment, enabling *S. putorius* to escape.

ONTOGENY AND REPRODUCTION. The ovaries are lens-shaped, measure approximately 4 by 2 by 2 mm, and have a paired weight of 10–90 mg (Mead, 1968*a*). They are completely encapsulated by the mesosalpinx, except for a small opening near the fimbriated ostium of the oviduct. The horns of the bipartite uterus are 2.5–3.5 cm long. They fuse caudally to form a common corpus uterus that terminates at the internal os of the cervical canal (Mead, 1968*a*).

Mating and fertilization occur in late March–April for the eastern spotted skunk. Implantation is believed to occur 14–16 days after mating and is delayed briefly or not at all (Mead, 1968*a*). Females are spontaneous ovulators (Mead, 1968*a*). Greater ovarian activity was noted in wild-caught *S. p. interrupta* and *S. p. ambarvalis* in March and nearly all estrous females captured in late March-April were bred (Mead, 1968*a*). *S. p. interrupta* trapped in South Dakota and Iowa between August and March had inactive ovaries, and *S. p. ambarvalis* is anestrus from October to early March (Mead, 1968*a*). Estrus may recur in *S. p. ambarvalis*, with the second mating most likely occurring in July or August (Mead, 1968*a*). Parturition in eastern spotted skunks occurs in late May–early June after an estimated gestation period of 50–65 days; average litter size is 5.5 (Mead, 1968*a*).

Spermatogenesis in males begins during December–early January; spermiogenesis follows in March and testicular regression occurs in late April–May (Mead, 1968*a*). Males have a well-developed

prostate gland that measures from 7 by 7 by 3 mm to 11 by 16 by 9 mm (length, breadth, thickness), attaining its largest size during the breeding season (Mead, 1970). The prostatic urethra is 8–10 mm long, the muscular urethra about 12 mm, and the penis is 35–40 mm (Mead, 1970).

Young are born with sparse, fine fur, and have distinct white and black markings. A newborn female *S. p. interrupta* weighed 9.5 g, and a 14-day-old female weighed 45.5 g (Crabb, 1944). A 7-day-old male weighed 22.5 g and a 21 day-old-male weighed 73.5 g. Eyes and ears are closed, but claws are well developed, and neonates are able to vocalize with distinct squealing. At 25 days of age, littermates can elevate their tails in warning fashion when frightened. Teeth are visible at 30 days of age and eyes are open by 32 days of age. At 46 days of age, eastern spotted skunks are able to discharge musk. Six juvenile males averaged 150 g after mid-July and seven juvenile males averaged 330 g after mid-August. The young are weaned at about 54 days of age (Crabb, 1944).

ECOLOGY. Eastern spotted skunks are primarily insectivorous. Insect remains occurred in feces collected during all seasons in Iowa (Crabb, 1941). During summer and fall, insects occurred in 92% and 80% of fecal droppings. When insects are unavailable, *S. putorius* preys on small mammals, which occurred in 90% of winter and 86% of spring feces (Crabb, 1941). Birds, carrion, and plant material also are eaten (Crabb, 1941; McCullough and Fritzell, 1984; Selko, 1937). *S. putorius* is preyed upon by domestic dogs (*Canis familiaris*) and cats (*Felis catus*—Crabb, 1948), great horned owls (*Bubo virginianus*—Errington et al., 1940), and bobcats (*Lynx rufus*—Schwartz and Schwartz, 1981).

Potential food competitors sympatric with *Spilogale* are striped skunks and weasels. Morphological and behavioral evidence suggest that striped skunks occupy only the ground-level component of habitat whereas both species of spotted skunks use both ground and arboreal components, thus minimizing competition (Zeiner, 1975). Eastern spotted skunks occasionally pilfer weasel caches (Polder, 1968), but omnivorous habits of *Spilogale* when compared to carnivorous habits of weasels minimize potential food competition.

A density of 8.8 eastern spotted skunks per km² was estimated in an agricultural area in Iowa (Crabb, 1948). However, density could have been as high as 20 *S. putorius* per km², depending on the method of calculation. A re-analysis of mark-recapture data collected by Ehrhart (1974) in 1973–1974 at Canaveral National Seashore, Florida revealed a density of 40 skunks/km² (Kinlaw et al., 1995).

Yearly home-range size of one radio-collared adult male in oak-hickory (*Quercus-Carya*) forest habitat in Missouri was 4,359 ha (McCullough and Fritzell, 1984). Home range size and mean nightly movement were greater in spring than in summer or fall (McCullough and Fritzell, 1984).

The sex ratio of three litters of *S. p. interrupta* was 1.3:1.0 (n = 16) in favor of males (Crabb, 1948). Commercial lures or catfood used as bait tend to attract more males (3.66:1.0, n = 67—Crabb, 1948; 2.5:1.0, n = 132—Ehrhart, 1974), but a wider variety of natural baits reveal a more balanced ratio (1.81:1.0, n = 76—Crabb, 1948; 1.0:1.0, n = 63—Kinlaw, 1990).

Eastern spotted skunks occur in brushy, rocky, and wooded habitats (Nowak, 1991). Although they have been reported to avoid dense forest areas (Nowak, 1991), they have been trapped in second-growth forest in Garrett Co., Maryland (Larsen, 1968). They avoid wetlands (Nowak, 1991); no spotted skunks were captured in marsh or semi-aquatic habitats during a major capture-recapture study conducted in various habitats of Kennedy Space Center, Florida (Ehrhart, 1974). Eastern spotted skunk are numerous in the dense palmetto (*Serenoa repens*) thickets occurring on sandy soils along the east coast of Florida (Bangs, 1898; Schwartz, 1952) and they have been reported on adjacent ocean beaches (Howell, 1906). Their abundance in these thickets is probably due to availability of numerous gopher tortoise (*Gopherus polyphemus*) burrows used as dens, an abundance of rodents taken as prey, and thick vegetative cover offering protection from owl predation (Kinlaw, 1990).

Eastern spotted skunks are captured in habitat with extensive vegetative cover, but rarely in open areas. A radio-telemetered *S. putorius* in Missouri used oak-hickory forests more than open areas such as old fields or glades; within oak-hickory forests they used sites with moderate to high levels of ground litter or slash more than sites with a clear forest floor (McCullough and Fritzell, 1984). In other studies, they were not captured in live traps placed adjacent to apparently suitable dens located in the middle of open ground 3 m (Manaro, 1961) or 25 m (Crabb, 1948) from vegetative cover. Significantly more eastern spotted skunks were captured in a southern portion of a Florida barrier island that had almost 100% ground cover than in an adjoining equal-sized area that was considerably more open ($P < 0.025$—Kinlaw, 1990).

In natural landscapes, eastern spotted skunks den in any natural cavity or crevice under a rock pile, hollow log, or stump (Seton, 1929). In the North Carolina mountains, they den along talus slopes (Lee et al., 1982). They use cavities in standing trees (Crabb, 1948); in Missouri, 10 dens with entrances 1–7 m above ground were located in seven standing hollow trees having an average diameter at breast height of 26.3 cm. (McCullough and Fritzell, 1984). They can dig their own burrows (Seton, 1929), or use burrows dug by pocket gophers (*Geomys bursarius*) or Franklin's ground squirrels (*Spermophilus franklinii*—Polder, 1968), thirteen-lined ground squirrels (*Spermophilus tridecemlineatus*—Crabb, 1948), woodrats (*Neotoma* sp.—Seton, 1929), striped skunks or long-tailed weasels (*Mustela frenata*—Crabb, 1948), gopher tortoises (*Gopherus polyphemus*—Frank and Lips, 1989), armadillos (*Dasypus novemcinctus*—Lowery, 1974), or burrowing owls (*Speotyto cunicularia*—Seton 1929).

In man-dominated landscapes, eastern spotted skunks den in haystacks, woodpiles, under and in farm buildings, strawpiles and corncribs, grain elevators, or wells with rock walls (Crabb, 1948; Seton, 1929). Requirements for den-site selection include darkness and protection from weather and natural enemies (Crabb, 1948). Dens apparently were selected for their thermal suitability in Missouri. In Missouri, 58% of underground dens used in the summer faced in a northerly direction. During colder autumn months, 80% of dens faced a southerly direction, and 100% faced south in winter (McCullough and Fritzell, 1984). Ground dens in Iowa contained a nest of grass or hay and those in buildings frequently were built in hay or between hay bales (Crabb, 1948). Eastern spotted skunks move from den to den and more than one individual has been captured at the same den site in capture-recapture studies (Crabb, 1948; Manaro, 1961). Disturbance by humans or dogs around dens may cause *S. putorius* to abandon the site (Crabb, 1948).

S. p. interrupta has undergone a rapid decline in numbers throughout most of the Midwest where it once was quite abundant (Kaplan and Mead, 1991). It is now listed as endangered in Missouri, threatened in Kansas and Iowa, "species of special concern" in Montana, "species in need of conservation" in Nebraska, and rare by the states of North Dakota and Oklahoma; the status of this subspecies is presently unknown in Louisiana, South Dakota, Mississippi, Arkansas, and Texas (Kaplan and Mead, 1991). *S. p. putorius* was assigned a "vulnerable" status by the Pennsylvania Biological Survey in 1985 (Genoways and Brenner, 1985). *S. p. ambarvalis* is still abundant in southern Florida (Kaplan and Mead, 1991) and east-central Florida (Kinlaw et al., 1995).

Ectoparasites reported to occur on *S. p. ambarvalis* include the flea *Polygenis gwyni* (Layne, 1971; Schwartz 1952) and ticks *Dermacentor variabilis* and *Ixodes cookei* (Ehrhart, 1974). Endoparasites occurring in the eastern spotted skunk include the following tapeworms: *Oochoristica pedunculata, Oochoristica wallacei* (Chandler, 1952), and *Oochoristica oklahomenis* (Peery, 1939). Roundworms reported are *Skrjabingylus chitwoodorum* (Hill, 1939) and *Capillaria hepatica* (Layne and Winegarner, 1971). Two species of coccidian protozoans (*Isospora spilogales* and *I. sengeri*) have been described from Florida eastern spotted skunks (Levine and Ivens, 1964).

Humans have been reported to be the main cause of current mortality as a result of automobile roadkills (Rosatte, 1987). Of 77 dead *S. putorius* found in Iowa in 1948, only three deaths were caused by automobiles (Crabb, 1948). Forty-five were killed by farmers or their dogs and cats and 25 were trapped for fur (Crabb, 1948). Pneumonia and coccidiosis have been reported to be major causes of death in captive individuals (R. Mead, pers. comm.). Only two of 52 eastern spotted skunks captured in Iowa from 1964 to 1968 were rabid (Hendricks and Seaton, 1969), and <1% of skunk rabies cases reported in Texas since 1978 were due to eastern spotted skunks (K. Clark, pers. comm.). Histoplasmosis (*Histoplasma capsulatum*) was isolated in cultures from *S. putorius* trapped in Georgia (Emmons et al., 1949). Eastern spotted skunks probably also contract microfilaria, listeriosis, mastitis, tularemia, distemper, and Q fever (Howard and Marsh, 1983).

The pelts of both eastern and western spotted skunks represent

an insignificant fraction of the modern fur trade. In the 1983–1984 trapping season, 5,588 pelts described as spotted skunk were harvested in the United States (Novak et al., 1987); however, additional pelts of spotted skunk were included with *Mephitis* pelts and classified under the generic term "skunks" by some states. Management is done through game laws and regulations (Howard and Marsh, 1983) and involves two opposing approaches: to increase skunk population density as desirable furbearers, or to decrease their numbers by trapping when they become pests. In 1976, Colorado and Missouri were the only two states with a habitat management program that benefitted eastern spotted skunks (Deems and Pursley, 1978).

BEHAVIOR. *Spilogale putorius* and other members of the genus are quicker, more alert and more agile than other North American skunks (Seton, 1929; Zeiner, 1975). They will readily climb into trees and attics of houses (Crabb, 1948). They are secretive and rarely seen. *S. putorius* has been observed "freezing" its position and elevating its tail in a defensive posture when sound is detected (Crabb, 1948:216). Wild individuals invariably bite when removed from live traps; however, the majority of captive eastern spotted skunks become docile and do not bite when handled (R. Mead, pers. comm.).

Eastern spotted skunks are primarily nocturnal. In Missouri, four male *S. putorius interrupta* located by radiotelemetry 127 times between 0600–1800 h were not active, but were active on 186 of 333 occasions between 1800 and 0600 h (McCullough and Fritzell, 1984). During one bright Florida night with a full moon during April, no *S. putorius* was captured before the moon set at 0330 h, but nine individuals were taken in darkness after the moon set between 0330 h and sunrise at 0610 h (Manaro, 1961). Also, more eastern spotted skunks were captured on cool, cloudy, dryer nights than on hot, clear, wetter nights (Kinlaw, 1990). However, Florida *S. putorius* has been observed hunting in daylight hours (J. N. Layne, pers. comm.; I. J. Stout, pers. comm.)

Eastern spotted skunks are inquisitive and exhibit more exploratory behavior than striped skunks when presented with novel objects (Zeiner, 1975). They sometimes open Sherman live traps and catch and kill rodents captured inside (I.J. Stout, pers. comm.) or eat pocket gophers (*Geomys* sp.) caught in snap traps (Howell, 1920). They show more overall activity and more climbing ability than *Mephitis* (Zeiner, 1975). Early authors described them as "acrobats" (Howell, 1920) or "animated checkerboards" (Seton, 1929).

The behavior recognized as being most characteristic of the species is the handstand (Fig. 1) that is used in defensive situations (Howell, 1920; Johnson, 1921). In this special threat behavior, *S. putorius* runs at an opponent, then stops abruptly and elevates the hindquarters so that it balances on its hands with its tail turned to one side and the everted openings of the anal sac directed toward the enemy (Johnson, 1921). The tail may twitch and the animal may hiss. This handstand posture might enable the skunk to see where it aims its spray and to direct the spray into the face of a taller opponent (Johnson, 1921). Crabb (1948) reported that eastern spotted skunks could walk about a meter in this position but Manaro (1961) stated that an individual advances and retreats on its forelegs only a few centimeters to maintain balance. Manaro (1961) noted that this response was elicited when an intruder was 3–4 m away. When an intruder approaches to within 2 m, eastern spotted skunks invariably drop to all fours and assume a horseshoe-shaped stance with both the anus and head directed at the aggressor, often spraying from this position (Manaro, 1961). Caged *S. putorius* cease to exhibit this defensive behavior toward humans after 4–5 days of exposure to people, but continue to display it toward a dog, cat, or horse brought close to the cage (Manaro, 1961). Eastern spotted skunks were reported to spray musk down from trees they had climbed (Cuyler, 1924).

A second stereotyped behavior is foot-stamping, often given in association with the handstand. This is done with the forepaws and is an audible reponse (Zeiner, 1975).

A third ritualistic behavior pattern is the egg-opening technique (Van Gelder, 1953), somewhat similar to the technique used by some mongooses (*Herpestes* sp.). Initially, the animal straddles an egg with its forelegs and attempts to open it by biting. If this is unsuccessful, it pushes the egg backward with the forelegs; as the egg passes beneath the hind end of the animal, the skunk gives it a quick kick to the rear with one hindleg. However, captive eastern spotted skunks only occasionally use this technique; they simply begin biting the eggs after a few have been broken for them (R. Mead, pers. comm.).

Another fixed-action pattern of eastern spotted skunks is the method used to kill mice or birds. When presented with a live chick (*Gallus* sp.), spotted skunks made immediate kills in 21 of 22 tests (Ziener, 1975). They attacked the back first; then, after struggling with the chick for a brief time, gave a killing neckbite. Both forepaws and hindpaws are used to restrain the struggling victim, similar to the killing technique reported by Heidt (1972) for the least weasel (*Mustela nivalis*). The carcass was carried some distance in each test and the head was eaten first.

Eastern spotted skunks sleep with the head and forelegs tucked beneath the abdomen with the crown of the head, shoulders, hind feet, and tail in contact with the ground (Manaro, 1961). Their voice includes throaty grunts and a high-pitched screech similar to that of a blue-jay (*Cyanocitta cristata*—Manaro, 1961).

Eastern spotted skunks do not hibernate but have seasonal periods of inactivity that vary geographically. In Iowa, they restrict their movements during winter; activity of males increases in spring (Crabb, 1948). In Florida, eastern spotted skunks, especially males, are difficult to trap and presumably are inactive during the hot summer months. However, both sexes are active and subject to trapping during the mild winter and spring (Ehrhart, 1974; Kinlaw, 1990). Ziener (1975) found no diminution of gross activity of caged *S. putorius* over an ambient temperature range of −7 to 41°C.

GENETICS. *Spilogale p. ambarvalis* and *S. p. interrupta* have a diploid number of 64 with four pairs of biarmed autosomes (Hsu and Mead, 1969).

REMARKS. After reviewing fossil and recent distribution records, Van Gelder (1959) postulated that *Spilogale* may have originated in central Mexico and extended its range northward after recession of the glaciers. The Continental Divide may have constituted a barrier that restricted gene flow between populations to the east and west, resulting in two species (*S. putorius* and *S. gracilis*; Mead, 1989).

Based on morphometrics, Hall and Kelson (1959) assigned a third species, *S. angustifrons*, to spotted skunks occurring in southern Mexico and Central America. Recent evidence showing chromosomal differences in skunks from this region led Owen et al. (in litt.) to conclude that additional biological species may be present in the *Spilogale* complex.

Researchers planning to conduct ecological studies of spotted skunks should be advised of certain difficulties. *Spilogale* is dextrous with its claws and usually removes externally attached radiocollars or harnesses (McCullough and Fritzell, 1984; Kinlaw, 1990), thus radiotransmitters should be surgically implanted. Ear-tags frequently tear out of the pinna, expecially if cinched so tightly as to pinch the ear (Crabb, 1948; Kinlaw, 1990). Eastern spotted skunks can escape through very narrow openings along the door of box traps. Live traps containing skunks should be approached by holding a blanket or piece of plastic between the person and the trap to intercept any sprayed musk. Although some researchers have anesthetized wild-caught animals in order to handle them, this is not necessary if welder's gloves are worn to protect the hands from bites.

Various agents have been recommended to remove the musk odor of skunks from humans or dogs, including organic solvents such as gasoline (Cuyler, 1924) or dilute naphthalene-alpha solution (Howard and Marsh, 1983). Water-based solutions such as ammonia (Cuyler, 1924), tomato juice (Howard and Marsh, 1983), and vinegar (Patton, 1974; R. Mead, pers. comm) have been used with success. A hot bath containing 500 ml of commercial bath oil solubilizes and removes the mercaptan odor from the body. Naphthalene crystals can be used in an attic or beneath a building to repel skunks (Howard and Marsh, 1983).

The word *Spilogale* is derived from the Greek *spilos*, meaning spot, and *gale*, meaning weasel. The word *putorius* is Latin for fetid odor. Common names for spotted skunks are civet cat, tree skunk, weasel skunk, polecat, hydrophoby cat, phoby cat, black marten, little spotted skunk, four-striped skunk, four-lined skunk, and sachet kitty (Hall and Kelson, 1959; Howard and Marsh, 1983; Lowery, 1974).

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