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Mustela vison.

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Mustela Linnaeus, 1758

Mustela Linnaeus, 1758:45. Type species *Mustela erminea* Linnaeus.

Arctogale Kaup, 1829:30. Type species *Mustela erminea* Linnaeus.

Ictis Kaup, 1829:30. Type species *Mustela vulgaris* Erxleben [= *Mustela nivalis* Linnaeus].

Gale Wagner, 1841:234. Type species *Mustela vulgaris* Erxleben [= *Mustela nivalis* Linnaeus].

Neogale Gray, 1865:114. Type species *Mustela frenata* Lichtenstein.

Mustelina Bogdanov, 1871:167. Type species *Mustela erminea* Linnaeus and *M. vulgaris* Erxleben [= *Mustela nivalis* Linnaeus].

Eumustela Acloque, 1899:62. Type species *Mustela vulgaris* Erxleben [= *Mustela nivalis* Linnaeus] and *Mustela erminea* Linnaeus.

CONTEXT AND CONTENT. Order Carnivora, Family Mustelidae, Subfamily Mustelinae. *Mustela* is divided into five subgenera: *Grammogale, Mustela, Lutreola, Vison,* and *Putorius* (Nowak, 1991). The genus *Mustela* includes 16 living species (Wozencraft, 1993). A key to species (modified from Hall 1981; Nowak, 1991; Peterson, 1966; Stroganov, 1969) follows:

1. Species present in at least parts of North America 2
   Species absent in North America 6
2. Length of upper tooth-rows <20 mm in males and <17.8 mm in females; pelage white in winter 3
   Length of upper tooth-rows >20 mm in males and >17.8 mm in females; pelage coloration constant throughout the year 5
3. Postglenoidal length of skull >47% of condylobasal length 4
   Postglenoidal length of skull <47% of condylobasal length .... *M. frenata*
4. Total length <210 mm; tail <40 mm, without black pencil or with few black hairs at extreme tip; skull length <33 mm; mastoid breadth usually exceeds breadth of brain case .... *M. nivalis*
   Total length >210 mm; tail >40 mm, and with black pencil; skull >33 mm; mastoid breadth smaller than breadth of brain case in females .... *M. erminea*
5. Abdomen white; face with blackish mask; m1 lacking trace of metaconid .... *M. nigripes*
   Abdomen dark brown; face uniformly brown without blackish mask; m1 with incipient metaconid .... *M. vison*
6. Distributed in central or South America, but not in North America 7
   Not distributed in western hemisphere 8
7. Distributed in southwestern Columbia and northern Ecuador; tail length <120 mm; head and body length <240 mm .... *M. felipei*
   Distributed in the Amazon basin of Brazil, eastern Ecuador, and northeastern Peru; tail length >150mm; head and body length >240 mm .... *M. africana*
8. Distributed in western Europe 9
   Not distributed in western Europe 11
9. Tail >40% of head-body length; cheeks without light markings .... *M. lutreola*
   Tail <40% of head-body length; light markings on cheeks 10
10. Tail predominantly black; ventral pelage dark; postorbital constriction ca. 25% of condylobasal length .. *M. putorius*
    Tail black only towards the tip; ventral pelage pale; postorbital constriction about 20% of condylobasal length .... *M. eversmannii*
11. Species present from eastern European Russia to eastern Siberia and Thailand, Japan and Taiwan .... *M. sibrica*
    Species absent from Japan or Taiwan 12
12. Species with underparts deep yellow .... *M. kathiah*
    Species with underparts not deep yellow 13
13. Species with narrow whitish stripe centrally on back and venter .... *M. strigidorsa*
    Species without narrow whitish stripe centrally on back and venter 14
14. Distributed from southern Siberia to the Himalayan region and Korea .... *M. altaica*
    Not distributed in Korea or Siberia 15
15. Distributed in Malay Peninsula, Sumatra, and Borneo; head much paler than rest of body; tail >200 mm .... *M. nudipes*
    Distributed in southern Sumatra and Java; absence of masks or other facial markings; tail <200 mm .... *M. lutreolina*

Mustela vison Schreber, 1777
American Mink

Mustela vison Schreber, 1777:pl. 127B. Type locality "Eastern Canada" (= Quebec). (*M. nigrescens* Audubon and Bachman and *M. winingus* Baird are synonyms).

Putorius (*Lutreola*) *lutensis* Bangs, 1898:229. Type locality "salt marsh opposite Matanzas Inlet, [St. Johns County,] Florida."

Mustela mink Peale and Palisot de Beauvois, 1796:39. Type locality "Maryland" (*M. lutreocephala* Harlan, *M. rufa* Hamilton-Smith, and *M. minx* Turton are synonyms).

Putorius (*Lutreola*) *vulgivagus* Bangs, 1895:539. Type locality "Burbridge, [Plaquemines Parish,] Louisiana."

CONTEXT AND CONTENT. Subgenus *Vison.* The extinct sea mink (*M. macrodon*) is here considered as a separate species (Hall, 1981; Nowak, 1991), although it is considered by many as a subspecies of *M. vison* (Wozencraft, 1993). Fifteen subspecies of *M. vison* currently are recognized (Hall, 1981).

M. v. aestuarina Grinnell, 1916:213. Type locality "Grizzly Island, Solano County, California."

M. v. aniakensis Burns, 1964:1073. Type locality "vicinity of Aniak, along the Salmon River," Alaska.

M. v. energumenos (Bangs), 1896:5. Type locality "Sumas, British Columbia," Canada.

FIG. 1. Adult *Mustela vison.* Photograph courtesy of H. Thomas.

M. v. evagor Hall, 1932:418. Type locality "Little Qualicum River [eight to nine miles west of Parksville], Vancouver Island, British Columbia," Canada.
M. v. evergladensis Hamilton, 1948:139. Type locality "Tamiami Trail (U.S. Route 94), 5 miles SE Royal Palm Hammock, Collier County, Florida."
M. v. ingens (Osgood), 1900:42. Type locality "Fort Yukon, Alaska."
M. v. lacustris (Preble), 1902:66. Type locality "Echimamish River (near Painted Stone), Keewatin [Manitoba], Canada."
M. v. letifera Hollister, 1913:475. Type locality "Elk River, Sherburne County, Minnesota."
M. v. lowii Anderson, 1945:57. Type locality "Mistassini Post, Mistassini Lake, Mistassini District, Quebec", Canada.
M. v. lutensis (Bangs), 1898:229. See above.
M. v. melampeplus Elliot, 1903:170. Type locality "Kenai Peninsula, Alaska."
M. v. mink Peale and Palisot de Beauvois, 1796:39. See above.
M. v. nesolestes (Heller), 1909:259. Type locality "Windfall Harbor, Admiralty Island, Alaska."
M. v. vison Schreber, 1777:pl. 127B. See above. (*Lutreola v. borealis* Brass is a synonym).
M. v. vulvivagus (Bangs), 1895:539. See above.

DIAGNOSIS. In the New World, the American mink is the largest member of the genus *Mustela*. It is longer (body length >300 mm), heavier (>1,000 g), darker, and has a bushier and darker tail than the weasels *M. nivalis, M. erminea,* and *M. frenata* (Jackson, 1961). The skull of adult *M. vison* is always >54 mm in length and >29 mm in width, whereas the skulls of all weasels measure much less (Jackson, 1961). The North American river otter (*Lontra canadensis*) is similar in color but is much larger (>5 kg), has a tail tapering at the base, a grayish throat, and no white markings (Larivière and Walton, 1998).

In the Old World, the American mink may be confused with the European mink (*M. lutreola*). However, *M. vison* typically is 20–60% larger than *M. lutreola* (Maran and Henttonen, 1995; Youngman, 1982) and can be distinguished by the small size or absence of the white patch typically present on the upper lip of *M. lutreola*. In some areas, skull measurements may be necessary to distinguish *M. vison, M. lutreola,* and *M. putorius* (Linn and Birks, 1989; Lodé, 1995).

GENERAL CHARACTERS. The American mink (Fig. 1) has a long tubular body and short ears which scarcely project above the fur. The tail is 33% of body length. The feet are fully furred except for the pads and the tip of the toes, and the toes are only webbed at their base (Jackson, 1961). Females have two abdominal and four inguinal mammae (Peterson, 1966).

The pelage is uniformly dark brown, becoming nearly black at the tip of the tail. The chin is usually white, and white markings also occur on the throat, chest and belly. Coloration does not change with season or age, but old animals may be grizzled with white hairs (Jackson, 1961). Albino, tan, or blond pelts occur infrequently (Lowery, 1974). By selective breeding, mink farmers have produced many colors that do not occur in the wild (e.g., ambergold and gunmetal—Jackson, 1961).

There is slight sexual dimorphism, with females 10% smaller in size and 50% lighter in mass (Hall, 1981). Averages and ranges (in parentheses) of external measurements (in mm) of *M. vison* in Louisiana (Lowery, 1974) for 29 males and 5 females, respectively, are as follows: total length, 568 (504–680), 517 (488–580); length of tail, 184 (167–200), 172 (152–185); length of hind foot, 68 (60–79), 52 (50–57); length of ear, 23 (19–27), 23 (21–25). Body mass (g) of *M. vison* averages (range), for males and females, respectively: 1,091.0 (905–1,392) and 671.8 (455–840) in northern United Kingdom (Scotland—Hewson, 1971); 1,153 (850–1,805) and 619 (450–810) in southern United Kingdom (England—Chanin, 1983); 1,523 and 852 (ranges unknown) in North Dakota (Eagle et al., 1984). Bacula of 126 males from North Dakota averaged 48.0 mm in length (range, 41.2–52.5 mm; Burt, 1960). Additional body measurements are available (Dunstone, 1993; Fairley, 1980; Hewson, 1971).

The skull (Fig. 2) is somewhat flattened with a short, broad rostrum and evenly spreading zygomatic arches. The lambdoidal ridge is well developed in adults and extends posteriorly as far as the posterior border of the condyle. Auditory bullae are moderately inflated, about 1.5 times longer than wide. The bony palate extends posteriorly to the back molars (Jackson, 1961). Skulls of males and females are sexually dimorphic in size, but not in shape (Wiig, 1986). Average cranial measurements (in mm; range in parentheses) for 54 males and 35 females from Canada (Youngman, 1982), respectively, are as follows: condylobasal length, 70.8 (65.3–76.3), 63.7 (58.7–68.9); mastoid breadth, 36.5 (32.8–40.1), 31.8 (28.6–36.0); zygomatic breadth, 41.1 (35.9–47.1), 36.8 (33.6–40.6); palatal length, 32.4 (29.9–35.2), 28.7 (26.4–31.0); and cranial height, 24.7 (22.4–27.8), 22.5 (20.6–25.8). Skulls of mink raised on ranches are larger and have a relatively shorter palate and a relatively narrower postorbital constriction compared with those of wild mink (Lynch and Hayden, 1995). The dental formula is i 3/3, c 1/1, p 3/3, m 1/2, total 34. Deciduous teeth erupt 16–49 days after birth and permanent teeth erupt at 44–71 days (Aulerich and Swindler, 1968).

FIG. 2. Dorsal, ventral and lateral views of cranium, and lateral view of mandible of *Mustela vison* from Pisgah National Forest, North Carolina (male, USNM 250141). Greatest length of cranium is 70.8 mm.

DISTRIBUTION. The American mink is found throughout Canada and most of the United States except Arizona and the dry parts of California, Nevada, Utah, New Mexico, and western Texas (Fig. 3). Mink were first brought to Newfoundland, Canada, in 1934 for fur farming operations. Subsequent escapes led to the estab-

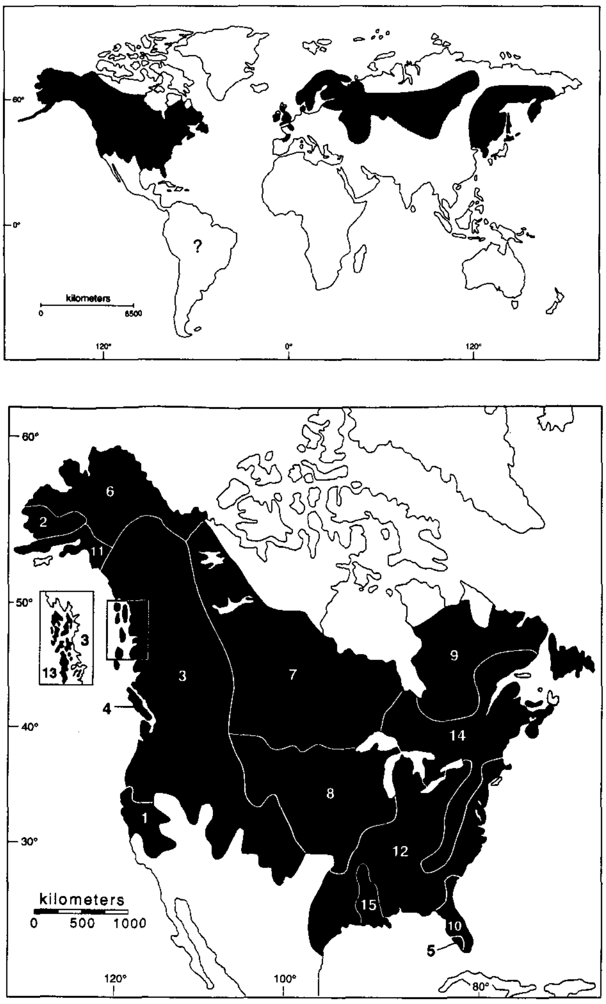

FIG. 3. Distribution of *Mustela vison* a) across the world, and b) in North America (modified from Dunstone, 1993; Eagle et al., 1987; Hall, 1981): 1, *M. v. aestuarina*; 2, *M. v. aniakensis*; 3, *M. v. energumenos*; 4, *M. v. evagor*; 5, *M. v. evergladensis*; 6, *M. v. ingens*; 7, *M. v. lacustris*; 8, *M. v. letifera*; 9, *M. v. lowii*; 10, *M. v. lutensis*; 11, *M. v. melampeplus*; 12, *M. v. mink*; 13, *M. v. nesolestes*; 14, *M. v. vison*; 15, *M. v. vulgivaga*.

lishment of a wild population in Newfoundland (Northcott et al., 1974). Mink were voluntarily released on Anticosti Island (Quebec) in 1912, but now are extremely rare or extirpated there (Peterson, 1966).

The American mink was deliberately introduced as a fur animal in Russia, and in other parts of Europe; escapees from fur farms have established populations in England, France, Germany, Iceland, Ireland, Norway, Poland, Scotland, and Sweden (Bevanger and Henriksen, 1995; Chanin, 1983; Day and Linn, 1972; Deane and O'Gorman, 1969; Gerell, 1967*b*; Ruprecht et al., 1983). The ability of the species to colonize new habitats is excellent, and it is estimated that all of Sweden was invaded in ca. 35 years (Gerell, 1967*a*). *M. vison* was brought to South America for fur farming in the 1930s, and numerous populations were recorded in the wild in 1960–1961 (Daciuk, 1978). The current distribution of *M. vison* in South America is unknown (Medina, 1997; Fig. 3).

FOSSIL RECORD. In the United States, remains of *M. vison* occur in a few Irvingtonian (early Pleistocene) faunas and ca. 25 late Pleistocene sites including Alaska, Colorado, Idaho, Indiana, Missouri, Ohio, South Carolina, Tennessee, Texas, Utah, Virginia, West Virginia, Wyoming (Anderson, 1984, 1989; Kurtén and Anderson, 1980). Pleistocene *M. vison* did not differ in size or morphology, but there is a slight trend for increased size from the Irvingtonian through Rancholabrean times (Kurtén and Anderson, 1980).

FORM AND FUNCTION. The long, tubular body shape of the American mink makes it vulnerable to extreme temperatures (Brown and Lasiewski, 1972; Segal, 1972), and thermoregulation is achieved through behavior instead of morphology (Segal, 1972). Values for heart rate (ca. 265/min) and basal metabolic rate ($B = 84.6\ W^{0.78}$) for American mink are higher than predicted from energetic equations, likely as a consequence of the fusiform shape (Gilbert and Gofton, 1982*a*; Iversen, 1972). Nevertheless, the streamlined body shape of the mink helps to reduce drag in the water while swimming (Williams, 1983) and enables access to the burrows of prey such as muskrats (*Ondatra zibethicus*) and rabbits (*Oryctolagus*, *Sylvilagus*, and *Lepus*).

The thick underfur and the oily guard hairs render the fur water-resistant (Lowery, 1974). The mean density of guard hairs from the mid-back section (780/cm^2) and the length of guard hairs (24 mm) have an intermediate value between those of the more aquatic otters (*Lutra* and *Lontra*) and strictly terrestrial ferrets (*M. putorius*); this suggests that American mink possess incomplete adaptations to aquatic life (Dunstone, 1979). Molting occurs twice a year, during spring and autumn (Chanin, 1983). The spring molt begins in March–April, and the shorter summer fur is acquired by May. Pelage cycles are controlled by photoperiod (Duby and Travis, 1972; Rust et al., 1965).

Vision of the American mink is clearer in air than underwater (Sinclair et al., 1974). The peripheral olfactory structures of the mink are slightly regressed, and olfactory membranes cover only 14 cm^2; reduction in the amount of olfactory membrane is likely the result of the semiaquatic lifestyle (Ferron, 1973). The American mink is able to hear ultrasonic vocalizations in the range emitted by rodent prey (40 kHz—Powell and Zielinski, 1989).

Mustela vison undergoes rapid bradycardia during submersion, and heart rate is lower during diving than during any other behavior (Gilbert and Gofton, 1982*b*). Rapid onset of bradycardia is likely an adaptation to the conservation of oxygen during the short periods of asphyxia experienced by this unspecialized diver (Stephenson et al., 1988; West and van Vliet, 1986).

Mustela vison has two anal glands, which are used for territorial marking when excreting feces or by deliberate rubbing of the anal region on the ground. Anal gland secretions are composed of 2,2-dimethylthietane (main component), 2-ethylthietane, cyclic disulfide, 3,3,-dimethyl-1,2-dithiacyclopentane, and indole (Brinck et al., 1983). Mink are able to empty gland contents when under stress (Brinck et al., 1978), and the sulfur-containing compounds suggest that the secretions have a function for defense (Brinck et al., 1978).

Feces have a strong odor which originates from the proctodeal glands which open into the rectum. Feces are deposited in prominent places, likely to enhance the active range of the scent for territorial marking (Brinck et al., 1978).

REPRODUCTION. Mating season ranges from February to April (Hansson, 1947; Sidorovich, 1993), but most matings occur in March (Chanin, 1983; Venge, 1959). In Alaska, mating occurs in late April or early May, and parturition occurs in late June or early July, which is likely to coincide with the high availability of carcasses of spawning Pacific salmon (Ben-David, 1997). Ovulation is induced by the presence of males or by attempted or successful copulation (Adams, 1981; Hansson, 1947; Venge, 1959). Duration of copulation averages 64 min but ranges from 10 min to 3–4 h (Hansson, 1947; Venge, 1959). Ovulation follows copulation by 36–48 h (Enders, 1952; Hansson, 1947). In one study of captive mink, 84% of eggs released were implanted, whereas as few as 50% of eggs released resulted in young (Hansson, 1947).

Mustela vison exhibits facultative delayed implantation (Hansson, 1947). Gestation averages 51 days, but may vary from 40 to 75 days, typically decreasing with increased temperature (Enders, 1952; Hansson, 1947). Actual embryonic development is 30–32 days (Enders, 1952). Onset of mating and gestation is controlled by photoperiod (Duby and Travis, 1972; Hammond, 1951).

Litter size averages four (range, 2–8; Mitchell, 1961; Sidorovich, 1993) and increases with female age (Sidorovich, 1993). Parturition occurs from April to June (Hansson, 1947; Sidorovich, 1993). At birth, the young are blind, possess a fine coat of short, silvery-white hairs, and weigh ca. 6 g (Svihla, 1931). Eyes open at 25 days, and weaning occurs after 5 weeks. Juveniles begin hunting at 8 weeks of age but remain with the mother until autumn (Peterson, 1966; Poole and Dunstone, 1976).

ECOLOGY. *Mustela vison* usually is associated with water, although the species can be found in xeric habitats if food is abundant (Arnold and Fritzell, 1990; Gerell, 1967*a*). In prairie environments, mink activity is most frequent on large wetlands with irregular shorelines and large areas of open water (Arnold and Fritzell, 1990). In Florida, mink abundance is lowest in freshwater marshes, intermediate in saltwater marshes, and highest in swamp forests; *M. vison* will move from seasonal to permanent wetlands as the dry season progresses (Humphrey and Zinn, 1982).

In marine environments, American mink select shallow vegetated and tidal slopes and sites protected from waves. Beaches with small rocks are avoided because of the low abundance of prey (Ben-David et al., 1996).

The American mink is strictly carnivorous, and its diet reflects the local prey base (Ben-David et al., 1997). Typically, the diet is comprised mostly of fish, amphibians (mostly frogs), crustaceans (crayfish and crabs), muskrats, and small mammals (Birks and Dunstone, 1985; Bueno, 1994; Chanin and Linn, 1980; Cuthbert, 1979; Day and Linn, 1972; Errington, 1954; Proulx et al., 1987; Ward et al., 1986). Opportunistically, *M. vison* also consumes lagomorphs, sciurids, birds and their eggs, reptiles, aquatic insects, earthworms, and snails (Akande, 1972; Arnold and Fritzell, 1987*b*; Hamilton, 1959). Bats (*Myotis*), carrion, small carnivores, and large (>20 cm) or fast swimming fish (e.g., salmonids) rarely are consumed (Burgess and Bider, 1980; Dunstone and Birks, 1987; Gerell, 1968; Goodpaster and Hoffmeister, 1950).

The American mink is an important predator of waterfowl and their eggs (Eberhardt and Sargeant, 1977). Adult mink may kill incubating hens on their nests (Arnold and Fritzell, 1989), and in Manitoba, Canada, it was estimated that a male mink consumed 3–7 adult ducks, 15–25 one-week-old ducklings, and 18–30 duck eggs during a single waterfowl breeding season (Arnold and Fritzell, 1987*b*). Within a season, predation on waterfowl increases when the birds have limited mobility such as during incubation, brood rearing, or molting (Arnold and Fritzell, 1987*b*; Sargeant et al., 1973). Mink predation and disturbance also may cause mortality among young of colonial nesting birds (Burness and Morris, 1993; Craik, 1997).

Adults have larger home ranges than juveniles, and males have larger home ranges than females (Gerell, 1970). Linear home ranges of adult male and female mink average (n, range), respectively: 2.5 km (3, 1.9–2.9) and 2.2 km (2, 1.5–2.9) in England (Birks and Linn, 1982); 5.3 (1) and 4.2 (1) in Finland (Niemimaa, 1995); 2.6 (4, 1.8–5.0) and 1.9 (2, 1.0–2.8) in Sweden (Gerell, 1970). In Tennessee, home range of three males averaged 7.5 km (SE = 1.8; Stevens et al., 1997*a*). Comparative home range length (km) for male and female *M. vison* in England was 2.53 and 2.16 in riverine habitats, 1.90 and 1.46 in lacustrine environments, and 1.50 and 1.09 in coastal habitat (Dunstone and Birks, 1985). In the Canadian Prairie Pothole Region, summer home ranges of males average 7.7 km^2 (Arnold and Fritzell, 1987*a*). In archipelagos, home ranges of *M. vison* may include several islands often separated by >500 m (Niemimaa, 1995).

In riverine and lacustrine habitats, home ranges of American mink exhibit low intersexual overlap and no intra-sexual overlap (Dunstone and Birks, 1985). In marine environments, intersexual overlap is higher, but intra-sexual overlap remains low (Dunstone and Birks, 1985). Greater densities in coastal habitats may be explained by smaller home ranges and greater intersexual overlap (Dunstone and Birks, 1985).

Densities of adults vary from 0.1–0.7/km^2 (Halliwell and Macdonald, 1996). In England, American mink were most numerous at sites which had high availability of den sites and low emergent vegetation cover (Halliwell and Madonald, 1996). Near lakes, mink density decreases with increased cottage development (Racey and Euler, 1983). It has been suggested that some populations of *M. vison* may follow a 10-year cycle synchronous with the cycle of the snowshoe hare (*Lepus americanus*—Keith and Cary, 1991).

The sex ratio (M : F) of 32 juveniles captured in Montana was 1.3:1 (Mitchell, 1961). Sex ratios favoring males have been reported in numerous locations (Errington, 1936; Mitchell, 1961) but often result from trapping bias (Buskirk and Lindstedt, 1989). During population decreases, the sex ratio of litters favors females (Sidorovich, 1993).

Movements of *M. vison* are either small-scale foraging movements or extensive travel between dens or foraging areas (Birks and Linn, 1982). In the Canadian prairies, nightly movements ranged from 0 to 12 km (Arnold and Fritzell, 1987*a*) whereas in Tennessee, daily movements were <4.3 km (Stevens et al., 1997*a*). Largest movements are performed by juveniles during dispersal (≤45 km away from natal areas), and by males during the mating season (Gerell, 1970).

In freshwater environments of North America, American mink and North American river otters show niche separation through resource partitioning (Ben-David et al., 1996). *M. vison* typically occupies drier sites and consumes a lower proportion of fish and invertebrates and a higher proportion of mammals and birds, compared to *L. canadensis* (Gilbert and Nancekivell, 1982; Humphrey and Zinn, 1982). In marine environments, *M. vison* and *L. canadensis* show high dietary overlap (ca. 80%), but they exhibit niche separation through differential habitat preferences (Ben-David et al., 1996). The American mink prefers sites with low-to-medium wave exposure whereas river otters prefer sites with heavy wave exposure and good overstory cover (Ben-David et al., 1996).

In South America, introduced *M. vison* has a sympatric distribution with the southern river otter *(L. provocax)*. However, *M. vison* consumes mostly crustaceans and rodents whereas *L. provocax* consumes mostly crustaceans and fish (Medina, 1997). Finally, habitat overlap is low (5–22%), and there is little evidence for competition between the two species (Medina, 1997).

In Europe, introduced American mink competes with the European otter (*Lutra lutra*). The diet of both species overlap greatly (ca. 60–70% of species consumed—Erlinge, 1969), but *M. vison* consumes smaller prey, less fish, and a higher proportion of mammals and arthropods than *L. lutra* (Bueno, 1996; Chanin, 1981; Jenkins and Harper, 1980). *M. vison* also makes greater use of land (Akande, 1972; Chanin and Linn, 1980; Day and Linn, 1972; Erlinge, 1969; Gerell, 1967*a*; Wise et al., 1981). Competition between *M. vison* and *L. lutra* is most intense in winter, and high densities of otters may prevent mink from occupying otherwise prime habitats (Erlinge, 1972).

The American mink also competes with the European mink. In some areas, the spread of American mink may have contributed to the decline of European mink, especially from marginal habitats (Maran and Henttonen, 1995). Non-fertile crossing between male American mink and female European mink may also prevent European mink from succesfully reproducing (Maran and Henttonen, 1995). There is no indication of competition between *M. putorius* (polecat) and *M. vison* (Gerell, 1967*a*). The polecat is strictly terrestrial, and although it is sympatric with the American mink, polecats typically consume more rodents and amphibians, whereas mink consume more fish and birds (Lodé, 1993).

In North America, adult mink may be killed by great-horned owls *(Bubo virginianus)*, hawks *(Buteo)*, coyotes *(Canis latrans)*, red foxes *(Vulpes vulpes)*, bobcats *(Lynx rufus)*, lynx *(Lynx)*, alligators *(Alligator)*, and otters (Erlinge, 1972; Gerell, 1967*a*; Lowery, 1974). Most common diseases include Aleutian disease, amyloidosis, botulism, distemper, hemorrhagic pneumonia, mink virus enteritis, feline panleukopenia, urolithiasis, and canine parvovirus (Nieto et al., 1995; Tomson, 1987). Endoparasites include the protozoan *Sarcocystis*; the nematodes *Bayliascaris devosti*, *Capillaria mucronata*, *Euparyphium melis*, *Filaroides martis*, *Skrjabinngylus nasicola*, and *Spirometra erinacei* (Dunstone, 1993; Hansson, 1967; Ramos-Vara et al., 1997; Sidorovich and Savcenko, 1992); and the cestode *Dioctophyma renale* (Wren et al., 1986). Ectoparasites include the ticks (*Ixodes*) and fleas *Ctenophthalmus*, *Megabothris*, *Malareus*, *Nosopsyllus*, *Paleopsylla*, *Typhloceras* (Chanin, 1983; Fairley, 1980; Page and Langton, 1996).

Most mortality occurs through trapping by humans. Accidental mortality may occur through roadkills (Eagle and Whitman, 1987) or by captures in fish cages or gill nets (Gerell, 1971). Mink can live up to 8 years in captivity (Dunstone, 1993), but in the wild a complete turnover of the mink population occurs every 3 years (Mitchell, 1961).

American mink, because of their position in the food chain, act as bio-indicators of pollution in aquatic environments (Aulerich and Ringer, 1979; Halbrook et al., 1996; Smits et al., 1996*a*, 1996*b*; Stevens et al., 1997*b*). The American mink tolerates low levels ($<1.0 \times 10^{-6}$) of mercury intoxication (Wobeser et al., 1976); however, at higher levels of contamination (>1.8 ppm), severe lesions or death occur (Wobeser and Swift, 1976). Clinical signs of heavy mercury intoxication include anorexia, loss of weight, incoordination, tremors, and convulsions (Aulerich et al., 1974). Pollution from heavy metals also produces an increased incidence of morphological anomalities, parasitism, and lower body mass and density (Sidorovich and Savcenko, 1992). *M. vison* also is sensitive to low quantities of dietary polychlorinated biphenyls (<1 ppm in diet), and intoxications lead to weight loss, decoloration and necrosis of liver, fibrosis of coronary arteries, and still births (Platonow and Karstad, 1973). Animals exposed to high levels of hexachlorobenzene may experience lower reproductive success (Moore et al., 1997). Similarly, mink may decrease in areas where intensive acid precipitation affects freshwater fishes (Bevanger and Albu, 1986).

Intensive mink farming for fur began in 1925 (Tomson, 1987), and the American mink is currently the most important species in fur-farming operations (Peterson, 1966; Thompson, 1968; Venge, 1959). Today, most of the mink fur used in commerce is produced on farms (Nowak, 1991). For this reason, extensive literature exists on the behavior (MacLennan and Bailey, 1969), metabolism and physiology (Wamberg, 1994), lactation (Clausen et al., 1996; Hansen et al., 1996), reproduction (Enders, 1952; Hansson, 1947; Sundqvist and Gustafsson, 1983; Sundqvist et al., 1988), selective breeding (Lagerkvist et al., 1994), stress levels (Gilbert and Bailey, 1967, 1969), veterinary care (Tomson, 1987), and economics (Lagerkvist, 1997) of captive animals. Demand for ranch mink affects the price of wild pelts, but about 400,000–700,000 wild American mink are taken each year throughout North America, for an annual income exceeding U.S. $5 million (Eagle and Whitman, 1987).

For research purposes, mink may be captured by excavating dens, by netting free-ranging animals, or with the aid of baited and unbaited box traps, mink decoys, or barrier tunnels (Eagle and Sargeant, 1985; McCabe, 1949; Ritcey and Edwards, 1956). Captured mink may be immobilized using ketamine (Birks and Linn, 1982), combinations of medetomidine-ketamine reversible with atipamezole (Arnemo and Søli, 1992), ketamine-xylazine (Eagle et al., 1984), ketamine-midazolam (Wamberg et al., 1996), ketamine-acetylpromazine (Tomson, 1987), ketamine-diazepam (Tomson, 1987), or methoxyflurane (Tomson, 1987). Telemetry transmitters may be affixed either as intraperitoneal implants or on harnesses or collars (Dunstone 1993; Eagle et al., 1984). For commercial fur harvest, minks can be humanely harvested using foothold traps with drowning sets (Gilbert and Gofton, 1982*b*), Conibear® 120 Magnum with pan trigger (Proulx et al., 1990), or the Bionic® trap (Proulx and Barrett, 1991; Proulx et al., 1993).

American mink can be aged by cementum annuli, sections of mandible, baculum morphology or weight, measurements of skull or pelvic girdle, or by the weight of various organs (Askins and Chapman, 1984; Birney and Fleharty, 1968; Elder, 1951; Franson et al., 1975; Greer, 1957; Lechleitner, 1954). Lens weight is a reliable indicator for mink ≤1.5 years old (Pascal and Delattre, 1981), and the condylo-premaxillary length enables sex differentiation by skull alone for mink >10-months old (Birney and Fleharty, 1966).

BEHAVIOR. The American mink is mostly nocturnal, but daytime activity may occur (Arnold and Fritzell, 1987*a*; Birks and Linn, 1982; Gerell, 1969; Niemimaa, 1995). In the wild, activity of *M. vison* coincides with that of its prey (Gerell, 1969). In captivity, food synchronizes activity (Zielinski, 1986). *M. vison* is active year-round, but activity levels decrease during winter (Birks and Linn, 1982) and during periods of cold weather (Marshall, 1935; Segal, 1972).

The American mink generally is solitary, but pairs may occur during the breeding season, or during late summer and early autumn. Most often, pairs are comprised of young or female-young associations (Mitchell, 1961).

Most foraging activity of the American mink occurs along waterways. Purely terrestrial activity may occur, but it generally is restricted to males foraging for lagomorphs (Birks and Dunstone, 1985; Birks and Linn, 1982; Dunstone and Birks, 1983, 1985). The American mink is an agile tree climber, capable of descending head first and of jumping from tree to tree (Larivière, 1996). When walking, the head is held close to the ground, the back is level, and the tail is held taut (Dunstone, 1979). During bounding, the head is held high and the tail taut and arched upwards (Dunstone, 1979). The mean speed of walking is 48 cm/s and of bounding, 262 cm/s (Dunstone, 1979).

Two forms of swimming are observed: when fully submerged, the mink alternates the use of all four limbs with either diagonally opposite legs or ipsilateral legs simultaneously (Dunstone, 1979). When swimming at the surface, only the forelimbs are used, occasionally aided by a power stroke from the hind limbs for turning or diving (Dunstone, 1979). Swimming speeds average 42 cm/s and 59 cm/s for surface and underwater swimming, respectively (Dunstone, 1979). Swimming is energetically costly, as both water resistance and oxygen consumption increase curvilinearly with speed (Williams, 1983). The lack of specialization for swimming contributes to high energetic costs but enables the mink to effectively forage in both aquatic and terrestrial environments (Williams, 1983).

Mustela vison does not stalk or ambush, but instead simply rushes upon its prey (Poole and Dunstone, 1976). Surplus killing may occur, and *M. vison* may cache food during periods of abundance (Burness and Morris, 1993; Gerell, 1968; Sargeant et al., 1973).

Aquatic prey are located from above the water surface (Poole and Dunstone, 1976). When water reflection is a problem, mink may locate prey by immersing their head underwater and scanning for prey (Poole and Dunstone, 1976). Occasionally, mink search for and capture prey underwater (Dunstone and Clements, 1979; Sinclair et al., 1974). Because mink possess few adaptations for underwater foraging, they compensate by focusing on prey refuges (Dunstone, 1978; Dunstone and O'Connor, 1979*a*; Poole and Dunstone, 1976).

Mink can dive to depths of 5–6 m and swim underwater for up to 30–35 m (Peterson, 1966). Captive mink spend 5–20 s underwater when fishing (Poole and Dunstone, 1976). Dive length and interdive intervals increase with water depth (Dunstone, 1983). Open water is unsuitable for a hunting mink because the species lacks the underwater endurance necessary for effectively pursuing prey (Dunstone and O'Connor, 1979*b*).

Daily consumption of dry matter (per kg of body mass) averages 40 g for male mink and 53 g for females, respectively (Bleavins and Aulerich, 1981). Mean passage time of food averages 187 min for males and females (Bleavins and Aulerich, 1981). A 1 kg mink requires 152 ± 11 calories of digestible energy per day for maintenance. In comparison, a female nursing 5 young requires ca. 3 times that amount for 3 wks postpartum (Cowan et al., 1957).

American mink rarely excavate their own burrows (Birks and Linn, 1982), and in North America, the most common den types used are abandoned muskrat burrows (Arnold and Fritzell, 1989; Marshall, 1935; Sargeant et al., 1973; Schladweiler and Storm, 1969). Other den sites include ground squirrel (*Spermophilus*) burrows, rabbit burrows, cavities under waterside trees, rockpiles, brushpiles, culverts, or bridge fundations (Birks and Linn, 1982; Dunstone and Birks, 1985). Most dens have 2–5 entrances (Schladweiler and Storm, 1969) and are located close (<2 m) to water (Birks and Linn, 1982). Dense stands of emergent vegetation also may be used by resting mink (Arnold and Fritzell, 1989; Birks and Linn, 1982; Sargeant et al., 1973).

The American mink emits defensive screams, warning squeaks, and hissing (Gilbert, 1969; Larivière, 1996). In addition, chuckling may be audible during the reproductive season and is associated with sexual stimulation (Gilbert, 1969). When stressed, *M. vison* will raise its fur, arch its back, bare its teeth, and run back and forth rapidly. Defensive behavior is accompanied by high-pitched squeals, hissing, and emptying of anal glands (Brinck et al., 1983). During the arched-back position, the tail is lifted and moved from side to side, possibly to disperse the strong odor of the anal gland secretions (Brinck et al., 1978).

GENETICS. The American mink has 2n = 30 chromosomes (Fredga, 1961; Lande, 1957). Both sex chromosomes are submetacentrics, 2 autosomes are acrocentrics, and 26 are either metacentrics, submetacentrics or subtelocentrics (Hsu and Benirschke, 1968). Rarely, diploid-triploid chimerism may produce viable hermaphrodites (Nes, 1966). Crossing between *M. vison* and *M. lutreola* leads to resorbtion of hybrid embryos (Ternovskii, 1977).

CONSERVATION STATUS. The American mink is generally abundant throughout its distribution. Only one subspecies, *M. v. evergladensis* (present only in southern Florida), is rare and may be threatened by human alteration of waterways (Nowak, 1991).

REMARKS. The generic name *Mustela* is Latin for weasel. The specific name *vison* is of doubtful origin, but likely comes from the Swedish word *vison* which means "a kind of weasel" (Lowery, 1974). Other vernacular names for the American mink include minx, *vison* (French), and water weasel (Jackson, 1961). Other literature reviews are provided by Linscombe et al. (1982), Eagle and Whitman (1987), and Dunstone (1993). N. Dion and B. R. Patterson reviewed earlier drafts of this manuscript. D. Dyck and M. Mierau helped with the map. H. Thomas provided animal and skull photographs.

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