Long-tailed Weasel, *Mustela frenata,* Movements and Diggings in Alfalfa Fields Inhabited by Northern Pocket Gophers, *Thomomys talpoides*

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Little is known about the movements of Long-tailed Weasels (*Mustela frenata*) in alfalfa (*Medicago* spp.) fields inhabited by Northern Pocket Gophers (*Thomomys talpoides*). In central Alberta, I intermittently followed the movements of Long-tailed Weasels during two consecutive winters. Three types of movements were observed: straight-line movements across the fields; sinuous movements along the edges of the field; and arc movements within the field, over concentrations of Northern Pocket Gopher burrow systems. Arc movements were 0.6-28-m-wide at their base, and extended from 6 to 45 m into the field. Movements of Long-tailed Weasels into the fields were accompanied by fresh diggings in Northern Pocket Gopher burrow systems, which became inactive thereafter. This study suggests that Long-tailed Weasels may have a cognitive map of the distribution of Northern Pocket Gophers in their home range.

Key Words: Long-tailed Weasel, *Mustela frenata*, Northern Pocket Gopher, *Thomomys talpoides,* Alfalfa fields, cognitive map, movements, Alberta.

In agricultural areas, Long-tailed Weasels (*Mustela frenata*) are associated with waterways and habitats with abundant prey, such as fields with pocket gopher (*Geomys* spp. and *Thomomys* spp.) burrow systems that are inhabited by several small terrestrial species (Vaughan 1961; Gamble 1980; Whittaker et al. 1991). Criddle and Criddle (1925) suggested that, in winter, weasels entered burrow systems to kill the resident pocket gopher and other rodents. Andersen and MacMahon (1981) suggested that a low survival rate in a population of Northern Pocket Gophers (*Thomomys talpoides*) was probably due to a sudden influx of weasels. Proulx and Cole (1998) identified Northern Pocket Gopher remains in Long-tailed Weasel scats. Although a predator-prey relationship between the two species undoubtedly exists, little is known about Long-tailed Weasel movements in fields inhabited by Northern Pocket Gophers.

Weasel foraging behavior has been described as a random search during which the animals explore every likely place for small prey (Powell 1978; King 1989). Soper (1964) considered that they wander erratically from place to place, visiting vegetation clumps, burrow openings, and boulders. In this study, I hypothesized that Long-tailed Weasels would investigate Northern Pocket Gopher burrow systems as they encounter them along their wanderings.

Study Area and Methods

This project study was carried out in two study areas along the Vermilion River approximately 4 km from Vegreville (53°N, 112°W), Alberta. Study areas were bordered by thickets of willow (*Salix* spp.) and aspen (*Populus tremuloides*), high grass, and alfalfa (*Medicago* spp.) fields inhabited by Northern Pocket Gophers.

1998-1999

Study Area I was surveyed for Long-tailed Weasel tracks 10 times from 18 November to 22 December 1998, when snow was ≤ 30 cm deep and without crust, and 15 times from 14 January to 30 March 1999, when snow was deeper and with crust. Air temperatures ranged from -29°C to 9°C. A female adult Long-tailed Weasel (track length: 3.8 cm; distance between jumps ≥ 45 cm) was captured on 6 December in a mesh trap, anesthetized in a veterinary clinic with isoflurane, ear-tagged, and radio-collared (2.5 g collar with loop antenna; Holohill Systems, Ottawa, Ontario). Because weasels are very sensitive to handling and collaring (Delattre et al. 1985), the animal was kept in captivity overnight, then released at the original capture site, and intermittently located from 6 to 22 December, at which time the radio-collar ceased to emit. Radio-telemetry was used to locate the Long-tailed Weasel's dens. Snow-tracking was used to determine the extent of the Long-tailed Weasel movements along the creek and in the alfalfa field. When following the animal, fresh diggings into the dirt were flagged and re-visited the following spring. Tracks of Mink (*Mustela vison*) and Short-tailed Weasel (*Mustela erminea*) were also identified on the basis of tracks and stride characteristics (Murie 1975; Rezendes 1992).

Study Area II was surveyed four times from 24 November to 22 December 1998, and six times from 15

January to 11 March 1999. The tracks of one Long-tailed Weasel, judged to be a male according to the size of its tracks (track length: 6.3 cm; distance between jumps ≥ 65 cm), were found and followed. Because of very cold nights, often below -20°C, no attempt was made to live-trap the animal. Tracks of Short-tailed Weasels were observed across the alfalfa field.

Animal movements and diggings were originally plotted on 1:20 000 scale maps drawn from air photos (Alberta Environmental Protection, Air Photo Service, Edmonton, Alberta). In April 1999, immediately after snow melting, the distribution of Northern Pocket Gophers in Study Area I was determined using dirt mounds (piles of soil pushed to the surface of the ground by pocket gophers). Because the animals' tunnel network may extend past the border delineated by the mounds (Proulx et al. 1995), boundaries delineated with dirt mounds were extended another 3 m to the outside. In Study Area II, Northern Pocket Gopher burrow systems were sparsely distributed across the alfalfa field and were not plotted on a map. Sites where Long-tailed Weasel tracks were recorded in the alfalfa field were visited in the spring and inspected for signs of Northern Pocket Gophers.

2000

One Long-tailed Weasel was followed four times in Study Area I from 4 to 31 January 2000, when temperatures ranged from -15°C to -5°C. A crust was present after 8 January, and tracking conditions were difficult. Although tracks were identical to those of the female studied the previous year, it is not sure that this was the same animal. Overlap between Long-tailed Weasel tracks and Northern Pocket Gopher burrow systems was determined using the presence of mounds, and the pocket gopher distribution map developed the previous year.

Results

Habitats

In 1998-1999, the female's movements encompassed an 8-ha area comprising approximately 1.3 km of the Vermilion River, and a continuous alfalfa field (Figure 1). Two dens were found at the interface of the riparian shelterbelt and the alfalfa field. The first one was located within the alfalfa field, 5 m from its edge, and it had three active openings in a Northern Pocket Gopher burrow system. The second den was located at the base of a rose (*Rosa* spp.) bush, in the grass-dominated riparian vegetation, 3 m from the edge of the alfalfa field. In 1999-2000, a Long-tailed Weasel was found within the same 8-ha area, with tracks leading to a den, in a coarse woody debris pile at the base of a large willow (Figure 1).

The male's movements encompassed an 18-ha area comprising approximately 1.2 km of the Vermilion River, and a continuous alfalfa field (Figure 2). Tracks led to consecutive holes in the river's bank, which may have been its den, near a Beaver (*Castor canadensis*) dam.

Straight-line movements

Straight-line movements were recorded in 1998-1999 when the female crossed from one side of the field to the other, at narrows (Figure 1). In 2000, a 43-m long straight-line movement into the field led to a digging site. The male crossed the field in a straight line to enter bush areas on either side of narrows, or to investigate the tracks of a smaller weasel (possibly *Mustela erminea*).

Sinuous movements

In 1998-1999, the female traveled in a sinuous way along the creek and the field's edge, investigating woody debris, ground openings, and boulders. Sinuous movements consisted of a series of zigzags with bends and turns approximately 30 cm on each side of an imaginary central line (Figure 3). Such movements were extensive along the field's edge and extended from one den to the other (Figure 1). In 2000, sinuous movements were recorded on the south side of the study area. The male Long-tailed Weasel also traveled all along the edges of the river and the field in a sinuous manner.

Arc movements

In November and December 1998, the female Long-tailed Weasel interrupted its continuous, sinuous movements along the riparian shelterbelt-field ecotone with pronounced arcs that extended into the alfalfa field (Figure 3). These arcs began and ended at the edge of the field. Seven arcs of various sizes were recorded (Figure 1). From the center of their base to the apex, they extended from 6 to 45 m into the field ($\bar{x}$ = 19.6 m, standard error = 5 m). The width at their base ranged from 0.6 to 28 m ($\bar{x}$ = 10.2 ± 4 m). Twenty-five Northern Pocket Gopher concentrations were found in the alfalfa field (Figure 1). Five (71%) of the seven Long-tailed Weasel arc movements overlapped Northern Pocket Gopher concentrations. Long-tailed Weasel tracks circled or crossed Northern Pocket Gopher mounds (Figure 4) and earth plugs (holes filled up with soil by pocket gophers returning from the surface to the underground tunnel of their burrow system).

Six male arc movements were recorded in 1998 (Figure 2). They extended from 5 to 52 m into the field ($\bar{x}$ = 14.8 ± 7.5 m). The width at their base ranged from 3 to 38 m ($\bar{x}$ = 12.5 ± 5.3 m). Three (50%) of the arc movements overlapped Northern Pocket Gopher burrow systems.

In 2000, 10 arc movements were recorded when tracking the Long-tailed Weasel in Study Area I (Figure 1). They extended from 6 to 20 m into the field (length $\bar{x}$: 11.2 ± 2 m; width $\bar{x}$: 6.8 ± 1 m). The Northern Pocket Gopher distribution had expanded considerably across the field since the previous year, and all arc movements overlapped burrow systems.

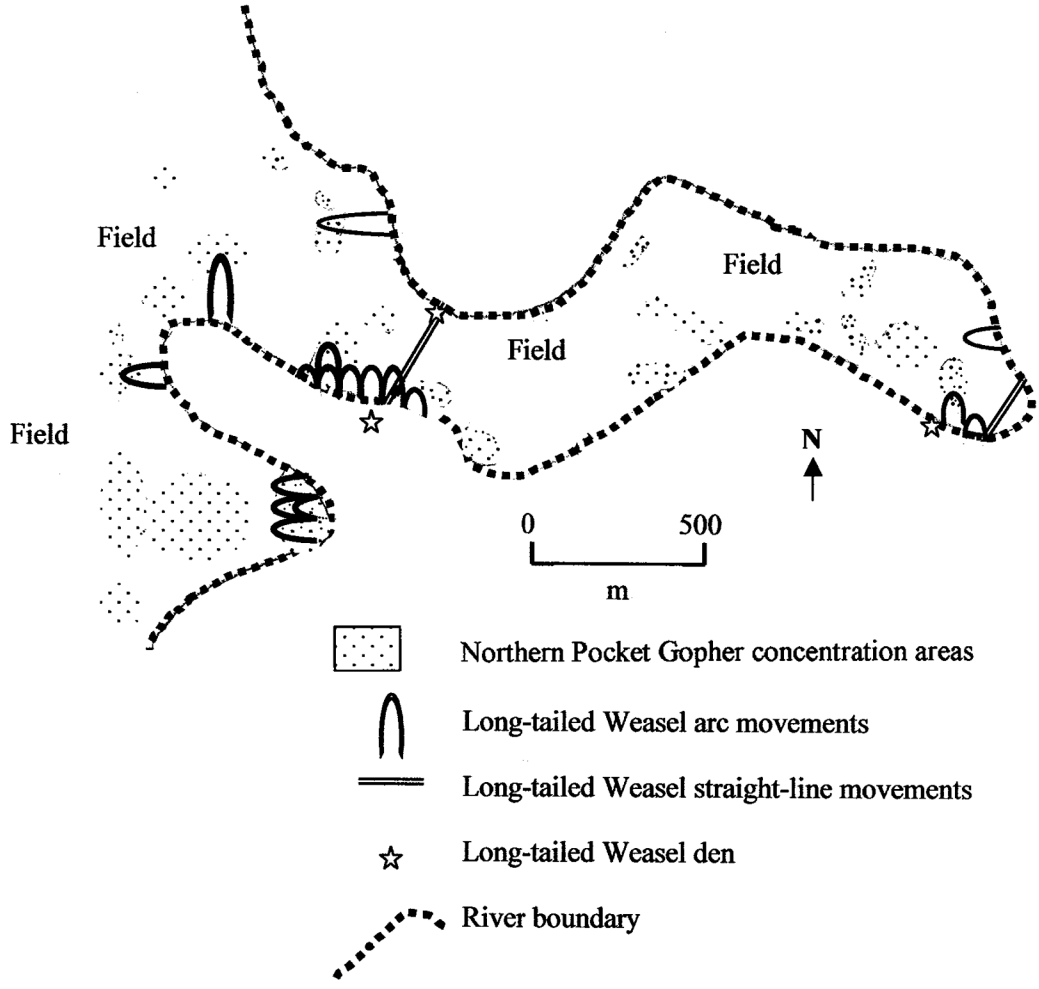

FIGURE 1. Dens and arc movements of Long-tailed Weasels in winters 1998-1999 and 2000 in Study Area I, Vermilion River, Vegreville, Alberta.

Diggings

Twenty fresh diggings by the female Long-tailed Weasel were flagged during the 1998 surveys, all in the alfalfa field and mostly along arc movements. Seventeen (85%) of them were in Northern Pocket Gopher burrow systems (Figure 4). The holes were still open when re-visited in April 1999.

Discussion

This study validated the hypothesis that Long-tailed Weasels investigated Northern Pocket Gopher burrow systems as they encountered them. However, encounters were not the result of random wanderings. Long-tailed Weasels left their line of travel along the field ecotone to enter the field and investigate it with arc movements of various lengths and widths that overlapped specific Northern Pocket Gopher concentrations. Peters (1978) and Powell (2000) suggested that carnivores had cognitive maps of where they live. Powell (1978, 1994) showed that the Fisher (*Martes pennanti*), another mustelid, did not use the space within its home range randomly. Powell documented cases where the Fisher crossed in straight-line areas of low prey availability, but spent more time investigating Porcupine (*Erethizon dorsatum*) winter dens. The arc movements recorded in this study suggest that Long-tailed Weasels also have a cognitive map of the distribution of potential preys. Long-tailed Weasel apparently directed their movements to active Northern Pocket Gopher burrow systems that they opened and entered. While Northern Pocket Gophers keep their burrow system closed from outside intruders (Witmer et al. 1999), the fact that the systems opened by the Long-tailed Weasels were not plugged back suggests that resident

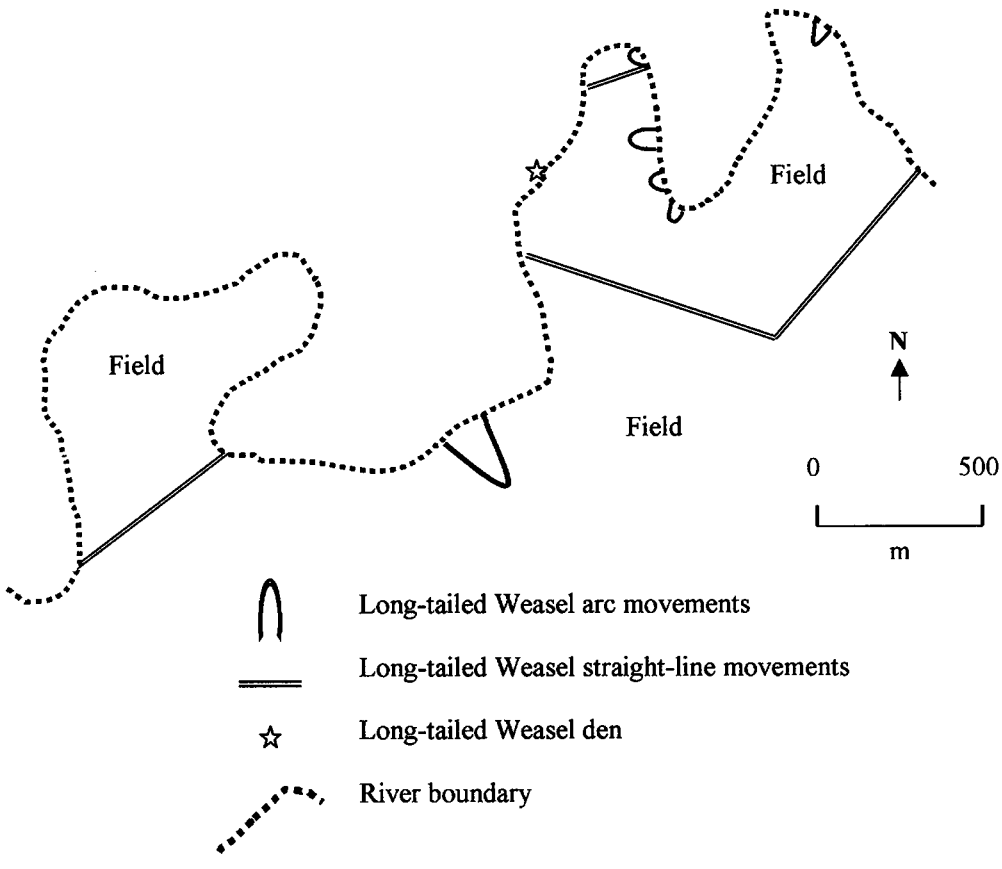

FIGURE 2. Arc movements and possible den of a male Long-tailed Weasel in winter1998-1999 in Study Area II, Vermilion River, Vegreville, Alberta.

Northern Pocket Gophers either abandoned their burrow system or more likely were killed by Long-tailed Weasels. Simms (1979) suggested that Long-tailed Weasels in western Canada preyed heavily on Northern Pocket Gophers. He estimated minimum passable tunnel diameter for average-sized male Long-tailed Weasels to be 4.3 cm, which is smaller than the minimum average diameter of 5.8 cm for tunnels of *Thomomys* spp. (Miller 1957; Bonar 1995*).

The sinuous movements of Long-tailed Weasels along riparian shelterbelts and field edges are in agreement with previous reports on the meandering nature of Long-tailed Weasel movements (Quick 1944; Wobeser 1966). Powell (1978) pointed out that weasel foraging behavior was characterized by frequent direction changes. Such movements would increase their chances to encounter small mammals, and might help avoiding predators (Powell 1978).

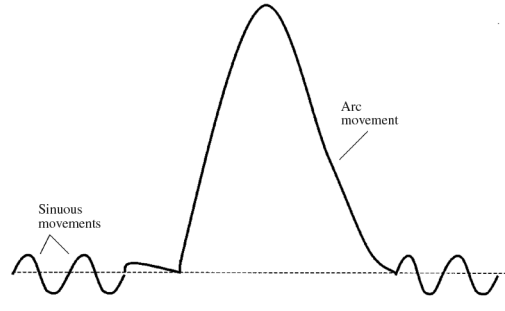

FIGURE 3. Schematic representation of Long-tailed Weasel sinuous and arc movements.

FIGURE 4. Snow-covered Northern Pocket Gopher mound opened (hole diameter: 5 cm) by a female Long-tailed Weasel in winter 1998-1999 in Study Area I, Vermilion River, Vegreville, Alberta.

Snowtracking is an advantageous technique as it allows one to study how Long-tailed Weasels use microenvironments. More snowtracking data should be gathered on Long-tailed Weasels in alfalfa fields to better understand their relationship with Northern Pocket Gophers. Unfortunately, the collection of such data is not an easy task. It is difficult to find alfalfa fields that are in proximity to water, and are inhabited by both species. On the other hand, a better understanding of the use of alfalfa fields and Northern Pocket Gopher populations by Long-tailed Weasels in a well-developed agricultural area such as central Alberta may be vital to ensure that this mustelid does not become threatened, as was feared a few decades ago (Gamble 1982*).

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