

An Addition to the Mammalian Fauna of Saskatchewan: The Western Harvest Mouse, *Reithrodontomys megalotis*

GILBERT PROULX and BENJAMIN P. PROULX

Alpha Wildlife Research & Management Ltd., 229 Lilac Terrace, Sherwood Park, Alberta T8H 1W3 Canada

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The Western Harvest Mouse (*Reithrodontomys megalotis*) is rare in Canada, and its distribution is believed to be restricted to south-central British Columbia and southeastern Alberta. Between 2008 and 2010, we identified Western Harvest Mouse hairs in 71 of 1424 scats (5%) of Red Fox (*Vulpes vulpes*), Coyote (*Canis latrans*), American Badger (*Taxidea taxus*), and Long-tailed Weasel (*Mustela frenata*) collected in southwestern Saskatchewan. The presence of Western Harvest Mouse was confirmed at the same latitude as populations reported in Alberta and British Columbia, in scats collected in or nearby grasslands. This is the first time that the presence of the Western Harvest Mouse has been confirmed in Saskatchewan.

Key Words: Western Harvest Mouse, *Reithrodontomys megalotis*, hair identification, Saskatchewan.

The current Canadian distribution of the Western Harvest Mouse (*Reithrodontomys megalotis*) is restricted to low-elevation grasslands in the southern Okanagan and Similkameen valleys of south-central British Columbia (*R. m. megalotis*) (Nagorsen 1995) and dry mixed grass prairie within the Canadian Forces Base Suffield National Wildlife Area (CFB Suffield) of southeastern Alberta (*R. m. dychei*) (Reynolds et al. 1999*) (Figure 1). The *dychei* subspecies of the Western Harvest Mouse is designated endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC); the *megalotis* subspecies is designated special concern (COSEWIC 2007*). Both are protected under the Species at Risk Act.

During a study of Richardson's Ground Squirrel (*Urocyon richardsonii*) populations in southwestern Saskatchewan between 2008 and 2010, we collected scats of Red Fox (*Vulpes vulpes*), Coyote (*Canis latrans*), American Badger (*Taxidea taxus*), and Long-tailed Weasel (*Mustela frenata*). This paper reports on the presence and frequency of Western Harvest Mouse hairs in the scats of these carnivores.

Methods

Between 2008 and 2010, we collected 1424 scats on privately owned lands in a region extending from Woodrow (49°41'N, 106°43'W) to Neville (49°57'N, 107°38'W) (Figure 1). The identification of scats was based on personal notes gathered in previous studies with animals in captivity and in the wild (e.g., Proulx and Barrett 1990; Proulx and Cole 1998; Proulx et al. 2009*), and on Murie (1975). Scats were dated, bagged, and kept frozen until they were processed. Scat analyses were conducted at the Alpha Wildlife Research & Management laboratory in Sherwood Park, Alberta. Canid and American Badger scats were soaked overnight in a mild water-bleach solution, washed through a sieve, and oven-dried at 75°C (R. T. Golightly, Hum-

boldt State University, personal communication, 2008). Long-tailed Weasel scats were only washed and oven-dried. Red Fox, Coyote, American Badger, and Long-tailed Weasel scats were collected during surveys of Richardson's Ground Squirrel burrows across fields in Mankota, Hazenmore, and Ponteix. Red Fox scats were also collected at 16 maternal dens between Woodrow and Neville.

The analysis of hairs from scats first involved the examination of cuticular scales, which constitute the surface pattern of the hair. Scale casts were made by squeezing hair between a microscope slide with a fresh acetone smear and a clean slide for approximately one minute to obtain an impregnation of the hair surface pattern. A three-dimensional view of the hair surface was also obtained by wiping the hair with methyl salicylate (Fisher Scientific, Fair Lawn, New Jersey). Casts and hair were examined with a compound light microscope.

Hairs briefly soaked in methyl salicylate were examined under microscope to identify medulla configuration in the basal area (the area of the hair shaft containing the root end) and the shield (the widened, flattened area located at various positions on the hair shaft) and to note the absence or presence of strictures (Moore et al. 1974). The medulla is the central portion of hairs which corresponds to a series of discrete cells or an amorphous spongy mass. The cells may be cornified and shrunken, with intercellular spaces filled with air (as in unbroken with cortical intrusions) (Moore et al. 1974). A stricture is a narrow region of the hair located adjacent to the shield region. It may correspond to a pronounced reduction in the hair shaft diameter, a change in medulla configurations, a change in scale pattern, or a pronounced localized bending causing the hair to appear angular. Microscopic views of hair scales and medullas were photographed with a Fujifilm FinePix F550EXR digital camera (Fujifilm Corporation, Tokyo, Japan).

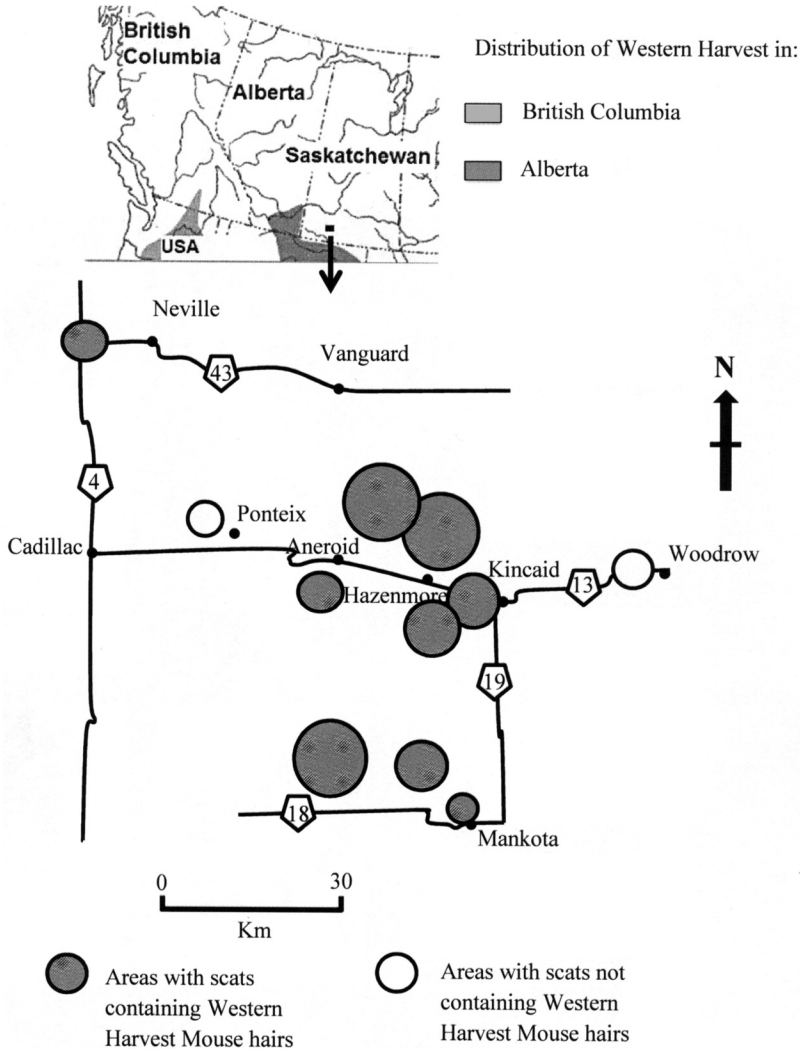
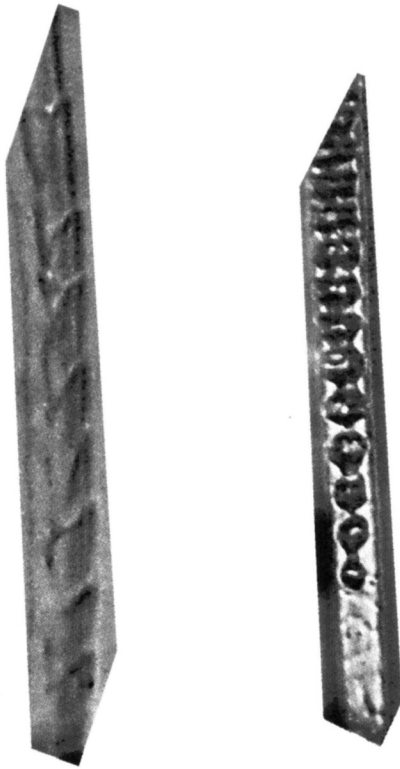


FIGURE 1. Distribution of the Western Harvest Mouse in British Columbia and Alberta (after COSEWIC 2007*) and in the study area in southwestern Saskatchewan where carnivore scats with Western Harvest Mouse hairs were collected, spring and summer, 2008 to 2010.

The identification of the Western Harvest Mouse hairs from scats was done using three different approaches. Hairs were first examined with a microscope, identified using the keys in Moore et al. (1974), and compared to photographs in Moore et al. (1974) and in Debelica and Thies (2009). Secondly, hair scales and medulla were compared to those of ventral, dorsal, and neck hairs of a female Western Harvest Mouse captured in July 1994 at CFB Suffield (specimen no. 95.8.60, 50°17'N, 110°37'W, Royal Alberta Museum, Edmonton, Alberta). Finally, hairs were identified through an elimination process by comparing them to hairs of species with similar scales or medullas. These species

included the Olive-backed Pocket Mouse (*Perognathus fasciatus*) (Royal Alberta Museum male specimen no. 01.16.10, 50°47'N, 110°25'W), the Northern Grasshopper Mouse (*Onychomys leucogaster*) (Royal Alberta Museum female specimen no. 95.8.70, 50°19'N, 110°40'W), the Northern Pocket Gopher (*Thomomys talpoides*) (Royal Alberta Museum female specimen 95.8.70, 50°19'N, 110°40'W), and the Bushy-tailed Woodrat (*Neotoma cinerea*) (Royal Alberta Museum male specimen no. 04.12.1, 50°38'N, 110°11'W). It is noteworthy to mention that the Bushy-tailed Woodrat is not believed to be present in the southwestern Saskatchewan study area (Bowers et al. 2004), and the



Petal scales

Basal medulla

FIGURE 2. Basal scales and medulla of Western Harvest Mouse hairs found in Red Fox scats, Hazenmore, 2010.

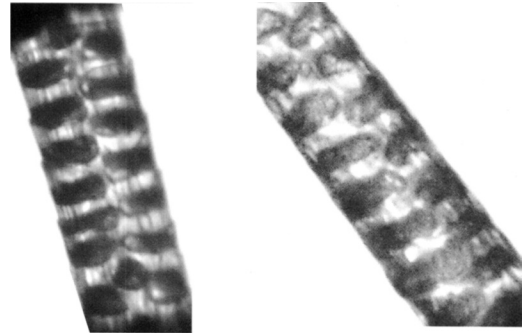
Northern Pocket Gopher is not well established in southwestern Saskatchewan (Provincial Council of Agriculture Development and Diversification Boards and the Sustainable Production Branch, Saskatchewan Agriculture and Food 2001*). Also, using Proulx's (2002) criteria to recognize the burrow systems of the Northern Pocket Gopher, we failed to find signs of this species during three consecutive years.

A sample of Western Harvest Mouse hairs from a Red Fox scat collected in Hazenmore was deposited in the Royal Alberta Museum.

Results

Identification using keys

Hairs from scats had a shield medulla without a multiserial (columns of cells) or uniserial ladder. The basal medulla was partly uniserial ladder, and one subshield stricture was present. The shield medulla was unbroken with cortical intrusions. Some hair had a colour band; the upper shaft was dark. According to the key in Moore



Nech hair - Museum sample

Hazenmore sample

FIGURE 3. Western Harvest Mouse hair shield medullas with cortical intrusions occurring in aggregations of two across in female specimen no. 95.8.70 from the Royal Alberta Museum and in a hair from a Red Fox scat, Hazenmore, 2010.

et al. (1974) for "mammal orders and families", the hairs belonged to "rodents."

The basal medulla did not correspond to an unbroken lattice. A subshield stricture was present. Hairs were charcoal grey and <24 mm long. Basal scales were overlapping like flower petals (Figure 2). According to the key in Moore et al. (1974) for "rodents," the hairs belonged to "native rats and mice."

The basal medulla did not have aggregations of three intrusions across, but rather began as a uniserial ladder immediately becoming unbroken with single cortical intrusions (Figure 2). The shield medulla was unbroken, with cortical intrusions occurring in aggregations of two or three across. According to the key in Moore et al. (1974) for "native rats and mice," the hairs belonged to "mice." Some hair samples were black (although Western Harvest Mouse also has banded hairs) and had a subshield stricture. They were identified as Western Harvest Mouse hairs. Photographs of the basal scales and medullas of hairs from scats matched those of Western Harvest Mouse published by Moore et al. (1974) and Debelica and Thies (2009). For undisputable evidence, however, the hairs were compared to museum specimen hairs.

Comparisons with museum specimen hairs

The hairs from scats had unbroken medullas with cortical intrusions in aggregations of two (Figure 3) and three (Figure 4) across that were identical to those of the hairs of the museum Western Harvest Mouse specimen. Their basal medullas also matched those of the hairs from the museum specimen (Figure 5). There is no doubt that the hairs from scats belonged to Western Harvest Mice.

Elimination process

The basal medullas of Western Harvest Mouse hairs from scats differed markedly from those of species

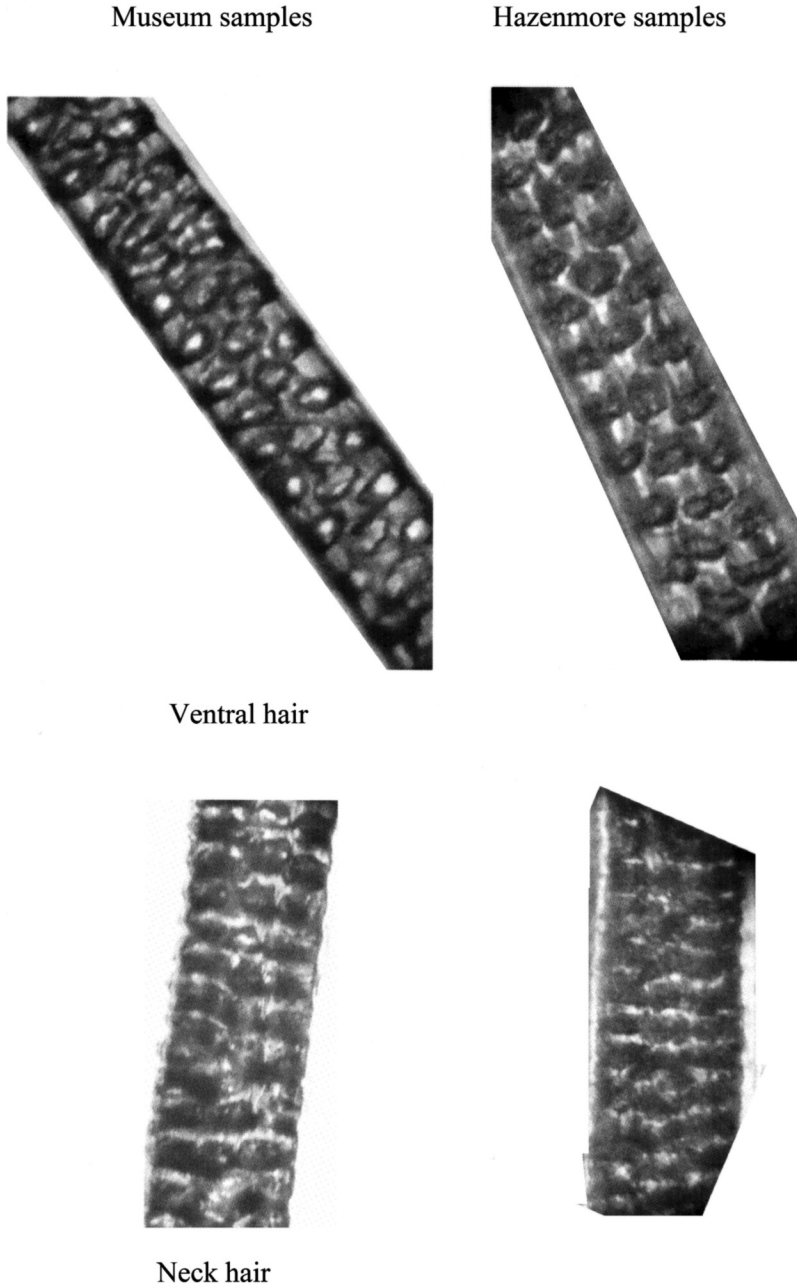


FIGURE 4. Western Harvest Mouse hair shield medullas with cortical intrusions occurring in aggregations of three across in female specimen no. 95.8.70 from the Royal Alberta Museum and in a hair from a Red Fox scat, Hazenmore, 2010.

with basal or shield medullas with cortical intrusions (Figure 5). The basal medulla of the hairs has a uniserial ladder at the beginning which gradually becomes unbroken with cortical intrusions (Figure 5). In contrast, the basal medulla of the Bushy-tailed Woodrat hair is unbroken with cortical intrusions usually in aggrega-

tions of three across (Figure 5). The basal medulla of the Northern Grasshopper Mouse corresponds to a thick, uniserial ladder (Figure 5) followed by stout single intrusions. The basal medulla of the Northern Pocket Gopher is a uniserial ladder at the beginning which immediately becomes unbroken with single cortical

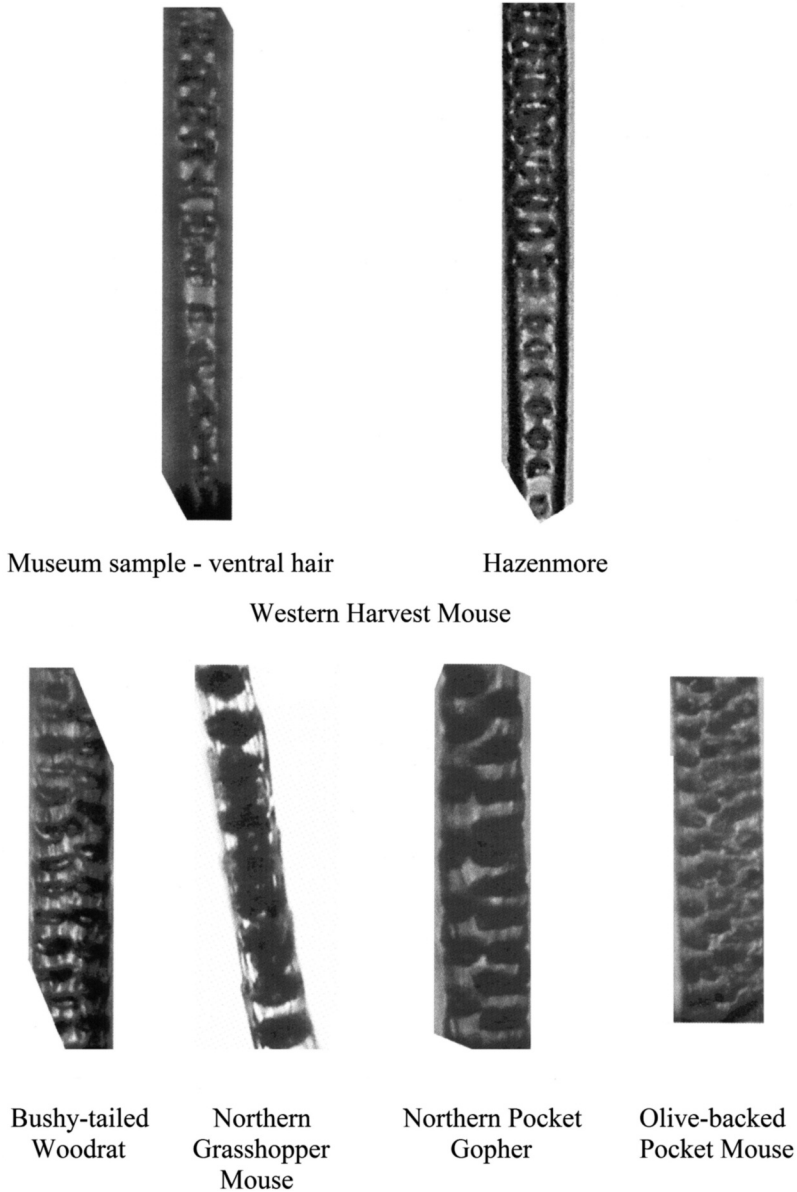


FIGURE 5. Basal medullas of Western Harvest Mouse hairs in female specimen no. 95.8.70 from the Royal Alberta Museum and in a hair from a Red Fox scat, Hazenmore, 2010, and in hairs from other rodents with similar hair characteristics: Bushy-tailed Woodrat (*Neotoma cinerea*), Royal Alberta Museum male specimen no. 04.12.1; Northern Grasshopper Mouse (*Onychomys leucogaster*), Royal Alberta Museum female specimen no. 95.8.70; Northern Pocket Gopher (*Thomomys talpoides*), Royal Alberta Museum female specimen 95.8.70; and Olive-backed Pocket Mouse (*Perognathus fasciatus*), Royal Alberta Museum male specimen no. 01.16.10.

intrusions distributed in a comb-like manner (Figure 5). The basal medulla of the Olive-backed Pocket Mouse is unbroken with cortical intrusions in aggregations of three or four across. It is noteworthy to mention that the

basal scales of the Olive-backed Pocket Mouse correspond to an irregular-waved mosaic with large lumpy scale edges on the hair surface that differ markedly from the basal scales of the Western Harvest Mouse.

TABLE 1. Number of Western Harvest Mouse (*Reithrodontomys megalotis*) hairs found in seats of Red Fox (*Vulpes vulpes*), Coyote (*Canis latrans*), American Badger (*Taxidea taxus*), and Long-tailed Weasel (*Mustela frenata*) collected in southwestern Saskatchewan in spring and summer 2008 to 2010, with frequency (%).

Period	Locations															
	Kincaid		Mankota		Hazenville		Aneroid		Ponteix		Vanguard		Woodrow		Neville	
	Hairs	Seats %	Hairs	Seats %	Hairs	Seats %	Hairs	Seats %	Hairs	Seats %	Hairs	Seats %	Hairs	Seats %	Hairs	Seats %
2008	3	41	7.3	2	41	4.9	-	-	-	-	-	-	-	-	-	-
2009	1	21	4.8	-	-	-	10	181	5.5	2	53	3.8	1	86	1.1	-
2010	-	-	-	-	-	-	24	197	12.2	-	-	-	1	14	7.1	3
Total	4	62	6.5	2	41	4.9	34	378	9.0	2	53	3.8	2	100	2.0	3
2008	-	-	-	3	22	13.6	0	21	0	0	7	0	0	7	0	-
2009	-	-	-	-	-	-	5	59	8.5	-	-	-	-	-	-	-
2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	3	22	13.6	5	80	6.3	-	-	-	0	7	0	-
2008	-	-	-	0	6	0	1	23	4.4	-	-	-	0	13	0	-
2009	-	-	-	-	-	-	0	2	0	-	-	-	0	7	0	-
2010	-	-	-	-	-	-	3	25	12.0	-	-	-	-	-	-	-
Total	-	-	-	0	6	0	4	48	8.3	-	-	-	0	20	0	-
2008	-	-	-	0	30	0	0	12	0	-	-	-	3	159	1.9	-
2009	-	-	-	-	-	-	0	11	0	-	-	-	1	6	16.7	-
2010	-	-	-	-	-	-	7	258	2.7	-	-	-	-	-	-	-
Total	-	-	-	0	30	0	7	281	2.5	-	-	-	4	165	2.4	-
Grand total	4	62	6.5	5	99	5.0	50	787	6.3	2	53	3.8	6	292	2.0	3

Distribution and frequency of scats containing Western Harvest Mouse hairs

Western Harvest Mouse hairs were found in 71 of 1424 scats (5%). Most Western Harvest Mouse hairs came from scats collected near Hazenmore, where a large number of scat samples were collected, but also from all surrounding areas except in two regions immediately west of Ponteix and Woodrow (Table 1). Western Harvest Mouse remains were relatively more frequent in scats of canids and the American Badger than in the scats of the Long-tailed Weasel (Table 1). Mesocarnivores, which have relatively larger home ranges, may find and consume more Western Harvest Mice. The presence of the Western Harvest Mouse was confirmed at the same latitude as populations reported in Alberta and British Columbia (Figure 1). Scats came mostly from dens and latrines located on abandoned estates and in or near fields with sand and sandy or clay loams with tall grass and shrubs.

Discussion

This study showed that the Western Harvest Mouse is undoubtedly present in southwestern Saskatchewan. The identification of hairs from scats was thorough. The hairs matched the ventral, dorsal, and neck hairs of a museum specimen, and matches occurred at all levels, i.e., colour, shape, scales, and basal and shield medullas. Also, these hairs could not be confused with those of other species that have medullas with cortical intrusions.

This is the first time that the presence of the Western Harvest Mouse has been confirmed in Saskatchewan despite extensive efforts in the last 15 years to find it during small mammal capture programs and owl pellet studies (R. Poulin, Royal Saskatchewan Museum, personal communication, 2011). This shows that the analysis of carnivore scats is a valuable approach to determining the presence of a relatively rare rodent such as the Western Harvest Mouse in the prairies. This is particularly true when one considers that success in live-trapping Western Harvest Mice may vary considerably from year to year in areas where it is known to occur (Heske et al. 1984; Reynolds et al. 1999*).

Sullivan and Sullivan (2008) suggested that the Western Harvest Mouse could persist among habitats of diverse quality through dispersal, which is generally <300 m (Clark et al. 1988; Skupski 1995). However, long-distance movements of 375–3200 m have been reported by Clark et al. (1988). In this study, Western Harvest Mouse hairs were found in scats that were collected at 15 different Red Fox dens, and in other locations that were usually less than 1 km apart from each other (Figure 1). Therefore, the Saskatchewan population should be ranked as S2S3 (imperiled to vulnerable, generally consisting of 6 to 100 occurrences) by the Nature Conservancy Data Centre, and it should be designated at least as special concern by COSEWIC, because the species is particularly sensitive to human

activities and natural events. Agricultural practices, including livestock grazing, are likely the greatest threats to the habitat of the Western Harvest Mouse, and the use of rodenticides is likely the greatest threat to the animals themselves (COSEWIC 2007*; Proulx 2010, 2011).

The confirmed presence of the Western Harvest Mouse in southwestern Saskatchewan warrants further research to delineate the limits of its distribution, identify habitats, and assess the resilience and persistence of populations inhabiting unprotected, private landscapes, where grasslands are highly fragmented by agricultural activities.

Acknowledgements

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