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Chapter 11

Fact or Fantasy? Damage to Livestock and Agricultural Machinery by American Badgers and Other Burrowing Mammals in British Columbia, Canada

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Abstract – *Taxidea taxus jeffersonii* is an endangered subspecies of the American badger that occurs in the southern interior of British Columbia, Canada, where its habitat overlaps with many agricultural operations. Activity of badgers and other burrowing mammals often are cited as sources of injury to livestock and damage to agricultural machinery. We conducted a telephone survey of 131 randomly selected cattle ranchers within the range of badgers in British Columbia to better document the frequency and extent of this purported damage. Of the ranchers who reported badgers occurring on their land, 66% believed that they were either beneficial or had no effect on their agricultural operations; 21% believed that they were detrimental; and the remainder (13%) had no opinion. Although damage to farm machinery by other burrowing mammals was frequently reported, burrows of badgers were

not conclusively linked to any damage. Injury to livestock as a result of animal burrows was reported less frequently than damage to machinery, of which 1 case was attributed to a badger burrow (1 of 131 respondents; <1%). A carefully designed extension program, making use of the body of existing badger information, data from this survey, and rancher testimonials, could help reduce the residual negative attitudes about badgers within British Columbia's agricultural community.

INTRODUCTION

American badgers (*Taxidea taxus*) are large-sized members of the Mustelidae and are highly specialized for digging (Messick 1987). Propensity of the badger for burrowing, either when foraging for prey or creating shelter, occasionally induces conflict with humans. Because of these burrowing habits, badgers occassionally are considered a minor pest to agricultural operations throughout their range (Minta and Marsh 1988).

Badgers may cause several types of damage in agricultural settings. Soil disturbance when foraging for prey can damage crops. Badgers also have been reported to damage water storage areas where burrowing destabilizes earthen dams, dykes, and levees (Minta and Marsh 1988). Similarly, burrows can damage building foundations and roads. Badgers infrequently prey on livestock, mostly poultry, but occasionally newborn lambs (Minta and Marsh 1988). Also, badgers have been observed injuring domestic dogs during confrontations (H. Davis, personal observations).

The most commonly reported concerns, however, are injuries to livestock such as horses and cattle that step into burrows, or damage to agricultural machinery. Researchers have cited these types of damage as the primary sources of discord arising from burrowing activity (e.g., Lindzey 1982, 1994; Minta and Marsh 1988). Many land and livestock owners view badgers and their prey as "pests" because of their burrows. The Wildlife Service of the Animal and Plant Health Inspection Service (USDA) performs routine culls of "problem badgers" in many states (Wildlife Services 1997, 1999). The fear of injury to livestock was the most frequently lodged complaint about badgers filed by landowners to the California Animal Damage Control (ADC) agency between 1978 and 1987, despite these injuries being very rare (Minta and Marsh 1988).

However, to our knowledge, no comprehensive survey has been completed that has assessed the frequency or extent of damage from badger burrows to livestock or agricultural equipment. Minta and Marsh (1988) summarized the management of badger damage in California from 1978 to 1987. During this 10-year period, over 1,700 badgers were destroyed by the ADC because of concerns about damage. However, they were unable to assess the frequency with which this type of damage occurred.

The subspecies *Taxidea t. jeffersonii* that occurs in British Columbia (BC) is considered federally endangered (Committee on the Status of Endangered Wildlife in Canada, COSEWIC, 2013), but negative perceptions by landowners of effects of burrowing may hamper support for recovery. Lack of data about the effects of badger activity on livestock and machinery necessitates an assessment of the threats burrows actually pose to agricultural operations.

Our objective was to determine whether badger burrows are a significant cause of damage

to farm machinery or livestock injury. We interviewed livestock managers and farmers to assess the frequency and extent of damage perceived to be caused by burrows. Results of this project may promote education to decrease persecution of badgers, allow examination of the actual threats posed by burrows, and foster work with landowners and land managers to develop strategies to minimize problems.

METHODS

Our survey targeted ranchers with livestock operations within the range of badgers in British Columbia. We were unable to obtain contact information for all livestock operators because of privacy constraints, but we obtained mailing addresses for 590 individuals that held range tenures on Crown (public) lands for 2002 (Figure 1). Because the majority of cattle ranches likely also hold Crown land range tenures, we assumed that the sample of range tenure holders represented an unbiased sample of relevant operators. Starting with a random number between 1 and 5, we selected the first name from our sample population, and then chose every fifth name thereafter. Telephone numbers were obtained by a manual search using directory services. We conducted the telephone survey between 29 February and 13 March 2004.

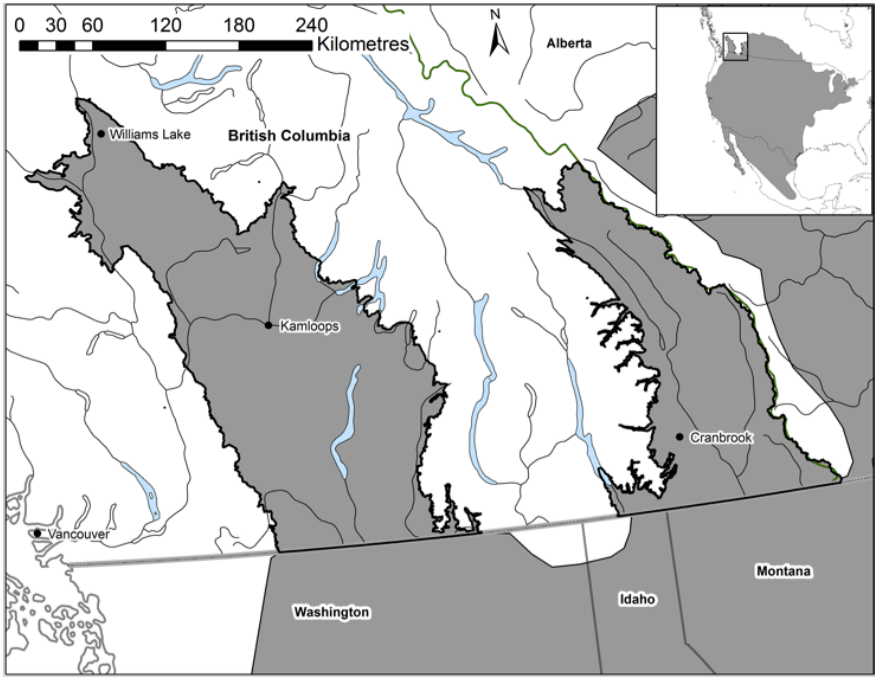

Figure 1. Distribution of American badgers (*Taxidea taxus jeffersonii*) in British Columbia (dark line), Canada from which a random systematic sample of Crown range tenure holders were selected for survey. Inset shows survey area within the range of American badgers.

We asked questions about all burrowing animals to gauge the perceptions of damage caused by badgers relative to that of other burrowing species. Accordingly, the survey tool contained separate questions regarding damage caused by badgers, Columbian ground squirrels (*Urocitellus columbianus*), northern pocket gophers (*Thomomys talpoides*), and yellow-bellied marmots (*Marmota flaviventris*). The questions focused on lands owned or leased during the previous 5 years and excluded Crown range tenures. Specific sections of the survey were designed to evaluate the prevalence of each species of burrowing animal, the types and extent of damage to equipment and livestock caused by burrowing animals, methods by which the rancher managed damage caused by burrowing, and information about the size and type of agricultural operation.

RESULTS

We contacted 174 range-tenure holders with ranches from throughout the range of badgers in BC. Of these, 131 ranchers (75%) participated in the study, which represented approximately 22% of the population of range-tenure holders in this area. Most ranches (95%) were ≥20.2 ha (50 ac) in size and had ≥30 head of cattle (82%). Ranches had been operating under the current ownership between 2 and 150 years, with 50% of respondents having been in operation between 20 and 55 years (median = 30 years).

Burrowing animals

Burrowing animals were reported on 90% of the surveyed ranches ($n = 131$). Columbian ground squirrels were the most common burrowing species, reported as being present by 63% of ranchers. Pocket gophers (59%) and yellow-bellied marmots (56%) also were common. Badgers were relatively uncommon; only 33% of respondents reported badgers on their ranches during the previous 5 years.

Ranchers had varying perspectives on the effects that each species of burrowing animal had on their operations (Figure 2). Most ranchers considered Columbian ground squirrels and northern pocket gophers to be detrimental to their ranching operations (79% and 72% of respondents, respectively), whereas half considered yellow-bellied marmots to either have no effect or be beneficial and 46% considered them to be detrimental. Interestingly, almost half of the ranchers surveyed (48%) believed that badgers were beneficial to their operations, whereas 21% believed that badgers were detrimental.

The perceived abundances of these species also varied among ranchers (Figure 3). Most ranchers observed more than 50 Columbian ground-squirrels and 20 yellow-bellied marmots and also had considerable densities of sign of northern pocket gophers each year on their property. Most ranchers saw badgers very infrequently on their property; usually only 1 badger sighting every 2–3 years. Of 35 ranchers that responded to further questions about badgers, 17 (49%) responded that the number of badgers that they encountered on their property in the previous 5 years had not changed, 13 (37%) responded that numbers had gone down, and 5 (15%) responded that badger numbers had increased.

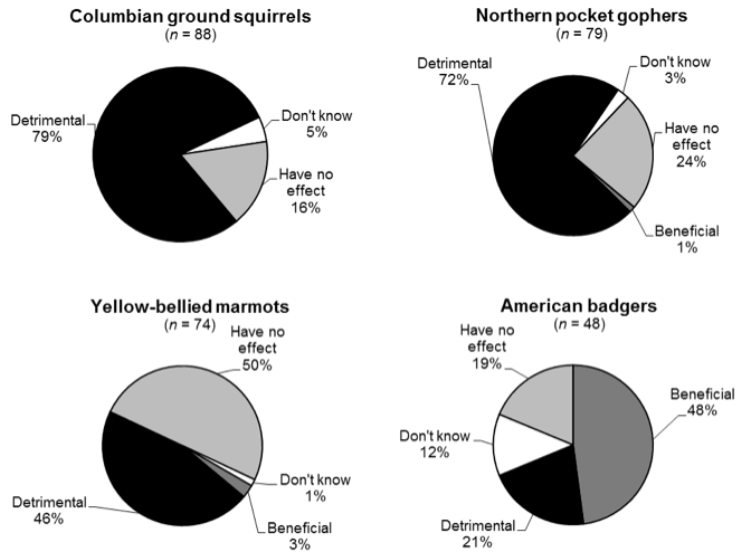

Figure 2. Perceptions of surveyed ranchers regarding the effects of Columbian ground squirrels (*Urocitellus columbianus*), northern pocket gophers (*Thomomys talpoides*), yellow-bellied marmots (*Marmota flaviventris*), and American badgers on their ranching operations in British Columbia.

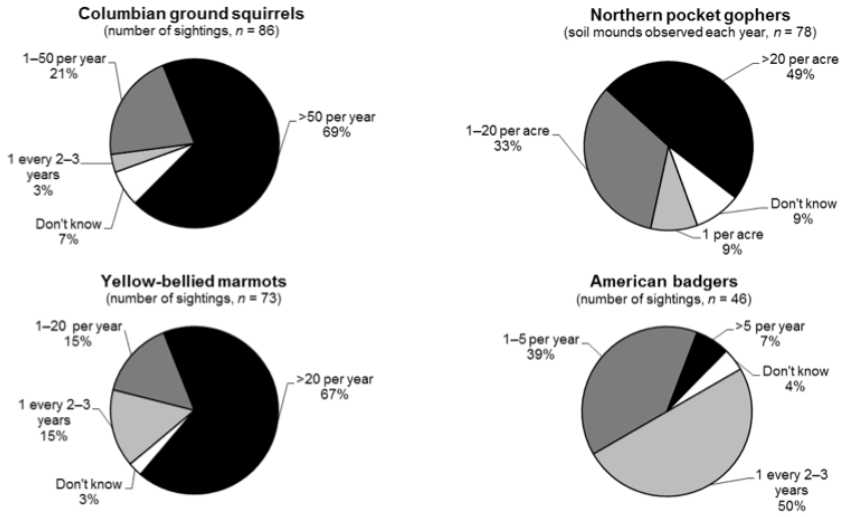

Figure 3. Approximate abundances of Columbian ground squirrels, northern pocket gophers, yellow-bellied marmots, and American badgers estimated by ranchers on their lands in the range of badgers in British Columbia.

Damage to machinery and livestock

Just over half of the respondents (56%, $n = 131$) experienced damage to some aspect of their agricultural operation caused by burrowing animals during the previous 5 years. Machinery damage was most commonly reported; 53% of ranchers had experienced farm equipment damage, although only 51 of the 70 respondents provided details. Of these, 46 reported damage to grass swathers, 10 damage to balers, 10 to miscellaneous equipment, 3 to tractors, and 1 to a truck. Rodent burrows were the primary cause of damage to farm equipment, accounting for all but 2 instances of equipment damage (for which the respondent was unsure of the source of the burrow). Badgers were not reported to be the cause of any damage to equipment. Damage to swathers primarily was to the cutting tines, which resulted not only in monetary costs but delays in production, largely because operators had to adjust their speed and cutting height of the swather when operating in fields with burrows. Damage to balers was primarily through soil being mixed in with hay and dulling the cutter knives. Soil in the hay also negatively affected hay quality. Damage to vehicles (i.e., tractors and trucks) was primarily through increased wear and tear.

Livestock injuries were reported much less commonly than damage to machinery, with 16% of respondents reporting injuries resulting from burrows during the previous 5 years. Of 24 cases of livestock injury, 19 were the result of rodent burrows (Table 1). Four respondents were unsure of the cause of their respective livestock injuries. Among 131 respondents, badger burrows caused 1 livestock injury (0.76% of respondents). Fourteen of the 24 cases of animal injury involved horses, 9 involved cattle, and 1 involved unidentified livestock.

Table 1. Frequency of documented injury to livestock from animal burrows reported by cattle ranchers during the previous 5 years from throughout the range of American badgers (*Taxidea taxus jeffersonii*) in British Columbia. $n = 24$ respondents.

Livestock species	Rodent burrow	Badger burrow	Unknown burrow
Cattle	7	0	2
Horse	12	1	1
Other[a]	0	0	1

[a] Sheep, goats, and unidentified species

Injuries to livestock from all types of burrows usually occurred when they were being ridden or driven, but some injuries occurred during unmonitored activities. For the 11 instances of injury to horses that the respondent recalled, treatment involved nothing specific (i.e., letting the injury heal on its own; 7 cases), treatment by veterinarian (1 case), and euthanasia (3 cases). The 1 incident of a horse being injured in a badger burrow resulted in euthanasia. Aside from the cases of euthanasia and unreported outcomes, 3 horses made a full recovery and 2 horses made partial recoveries. Injury to cattle occurred when they were grazing (5 cases), travelling between areas (1 case), on pasture (1 case); 2 injuries occurred during unmonitored activities. Of the 9 cases of injury to cattle, treatment included letting the injury heal on its own (5 cases), treatment by the rancher (2 cases), and euthanasia (2 cases).

Perceptions about badgers

Most ranchers had positive attitudes towards badgers and concern among ranchers about damage caused by badger burrows was generally not common (Figure 4). Many respondents were "not concerned" about damage to either machinery or livestock caused by badger burrows (71% and 72%, respectively). Only 14% of respondents were either "concerned" or "very concerned" about damage to machinery, and 16% were "concerned" or "very concerned" about damage to livestock.

The characteristics of ranchers who had negative perceptions about badgers (i.e., either considered badgers "detrimental" or were "concerned" or "very concerned" about damage) were not easily identified. The size of ranch seemed to affect the negative views of badgers by ranchers (Chi-square test of independence, $\chi^2 = 12.2$, $df = 3$, $p = 0.002$), with ranchers with mid-sized land holdings (i.e., 20.2–202.3 ha [50–500 ac]) being more likely to have negative views of badgers compared to other-sized ranches (Bonferroni-adjusted z-test, $p < 0.05$; Figure 5). Our analysis also suggested that ranchers with larger cattle herds had more negative attitudes towards badgers than those with smaller herds, but the relationship was not significant at $\alpha = 0.05$ ($\chi^2 = 12.2$, $df = 3, p = 0.07$). There were no substantial differences in the median number of years ranching for those respondents with negative views of badgers (median = 37 years, $n = 16$) compared to those who had positive views (median = 40 years, $n = 47$). Respondents with neutral views of badgers generally had been ranching for shorter periods (median = 23.5 years, $n = 14$). Of those 16 respondents that were concerned about damage to either equipment or livestock, 7 reported badgers on their property during the previous 5 years.

Management of burrowing animals

Respondents used a variety of lethal and non-lethal methods to manage damage caused by burrowing animals. Lethal management was used for rodents much more commonly than non-lethal methods. Of 114 respondents that managed for rodent damage, 52% used shooting, 27% poison baits, 23% traps, and 8% gas delivered to burrow systems. Non-lethal management for rodents included ignoring them (19% of respondents), harassment (11%), predator enhancement (8%), and changing crops (7%). For badgers, however, the vast majority of respondents simply ignored the species or filled in their holes (98%; 45 of 46 respondents). Only 1 respondent (2%) indicated that they would shoot badgers that occupied certain fields on their ranch.

DISCUSSION

Our survey found that damage caused by badgers to either equipment or livestock was exceedingly rare in BC (<1% of respondents). Conversely, burrowing rodents caused frequent damage (56% of respondents). Although the risk to ranchers in BC was apparently low, 14% and 16% of respondents were "concerned" or "very concerned", respectively, about damage to equipment and livestock, from badger burrows. Twenty-one percent of respondents also viewed badgers as being "detrimental" to their operations. The low rates of damage may be partly related to the relatively low density of badgers in the northwestern portion of the species range compared to elsewhere.

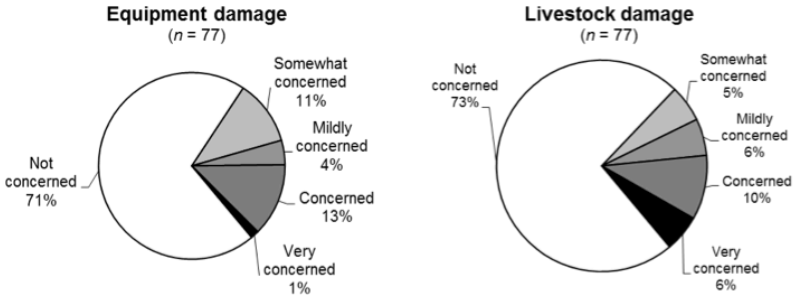

Figure 4. Levels of concern about damage from American badger burrows to farm equipment and livestock in the range of badgers in British Columbia.

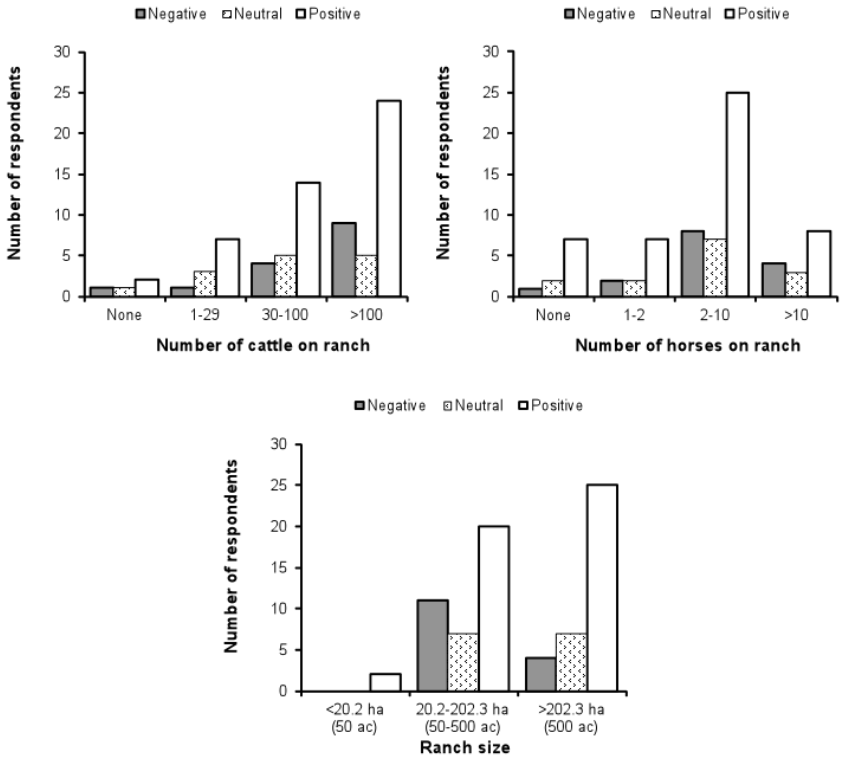

Figure 5. Frequencies with which ranchers viewed badgers negatively (i.e., "detrimental", "concerned" or "very concerned"), positively (i.e., "beneficial", "not concerned"), or neutrally (i.e., "have no effect", "mildly concerned", or "somewhat concerned") in British Columbia. Sample sizes for each type of respondent are noted.

Machinery damage

The rarity of damage to equipment from badger burrows may be due in large part to the nature of the areas in which badgers burrow in BC. Weir *et al*. (2003) noted that 90% of badger burrows in the Thompson region of BC occurred at sites with >7% slope and that badgers rarely burrowed into flat ground. This relationship with using slopes for burrowing may be because soil is more easily evacuated on slopes or the soils are better drained, as has been observed with European badgers (*Meles meles*; e.g., Do Linh San 2003). Because most machinery is used on flat ground, it is unlikely that operators would encounter badger burrows during normal activities. We believe that the risk to farm equipment from badger burrows in BC appears to be minimal. Burrowing activity of rodents, however, caused extensive damage to farm machinery, perhaps because these species are more likely to burrow in areas in which machinery is operated.

Livestock injury

The paucity of badgers in BC likely played a role in the low level of livestock injury caused by badgers. Combined badger population estimates for Alberta, Saskatchewan, and Manitoba range between 16,700 and 33,900 individuals (Newhouse and Kinley 2000; Scobie 2002), with approximately 75% of those occurring in Saskatchewan. Comparing this with the estimate of <350 adults in BC (COSEWIC 2013), we anticipate that injury rates should be lower in BC than elsewhere.

Horses may be more prone to injury than cattle. Legs of horses are more fragile than those of cattle, so serious injury (e.g., fractures) may occur more often to horses that step into badger burrows. Minta and Marsh (1988) speculated that cattle are much less prone to injury from badger burrows because they move slowly, whereas horses often move quickly over unfamiliar ground, which may increase their risk of injury. Horses also may be more susceptible to badger burrows when being ridden because they are distracted by the rider. Similarly, pasture-breeding bulls may be at higher risk due to distraction. Calves also may be at greater risk due to their small size relative to badger burrows. However, the risk to livestock from badger burrows is likely minimal, particularly when compared to other sources of injury, such as fences (R. Weir, personal observation). The disproportionate vulnerability of horses to injury in burrows relative to cattle may explain our observation of the equivalent number of cattle and horses injuries, despite the much greater abundance of cattle on ranches.

It is useful to compare our observed rates of machinery damage and livestock injury data with equivalent European research. Although very different in many respects from American badgers, European badgers are fossorial mustelids that occurs in many areas used for livestock ranching. In a survey of damage caused by European badgers on farms in the United Kingdom, Moore *et al*. (1999) determined that injuries to livestock and damage to machinery occur relatively infrequently (1.7% and 2.7% of survey respondents, respectively), considering the high abundance of European badgers in their survey area. However, European badgers may not dig as many widely spaced burrows as American badgers (Long and Killingley 1983), so conflict may be less likely. Nonetheless, our survey suggests that damage to equipment and livestock caused by American badgers is much less common in BC than similar damage caused by European badgers in some areas of the United Kingdom.

Rancher perceptions

The majority of respondents considered badgers to be either beneficial or to have no effect on their ranching operations. Also, most ranchers dealt with badger burrows by simply ignoring them or filling them. A minority of ranchers believed that badgers were detrimental to their operations or were a cause for concern. Those types of ranchers generally owned more horses on smaller parcels of land.

The concern expressed by ranchers about badger burrows may be more closely linked to their concern about burrows in general. Damage from other burrowing animals was common and ranchers may have experienced considerable amounts of this type of damage. Thus, some ranchers may perceive all burrowing animals to be a source of damage and not consider badgers to be any less of a risk to their operations than other, more damage-causing, species. Further surveys could examine the source of these negative perceptions about badgers.

Survey limitations

The voluntary nature of participation in the survey may have implications for the responses that we collected. The 25% of ranchers that were contacted and who did not participate in the survey may have had experiences and perceptions that were different from participating ranchers. Ranchers that are wary of any documentation of badgers on their ranches may not have wished to participate in the survey, despite that the survey was introduced to them as one about burrowing animals in general. In addition, because the survey was being conducted for a government agency, some ranchers were unwilling to participate because of ongoing conflicts with this agency.

Our survey population was probably not an unbiased sample of all cattle ranchers within the range of badgers in BC. We limited the survey to the immediately available list of range tenure holders. Not all cattle ranchers hold Crown tenure permits, so some ranches have not been included in our survey population. Large cattle operations are probably more likely to have Crown tenure permits than smaller operations, so our sample was probably biased towards these larger operations. Because the attitudes and pest management practices of smaller operations may not be the same as those of large ranchers, our results may not reflect those of all cattle ranchers or those of "hobby farmers" throughout the range of badgers in BC.

MANAGEMENT AND CONSERVATION IMPLICATIONS

Ranchers attitudes about badgers were generally positive and negative attitudes may have been due to perception or lack of knowledge about badger ecology. We believe that a carefully designed extension program, making use of the body of existing badger information, data from this survey, and rancher testimonials, could help reduce the residual negative attitudes about badgers within BC's agricultural community. Although damage to machinery represents a potential financial loss to ranchers, injury to livestock (particularly horses) could represent considerable losses of time and personal investment. It is perhaps the perceived risk to livestock, however low, that is the most difficult barrier to overcome to improve perspectives about badgers and their burrows. An effective extension program should help ranchers differentiating among different types of burrows (i.e., badger versus rodent burrows)

to help them better identify sources of damage and allow them to better manage burrowing rodents. Specifically, extension material should be targeted to mid-size landowners (20.2–202.3 ha [50–500 ac]), as this group was more likely to have negative perceptions of badgers. Future research should attempt to quantify the positive effects of badgers on controlling prey populations because this information would be helpful in promoting badgers as effective rodent control agents.

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