

# PERCEPTIONS OF MOOSE-HUMAN CONFLICTS IN AN URBAN ENVIRONMENT

Alaina Marie H. McDonald<sup>1</sup>, Roy V. Rea<sup>1</sup>, and Gayle Hesse<sup>2</sup>

<sup>1</sup>Ecosystem Science and Management, University of Northern British Columbia, 3333 University Way, Prince George, British Columbia, Canada, V2N 4Z9; <sup>2</sup>Wildlife Collision Prevention Program, British Columbia Conservation Foundation, 4155 Montgomery Crescent, Prince George, British Columbia, Canada, V2K 2E4.

**ABSTRACT:** Urban expansion produces obvious and deleterious ecological effects on wildlife habitat. Land development plans continue to be approved in Prince George, British Columbia, both within and on proximate land that is occupied by moose (*Alces alces*). We surveyed 100 residents of Prince George to determine how they perceive potential conflicts with moose and compared those perceptions with available local data. The majority (~75%) indicated that there were <50 moose-human encounters within Prince George in any given year; however, 222 moose-related reports occurred from April 2007-March 2008. This discrepancy indicates that the public probably underestimates both the presence of moose and moose-human conflicts in Prince George. We did not find that outdoor enthusiasts were more knowledgeable than others about managing moose-human conflicts, suggesting that broad public education and awareness programs are warranted. Understanding how to respond to moose and developing a “Moose Aware” program were two suggested strategies to reduce conflict. The vast majority of residents (92%) enjoy moose and want moose to remain part of the Prince George environment; only 9% were in favour of euthanasia or sharp-shooting to resolve conflicts. Because 40% indicated that the best option was leaving moose alone, managers will need to develop more effective strategies to minimize and manage moose-human conflicts.

ALCES VOL. 48: 123-130 (2012)

**Key words:** *Alces alces*, conflict, development, moose, urban, wildlife interaction.

---

As human populations increase globally, urban/suburban expansion and sprawl increasingly occurs in adjacent landscapes. Such development has an obvious and deleterious effect on ecological systems connected to the land base under development (Marcotullio 2003), including impacts on local hydrology, habitat, and migratory routes. Development activities such as land clearing, road building, and lot development impact large charismatic megafauna including cougars (*Puma concolor*), deer (*Odocoileus* spp.), and moose (*Alces alces*) that often have established home ranges at the urban-rural interface (Whittaker et al. 2001, Lopez et al. 2004). Further, development and sprawl increase the probability of human-wildlife interactions, which in turn can desensitize wildlife to humans, and vice

versa. Such desensitization can facilitate behaviour in both humans and wildlife that leads to increased human-wildlife conflict. Understanding both causes and human perceptions associated with human-wildlife interactions will provide better management of the inevitable conflicts that arise.

Although current economic conditions have temporarily slowed development within the city of Prince George (British Columbia, Canada; 53°53'06" N 122°46'35"), development continues as does approval of future development both within and at the outskirts of the city where moose are common and well-established. As part of a larger project to design a Human-Moose Conflict Prevention Strategy (funded by the British Columbia Real Estate Foundation) for areas undergoing land

development in and around Prince George, we surveyed a portion of the city residents. Our objective was to determine how residents perceive potential conflicts with moose and to compare their perceptions with local information about moose-human conflicts. Ultimately, we hoped to identify misconceptions about moose behaviour and habitat use to aid the development of effective guidelines to address local human-moose interactions.

## METHODS

We developed a 23-question survey that was pre-tested with 6 undergraduates and 2 instructors, and approved by the University of Northern British Columbia Research Ethics Board in summer 2008. It focused on residents' perceptions of behaviour and movement patterns by urban moose, and management options for mitigating moose-human conflicts. The survey questions were posed in a variety of closed- and opened-ended formats (i.e., yes/no, fill in the blank, short answers).

The survey included demographic questions such as respondent address, and whether they hunted, enjoyed seeing moose in the city, considered themselves an outdoor enthusiast, and were confident in their reaction if encountering a moose. We asked where and when people were most likely to see moose, if they had previous encounters with moose and what type, and what types of encounters they considered most dangerous. There were general questions about moose biology and ecology such as why they thought moose were in urban and suburban areas and when different age and sex classes were most dangerous. Questions concerning moose-human conflicts addressed mitigation, reporting procedures, and current management strategies. Finally, we asked if areas that moose utilize within city limits should be converted to less attractive habitat.

We conducted the survey twice during August 2008 – once at a local farmer's market and once at a large shopping center – from

manned booths with signage describing the research. City residents 18 years of age or older showing interest in the survey were encouraged to participate; a total of 100 surveys were completed. Results were analyzed by comparing neighbourhoods (address), hunters versus non-hunters, and whether respondents were outdoor enthusiasts. We used simple descriptive statistics to compare survey responses with local data on moose-human interactions/conflicts.

## RESULTS

Respondents lived throughout the city and surrounding area. The largest group (38%) resided in the main residential area (Bowl) of Prince George, 12% in the College Heights subdivision (southwest portion of town), and 16% in the Hart subdivision north of town (Fig. 1); 24% lived in peri-urban or outskirts developments and commuted daily into the city. The vast majority (83%) were outdoor enthusiasts and 27% were hunters.

The majority (85%) considered their neighbourhood accessible to moose; 14 of 15 responding "no" lived in the Bowl. Only 20% had experienced a moose encounter (including vehicular collisions). Moose were observed mostly in morning (54%) and evening (50%), and less often during afternoon (14%) and night (11%). The observation rate was somewhat consistent in fall (44%), spring (37%), and winter (34%); it was much lower in summer (11%). Mature male moose in fall (52%) and mature female moose in spring (62%) were perceived as most dangerous. The majority (61%) believed that they knew how to react if confronted by a moose (Table 1).

Respondents were allowed multiple selections on certain questions concerning encounters; therefore,  $n = 232$  responses. Defense of young (36%), fear (23%), and self-defense (24%) were the primary reasons listed for why moose attack humans. People were most concerned about moose-vehicle collisions (65%) and moose-children interactions

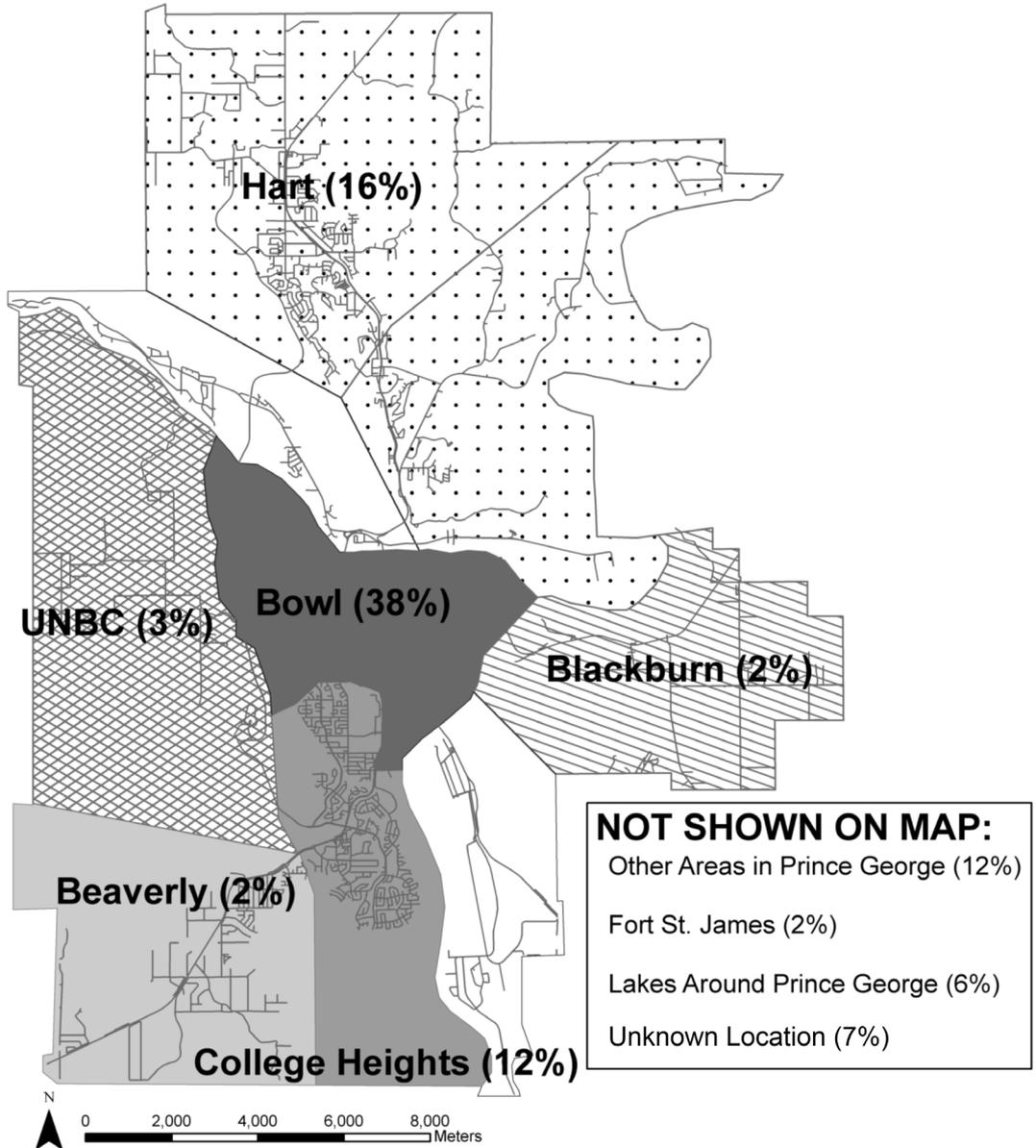


Fig. 1. Neighborhoods and proportion of respondents participating in an urban moose survey in Prince George, British Columbia, August 2008.

(58%); less concern existed about recreational interactions, property damage, and interactions with pets (Fig. 2). The majority (75%) thought that all moose-human interactions should be reported, but 45% indicated that they would not use a reporting database; about half were satisfied with management of moose-human conflicts, but nearly one-quarter were unsure (Table 1). The vast majority (92%) enjoyed

seeing moose versus supporting that moose should be kept outside the city limits; 73% believed that moose habitat should be maintained within the city, and conversely, 14% believed it should be removed or made less attractive.

There was little consistency in the number of perceived moose encounters as similar proportional estimates (12-15% of

Table 1. Responses about safety and management of moose-human conflicts by residents of Prince George, British Columbia participating in an urban moose survey, August 2008.

Question	Yes	No	Unsure	Blank
Do you know how to react to a moose?	61	25	10	2
Should all moose-human interactions be reported?	22	74	1	2
If there was a database to report moose human interactions would you use it?	53	45	1	1
Are you satisfied with how moose-human conflicts are currently addressed in Prince George?	56	19	22	1

respondents) existed for 0-5 through 31-40 annual encounters; however, about one quarter perceived 50+ annual encounters (Fig. 3a). More hunters (33%) than non-hunters (21%) estimated 50+ encounters; conversely, more non-hunters (42%) than hunters (22%) estimated <20 annual encounters. About half of the respondents observed moose 1-4 times annually within the city limits (Fig. 3b); 30% of hunters, versus 7% of non-hunters, saw ≥10 moose annually. Respondents associated moose presence within the city with habitat alteration related to development and logging (27%), food availability (24%; Fig. 4), availability of road salt (18%), and use of green spaces and parks as travel corridors (15%);

refuge from predators (5%) was not ranked highly (Fig. 5).

The 2 most common suggestions to alleviate moose-human conflicts were to reduce attractants such as shrubs/forage (45%), and to tranquilize and translocate moose (15%); interestingly, 37% indicated that no action was appropriate. Other suggestions included creating educational programs about encounters, providing public information about moose habitat and land development, establishing warning signs, building under-/overpasses, adjusting speed limits in collision hotspots, and creating moose habitat outside the city.

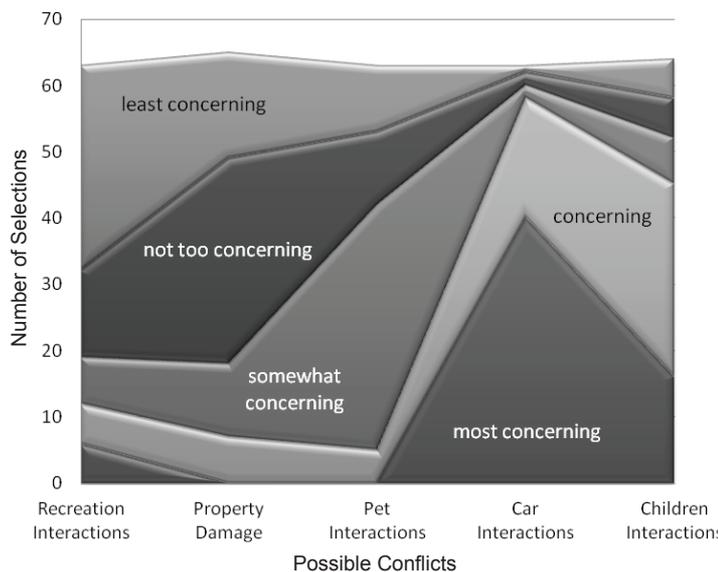


Fig. 2. The relative degree of concern associated with potential moose-human conflicts as measured in an urban moose survey of residents of Prince George, British Columbia, August 2008.

**DISCUSSION**

**Respondent experiences**

Our respondents either lived in (76%) or around (24%) Prince George with 85% acknowledging the possibility of a moose encounter within the city limits and/or on their own property. Only those living in the Bowl felt it improbable that they would encounter moose near their home, and this was corroborated by the fact that only 1 newspaper report cited an encounter within the Bowl from 1998-2008 (R.V. Rea, unpublished data).

Prince George residents had a reasonable understanding of moose behaviour as most indicated that a mature

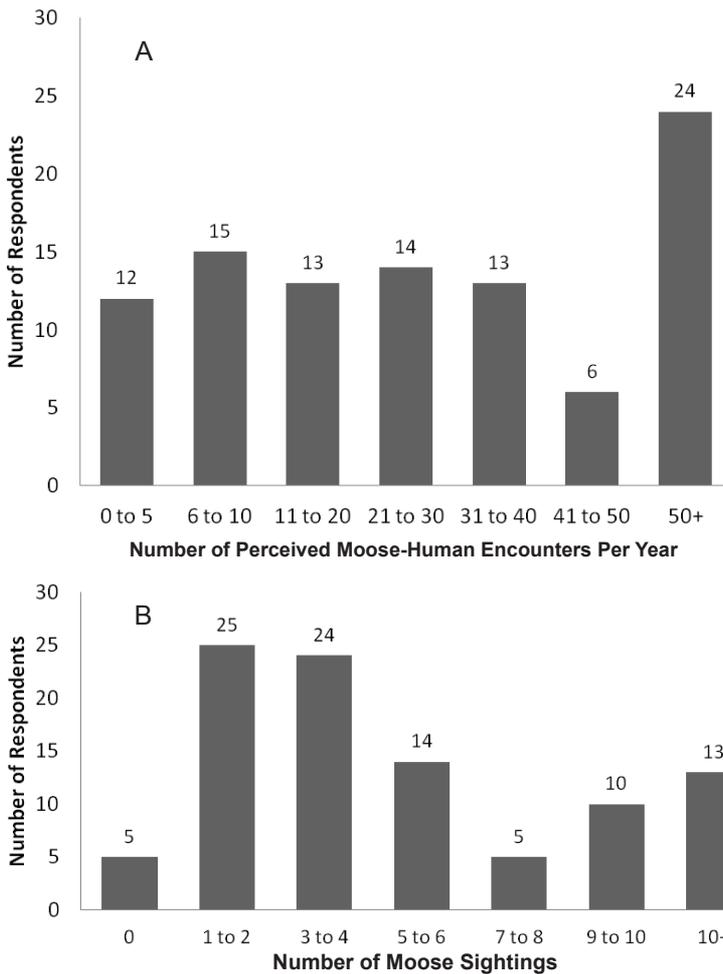


Fig. 3. The perceived number of annual moose-human encounters (A) and reported numbers of moose sightings (B) measured in an urban moose survey of residents of Prince George, British Columbia, August 2008.

female moose in spring and a mature male in fall were of most potential danger to humans. Of significance is that 93% of Conservation Officer Service (COS) reports were between the beginning of the May-June calving period and the end of the fall rut in November. Most (75%) indicated that there were <50 moose-human encounters (sightings to aggressive behaviour to moose-vehicle collisions) annually within Prince George. However, >220 moose-related reports (e.g., sightings, aggressive behaviour, moose-vehicle collisions) were filed with the COS from April 2007-March 2008 (COS, unpublished data). Presumably,

this is a conservative estimate given that all encounters are not reported, albeit an individual moose may represent multiple reports. This poses a potential management dilemma because public perception directly influences development of policies and procedures (Ericsson 2003). However, it is interesting that only 35 COS reports were associated with actual moose-human conflicts (i.e., aggressive behaviour, habituation, yard conflicts, pets, property damage, and nuisance), suggesting that either the survey data might be biased toward actual encounters (minus sightings), or simply that the public grossly underestimates moose activity in Prince George.

#### Human dimensions

Surprisingly, none of the respondents identified as outdoor enthusiasts knew how the city of Prince George addressed moose-human conflicts. However, research

of the human dimensions of moose management and public perception of moose behaviour and habitat use is limited (Ericsson 2003). We expected that outdoor enthusiasts would have a better understanding of wildlife management and policies since they presumably have a higher chance of encountering moose than others (Base and Zender 2003). Since this was not the case, it seems that increased public awareness activity should be directed towards the public at large. Notwithstanding their unawareness about management of moose conflicts in Prince George, it is evident that most respondents (92%) enjoy and prefer



Fig. 4. Urban moose browsing ornamental plants on a residential property in Prince George, British Columbia.

moose as part of the city environment.

The only on-site wildlife information available to most outdoor enthusiasts are trail signs posted by the COS or recreational groups; however, with the exception of bear warnings, these rarely provide information beyond “species of interest” in the area. Signs seldom provide specific information about moose encounters and related, appropriate behaviour to minimize/deter conflict. Availability of warning signage and a sighting hotline number might help the city, COS, and other interest groups to better monitor and react to moose activity in a preventative nature. Most residents (53%) indicated that they would use an internet or phone database service to anonymously report sightings, if management response was handled proactively.

**Management options**

Many respondents were not in favor of removing problem moose, or any active management to reduce moose-human conflicts in the city. Public attitude has shifted towards non-lethal management of nuisance wildlife, and although special hunts have been used to reduce urban moose populations (Whit-

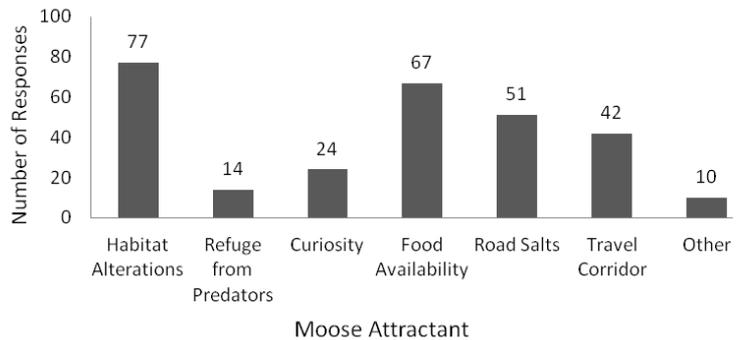


Fig. 5. The ranking of moose attractants as measured in an urban moose survey of residents of Prince George, British Columbia, August 2008. Respondents could select multiple answers.

taker et al. 2001), this approach guarantees controversy over belief systems, safety, and hunting regulations. Davis et al. (2002) found declining support for lethal removal of wildlife, even bears (*Ursus* spp.), so it was of little surprise that only 9% of respondents supported euthanization or sharp-shooting to resolve moose-human conflicts.

An approach that integrates education, habitat management, and the ecology of an animal can be used to best manage wildlife-human conflicts (Kretser et al. 2008). This approach is used in urban bear awareness programs (Davis et al. 2002), and similar programs could be developed for moose. The city of Anchorage, Alaska has similar moose-human conflicts, and has taken a proactive management approach that includes public education programs, and research of urban moose ecology and hunter-predator relationships (Regelin and Franzman 1998, Whittaker et al. 2001). Limited research of urban moose has occurred in Prince George (Rea 2004, 2012), but further research and improved management strategies are needed to balance better the presence of moose with tolerable levels of conflict.

While moose behaviour is seldom predictable (Rea and Schneider 2010), understanding how to best respond to moose is important for city residents; 20% of respondents had a previous encounter. The development of a "MooseAware" program and the development of educational pamphlets or classes could help educate residents about encounters (Taylor and Knight 2003, Kretser et al. 2008), and respondents recognized such in the survey.

Base and Zender (2003) found that in certain parts of Washington State, nuisance moose problems are usually handled by either herding moose out of the city limits or stopping traffic long enough for animals to move away. Although practical in a small community, this approach would be impractical in Prince George where traffic volume is too great to stop traffic for each moose crossing a highway.

Because moose frequent highways 4 times as often at night than in the day (Laurian et al. 2008), enhanced road lighting might reduce nocturnal moose-vehicle collisions.

Certain respondents indicated that exercising more tolerance, learning to co-exist with moose, and leaving them to roam free were the safest options for dealing with local moose-human conflicts. About 40% indicated that the best solutions for urban moose were to "let nature be" or that "nature would find its own medium". It may be true that most moose enter and leave Prince George without incident, but a "hands-off" approach may not necessarily lead to increased tolerance for moose-human co-existence. If the public is truly interested in "letting nature be" and ensuring that moose are part of an urban environment of Prince George, interested parties will need to develop management protocols to both better predict and minimize moose-human conflict.

#### ACKNOWLEDEMENTS

We would like to thank Anna deHoop for help with developing, delivering, and analyzing surveys. We thank Sean Haughian and Jamie Svendsen and two anonymous reviewers for commenting on an earlier draft of this manuscript and Pete Pekins for a thorough editing.

#### REFERENCES

- BASE, D., and S. ZENDER. 2003. Game Status and Trend Report. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, Washington, USA.
- DAVIS, H., D. WELLWOOD, and L. CIARNIELLO. 2002. Bear Smart Community Program: Background Report. British Columbia Ministry of Water, Land and Air Protection, Victoria, British Columbia, Canada.
- ERICSSON, G. 2003. Of moose and man: the past, the present, and the future of human dimensions in moose research. *Alces* 39: 11-26.

- KRETZER, H., P. SULLIVAN, and B. KNUTH. 2008. Housing density as an indicator of spatial patterns of reported human-wildlife interactions in northern New York. *Landscape and Urban Planning* 84: 282-292.
- LAURIAN, C., C. DUSSAULT, J.-P. OUELLET, R. COURTOIS, M. POULIN, and L. BRETON. 2008. Behaviour of moose relative to a road network. *Journal of Wildlife Management* 72: 1550-1557.
- LOPEZ, R. R., N. J. SILVY, R. N. WILKINS, P. A. FRANK, M. J. PETERSON, and M. N. PETERSON. 2004. Habitat-use patterns of Florida Key Deer: implications of urban development. *Journal of Wildlife Management* 68: 900-908.
- MARCOTULLIO, P. J. 2003. Globalisation, urban form, and environmental conditions in Asia-Pacific cities. *Urban Studies* 40: 219-247.
- REA, R. V. 2004. Investigating methods to reduce urban moose-related vehicular collisions within the city of Prince George, British Columbia. Unpublished Report prepared for the City of Prince George, British Columbia, Canada.
- \_\_\_\_\_. 2012. Road Safety implications of moose inhabiting an urban-rural interface. *Urban Habitats* 7: 8pp. online access: [http://www.urbanhabitats.org/v07n01/moose\\_full.html](http://www.urbanhabitats.org/v07n01/moose_full.html)
- \_\_\_\_\_, and M. S. SCHNEIDER. 2010. Agitation and hyperactivity of moose and elk at a wildlife rehabilitation shelter in response to removal of temporary feeding stations. *Journal of Wildlife Rehabilitation* 30: 23-26.
- REGELIN, W., and A. FRANZMANN. 1998. Past, present, and future moose management and research in Alaska. *Alces* 34: 279-286.
- TAYLOR, A. R., and R. L. KNIGHT. 2003. Wildlife responses to recreation and associated visitor perceptions. *Ecological Applications* 13: 951-963.
- WHITTAKER, D., M. J. MANFREDO, P. J. FIX, R. SINNOTT, S. MILLER, and J. J. VASKE. 2001. Understanding beliefs and attitudes about an urban wildlife hunt near Anchorage, Alaska. *Wildlife Society Bulletin* 29: 1114-1124.