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WILDLIFE RESEARCH

'It's a people problem, not a goat problem.' Mitigating human–mountain goat interactions in a Canadian Provincial Park

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ABSTRACT

Context. Wildlife viewing is a primary reason people visit parks and protected areas. However, high rates of visitation increase the potential for interactions between humans and wildlife. This close proximity of humans and wildlife can lead to habituation to human presence and pose a threat to both animals and humans. **Aims.** We describe human–mountain goat interactions in Cathedral Provincial Park (CPP), in British Columbia (BC), Canada, and examine management and mitigation strategies to reduce these interactions. **Methods.** This project was a collaboration with BC Parks. We used community-based participatory research methodologies, conducting interviews and surveys from July 2020 to November 2021 with park visitors, staff, and researchers. **Key results.** Most respondents encountered mountain goats in the park and understood the park's messaging; however, not all respondents took the necessary steps to reduce encounters. We recommend further education efforts focused on formal staff training and improved infrastructure in the park. **Conclusions.** Our results can be used to inform management decisions related to human–wildlife interactions, primarily in parks and protected areas. On a proximate level, we suggest further educational efforts and improved infrastructure in the park to help overcome perceived lack of action by some participants. Ultimately, there is a need to incorporate human aspects of human–wildlife interactions into management decisions aimed at addressing potential and existing problems. **Implications.** Using a multitude of approaches to management, informed by biological, social, and cultural knowledge, can improve responses and mitigation strategies in human–wildlife interactions. Collaboration among different stakeholders allows for the exchange of ideas and innovations that can contribute to positive movement towards coexistence of humans and wildlife in parks and recreational areas.

Keywords: BC Parks, community-based participatory research, conservation, conservation education, human–animal interactions, human perceptions of wildlife, mitigation strategies, *Oreamnos americanus*.

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Introduction

Over 16 million people visited Canadian Nationals Parks in 2019 (Parks Canada 2021), and over 26 million visited British Columbia (BC) Provincial Parks in 2018 (BC Parks n.d.*a*). BC Parks is responsible for the designation, management and conservation of a system of ecological reserves, provincial parks, conservancies, protected areas and recreation areas located throughout the province. The provincial system of parks is dedicated to the protection of natural environments for the inspiration, use and enjoyment of the public (BC Parks n.d.*b*). For many people, wildlife viewing is a primary reason for visiting parks and protected areas, and provincial and national parks provide ample opportunities for the public to be near and view wildlife. However, as animals become habituated to human presence, close proximity of humans and wildlife can lead to interactions that pose a threat or injury to both animals and humans (Orams 2002). Human–wildlife interactions are often classified as people enjoying wildlife, people harassing or negatively affecting wildlife, or wildlife conflicting with people (Bath and Enck 2003). Otherwise insignificant interactions can become conflicts when visitors intentionally get

too close to animals in an effort to view or photograph them, or when animals approach humans. In light of rising visitation to parks (BC Parks n.d.*a*), the risk of negative interactions between humans and wildlife grows. Protecting humans and animals from negative interactions and potentially dangerous conflict must be balanced with opportunities for people to see and learn about wildlife (Bath and Enck 2003).

Cathedral Provincial Park (CPP), in the western Canadian province of BC, is the location of one noteworthy example of increasing human–wildlife interactions, in this case, between humans and mountain goats (*Oreamnos americanus*). In this paper, we outline human–mountain goat interactions in CPP and examine possible mitigation strategies to reduce such interactions and potential conflict. Contact between humans and mountain goats is usually rare because mountain goats inhabit steep slopes in high-elevation alpine environments that are difficult to access (Shackleton 1999; Festa-Bianchet and Côté 2008). In areas where mountain goats are unfamiliar with humans, humans are treated as a potential threat and mountain goats flee on encountering them (Sarmento and Berger 2020). However, mountain goats occasionally leave the security of cliffs, particularly in the summer, and use lower-elevation subalpine or montane terrain to access essential resources such as mineral licks (Ayotte *et al.* 2008; Rice 2010). Mineral licks have important ecological functions and many ungulate species travel long distances, often outside their usual home ranges, to access these sites (Ayotte *et al.* 2006; Slabach *et al.* 2015). Because essential resources are seasonally and spatially heterogenous (Rice 2008), constraints on access to specialised and limiting resources, such as mineral licks, can influence goat movement patterns (Myers 1990; Reid 1998). Indeed, mountain goats make deliberate, long-distance movements to access certain dry mineral licks (Rice 2008). In areas of repeated and established human use, such as parks and campgrounds, mountain goats can reliably find salt and other minerals from human urine and sweat. In Glacier National Park, Montana, USA, for example, mountains goats have reduced or eliminated their use of natural mineral licks (Sarmento and Berger 2017), in favour of anthropogenic sources. Accessing such anthropogenic sources of salt and minerals has resulted in increasing occurrences of mountain goats being attracted and habituated to humans (Sarmento and Berger 2017).

Although mountain goats are typically reclusive and flee in the presence of humans (Wright 1977; Festa-Bianchet and Côté 2008), encounters in lower-elevation areas of parks such as Glacier National Park, (Sarmento and Berger 2017), Olympic National Park, Washington, USA (National Park Service 2018), and CPP (Balyx and Ford, n.d.) are increasing. These regular encounters, and the resultant habituation of mountain goats, can lead to conflict, including mountain goats exhibiting aggressive behaviour. In one instance at Olympic National Park in 2010, a human fatality resulted from a physical conflict with a mountain goat (BBC News 2010; Sarmento and Berger 2017). Investigating the ways animals change their behaviour and movement patterns in response to scarce resources is an important step in exploring human–animal interactions that can form the basis for revisiting parks' conservation and management strategies (Kroesen *et al.* 2020). But focusing only on animal behaviour is not enough. There is an increasing need for peoples' perspectives and understandings of educational programming to be considered because human knowledge of wildlife and human behaviour towards wildlife are typically linked (Eagly and Chaiken 1993; Fishbein and Ajzen 2010). Incorporating peoples' attitudes into planning contributes to the development of stronger educational programs, policy (Lute and Gore 2019) and management strategies (Riley *et al.* 2002). Effectively mitigating human–wildlife interactions, especially in government-managed areas such as parks, requires approaches that account for the complexities of animal and human behaviour, and the roles human understandings and values play in conservation (Lischka *et al.* 2018; Lozano *et al.* 2019).

In this study, we used 2 years of survey and interview data to examine human–mountain goat interactions, and current mitigation and management strategies in CPP. To investigate these topics, we asked the following three main questions: (1) how can human–mountain goat interactions be categorised in CPP and what factors are contributing to these interactions; (2) what are the current mitigation strategies at CPP and are they effective; (3) what additional strategies could be implemented to reduce human–mountain goat interactions at CPP? This study will add to existing data about the potential negative effects of close interactions with animals and ways to mitigate these effects (e.g. Riley *et al.* 2002; Bath and Enck 2003; Leong *et al.* 2016). Deepening our understandings of the human aspects of human–wildlife interactions can inform management decisions aimed at addressing potential and existing problems associated with these interactions (Riley *et al.* 2002).

Materials and methods

Study site

CPP was established in 1968 and is a 33 077-ha park located south-west of Keremeos, BC. The southern boundary of the park is the BC–Washington State border. In 2001, Cathedral Protected Area was established in the core of the park to enhance ecological viability and protect low-elevation forests (BC Parks n.d.*c*). The core area of the park is remote and visitors are cautioned by BC Parks that the park is a wilderness area and that they should bring suitable equipment, clothing, and supplies to withstand periods of inclement weather. Temperatures at CPP can fall below freezing and snow can occur at any time of the year. Three backcountry campsites are located in the core area, namely, Quiniscoe Lake, Lake of the Woods, and Pyramid Lake. In total, there are 58 campsites

available in Quiniscoe Lake and Lake of the Woods, whereas Pyramid Lake campsite is closed because of bug-killed [spruce beetle (*Dendroctonus rufipennis*)] trees within the campsite (BC Parks n.d.*c*). Pit toilets are available in all campsites, but no other facilities or services are available. In addition to the public campgrounds, a private lodge, Cathedral Lakes Lodge (CLL), is located in the core area of the park at Quiniscoe Lake. The lodge offers all-inclusive and self-catered accommodations in lodge rooms, cabins, and bungalows. CLL provides the only transportation into and out of the campgrounds, offering a shuttle three times daily. The only other way into the core area of the park is a full day hike via the Lakeview Trail, The Twin Buttes Trail, or the Wall Creek Trail (Fig. 1).

The conservation status of mountain goats

The current distribution of mountain goats, including native, reintroduced, and introduced populations, ranges across western North America from Utah and Colorado, extending north to the Yukon, Northwest Territories and south-eastern Alaska. The majority of the population is in BC and south-eastern Alaska (Festa-Bianchet and Côté 2008; Mountain Goat Management Team 2010). In 2010, the total mountain goat population estimates for Canada were 43 700–70 200 and for the United States 37 000–47 000. Mountain goats are considered secure globally (G5 ranking), with a very low risk of extinction or collapse because of their extensive range, abundant population, and little to no concern from

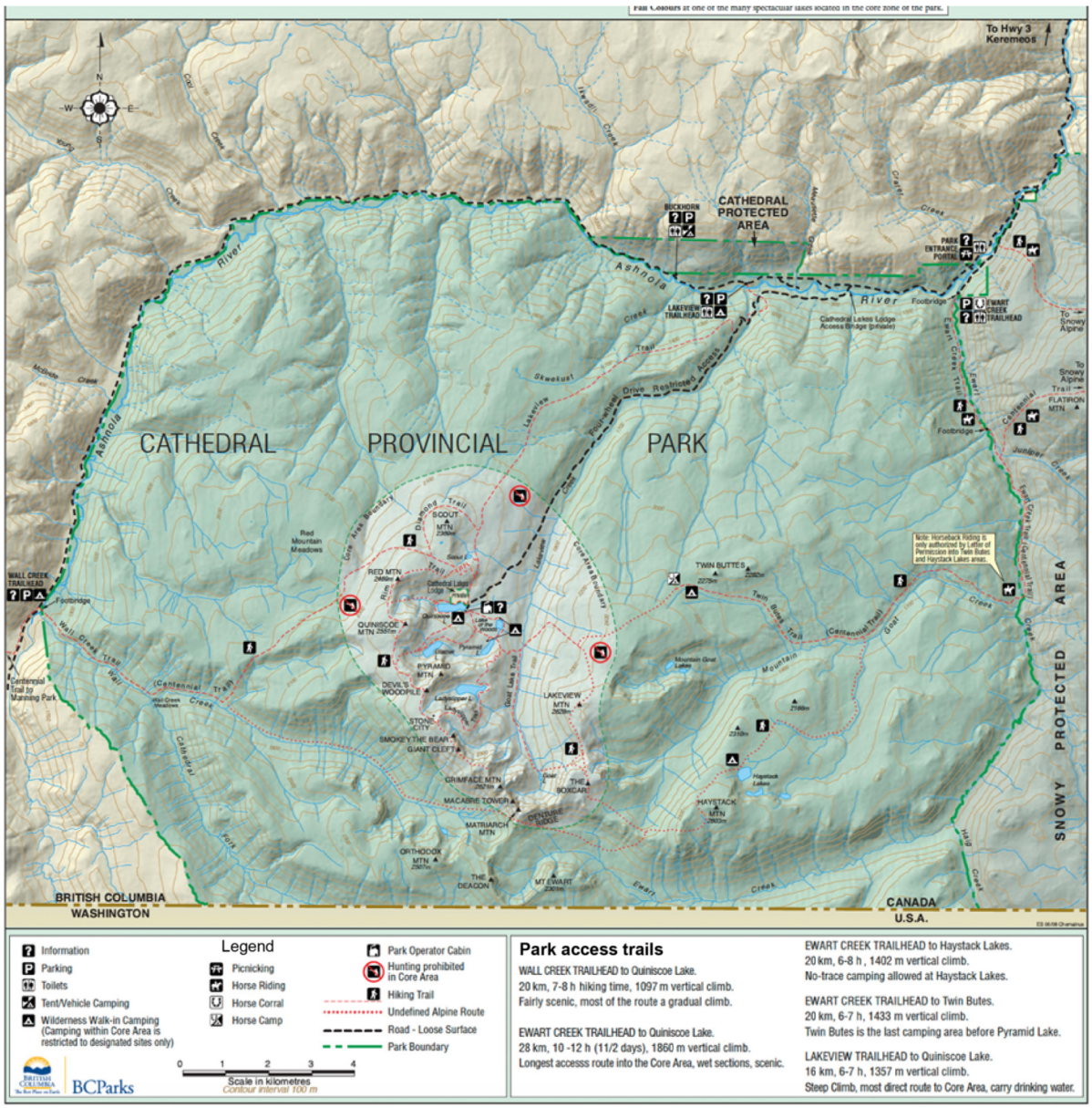

Fig. 1. Map of Cathedral Provincial Park. (Map Source: BC Parks, n.d.*c*).

Table 1. Total mountain goat population estimates for Canada and the United Sates for 2010.

Item	Canada	British Columbia	Alberta	Northwest Territories	Yukon	United States	Alaska	Contiguous States
Population estimate	43 700–70 200	39 000–65 500	2000	1000	1700	37 000–47 000	24 000–33 500	13 000
Ranking	N4	S3	S4	S2	S3	N5	S4	S2–S4 and SNA

Rank: S, state/province; N, national; G, global; 1, critically imperilled; 2, imperilled; 3, special concern, vulnerable to extirpation or extinction; 4, apparently secure; 5, demonstrably widespread, abundant, and secure; NA, not applicable. (NatureServe Explorer 2016).

declines or threats (NatureServe Explorer 2016). However, when broken down by specific regions, some populations are listed as imperilled and of special concern, vulnerable to extirpation, or extinction (Festa-Bianchet 2020; Table 1). Mountain goats are listed in the International Union for the Conservation of Nature (IUCN) Red List as Least Concern with a stable population trend (Festa-Bianchet 2020). Mountain goat status has not been assessed at the national level in Canada by the Committee on the Status of Endangered Wildlife (COSEWIC (Committee on the Status of Endangered Wildlife in Canada) 2021).

Data collection

This project was a collaboration between the authors and BC Parks. BC Parks staff identified several issues related to human–mountain goat interactions in CPP and recruited our research team to conduct the research and make recommendations. The issues included mountain goats habitually entering the campground and lodge areas, and humans and mountain goats in close proximity in the campground, the lodge area, and on trails. Mountain goats sought out areas of human use mainly to access anthropogenic sources of salt. A BC Parks Conservation Specialist informed the research with his existing knowledge, background, and context at CPP, and we collaborated to identify the extent of human–mountain goat interactions, build research tools, identify participants, and inform the results. Because of our close working relationship with BC Parks staff, our research was a good fit with the guiding principles of community-based participatory research (Ashok *et al.* 2017), which include the promotion of active collaboration and participation at multiple stages of the research, fostering co-learning, supporting projects that are participant-driven, and disseminating results in useful and culturally appropriate terms (O'Fallon and Dearry 2002).

Surveys provided baseline quantitative and qualitative data on encounters, their context, peoples' perceptions, knowledge, and sense of responsibility for mountain goats, and their views of messaging about mountain goats in the park. We conducted surveys and interviews over 2 years, from July 2020 to November 2021. We made minor revisions to the survey between 2020 and 2021, to clarify some questions from 2020 and add questions. As such, we have two results for respondent age categories (see Fig. 2). All other data are combined from 2020 to 2021 surveys. The survey guides

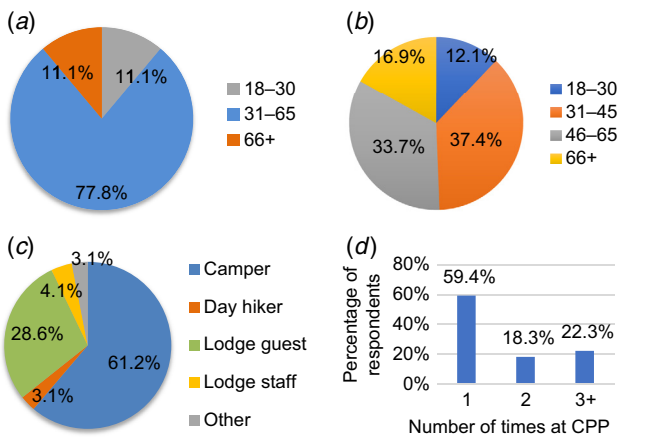

Fig. 2. (*a*) Percentage of survey respondents in each age category 2020 (n = 198). (*b*) Percentage of survey respondents in each age category 2021 (n = 115). (*c*) Percentage of survey respondents in user group in Cathedral Provincial Park (n = 196). (*d*) Number of times respondents have visited Cathedral Provincial Park (n = 197).

from 2020 to 2021, and interview guide are available as Supplementary information (Supplementary Material 1: Survey Guide and Supplementary Material 2: Interview Guide). For the surveys, we used the *Survey Monkey* online tool. Survey data were collected online through the CLL Facebook page, the CLL webpage, and the BC Parks CPP webpage from July 2020 to November 2021. We collected surveys in person at CPP from 20–26 August to 20–22 September 2020, and again from 13–16 August to 13–16 September 2021. We targeted adult campground users and hikers in the park, lodge guests, and lodge staff. To capture as much detail as possible from the survey respondents, we used a mixture of closed and open-ended questions. The survey was created in consultation with a BC Parks Conservation Specialist. All data are presented in percentages of total respondents for each question. Not all respondents answered all questions, so sample sizes vary among questions. For open-ended questions, we grouped the data into categories to clearly present the main responses. In some cases, these open-ended questions allowed respondents to choose more than one response, so the total percentages for some questions are greater than 100%. All data were compiled and analysed using Microsoft Excel Ver. 16.45.

In addition to the survey data, we conducted semi-structured interviews. Individual interviews allowed more

exchange opportunities with participants to provide a richer qualitative dataset (Barriball and While 1994). We conducted 22 in-person interviews at CPP and over video and telephone between August 2020 and August 2021. We focused on interviewing key park and lodge staff, campers and lodge guests who had visited CPP more than once and researchers who had worked in the park. We used snowball sampling to recruit interview participants (Noy 2008). The interview guide consisted of 11 open-ended questions and allowed participants to give in-depth responses (Hillman and Radel 2018). This type of semi-structured interview provides insight into topics that are important to individual participants and allows them to raise issues that the researchers may not have anticipated. All interviews were recorded and transcribed verbatim. On completion of the field work, we read through and open-coded each transcript separately. We then grouped participants' responses into key themes, denoting commonalities, and divergent patterns. We ensured trustworthiness of the data through content validation and collaboration between co-authors in data analysis (Elo and Kyngäs 2008). We use direct quotations from interviews so as to ensure that participants' voices are heard and to demonstrate their perspectives as clearly as possible. We distributed consent forms and offered anonymity to all participants. Ethics approval for this research was granted by the Thompson Rivers University Research Ethics Board (#102504).

Results

Demographics

We received a total of 217 responses to the survey. Respondents self-identified as female (54.5%), male (44.9%) and non-binary (0.5%) (n = 198). Age categories, type of users and number of park visits are presented in Fig. 2. Respondents spent a mean of 2.93 nights in the park (n = 190).

Encounters with mountain goats

Eighty-one per cent of park users encountered mountain goats in CPP (n = 171). Respondent mean group size during these encounters was three people (range: 1–10; n = 52). The majority of encounters occurred between 0500 hours and 1000 hours and the fewest encounters occurred between 1700 hours and 2200 hours. Fig. 3 shows the location of each encounter on the basis of time of day. Encounter duration varied and was longest in the campground. Fig. 4 shows the duration of human–mountain goat encounters on the basis of location. Sixty-six per cent of encounters were within 10 m of the mountain goats, Fig. 5 shows respondents' reported distances to mountain goats.

In addition to the survey respondents, interview participants described their encounters with mountain goats in the park. A camper who had come to Cathedral with her family every year for the past 10 years described the following:

> I'd say a typical encounter's being in the campsite and them coming down in the early morning and wandering about camp, doing their thing, and... we just watch them from the distance. And we've seen them also up on the ridges and in the alpine and snow patches... groups of them in Stone City and whatnot... We step off the trail and they walk by. (Interview 10)

Participants were surprised at how close and comfortable the mountain goats appeared to be with people. A camper, who had come to CPP with his family since 2014, described

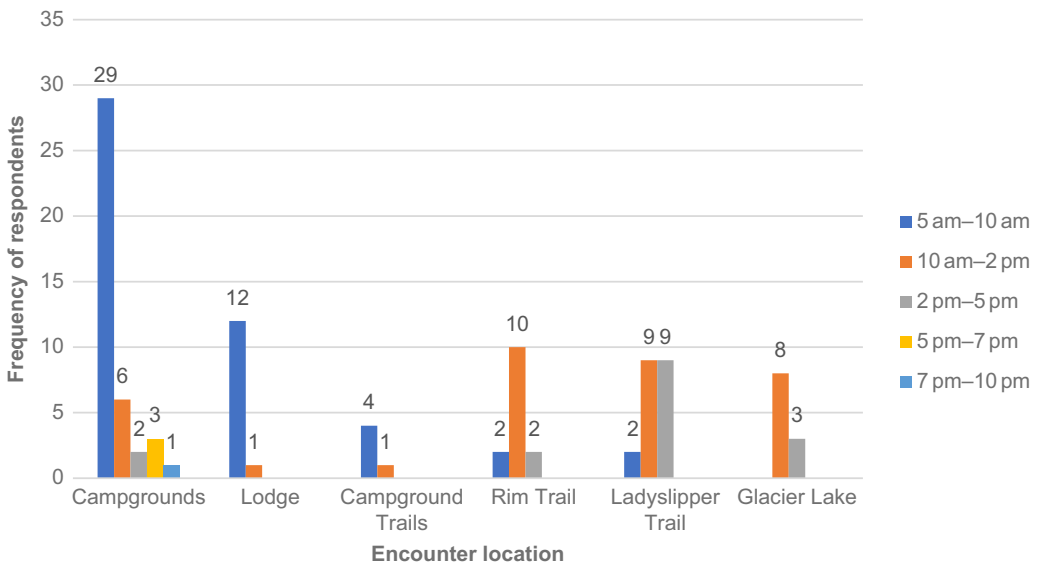

Fig. 3. Encounter location on the basis of time of day (n = 104).

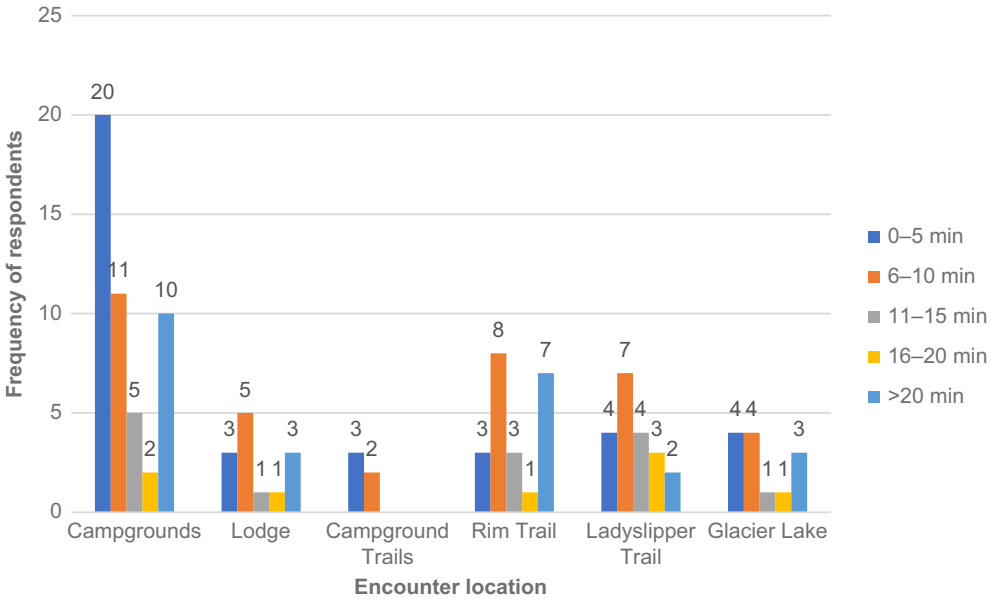

Fig. 4. Duration of human–goat encounters on the basis of location (n = 121).

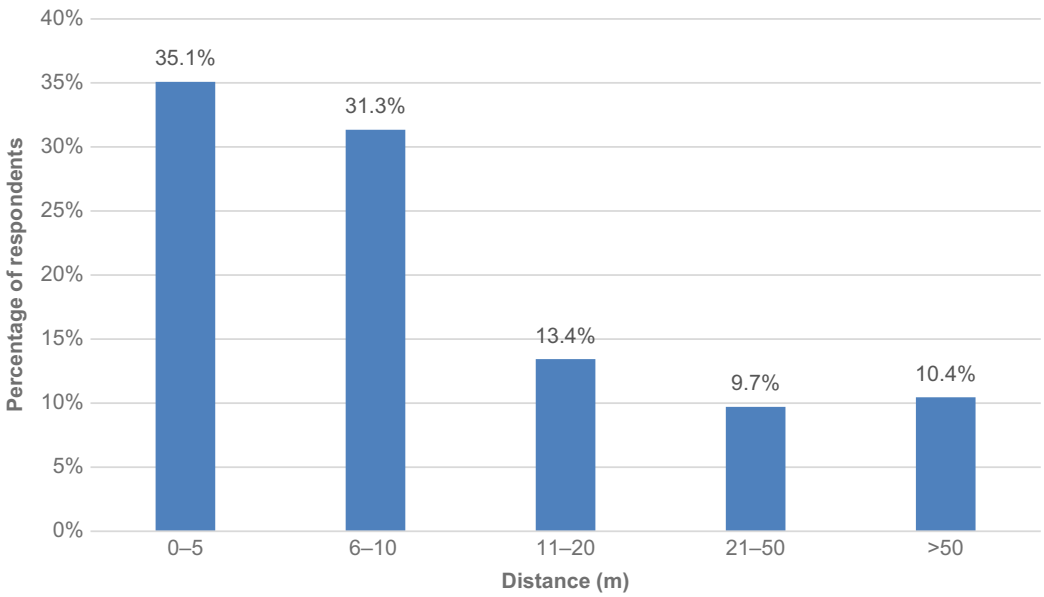

Fig. 5. Distance to mountain goats reported by respondents (n = 134).

his surprise at how much easier it is to see and get close to mountain goats in 2020 than it was in his first visit, as follows:

> The first time . . . we saw the goats up on the Rim, but that was on the way up. But [*last year*] I was absolutely stunned that they were walking within two metres of me. Like, in one case I was walking, I didn't know it was behind me, and I heard something, turned around and the goat was with a young kid! (Interview 9)

A lodge guest who has been visiting the park nearly every year since 2003 described both a typical encounter with mountain goats and the changes she had seen over the years, as follows:

> I will tell you that in hiking, and doing all these different hikes, I never saw a goat until 2009. So, in the 6 years that I was up there, I was looking specifically for them, I never saw them. And when I did see them in 2009 it was at the campsite. They were hanging around where the tent pads were. And once they were right beside the cabin [*at the lodge*], that was 2016. I opened the door and they were about 3 feet away from the door. I know historically that people that stay in those cabins, because

> they didn't have washrooms in the cabins, would pee outside in the middle of the night. I opened the door and it scared me because it was right there... it kind of looked over, seemed quite unfazed and just kept sort of digging in the ground, smelling around the ground outside of the cabin... then it just kind of made its way down towards the campsite. (Interview 12)

As pointed out by this lodge guest, one of the main issues she noted is people urinating outside, and that the mountain goats appear to be attracted to these sites. Of note is that the last cabin she talks about did not have a bathroom until recently and many people did not use the outhouse located approximately 30 m from the cabin, choosing instead to urinate on the ground close to the cabin.

Interview participants described similar reactions to mountain goats they encountered both inside and outside of the campsite. Participants mainly ignored the mountain goats and gave them space, but sometimes tried to scare them off. A survey respondent wrote, 'I always give them the right of way, stepping off the trail if they are on it.' (Survey Respondent #58). Typically, the mountain goats moved away on their own, or only looked at the people without changing their activity. Overall, park users avoided mountain goats when possible and gave way when necessary.

When asked about how the mountain goats behave when they are around the lodge, a lodge staff member recalled one billy goat in particular and what he considered aggressive behaviour, as follows:

> Then 2 or 3 years ago we had a big billy that was hanging around the lodge all the time. He would be underneath the deck... we would put paint finish on the log cabins and he started eating that. Chewing on the cabins, and he'd be around all the cabins and then he started getting aggressive, and people were trying to chase him away from the cabins, and he put his head down and start pawing the ground. I would meet him, as I stay down the lake, I walk all the time back and forth and I meet this guy on the trail sometimes early in the morning, and he would not move. I would go around him because he was not giving up the trail. He's fairly aggressive. (Interview 6)

With exception of one, participants described non-aggressive, uneventful encounters, in which people and mountain goats were aware of each other but tended to not interact in a direct way. When asked about aggressive encounters, only one camper, who had regularly visited Cathedral since 1993, described what she perceived as potential aggression; however, she went on to explain that she had never witnessed any overt aggression (Interview 10).

Four participants thought the mountain goats showed behaviour that indicated that they were being fed by people. For example, a lodge staff member described his experience and explained that the mountain goats appear to be attracted to humans, as follows:

> Yeah, I think people are feeding them too... because I've noticed over the years that... even when you're up hiking the goats will see you and they'll start coming towards you. So, I think it's because people have fed them and so they associate people with food now.

All survey respondents and interview participants described unremarkable encounters with mountain goats. With two exceptions, in which participants described potentially aggressive behaviour from a goat, no concerns were noted by participants. Encounters involved survey respondents and interview participants observing the mountain goats with no interaction, while the mountain goats carried on eating or resting, and taking little notice of humans. Although some survey respondents and interview participants expressed surprise at how comfortable the mountain goats were in the presence of humans, they mainly conveyed excitement at the opportunity to view mountain goats at such close proximity.

Existing messaging in Cathedral Provincial Park

Eighty-seven per cent (n = 159) of survey respondents saw or were given information about mountain goats on arrival at the campsite in the park. Respondents reported seeing information on signs, in brochures, on the park's website, information from staff, and other (Fig. 6). Only 2.8% reported not seeing or being given any information. Respondents who chose the 'Other' category reported being given information by other campers, friends, or previous visitors (n = 5), signs inside the lodge (n = 1), meeting a scientist who was collaring mountain goats (n = 1), and one respondent who could not recall (n = 1). Respondents understood the messages from existing information at CPP, with most respondents clearly remembering the need to manage salt attractants at their camp (keeping sweaty clothes away from mountain goats and always using the outhouses) and keeping their distance from and not feeding mountain goats (Fig. 7). One respondent commented, 'I am guilty of not using it [the outhouse] every single time I had to pee in the first couple of nights, but by the end of the trip I understood and used it every night. I didn't understand the importance until our goat encounters,' (Survey Respondent #85). Interview participants spoke about how effective and easy the signs were to understand. A lodge guest who had been to the park at least three times since 2011 explained how accessible and visible the signs were, as follows:

> I mean I have only been here for half a day, I've already read 3 of the signs, if not 4. And I already got the gist of it, so I would think that people would smarten up. I

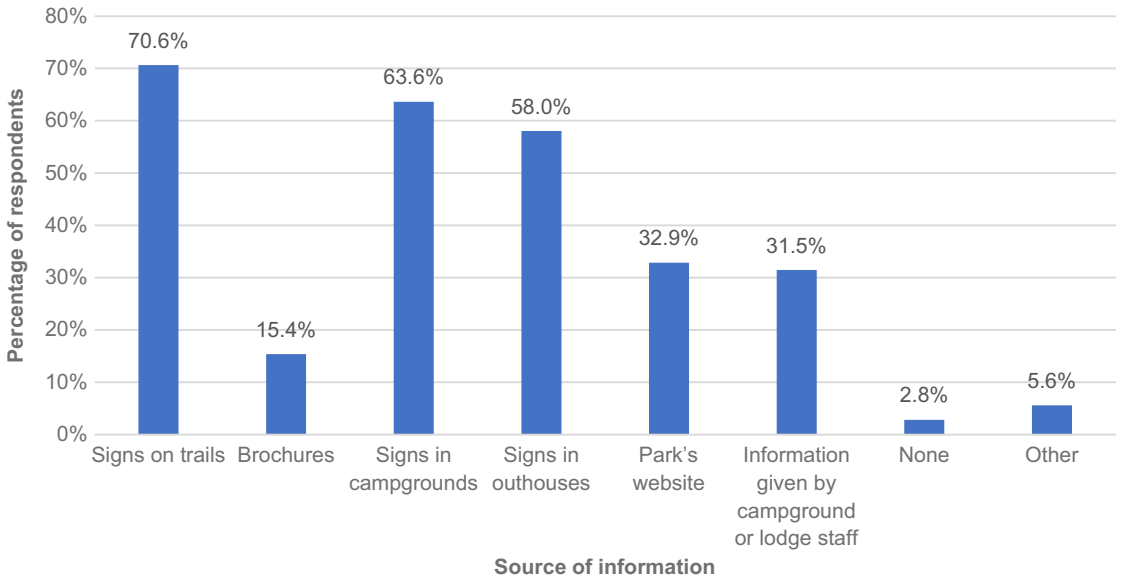

Fig. 6. Source of information survey respondents reported seeing or being given (n = 143).

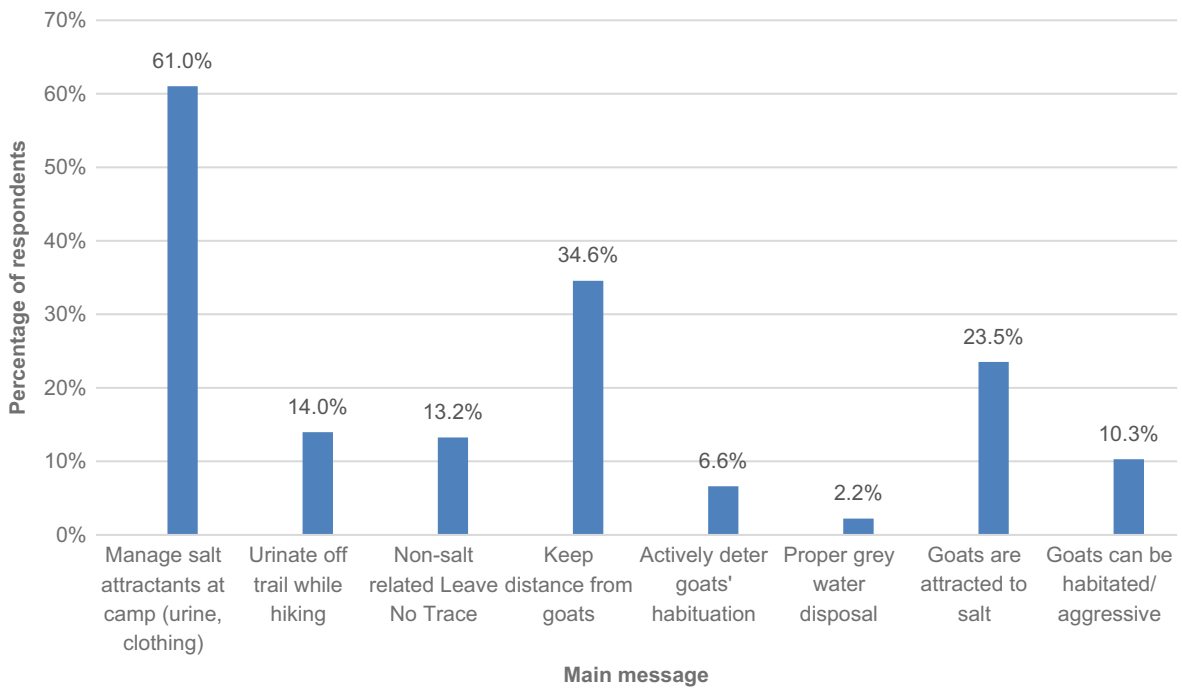

Fig. 7. Main message understood from existing information at Cathedral Provincial Park (n = 136).

would think so. Yeah, the sign is very effective. We saw it right away, everywhere. (Interview 11)

Despite the clear signage that participants seemed aware of and understood, some discrepancy existed between the knowledge that campers had and the knowledge that lodge staff had. For example, some lodge staff were not fully cognisant of the messaging in the park. A lodge employee, who had worked there for one season explained the following:

I don't know, I mean, I have seen some signs, I think about the goats up and around, we have some here, but . . . I don't know that I really can think of any messaging of what to do or not to do or how to interact other than the few signs that we have (in the lodge). (Interview 4)

A camper who had been coming to the park since 1993 explained that she had noticed the addition of signs but that she was not sure everyone was getting the message

about the hazards of being too close to the mountain goats, as follows:

> There's more signage now than when we first started coming, I think it's good, I think there's a lot of word of mouth, like people get excited about seeing goats. Like you see lots of people going to take their picture and stuff, and so... I think there could probably be more messaging about that it is hazardous to approach, I mean it's there but it's maybe not, they don't seem so dangerous, but you realised that they can be, right, and having negative reactions are going to be harmful to both them and the people. (Interview 10)

In spite of very clear messaging, very few respondents recalled the messaging about the need to properly dispose of greywater (2.2%, n = 136), and no one mentioned the directive to go 50 m off the trail to urinate when hiking. In fact, respondents expressed frustration with the signs asking them to always use an outhouse when there were no outhouses on the trails outside of the campgrounds. As one respondent put it, 'Yes, in camp (we used the outhouse), not while hiking. No outhouses on long trail, tried to make it back to camp but couldn't! Went far off trail.' (Survey Respondent #14). These quotations make it clear that at least some people did not understand or see the messaging about moving 50 m off the trail to urinate. A camper described what she thought were the unclear aspects of the signage, as follows:

> I don't think the part about the guy lines being 6 feet high makes sense to people. That part of the messaging. I think it's about your laundry and you know, anything that they can jump up and get. But I don't think people would really know that laundry would attract them and they would chew your clothes. I put all them away, because I know that's not even high enough for them and they will chew on that. (Interview 8)

All respondents (n = 212) were aware of the importance of using the outhouses and proper storage and disposal of attractants; however, only 62.4% (n = 149) of participants used the outhouses every time they went to the bathroom, including in the middle of the night. When asked for further detail about what prevented respondents from using the outhouse at night, the most common reasons were that the outhouses were too far away or difficult to get to, they were afraid to walk to the outhouses in the dark or the outhouses were unpleasant to use (Fig. 8). Of note is that 44.7% of respondents did not always use the outhouse because there were no facilities on the trails outside the campground, further suggesting a lack of clarity about the instruction to urinate 50 m off the trails.

Those campers who understood the need to mitigate their behaviour in response to the mountain goats reduced the risk of interaction or conflict by altering their behaviour in some way. Sixty-four per cent of respondents kept all attractants in their tent or in sealed containers and only used the designated washrooms (Fig. 9). 'Other' ways that visitors managed attractants included 73.7% of campers who kept their campsites clean and all food in the cages provided or hanging in trees, and 26.3% who maintained their distance from the mountain goats (n = 19). Nearly 24% of respondents did not alter their behaviour at all. Of those who gave a reason for their lack of change, three said they were already doing

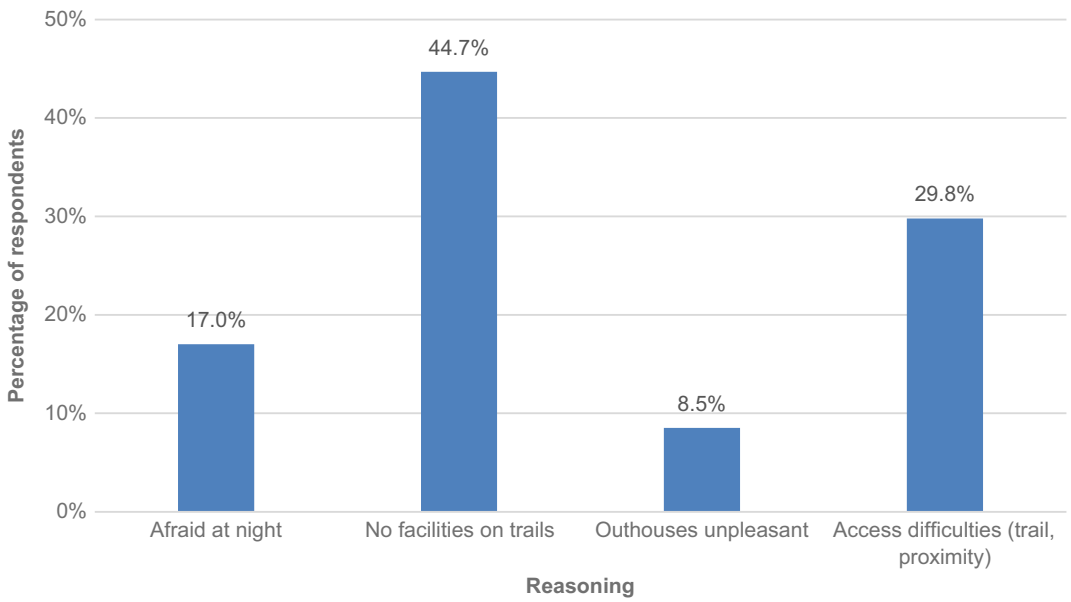

Fig. 8. Reason those respondents who did not always use outhouses gave for not always using the outhouse (n = 47).

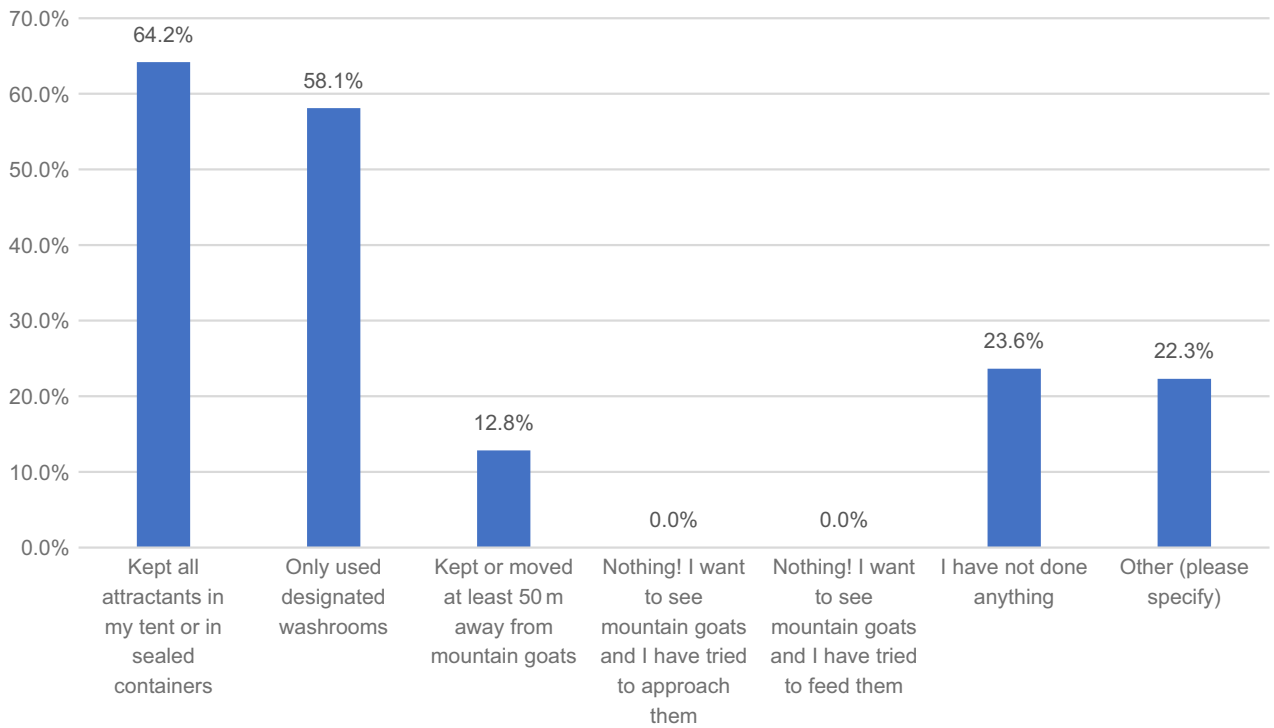

Fig. 9. Ways that survey respondents altered their behaviour in relation to mountain goats while in Cathedral Provincial Park (n = 148).

everything they could, so no change was necessary (n = 35). A camper at the site described that he found some of the messaging in contrast to what he learned about trying to have the least impact on the environment, as follows:

> Yeah, but one thing for instance . . . okay I go further off the trail now to pee on hikes than I did before, because before I was worried, this is not a high traffic area, but you don't want to walk on this fragile, go off the trail and walk – but now I realise if it's endangering the goats, I better. So that has changed my behaviour. (Interview 9)

Another respondent indicated they did not know what to do at the beginning of their trip, until they saw the signage or were informed by other campers.

Respondents and interview participants appeared to understand the existing messaging. In cases where participants were not aware of appropriate behaviour before their arrival, once they arrived and saw the messaging, they indicated that the existing signage was sufficient for them to understand the basic requirements to reduce human–mountain goat interactions.

Suggested messaging in Cathedral Provincial Park

Survey respondents had several recommendations for ways to create appropriate awareness of mountain goats and reduce human–goat interactions. The most common suggestion was clear verbal instruction on arrival to the park (Fig. 10). Among the 'Other' responses, respondents indicated that online educational resources, education by parks staff, more infrastructure, education given by shuttle drivers, and fines would all be helpful (Fig. 10). The majority of respondents recommended online information or, if the park adopts a reservation system, for campers to be also sent an email with information about mountain goats. One of the interview participants pointed out that they had seen no information on the park website, 'So I actually did look at the website and didn't see it,' (Interview 8). Another respondent wrote 'We were not given an orientation by the Parks Operator. As they interface with all visitors, I think they could be an effective way to make sure people get the information. In some parks, people even have to sign a form to say they've received and understood the information.' (Survey Respondent #72).

Interview participants also had ideas for what they thought would help mitigate the interactions between humans and mountain goats. One commonly discussed method was the need for Park Rangers to be present in the park. Respondents specified a need for Park Rangers who are BC Parks staff, rather than Park Facilities Operators, who are contracted by BC Parks through a private company. A long-term lodge staff member recalled previous years when there was a

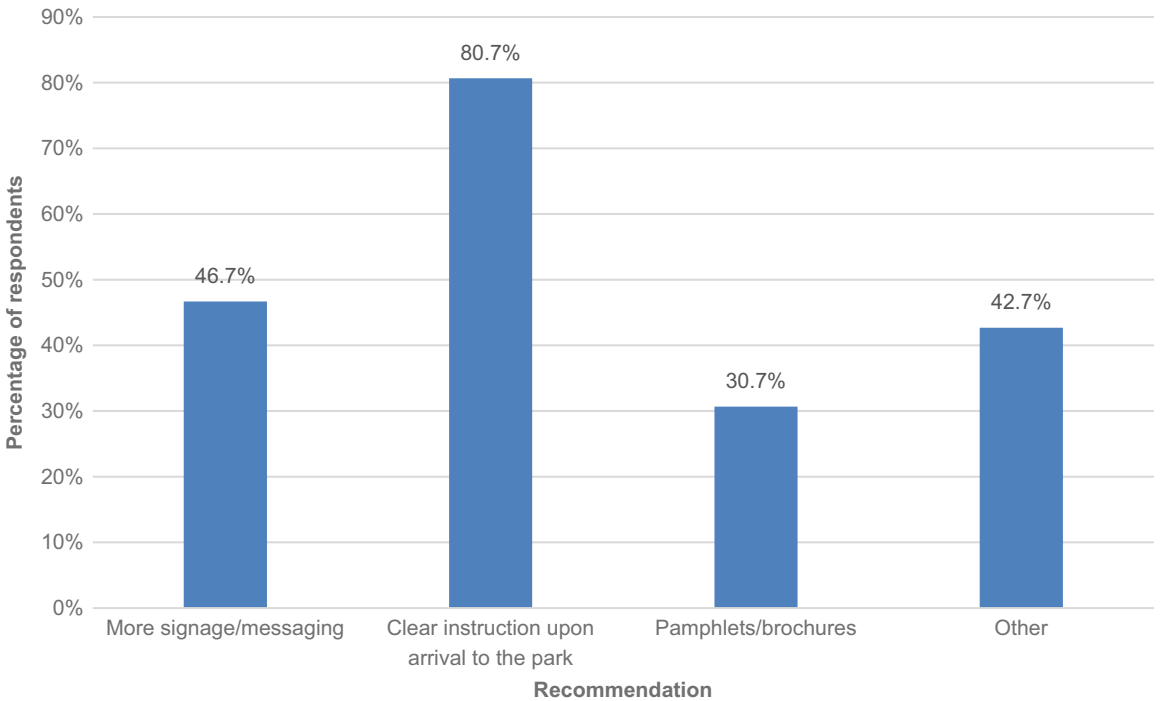

Fig. 10. Survey respondents' recommended ways of creating awareness of mountain goats and reduce human–mountain goat interactions (n = 150).

Ranger present at the park and the effectiveness of this Ranger's methods, as follows:

> ...I mean when we had the Rangers, they used to come over here (to the lodge). We would bring up the campers, the Park Rangers would be there at the truck, they would talk to everybody, explained things like do not pick flowers, don't walk off the trails. And they were pretty strict about it... (Interview 6)

A long-time visitor who has come to the park to camp every few years for over two decades also discussed the difference between their current experiences from those when there was a Park Ranger, as follows:

> Well, I'd been here like 20 years ago, and 15, and 10, and so... 10–15 years ago there was much clearer presence of actual Rangers here. Now it's a caretaker for the campsite and there's nobody out in the back country; there's nobody coordinating any activities...making sure that people follow the rules and that sort of thing, so I think the provincial government's Parks department presence has declined, like the official presence. (Interview 8)

Participants pointed out that Park Rangers used to work at the park and that their level of education and training, as well as their level of authority, made them more effective at both informing the public and having the authority to deal with issues.

Eighty per cent of respondents (n = 150) expressed the need to communicate directly to visitors. They stated that these instructions should touch on the importance of park users mitigating their behaviour, as well as the potential repercussions of conflict with humans. A lodge guest who had been coming to the park for 10 years said that 'If the Rangers came and gave a talk at night, you know, everyone welcome, for half an hour, I think that'd be just great, that person talking. It sets in a lot more.' (Interview 3).

A park employee discussed what other types of information might be useful to try to reduce the proximity and interactions of humans and mountain goats, as follows:

> I'd say, don't stalk them with your camera. Like last year I remember I was on top of Glacier, and a party came up the trail, and there was like 3 or 4 adults and 3 or 4 loud kids, and they saw a group of like 20 goats. And they just went right off the trail and they're heading towards these goats, and they were like 300 yards from the trail, and of course all the goats got up and shook themselves off and started moving over the hill. And they just keep following and you know... It's a people problem, not a goat problem. (Interview 9)

In addition to signage and someone to talk directly to park users, participants suggested fines for those users who do not follow the rules. While participants thought of this as a last resort, they did see value in using fines to enforce park rules. One BC Parks' employee explained that he thinks

advertising a fine could be effective in getting users to follow the rules. 'Maybe advertising a fine for if you're caught not following those rules, you know there's an 'x' dollar fine. A bit more of an enforcement presence in the park.' (Interview 16)

Participants who either worked at the lodge or in the park, recommended putting salt licks somewhere away from the campground. As they explained, this would give the mountain goats a source of salt outside of the campground and could reduce the occurrence of human–goat interactions. A long-time lodge staff member explained that, until 8 years ago, he had brought salt blocks up to the lodge for cattle ranchers who ranged cattle inside the park boundaries. He explained the change he saw after ranchers moved out of the area and that it was also about 8 years ago that the mountain goats began coming into the campgrounds and lodge area, as follows:

> For years we had cattle ranging up here and the cowboys would always bring up salt blocks. I used to drive their salt licks up for them, and they'd take them off by horseback for their cattle. They would put salt licks over there *[points to the east, toward Red Mountain*] and that was pretty much where the goats were, too, so I wonder if the goats were using that salt and then that stopped and so they started searching for salt. It was about eight years ago. So maybe that coincided with the fact that they [*the ranchers*] stopped coming, they stopped the cattle range, cattle grazing, and so therefore there's no more salt, and maybe that's when they [*the mountain goats*] started coming down. (Interview 6)

Another park worker mentioned the need for additional infrastructure to lessen human–goat interactions. While many of the survey respondents identified the issue of outhouses being unsanitary, this employee highlighted the details of his concern, as follows:

> Well, I think, this is probably one of the most . . . ignored parts in the province by BC Parks. For example, at Lake of the Woods, there's an outhouse there that is . . . full up to ground level, and for the last at least 5 years, I've been telling them it's full. It needs work. (Interview 9)

Like survey respondents, interview participants agreed that the signage in and around the park was sufficient and delivered a clear message. Only three participants suggested that additional signage and more clarity around messaging would be helpful. Interviewees mentioned that the signs had too many words in small font, and they worried that park users may not bother to read all the information. To reduce this possibility, they suggested fewer words, with a clear image or two. In addition, park users who used the larger park area, or hiked into the campgrounds, proposed a few large signs at all the main entrances to the park, on all the main trails leading into the park (e.g. Lakeview Trail), and at the shuttle pick-up and drop-off locations. Many respondents did not know about or understand the importance of proper greywater disposal, nor about not washing dishes in the lake. Other respondents commented that taking dishes to the outhouse to dump greywater or food waste was not only unpleasant but also unsanitary. The majority of respondents did not know about or did not see any information about the mountain goats on the CPP webpage. In addition to physical signage and messaging in the park and on the CPP webpage, a large proportion of respondents and interview participants indicated a need for a Park Ranger. Specifically, they described someone who is trained and has the authority to enforce park rules with a penalty or fine.

Discussion

The results of this study have demonstrated that respondents have a good understanding of the issue of human–mountain goat interactions and care about the need to mitigate potential conflicts. Nearly all respondents encountered mountain goats in the park and saw and understood the messaging. The existing signage at CPP appears to be very effective and conveys the main message to use the outhouses and reduce salt attractants. On the basis of our results, we made recommendations to BC Parks for further strategies to help mitigate or reduce human–mountain goat interactions. These are briefly outlined below and can be taken up by other park managers working to mitigate interactions between humans and wildlife.

Education efforts can effectively alter visitor knowledge and behaviour but depend on content and delivery (Marion and Reid 2007). The timing of education and signage, as well as the location, directly affect visitors' response to signage (Hockett 2000). For example, at CPP, park users who hike in and out of the core area, and beyond the main trails, noted that there was no signage beyond the campground and outhouses. Large signs at all the main entrances to the park, on all the main trails leading into the park, and at the shuttle pick-up and drop-off locations would target park users at all entrances. Similarly, adding signage on picnic tables about appropriate behaviour while eating is more likely to be followed, because it targets people while they are actually eating (Hockett 2000). This type of targeted information in key areas is most effective at capturing the intended audience at an appropriate moment (Hockett 2000).

The need for information sharing and education in CPP was highlighted by our respondents and interview participants. Human–wildlife conflict and interaction within parks is most often a product of visitors' lack of knowledge and understanding of wildlife and appropriate behaviour around wildlife (Ferretti-Gallon *et al.* 2021). This issue can be

addressed through education, particularly via public buy-in through signage, park-based education and programs, and the presence of law enforcement (Ferretti-Gallon *et al.* 2021). A large proportion of respondents and interview participants indicated the need for a 'Park Ranger' or 'Park Facilities Operator'. Respondents proposed someone who is well trained in the expectations and rules in the park and expressed a need for someone who has authority to enforce park rules with a penalty or fine. This person could transfer knowledge verbally, through formal meetings when people arrive at the park or at their campsite and ensure that there are no discrepancies or omissions in what park users need to know. Indeed, law enforcement can be fundamental to better park management, which is most often achieved through the presence of park rangers, who can enforce rules and regulations as well as educate the public about appropriate behaviours while in the park (Ferretti-Gallon *et al.* 2021).

During our time in the field, we became acutely aware that many lodge employees lacked knowledge of appropriate behaviour when near mountain goats, and what the main issues between humans and mountain goats are. Lodge employees were aware of the issue of urine but were not aware of other attractants or appropriate behaviour to minimise human–goat interactions. Some staff, mostly the new, short-term seasonal workers, also appeared reluctant to participate in the survey or interviews. We are aware that lodge staff are working and very busy, which may have contributed to their lack of participation. However, it is noteworthy that the majority of the staff are new each year and do not receive training or information about mountain goats, mitigating human–mountain goat interactions, or what was attracting the mountain goats to the campground and lodge areas. This presents an interesting challenge for CPP as these employees could act as educators in the park, but do not appear to have the information they would need to do so. Additionally, they are not park employees, so would need to be trained by their private employer. Lodge staff are the first point of contact for visitors taking the shuttle; shuttle drivers have a captive audience for nearly an hour on the drive to the lodge and campground areas and interact with guests throughout their stay. The lodge owner and staff have a vested interest in the park and the wildlife within it, because their business depends on the park, and, as such, they are local stakeholders. The role of local stakeholders, and linking them to other small- and large-scale stakeholders such as park users, park staff, wildlife managers, and policy makers, is vital in understanding human–wildlife interactions (Penker 2009; Barnes *et al.* 2017). Local stakeholder perceptions can affect the success of conservation and education initiatives within parks (Pătru-Stupariu *et al.* 2020). Partnerships between private tourism operators, such as the lodge, and public parks, such as CPP, are often contentious and require careful management to ensure sustainability (Wilson *et al.* 2009). Gaining full support from the lodge staff, including involving them in educational programming, aligning the educational program with employee values, and providing a sense of ownership of the project can all promote the success of this education initiative within the park (Pătru-Stupariu *et al.* 2020). The lodge owner expressed very clear concern for the mountain goats and their conservation and using his passion for protecting the park and the wildlife within it, he could provide the connection between upper-level decision-making and stakeholder buy-in that is needed to address the complex issue of human–wildlife interactions (Bodin *et al.* 2017; Manolache *et al.* 2018). We offer this feedback not as a critique of lodge staff, but as a gesture to the types of training that staff may benefit from. Since lodge employees interact with a large proportion of visitors at the park, we recommend educating all lodge staff at the beginning of each season and encouraging them to be actively involved by passing information on to guests. Education from lodge employees at multiple points of contact would ensure that park users gain direct access to important information about the park and about mountain goats.

Infrastructure

Infrastructure is fundamental to successful tourism in parks (Hanks 2000; Wilson *et al.* 2009; Grünewald *et al.* 2016). Adding to and improving existing infrastructure in the park can reduce human–mountain goat interactions. Namely, a designated area for campers to wash dishes and dispose of greywater, additional outhouses, and the maintenance of existing outhouses, are crucial. Many respondents did not know what greywater was and did not understand the importance of proper greywater disposal and the reasons for not washing dishes in the lake. This needs to be addressed by education and signage. Other respondents commented that taking dishes to the outhouse to dump greywater or food waste was not only unpleasant but also unsanitary. The addition of a designated area to wash dishes, and a disposal site for greywater, would not only help with the management of attractants, but also with the condition of the environment around the campsites. Respondents and interview participants also commented on the outhouses at the park. In particular, one park employee explained that some of the outhouses were full, but there was no one to do that work. There is a clear need for more outhouses, and maintenance of existing outhouses, to deal with the growing number of campers at the site. A partnership between the lodge and the park may provide mutual benefits with regards to infrastructure, whereby the lodge could provide a location for the disposal of greywater or the maintenance of outhouses. These types of partnerships between private tourism operators and public parks can ensure sustainable use of the park infrastructure (Wilson *et al.* 2009). They also provide further benefits for parks managers because they free up time to manage their core activities such as

protection, conservation, and research initiatives within the park (Buckley *et al.* 2012).

Infrastructure and human activity may also interfere with wildlife and limit or fragment their available habitat (Rogala *et al.* 2011). Mountain goats are coming into the park to access salt, which is a direct response to human activity within the area. Some respondents suggested a need for salt licks outside of the core area of the park to divert the mountain goats from the campground and lodge areas. Diversionary salting is commonly used in Canada, particularly in association with highways (Grosman *et al.* 2009; Poole and Ayotte 2019); however, we cannot make recommendations about diversionary salting, as we do not have data to support or refute this proposition. Our study is part of a larger project that is examining goat movements and behaviour patterns and has found support for diversionary salting (Balyx 2022). We therefore suggest further investigation into diversionary salting for the mountain goats at CPP.

Conclusions

This study examined human–mountain goat interactions and strategies to reduce potential human–wildlife conflict in CPP. Using data from surveys and interviews, we examined existing educational and mitigation strategies, and made recommendations for immediate and future approaches. Our main finding was that park users and workers are aware of human–mountain goat interactions and the potential for conflict, and they understand the need to mitigate these interactions. However, not all participants act on this knowledge consistently. As an immediate strategy in CPP, we suggest further educational efforts, particularly formal training for lodge and park staff, as well as improved infrastructure in the park.

Our results can be used to inform management decisions related to human–wildlife interactions, primarily in parks and protected areas. With park visitation rates rising and more people seeking out activities in remote areas, human–wildlife interactions and the probability of negative encounters will continue to increase (Blackwell *et al.* 2016; Senthilkumar *et al.* 2017; Songhurst 2017), requiring managers to balance the difficult mandate of preservation and visitation (Lemons 2010; Beissinger and Ackerly 2017). Addressing these conflicting demands and challenges will require both site- and species-specific solutions. Whereas education and infrastructure offer site-specific, short-term mitigation strategies, wildlife management research has demonstrated that human attitudes and behaviour toward wildlife are typically linked (Eagly and Chaiken 1993; Fishbein and Ajzen 2010). This creates an increased need for decision-makers to consider visitor and stakeholder perspectives to bolter mitigation strategies targeted at human behaviour. Future studies need to focus on insight into park visitors' and stakeholders' knowledge, perceptions, and values, because understanding of wildlife behaviour and concern for human impacts on wildlife can be used to improve localised management decisions and mitigation strategies that might otherwise lack local buy-in and applicability (Decker *et al.* 2001). Shifting research focus to human perceptions can contribute to stronger educational programs and policy (Lute and Gore 2019) and better inform the development of new management strategies (Riley *et al.* 2002).

Supplementary material

Supplementary material is available online.

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Data availability. The survey data that support the findings of this study are available from the corresponding author, [JVV], upon reasonable request. Due to the nature of this research, interview participants did not agree for their data to be shared publicly, therefore supporting interview data are not available.

Conflicts of interest. The authors declare no conflicts of interest.

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