HUMAN-BLACK BEAR CONFLICT IN BRITISH COLUMBIA

Analyzing trends in BCCOS black bear deaths between 2015-2021

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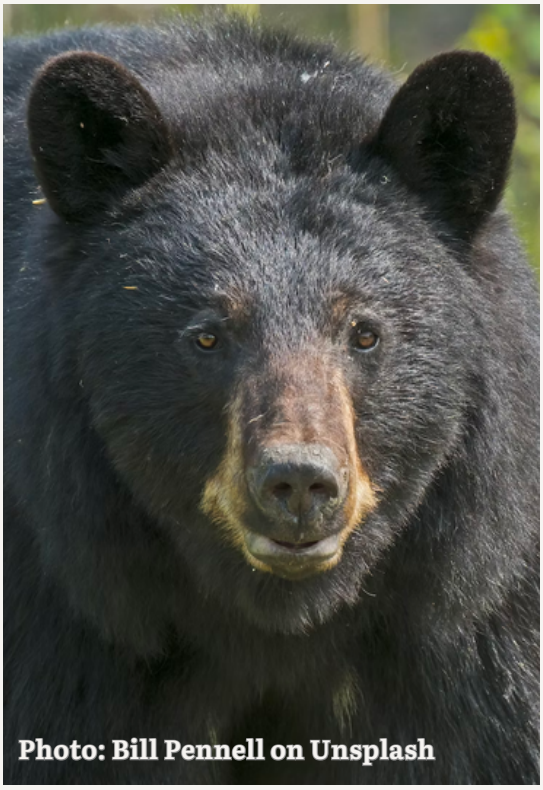
Photo: Lauren Yim

INTRODUCTION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Human-black bear conflict has been prevalent across British Columbia because of the proximity of urban cities to the forestlands and waterways of the province, as well as human actions that attract bears. Such actions include improper attractant management and fruit tree maintenance, which can result in accessible food sources for bears. Human-black bear conflict occurs when a human or bear, or both, experiences harm, or realized or perceived threats due to indirect and direct interactions. Conflict can include direct aggressive encounters as well as sightings of bears. Oftentimes, these black bears are killed by British Columbia Conservation Officers (BCCOS) if they are deemed public safety risks, which only perpetuates the problem since killing bears does not address the root cause of the issue. Moreover, it creates space for other bears to occupy the area, thus creating an ongoing cycle of conflict and death.

This report presents an analysis of five notable scientific journal articles that outline bear behaviour, heat maps and graphs that display trends in bear killings by the BCCOS between 2015-2021, and a review of five communities in British Columbia with a consistently large number of bear deaths across the years. By addressing drivers and potential patterns of human-black bear conflict in BC, this report aims to inform future management decisions in order to promote human-black bear coexistence in BC while minimizing risks and harms to all.


Photo: Lauren Yim

LITERATURE REVIEW

STOCHASTICITY IN NATURAL FORAGE PRODUCTION AFFECTS USE OF URBAN AREAS BY BLACK BEARS: IMPLICATIONS TO MANAGEMENT OF HUMAN-BEAR CONFLICTS
BARUCH-MORDO ET AL. (2014)

Background

Intensive transformation of land into urban areas has influenced the behaviour of wild black bears all over the world (Beckmann and Berger, 2003). This is largely due to their ability to successfully exploit novel environments and anthropogenic resources, which can be attributed to their omnivorous diet, opportunistic feeding behaviour, and intelligence (Shochat et al., 2006). Examples of some behavioural changes in black bears that use urban areas include increased activity at night as well as smaller home ranges (Beckmann and Berger, 2003). Previously, it was believed that these changes were permanent and irreversible, meaning that once a black bear started using urban areas, they would not utilize their original wildland habitats any longer (Baruch-Mordo et al., 2014). However, the reproductive and survival benefits of these behavioural changes compared to natural food foraging was still poorly understood. Natural food for black bears mainly consists of fruits, berries, nuts, and seeds from plants, as well as insects and other small animals (Greenleaf et al., 2009). If the use of urban areas was only in response to low natural food availability, this would suggest that the behavioural changes in bears that predominantly use anthropogenic resources is temporary and reversible (Baruch-Mordo et al., 2014). Baruch-Mordo et al. aimed to fill this knowledge deficit in their paper "Stochasticity in natural forage production affects use of urban areas by black bears: Implications to management of human-bear conflicts" (2014) by determining the relationship between natural food availability and the space use, activity patterns, and survival rate of wild black bears.

Methods

To accomplish this, Baruch-Mordo et al. (2014) conducted a study in Aspen along with other nearby locations within Pitkin County, Colorado. Their study area covered diverse landscapes including suburban neighbourhoods, forests, and dense city zones (Baruch-Mordo et al., 2014). To obtain data on wild black bears, a GPS collar was placed on 50 captured bears between 2005-2010 (Baruch-Mordo et al., 2014). These collars were designed to automatically fall off following significant neck growth, and collared bears were monitored daily (Baruch-Mordo et al., 2014). The gender and approximate age of these black bears were determined upon capture, and if a collared bear was no longer emitting GPS signals, an aerial search to locate the bear was carried out (Baruch-Mordo et al., 2014). The GPS collars provided the location of the bear every 30 minutes during non-denning season and every hour when the researchers suspected that the bears would reside in and emerge from their dens; additionally, activity was monitored by head movements which were recorded by the GPS collar (Baruch-Mordo et al., 2014).

Seasonal home ranges of the bears were estimated from the emitted GPS locations, and the overlap of these home ranges with urban areas (defined as land cover that is predominantly associated with human development) was determined using modelling software (Baruch-Mordo et al., 2014). These patterns were additionally compared to the production of natural food which was qualitatively determined each year from 2005 to 2010 (Baruch-Mordo et al., 2014). Plants that produced fruits, berries, seeds, and nuts in the study area were visually assessed to estimate annual yields of these plants (Baruch-Mordo et al., 2014). Temporal activity patterns of the bears were also acquired using a mathematical equation that considered the timing of an incident of activity based on head movement data that was collected by the GPS collars (Baruch-Mordo et al., 2014). Furthermore, a software program was used to estimate and model the survival rate and reproductive output of the black bears based on data collected by the GPS collars as well as researcher observations (Baruch-Mordo et al., 2014).

LITERATURE REVIEW

STOCHASTICITY IN NATURAL FORAGE PRODUCTION AFFECTS USE OF URBAN AREAS BY BLACK BEARS: IMPLICATIONS TO MANAGEMENT OF HUMAN-BEAR CONFLICTS
BARUCH-MORDO ET AL. (2014)

Major findings

The results from this study indicate that the behaviour of wild black bears using urban areas changes and fluctuates in response to natural food availability (Baruch-Mordo et al., 2014). For example, during years when natural food production was low, the home ranges of the bears primarily overlapped with urban residential areas in city zones, and male home ranges were smaller (Baruch-Mordo et al., 2014). However, during years when the yield of natural food was high, the home ranges would primarily overlap with neighbouring wildland areas (Baruch-Mordo et al., 2014). Because the latter was observed after periods of low natural food yield and high urban space use by wild black bears, this highlights the reversibility of their behavioural changes in terms of their use of space and resources. (Baruch-Mordo et al., 2014). Moreover, high natural food production was correlated with increased activity during daylight hours while low natural food production was correlated with increased activity during the night (Baruch-Mordo et al., 2014). While there was no relationship found between natural food availability and reproductive output, modelled survival estimates were lower during years with low natural food yield (Baruch-Mordo et al., 2014). However, as Baruch-Mordo et al. (2014) mention in their article, it is important to recognize that this correlation between black bear behavioural changes and natural food production may also be dependent on the resilience of local natural resources, which further depends on the ecological condition of the region (Baruch-Mordo et al., 2014). Despite this, Baruch-Mordo et al. (2014) were able to determine that the behavioural changes seen in bears using urban areas is both temporary and reversible.

Practical implications

Maintaining stable natural food sources for bears may minimize their use of urban areas and support human-black bear coexistence. This may be done through the active management of vegetation in wildland areas as well as the protection of forested areas from urban development. Additional mitigation of the impacts of human-caused disturbances to black bear habitats and natural food sources may also benefit bears and reduce their use of urban areas. Both direct (e.g., land-use change) and indirect (e.g., extreme weather events due to climate change) factors can impact the natural food availability for these animals.

References

Baruch-Mordo, S., Wilson, K. R., Lewis, D. L., Broderick, J., Mao, J. S., & Breck, S. W. (2014). Stochasticity in natural forage production affects use of urban areas by black bears: Implications to management of human-bear conflicts. *PloS One*, *9*(1), e85122.

Beckmann, J. P., & Berger, J. (2003). Rapid ecological and behavioural changes in carnivores: The responses of black bears (*Ursus americanus*) to altered food. *Journal of Zoology (1987)*, *261*(2), 207-212.

Greenleaf, S. S., Matthews, S. M., Wright, R. G., Beecham, J. J., & Leithead, H. M. (2009). Food habits of American black bears as a metric for direct management of human–bear conflict in Yosemite Valley, Yosemite National Park, California. *Ursus (International Association for Bear Research and Management)*, *20*(2), 94-101.

Shochat, E., Warren, P. S., Faeth, S. H., McIntyre, N. E., & Hope, D. (2006). From patterns to emerging processes in mechanistic urban ecology. *Trends in Ecology & Evolution (Amsterdam)*, *21*(4), 186-191.

LITERATURE REVIEW

INTERSPECIFIC RESOURCE PARTITIONING IN SYMPATRIC URSIDS BELANT ET AL. (2006)

Background

Brown bears and black bears in North America often exist in habitats that overlap with each other, which forces them to share space and resources (Herrero, 1972). To decrease competition and minimize potential conflicts, brown bears and black bears will adapt by utilizing areas differently, both spatially and temporally (Herrero, 1972). This is known as resource partitioning, where species will learn, across generations, to use limited resources in ways that do not directly coincide with other species (Belant et al., 2006). However, previous studies that analyzed the feces of wild brown bears and black bears concluded that these species share similar diets, meaning both direct and indirect competition for food may be occurring (Jacoby et al., 1999). Because diet and meat consumption in particular are strongly associated with reproductive success and body size in bears, understanding how these bears are adapting to minimize competition for limited resources is important (Belant et al., 2006). To further explore this topic, Belant et al. observed how salmon abundance influences brown bear and black bear physiology and behaviour as well as interactions between the two species in their study titled "Interspecific resource partitioning in sympatric ursids" (2006).

Methods

Belant et al. (2006) studied brown bears and black bears in south-central Alaska between 1998-2000 during May-September. The researchers also estimated the annual abundance of salmon that entered the streams within their study area to release or fertilize eggs from 1990-2000 using existing data from fisheries (Belant et al., 2006). Furthermore, observational surveys were conducted to determine the distribution of mature salmon (Belant et al., 2006). This distribution was then compared to the estimated home ranges of the bears observed in this study to determine which bears may have had access to the streams with salmon (Belant et al., 2006).

A total of 46 black bears and 31 brown bears were captured and weighed multiple times throughout the study; a dart gun was used to administer an immobilizing drug in the targeted bears (Belant et al., 2006). Additionally, a noninvasive analysis using electrical currents was used to measure body fat percentages of the bears (Belant et al., 2006). GPS collars were placed on adult females, and the presence of young was also recorded (Belant et al., 2006). Blood samples were obtained from a vein in the leg or arm from four brown bears and four black bears (Belant et al., 2006). Keratin samples taken from a portion of the claws of 15 brown bears and 27 black bears were also obtained during the study (Belant et al., 2006). The chemical composition of the keratin samples and the red blood cells in the blood samples were determined to estimate the diets of each bear (Belant et al., 2006). This is done by identifying the presence of certain forms of chemical elements such as carbon and nitrogen (i.e., isotopes) and associating it with certain food groups (Van der Merwe, 1982). In this study, the annual proportions of consumed salmon, terrestrial meat, and vegetation by each bear was analyzed (Belant et al., 2006). Terrestrial meat included moose, squirrels, and ants (Belant et al., 2006).

LITERATURE REVIEW

INTERSPECIFIC RESOURCE PARTITIONING IN SYMPATRIC URSIDS BELANT ET AL. (2006)

Major findings

Salmon are an important food source for both brown bears and black bears due to their nutritional value and relative accessibility (Belant et al., 2006). A comparison between the home ranges of the bears and the distribution of salmon in the study area suggested that all the bears had access to the streams containing mature salmon (Belant et al., 2006). In this study, brown bears consumed and digested more salmon and terrestrial meat on average than black bears, while black bears consumed more plant materials (Belant et al., 2006). Black bears only consumed salmon when salmon abundance was higher than average (Belant et al., 2006). For example, during a year when mature salmon abundance was low (1998), salmon was completely absent in the diet of black bears; however, the proportion of terrestrial meat in their diet was higher compared to brown bears (Belant et al., 2006). Moreover, salmon stocks were extremely low the previous year (1997) which may explain the observed decrease in black bear body fat percentages in 1998 (Belant et al., 2006). Overall, salmon made up 0-25% of the diet of black bears in this study (Belant et al., 2006). Reproductive success for black bears had a positive correlation with body fat percentage, where high body fat led to increased reproductive output (Belant et al., 2006).

Conversely, the average annual proportion of salmon in the diets of captured brown bears (56%) as well as their annual body fat percentage measurements and their reproductive success did not vary over the years (Belant et al., 2006). These results suggest that brown bears outcompete black bears for salmon, especially when salmon abundance is low (Belant et al., 2006). In response, black bears have adapted to consuming more vegetation and terrestrial meat, meaning resource partitioning is occurring (Belant et al., 2006).

Practical implications

This data is useful as it indicates that low salmon abundance may cause black bears to seek alternative food sources, which may include those of anthropogenic origin. To decrease the potential for conflict between humans and bears, we may ensure that there is adequate plant material for the bears to forage on through passive protection and active management in areas that surround urban locations. This is particularly important during years when mature salmon stocks are expected to be low.


Photo: Pete Nuij on Unsplash

References

Belant, J. L., Kielland, K., Follmann, E. H., & Adams, L. G. (2006). Interspecific resource partitioning in sympatric ursids. *Ecological Applications*, *16*(6), 2333-2343.

Herrero, S. (1972). Aspects of evolution and adaptation in American black bears (*Ursus americanus Pallas*) and brown and grizzly bears (*U. arctos Linné.*) of North America. *Bears, their Biology and Management*, 2, 221-231.

Jacoby, M. E., Hilderbrand, G. V., Servheen, C., Schwartz, C. C., Arthur, S. M., Hanley, T. A., Robbins, C. T., & Michener, R. (1999). Trophic relations of brown and black bears in several western North American ecosystems. *The Journal of Wildlife Management*, *63*(3), 921-929.

Van der Merwe, N. J. (1982). Carbon isotopes, photosynthesis, and archaeology. *American Scientist*, 70(6), 596-606.

LITERATURE REVIEW

MANAGING HUMAN-HABITUATED BEARS TO ENHANCE SURVIVAL, HABITAT EFFECTIVENESS, AND PUBLIC VIEWING GUNTHER ET AL. (2018)

Background

The development of roads through forests and the establishment of public parks in North America have increased the likelihood of human-bear encounters. A behavioural response that wild bears may have after repeated neutral encounters with humans is habituation (Gunther et al., 2018). Human-habituation is when a bear learns that they do not have to react, either by fleeing or fighting, to the presence of humans after multiple neutral interactions (Gunther et al., 2018). This allows the bears to save energy and continue using resources that may exist in areas with human activity (Gunther et al., 2018). For example, a bear may learn that slow-moving vehicles do not impose significant threat which would allow them to find food and forage near roads. Habituation is often incorrectly used to describe food-conditioning, which is a different behavioural phenomenon that occurs when a bear associates humans and urban developments with food (Aumiller and Matt, 1994). Habituated bears are less likely to cause conflict compared to food-conditioned bears due to the absence of an emitted behaviour towards humans (Herrero et al., 2005). However, habituation only occurs in contextual situations that are specific to each bear and regular management strategies to maintain the neutral response are required (Gunther et al., 2018). In their paper "Managing human-habituated bears to enhance survival, habitat effectiveness, and public viewing" (2018), Gunther et al. examined the bear management strategies being enforced in Yellowstone National Park (YNP) and Grand Teton National Park (GTNP) to evaluate how coexistence between habituated bears and humans may be supported. In other words, the relation between habituated bear management strategies, bear behaviour, and human-bear conflict in YNP and GTNP was studied in this paper (Gunther et al., 2018).

Methods

This study utilized data that was collected in YNP which occurs in Wyoming, Montana, and Idaho, in addition to GTNP which is situated in Wyoming (Gunther et al., 2018). This data existed in other literature (e.g., Haroldson and Gunther, 2013) or was collected and recorded by park staff (Gunther et al., 2018). In both parks, a stable population of grizzly bears and black bears exist (Gunther et al., 2018). A significant number of these bears are habituated to humans and are comfortable foraging along the roads that run through the parks (Gunther et al., 2018). Historical reporting of grizzly bear and black bear sightings and their associated traffic jams in YNP as well as early implementation of bear management strategies offered significant data and statistics on the management of bears in YNP (from 1979-2017) (Gunther et al., 2018). In contrast, the establishment of the current grizzly bear population in GTNP has been more recent, thus limiting the available data (from 2008-2017) (Gunther et al., 2018). In this study, Gunther et al. (2018) analyzed how the tolerance of habituated bears through specific bear management strategies have impacted the incidence of property damage, bear attacks, bear removal, and vehicle strike mortality in each park. Additionally, Gunther et al. (2018) considered the factors that influence the bears to occur beside roadways. With this, the effectiveness of certain management strategies in response to these factors was additionally analyzed (Gunther et al., 2018).

LITERATURE REVIEW

MANAGING HUMAN-HABITUATED BEARS TO ENHANCE SURVIVAL, HABITAT EFFECTIVENESS, AND PUBLIC VIEWING
GUNTHER ET AL. (2018)

Major findings

Habituated bears in YNP and GTNP have established a need for active management of park visitors to minimize potential conflict and traffic jams. For example, Gunther et al. (2018) noted that between 1990-2017, 5,272 and 8,979 occurrences of traffic congestion in YNP occurred due to the presence of grizzly bears and black bears foraging along the road, respectively. These traffic jams were instigated by people who stop to observe the habituated bears (Gunther et al., 2018). Moreover, the spatial distribution of bears was primarily influenced by food availability, as bears will seek natural food resources by the road if they are nutritious or when other crops in the interior are low (Gunther et al., 2018). Additionally, grizzly bears existing along roadways were predominately females with young, or juveniles (Gunther et al., 2018). Gunther et al. (2018) hypothesized that this is because the adult male grizzly bears outcompete these individuals for interior space and resources. Despite this, Gunther et al. (2018) found that the incidence of property damage, bear attacks, bear removal, and vehicle strike mortality in each park decreased or did not change when management strategies that tolerated (rather than removed) habituated bears were enforced in both parks.

The most effective strategies that promoted neutral encounters between bears and humans required the dispatch of park rangers during traffic jams caused by bear sightings (Gunther et al., 2018). These park rangers would then monitor and teach the visitors to act in a slow and predictable manner as well as maintain a safe distance from the bears (Gunther et al., 2018). Another important strategy was to prevent the bears from becoming food-conditioned by ensuring that park visitors were not feeding them and eliminating access to garbage (Gunther et al., 2018). Additionally, setting spatial boundaries was vital to ensure that habituated bears did not comfortably enter urban developments (Gunther et al., 2018). This was done using hazing techniques such as emitting loud noises and using rubber bullets (Gunther et al., 2018).

Practical implications

This paper highlights that human-habituated bears can exist without causing consistent conflict with humans. Rather, habituated bears can coexist with respectful humans when management strategies that focus on modifying human behaviour and practices are enforced and education strategies are implemented. In addition to the strategies discussed above, it is recommended that natural and preferred foods for bears be planted away from roads and urban developments to maintain safe physical buffers between bears and humans.

References

Aumiller, L. D., & Matt, C. A. (1994). Management of McNeil River State Game Sanctuary for viewing of brown bears. *Bears, their Biology and Management*, *9*, 51-61.

Gunther, K. A., Wilmot, K. R., Cain, S. L., Wyman, T., Reinertson, E. G., & Bramblett, A. M. (2018). Managing human-habituated bears to enhance survival, habitat effectiveness, and public viewing. *Human-Wildlife Interactions*, *12*(3), 373-386.

Haroldson, M. A., & Gunther, K. A. (2013). Roadside bear viewing opportunities in Yellowstone National Park: Characteristics, trends, and influence of whitebark pine. *Ursus (International Association for Bear Research and Management)*, *24*(1), 27-41.

Herrero, S., Smith, T., DeBruyn, T. D., Gunther, K., & Matt, C. A. (2005). From the field: Brown bear habituation to people-safety, risks, and benefits. *Wildlife Society Bulletin*, *33*(1), 362-373.

LITERATURE REVIEW

FROM THE FIELD: BROWN BEAR HABITUATION TO PEOPLE—SAFETY, RISKS, AND BENEFITS
HERRERO ET AL. (2005)

Background

Determining ways for humans to coexist peacefully with wildlife, especially large carnivores, is important for the success of long-term conservation goals. For example, brown bears are known to be able to successfully adapt to various new settings due to their high level of intelligence and opportunistic lifestyle (Gunther et al., 2018). Taking advantage of this behavioural adaptability of brown bears and determining ways to coexist with bears that tolerate the presence of humans may help protect population declines due to lethal removal (Herrero et al., 2005). When a brown bear does not overtly respond when a person is in relatively close proximity (e.g., within sight) after they have had multiple neutral encounters in the past, they are considered habituated to humans (Gunther et al., 2018). In their paper "From the Field: Brown bear habituation to people—safety, risks, and benefits," (2005), Herrero et al. assessed how brown bears are positively and negatively affected when they tolerate the presence of people within close proximity. Herrero et al. (2005) additionally considered multiple external factors, such as population density, that may affect their tolerance of humans.

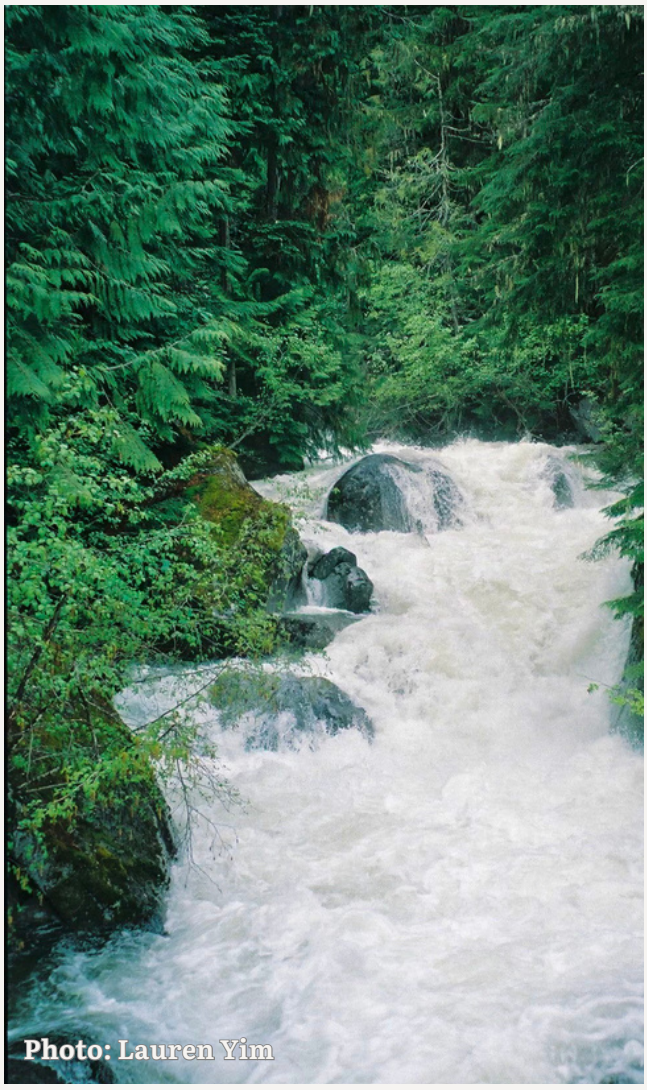
Photo: Lauren Yim

Methods

To better understand human tolerance in bears as well as the factors that influence this behaviour, Herrero et al. (2005) reviewed available literature that observed this behavioural response. Herrero et al. (2005) also suggested a new term, overt reaction distance, to describe the distance between a bear and a person at which the bear externally reacts to the person. Examples of external reactions include fleeing, vocalizing, and yawning (Herrero et al., 2005). To determine factors that affect a bear's overt reaction distance, scientific journal articles that outline studies on the topic, in addition to data and statistics from parks in North America, were analyzed (e.g., Smith et al., 2005) (Herrero et al., 2005). Because habituation is a primary factor that affects the distance at which a bear overtly reacts to a human, specific cases where habituated bears are tolerated, such as in Yellowstone National Park and Brooks Camp, were also examined in this paper (Herrero et al., 2005). Results obtained from this analysis were discussed in relation to bear and human management policies, and a table comparing the respective benefits and costs of human-habituated bears to both humans and bears was created (Herrero et al., 2005).

LITERATURE REVIEW

FROM THE FIELD: BROWN BEAR HABITUATION TO PEOPLE—SAFETY, RISKS, AND BENEFITS
HERRERO ET AL. (2005)

Major findings

Brown bears that tolerate conspecifics (i.e., other brown bears) at a close range are more likely to become habituated to humans due to their inclination to accept potential dangers for food rewards (Herrero et al., 2005). In other words, bears that exist in high density populations, such as coastal brown bears in Alaska and British Columbia, are more likely to have smaller overt reaction distances (Smith et al., 2005; Herrero et al., 2005). However, in areas where bear populations are not as dense, such as in interior locations, bears are still able to become habituated to humans despite a lack of interactions with conspecifics (Herrero et al., 2005). For example, bears in Yellowstone National Park have become habituated to humans along roadways likely due to the high number of visitors that enter the park each year (Herrero et al., 2005). Herrero et al. (2005) hypothesize that both frequent interactions with conspecifics and high exposure rates to humans with neutral outcomes results in bears having smaller overt reaction distances.

Bears that are habituated to humans benefit by having access to food and resources near areas with human activity and minimizing competition with dominant conspecifics (Herrero et al., 2005). Humans additionally benefit from the existence of human-habituated bears by having the opportunity to safely view brown bears in the wild, support local economies through visitors that visit parks in North America with brown-bear viewing opportunities, and being less likely to be attacked when in sight of a wild bear (Herrero et al., 2005). Conversely, some risks that habituated bears face are vehicle-related mortality, poaching, food-conditioning, and humans invading their personal space (Herrero et al., 2005). For humans, some relevant costs include an increased chance of injury by a bear due to increased encounters through viewing opportunities, economic costs associated with managing humans around habituated bears in parks, and increased traffic jams (Herrero et al., 2005). In all, Herrero et al. (2005) have offered a concise analysis outlining the benefits and risks of managing habituated bears, while also emphasizing that every bear population is unique and requires specific management policies that fulfills those bears' needs.

Practical implications

The findings in this paper suggest that both benefits and risks are associated with the tolerance of human-habituated bears in the wild. It is recommended that the following factors should be considered when the tolerance of human-habituated bears in parks in North America is in question: the density of the bear population, the setting and location (e.g., habituated bears alongside high-speed roads may lead to high mortality rates), and the feasibility of regular visitor management. Because habitat loss is causing brown bears to overlap spatially with humans, it is important to develop strategies to peacefully share space and resources without resorting to aversive or lethal management of bears.

References

Gunther, K. A., Wilmot, K. R., Cain, S. L., Wyman, T., Reinertson, E. G., & Bramblett, A. M. (2018). Managing human-habituated bears to enhance survival, habitat effectiveness, and public viewing. *Human-Wildlife Interactions*, *12*(3), 373-386.

Herrero, S., Smith, T., DeBruyn, T. D., Gunther, K., & Matt, C. A. (2005). From the field: Brown bear habituation to people-safety, risks, and benefits. *Wildlife Society Bulletin*, *33*(1), 362-373.

Smith, T. S., Herrero, S., & DeBruyn, T. D. (2005). Alaskan brown bears, humans, and habituation. *Ursus (International Association for Bear Research and Management)*, *16*(1), 1-10.

LITERATURE REVIEW

COEXISTENCE OR CONFLICT: BLACK BEAR HABITAT USE ALONG AN URBAN-WILDLAND GRADIENT
KLEES VAN BOMMEL ET AL. (2022)

Background

Urban expansion in North America has influenced the geographical range and behaviour of wild black bears. This is due to the increasing amount of natural habitat that occurs adjacent to developmental areas, thus creating a unique environment where human activity and wildlife activity coincide at an equal rate (Klees van Bommel et al., 2022). This environment is known as the urban-wildland interface, and it typically refers to rural areas (Klees van Bommel et al., 2022). Such behavioural changes include active avoidance of people by adopting nocturnal behaviour, or conversely, reducing movement and using urban areas to take advantage of anthropogenic resources (Baruch-Mordo et al., 2014; Klees van Bommel et al., 2022). These adaptations by black bears, however, can have both positive and negative impacts on humans, meaning it can promote coexistence or conflict depending on the environmental and temporal context of which these behaviours are performed (Klees van Bommel et al., 2022). For example, black bears may become more active at night which would promote human-bear coexistence through active sharing of space; however, this may allow the bears to predate on livestock at night when human presence is absent, thus causing conflict (e.g., Wang et al., 2017). To further understand how bears are using habitats with relation to human density and reported conflict, Klees van Bommel et al. observed the spatial and temporal distribution of black bears on Vancouver Island, BC in their paper "Coexistence or conflict: Black bear habitat use along an urban-wildland gradient" (2022).

Methods

This one-year study began in July 2018 and was conducted in Sooke and its outskirts, which is a municipality located in southern Vancouver Island, BC (Klees van Bommel et al., 2022). Two hypotheses were created for this study (Klees van Bommel et al., 2022). The first hypothesis suggested that black bears use habitats based on access to both anthropogenic food and natural food, meaning they would primarily use rural areas (Klees van Bommel et al., 2022). This suggests that behavioural changes to avoid conflict such as nocturnality would be unlikely to occur (Klees van Bommel et al., 2022). Alternatively, the second hypothesis proposed that bears used habitats to avoid humans and the associated mortality risk, meaning behavioural changes would occur and habitats with low conflict probability would be predominantly used (Klees van Bommel et al., 2022).

To test these hypotheses, Klees van Bommel et al. (2022) used motion-activated trail cameras to collect images and data on the temporal and spatial activity of black bears in Sooke. A total of 54 camera traps were used and placed in urban, rural, and wild areas (Klees van Bommel et al., 2022). Moreover, Klees van Bommel et al. (2022) used modelling software to describe bear habitat use with relation to multiple variables such as vegetation productivity, human density, and elevation. Additionally, seasonal conflict probabilities were measured using the camera trap data and was modelled to determine its relationship with black bear habitat use (Klees van Bommel et al., 2022). Lastly, data on black bear nocturnality in urban, rural, and wild areas was collected from the camera trap data and was quantified using a statistical equation (Klees van Bommel et al., 2022).

LITERATURE REVIEW

COEXISTENCE OR CONFLICT: BLACK BEAR HABITAT USE ALONG AN URBAN-WILDLAND GRADIENT
KLEES VAN BOMMEL ET AL. (2022)

Major findings

The second hypothesis in this study which posited that black bears use habitats in ways to avoid humans, rather than to obtain anthropogenic foods, was supported by the results obtained from this study (Klees van Bommel et al., 2022). Black bears were more likely to become nocturnal in urban and rural areas, and diurnal activity mostly occurred in wildlands (Klees van Bommel et al., 2022). They also preferred to use forested habitats with high vegetation productivity and low conflict probability (Klees van Bommel et al., 2022). These factors suggest that coexistence and human avoidance is favoured by the bears (Klees van Bommel et al., 2022). However, black bears were likely to use rural areas where conflict probabilities were high in late summer and fall, which is during the time when crops are ripe and abundant (Klees van Bommel et al., 2022). It is also when bears consume significantly more calories to prepare for hibernation (Klees van Bommel et al., 2022). Thus, it is likely that the temporal and spatial distribution of black bears fluctuates in response to seasonal changes in food availability as well as caloric demand (Klees van Bommel et al., 2022). In late summer and fall, human-bear conflict is more likely to occur due to their tendency to use rural areas to obtain both natural and anthropogenic foods (Klees van Bommel et al., 2022). This study demonstrates the spatial and temporal flexibility in black bear behaviour in relation to their use of areas with varying levels of human development.

Practical implications

To mitigate the high probability of conflict during late summer and fall, managing crops and compost near residences in rural areas is important. This includes prompt harvesting, using bear-proof compost and garbage bins, and avoiding planting vegetation that would attract black bears. Additionally, maintaining stable natural food sources in wild forest areas would help promote the existence of black bears in their natural habitat, away from urban developments.

References

Baruch-Mordo, S., Wilson, K. R., Lewis, D. L., Broderick, J., Mao, J. S., & Breck, S. W. (2014). Stochasticity in natural forage production affects use of urban areas by black bears: Implications to management of human-bear conflicts. *PloS One*, *9*(1), e85122.

Klees van Bommel, J., Sun, C., Ford, A. T., Todd, M., & Burton, A. C. (2022). Coexistence or conflict: Black bear habitat use along an urban-wildland gradient. *PloS One*, *17*(11), e0276448.

Wang, Y., Smith, J. A., & Wilmers, C. C. (2017). Residential development alters behavior, movement, and energetics in an apex predator, the puma. *PloS One*, *12*(10), e0184687-e0184687.

DATA VISUALIZATION

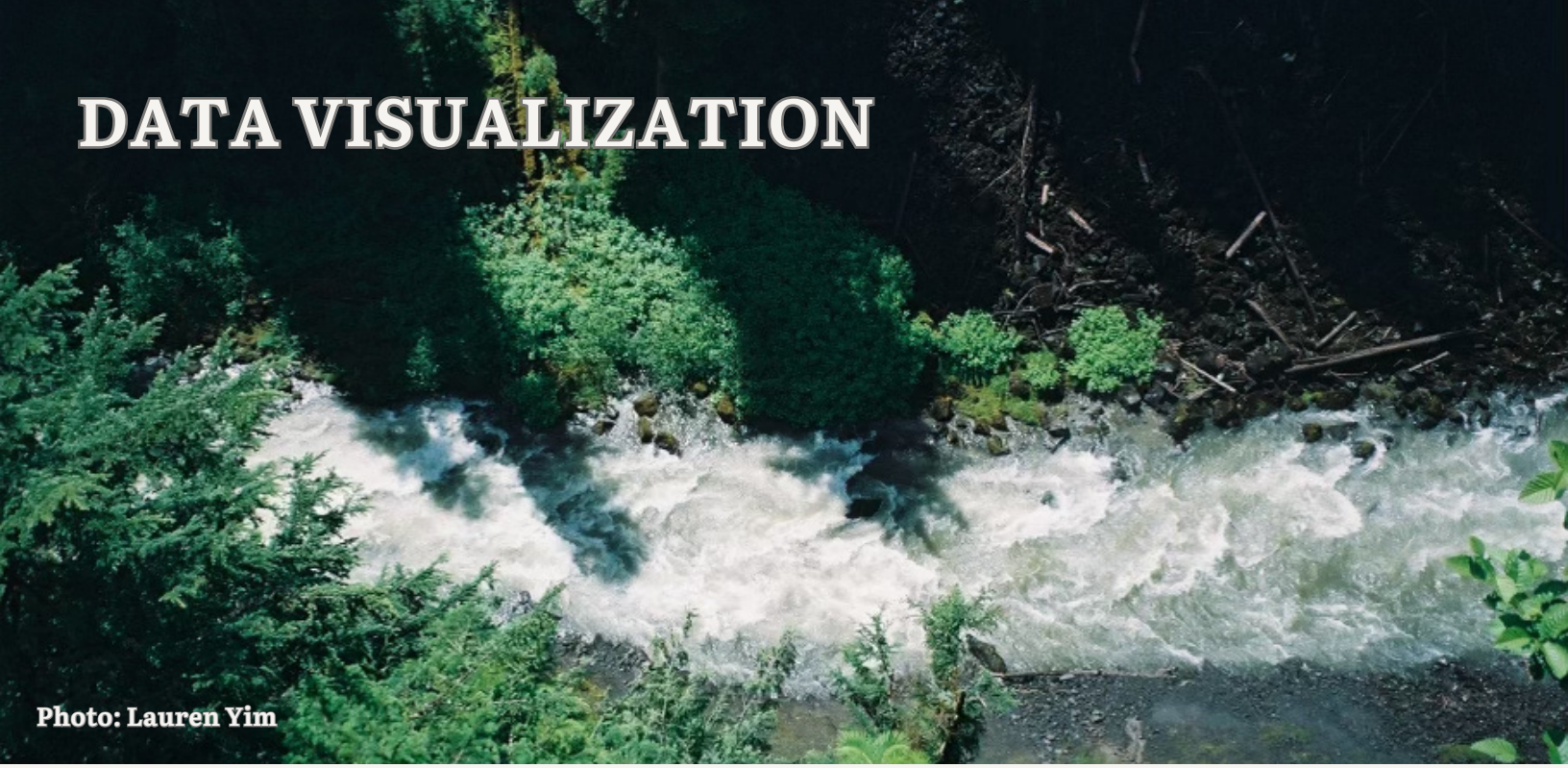

Photo: Lauren Yim

To better understand where human-black bear conflict may be occurring in BC, annual spatial distributions and the relative densities of black bears killed by the BCCOS in communities across BC from 2015-2021 have been presented on heat maps made with ArcGIS. Additionally, graphs highlighting the communities with the highest number of black bears killed in each year were produced to further visualize potential trends and patterns. These heat maps and graphs were created based on data that was obtained through a Freedom of Information request by The Fur-Bearers, which was provided by the Ministry of Environment and Climate Change Strategy (Government of British Columbia, 2022).

The BCCOS may kill a black bear if they are considered aggressive, food-conditioned to a point where the bear will return to areas with human activity if moved, diseased, or suffering in poor health, as well as if the translocation of the bear is considered unfeasible (e.g., due to the absence of a suitable translocation site) or dangerous (MFLNRORD, 2019). Observing the spatial patterns and relative densities of these black bear deaths over time allows us to further understand the geographical and anthropogenic factors that may contribute to black bears being killed by conservation officers.

References

Government of British Columbia. (2022). *FOI Request - MOE-2022-21065*. Retrieved from Ministry of Environment and Climate Change Strategy. https://www2.gov.bc.ca/enSearch/detail?id=26EE74C124B8476EA280E7A3C823A2D8&recorduid=MOE-2022-21065

Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD). (2019). *Procedure Manual*. Preventing and Responding to Conflicts with Large Carnivores. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-policy-legislation/fish-and-wildlife-policy/4-7-04011_preventing_and_responding_to_conflicts_with_large_carnivores.pdf

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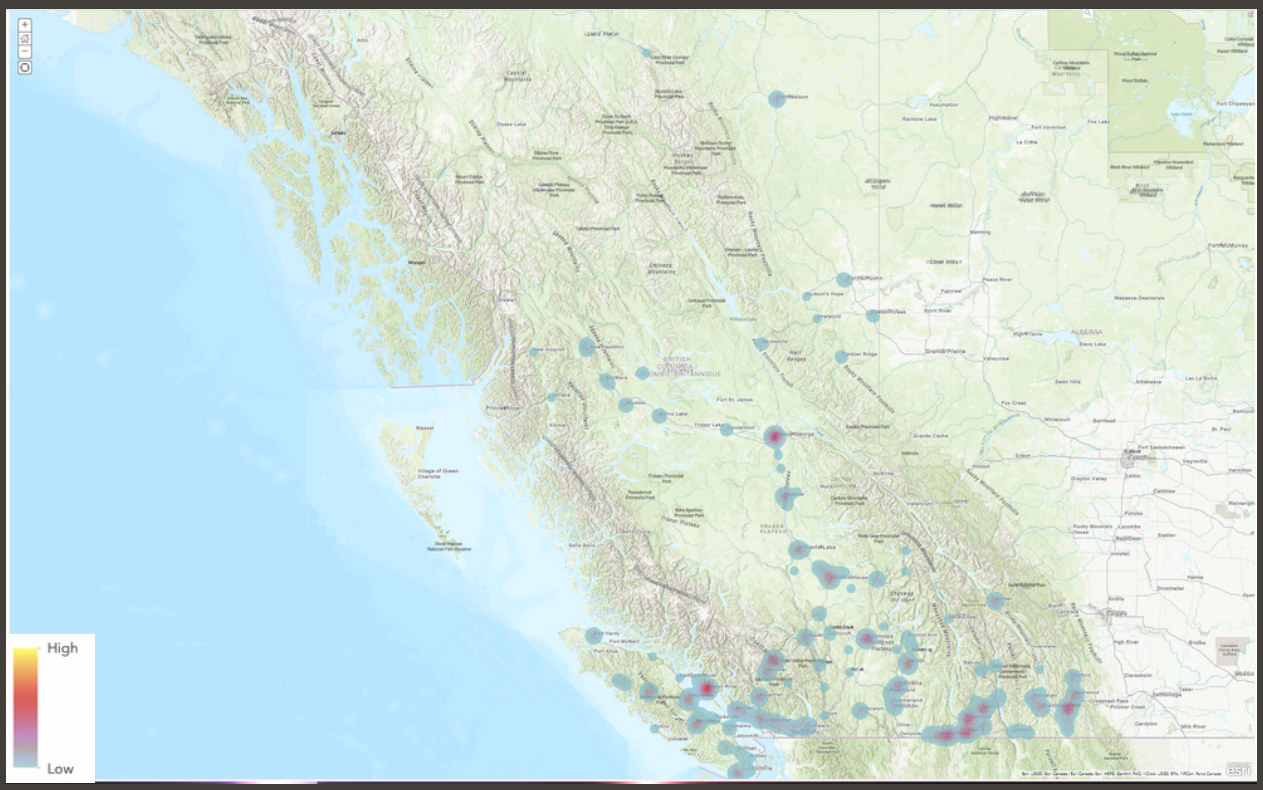

Figure 1. Spatial distribution and relative densities of black bears killed by the BCCOS in BC communities in 2015.

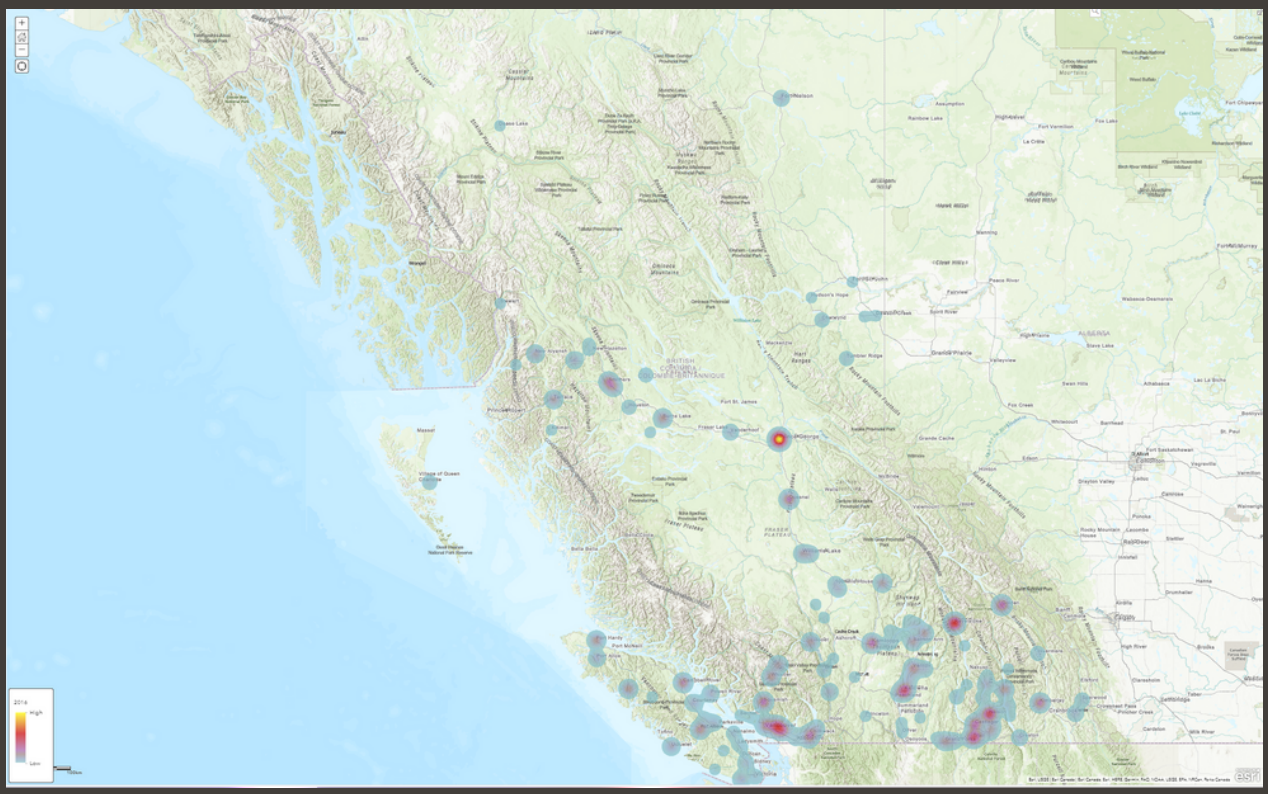

Figure 2. Spatial distribution and relative densities of black bears killed by the BCCOS in BC communities in 2016.

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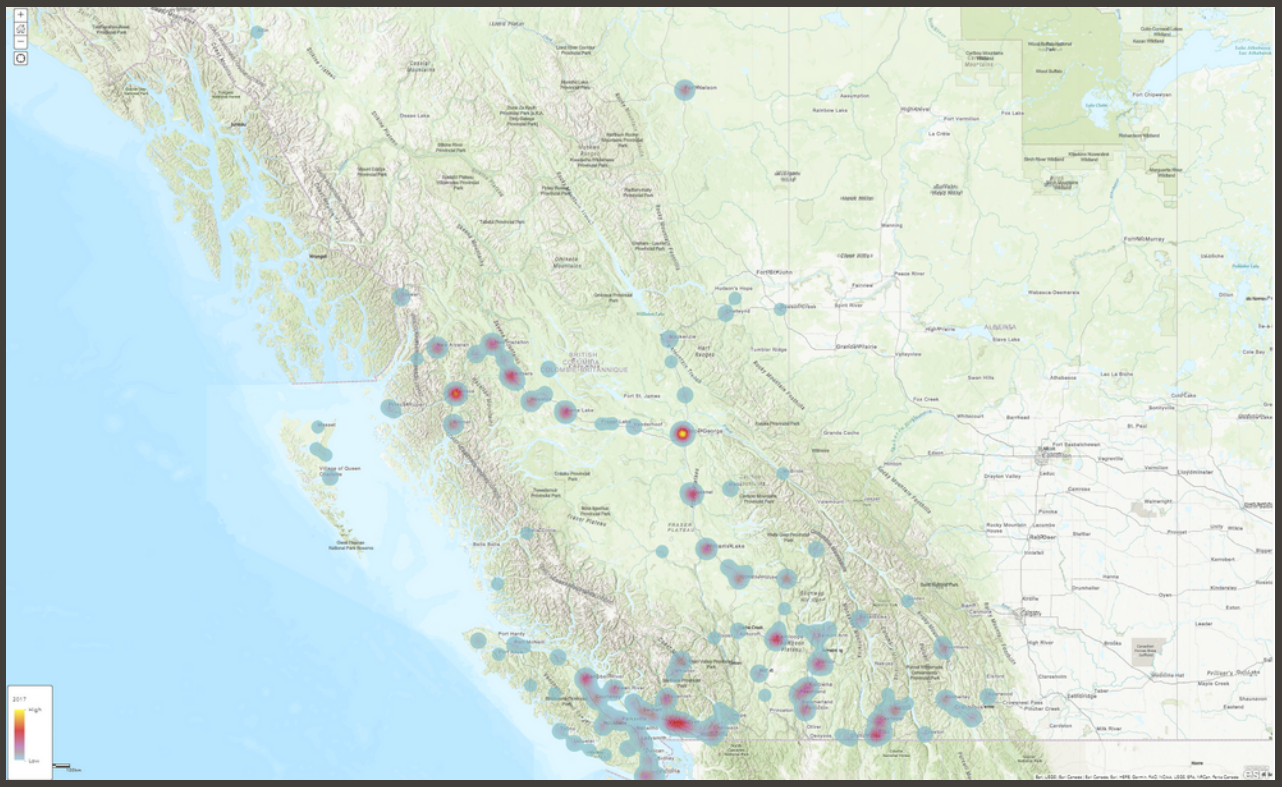

Figure 3. Spatial distribution and relative densities of black bears killed by the BCCOS in BC communities in 2017.

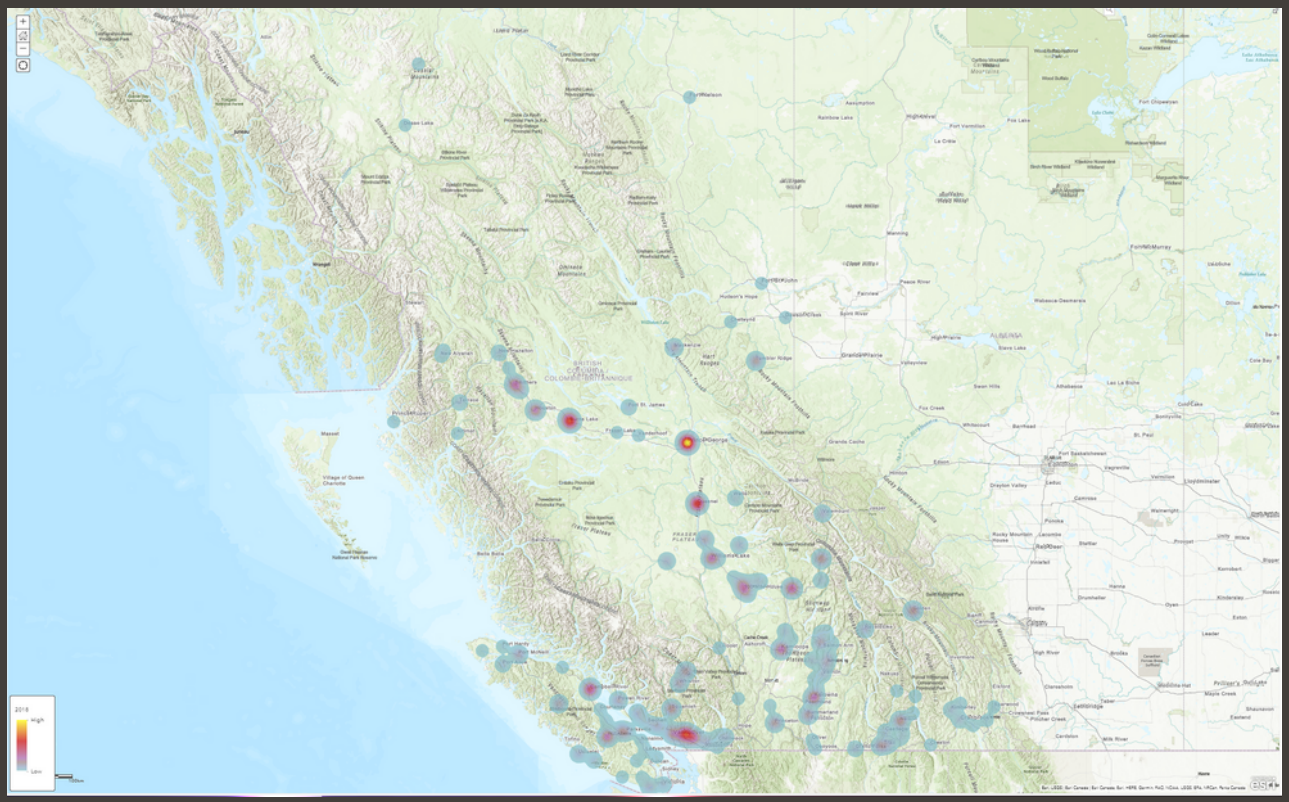

Figure 4. Spatial distribution and relative densities of black bears killed by the BCCOS in BC communities in 2018.

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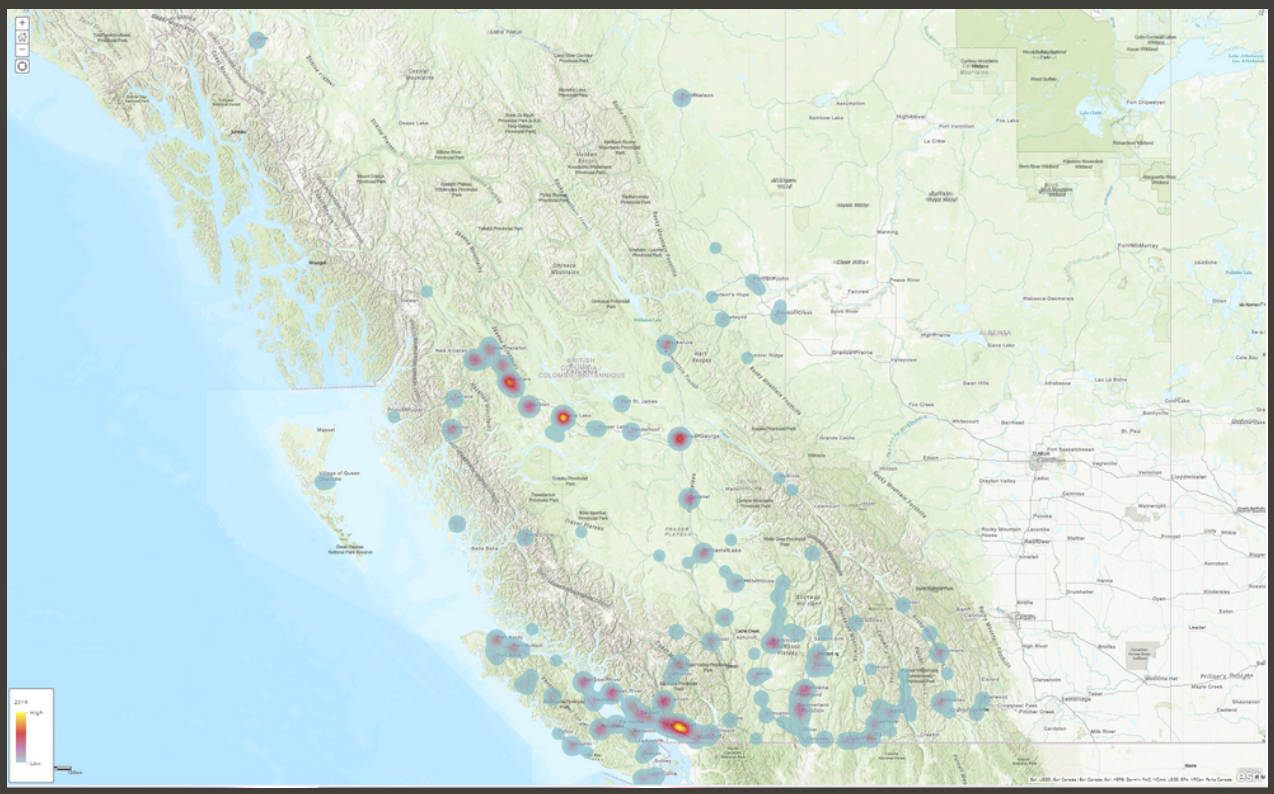

Figure 5. Spatial distribution and relative densities of black bears killed by the BCCOS in BC communities in 2019.

Figure 6. Spatial distribution and relative densities of black bears killed by the BCCOS in BC communities in 2020.

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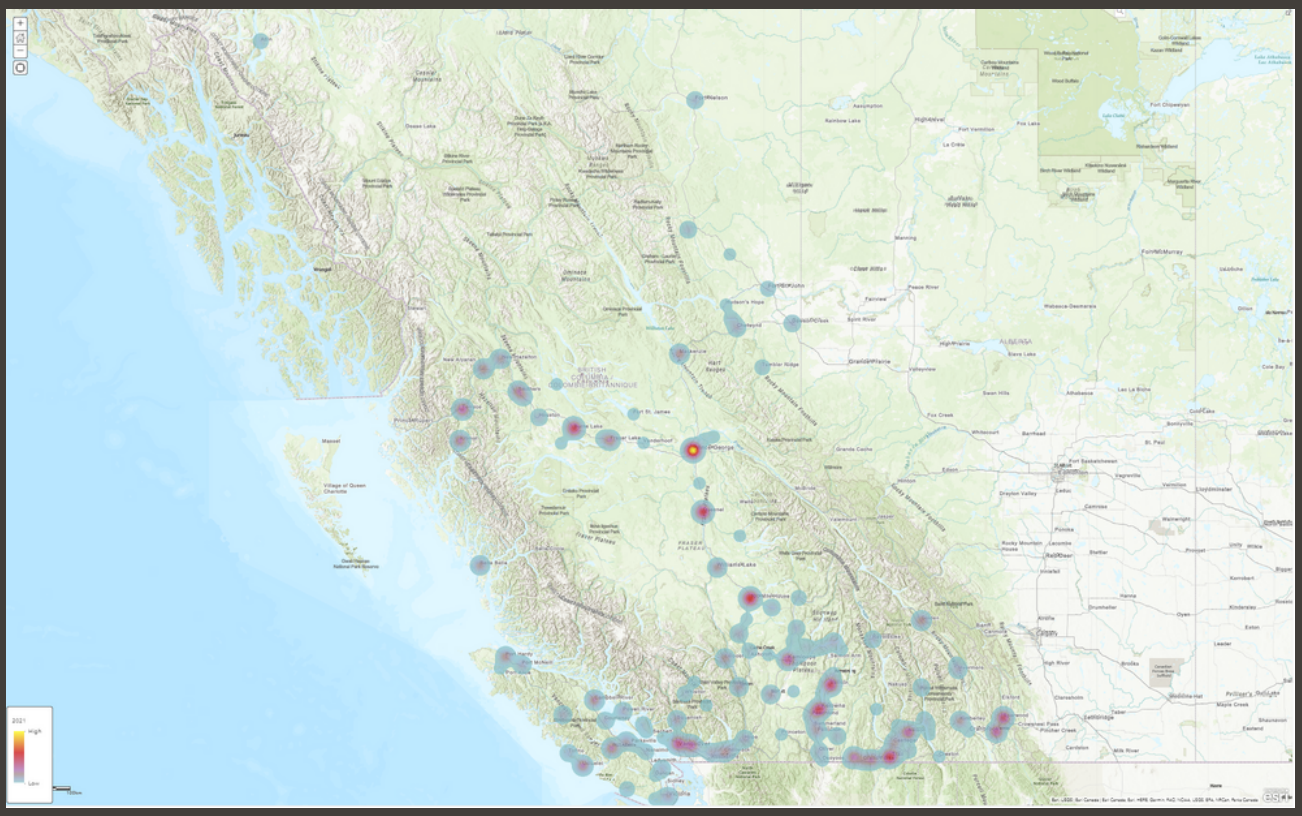

Figure 7. Spatial distribution and relative densities of black bears killed by the BCCOS in BC communities in 2021.

Table 1. The number of black bears killed by the BCCOS between 2015-2021 in BC communities that are not located on the heat maps due to software limitations.

COMMUNITY	2015	2016	2017	2018	2019	2020	2021	TOTAL
ALEZA CREEK	0	0	0	0	1	0	0	1
GITANYOW	0	0	1	0	0	0	0	1
GLENVOWELL	0	0	1	0	2	1	0	4
GREEN LAKE - 70 MILE HOUSE	1	0	0	0	3	0	0	4
JOHNSON'S LANDING	0	0	0	0	0	1	0	1
KALADEN	0	0	0	1	0	0	0	1
KITAMAAT VILLAGE (HAISLA NATION)	0	0	0	0	0	0	1	1
KITAMAT VILLAGE	0	0	1	0	0	0	0	1
SKIDEGATE IR	0	1	0	0	0	3	2	6
SOUTH SLOCAN - NORTH OF THE DAM INN	1	0	0	0	0	0	1	2
SOUTH SLOCAN - SOUTH OF THE DAM INN	1	0	0	0	0	0	0	1
SUNSET PRARIE	0	0	0	0	0	0	1	1
TAKSYIE LAKE	0	0	0	1	0	0	0	1
TATA CREEK	0	1	0	2	0	0	0	3
WILDWOOD (WILLIAMS LAKE)	0	0	0	0	1	0	0	1
WINDERMER	0	0	0	0	0	0	2	2

HIGH-INCIDENCE COMMUNITIES

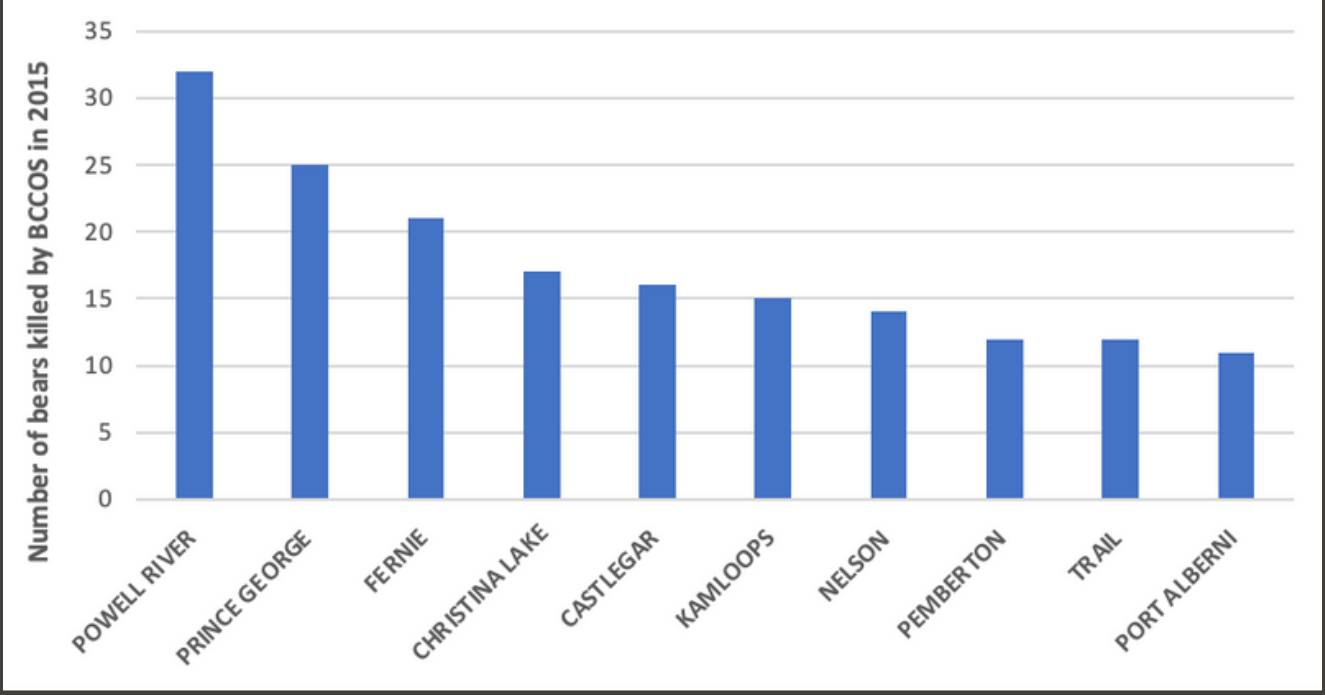

Figure 8. Communities in BC with the ten highest numbers of black bears killed by the BCCOS in 2015.

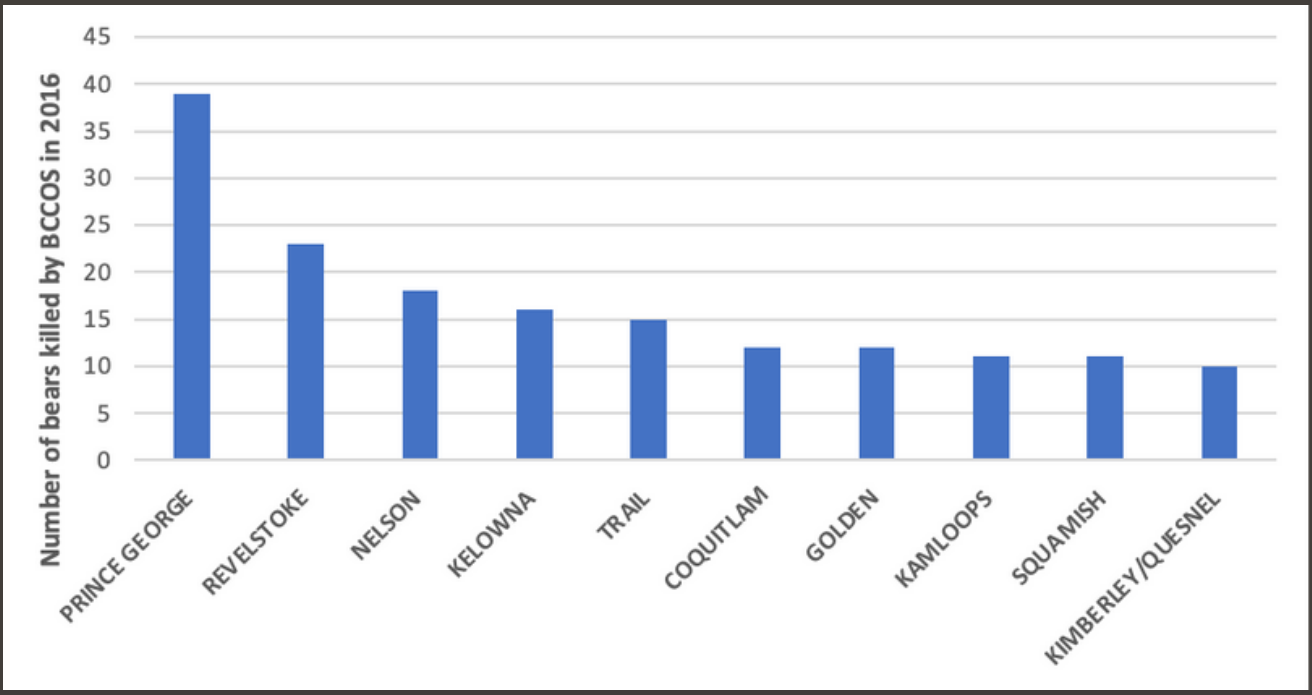

Figure 9. Communities in BC with the ten highest numbers of black bears killed by the BCCOS in 2016.

HIGH-INCIDENCE COMMUNITIES

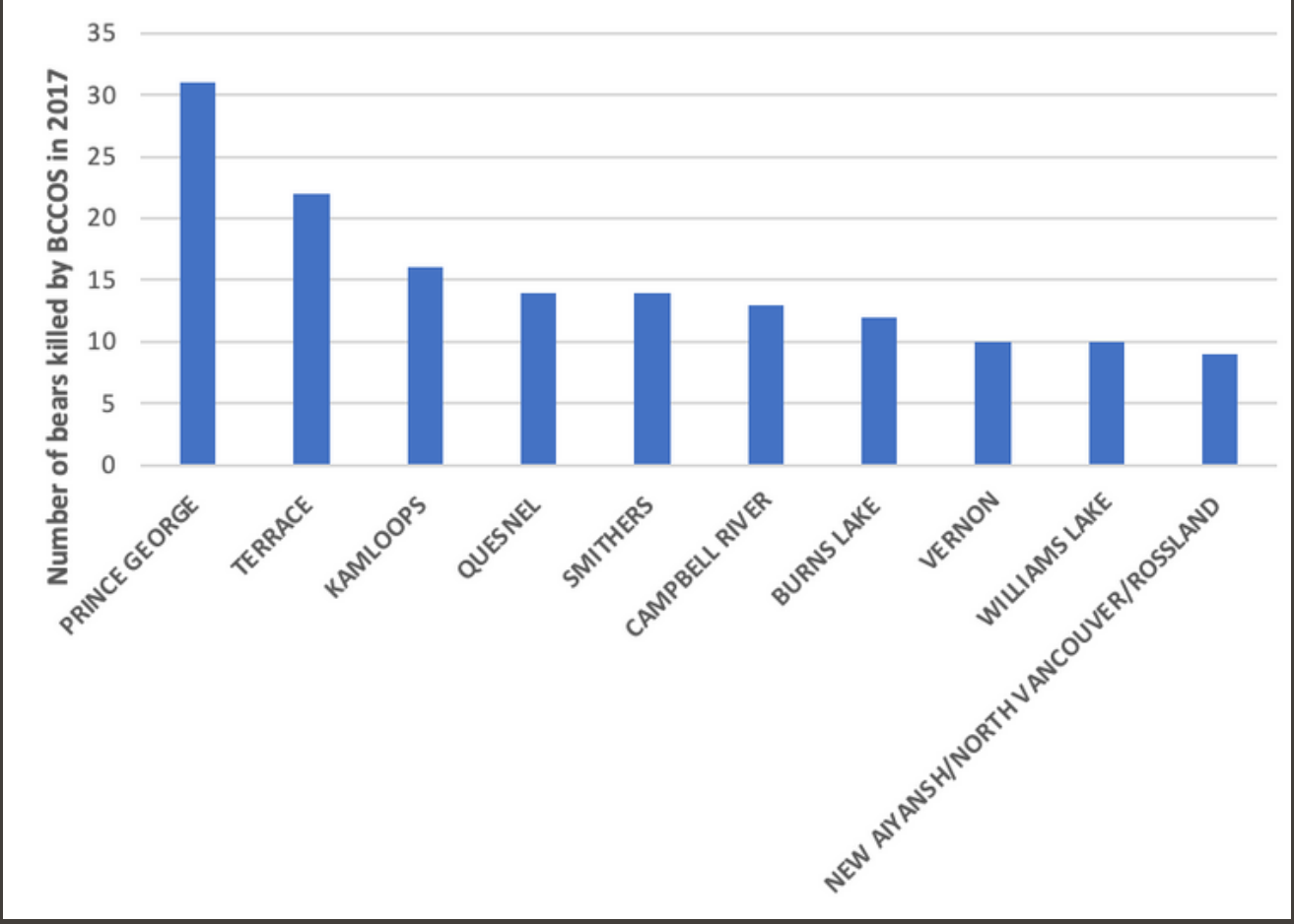

Figure 10. Communities in BC with the ten highest numbers of black bears killed by the BCCOS in 2017.

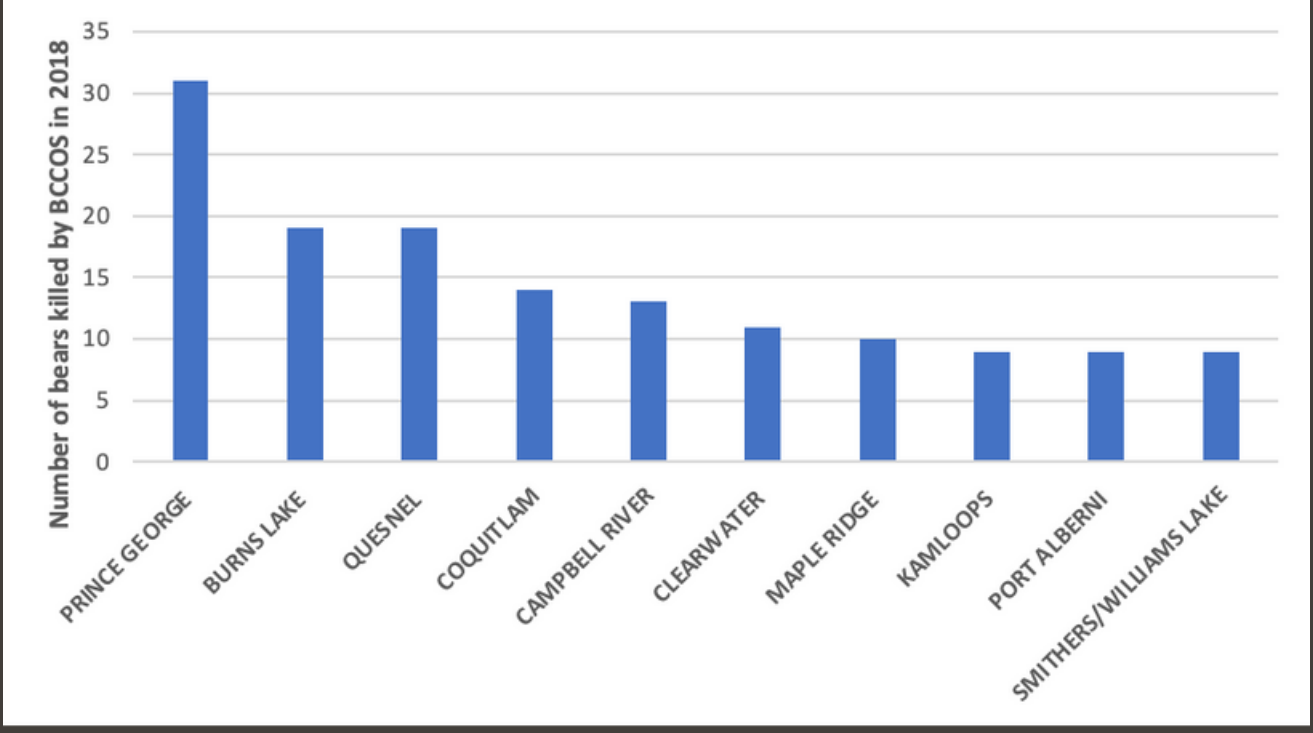

Figure 11. Communities in BC with the ten highest numbers of black bears killed by the BCCOS in 2018.

HIGH-INCIDENCE COMMUNITIES

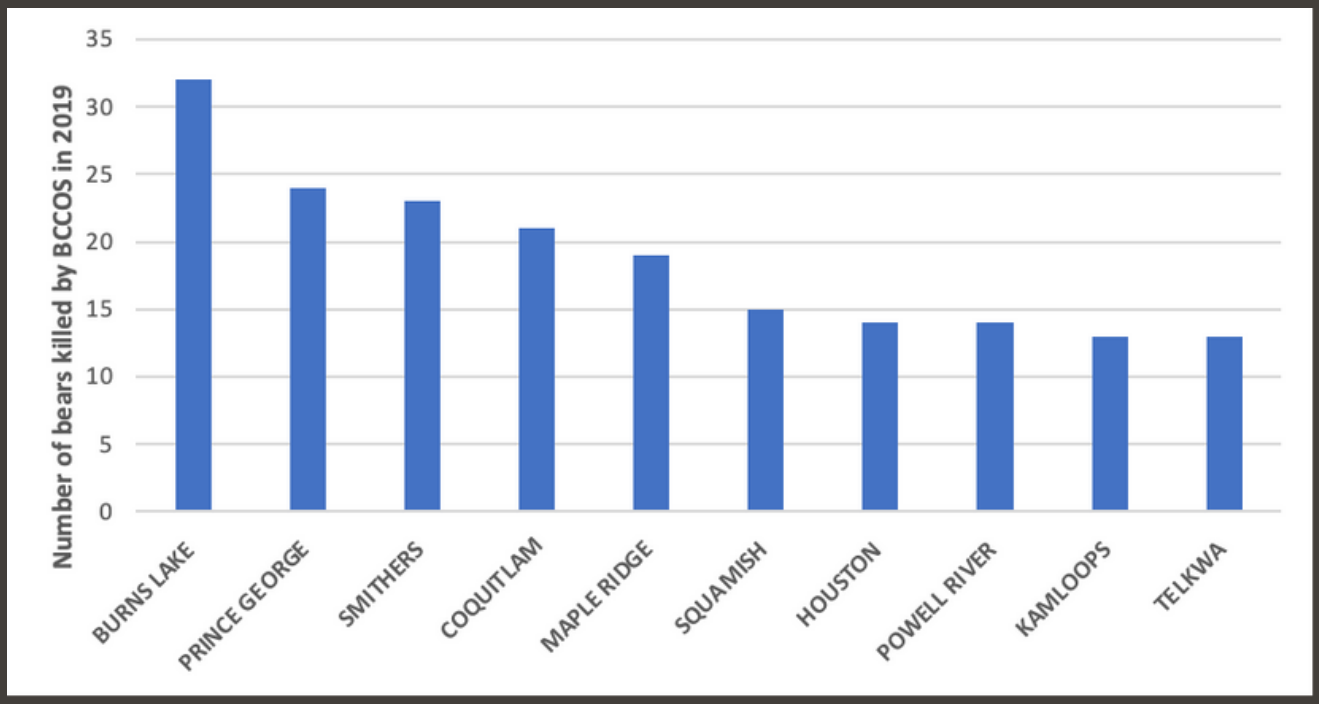

Figure 12. Communities in BC with the ten highest numbers of black bears killed by the BCCOS in 2019.

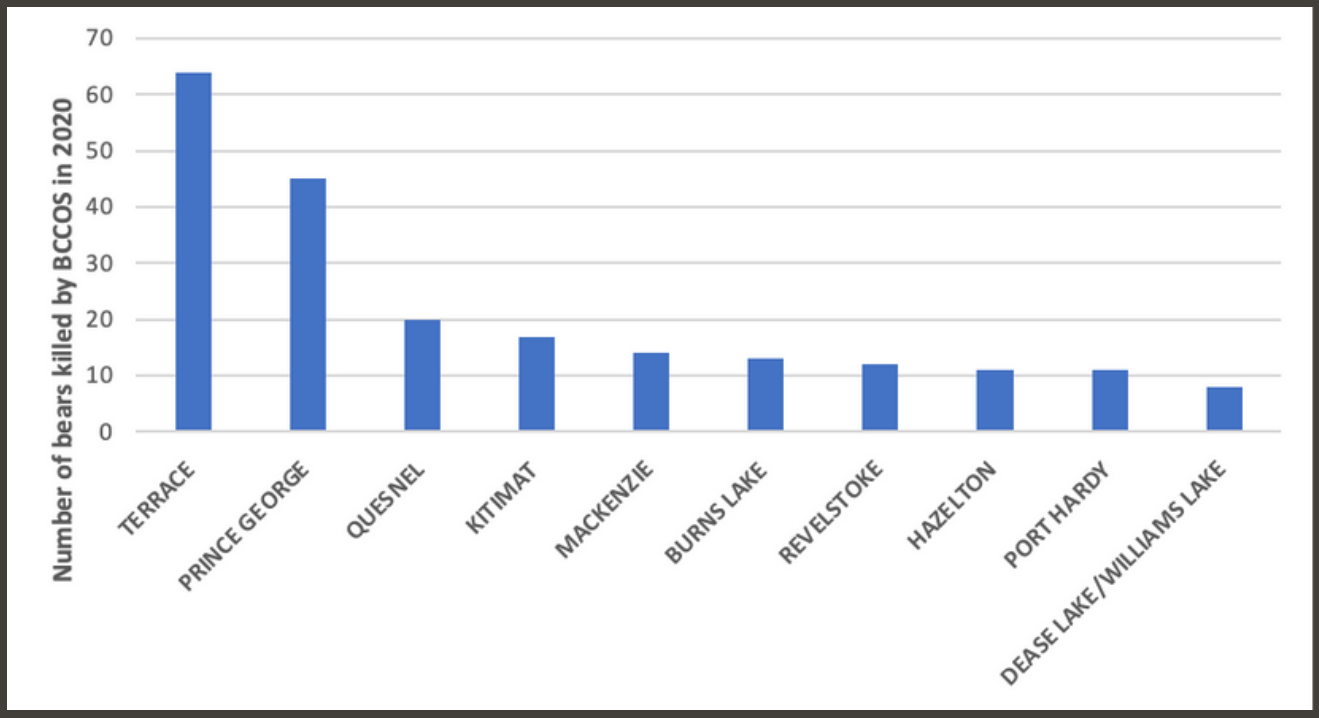

Figure 13. Communities in BC with the ten highest numbers of black bears killed by the BCCOS in 2020.

HIGH-INCIDENCE COMMUNITIES

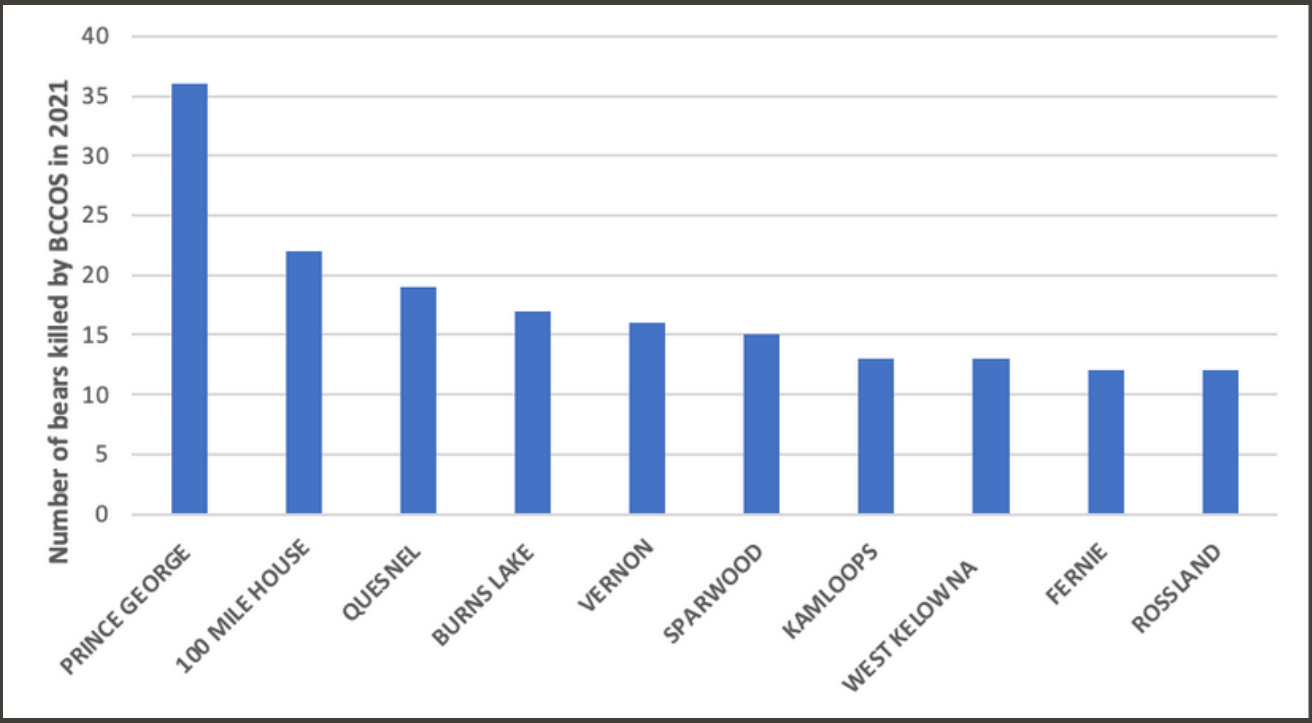

Figure 7. Communities in BC with the ten highest numbers of black bears killed by the BCCOS in 2021.

MUNICIPAL LEVEL MANAGEMENT

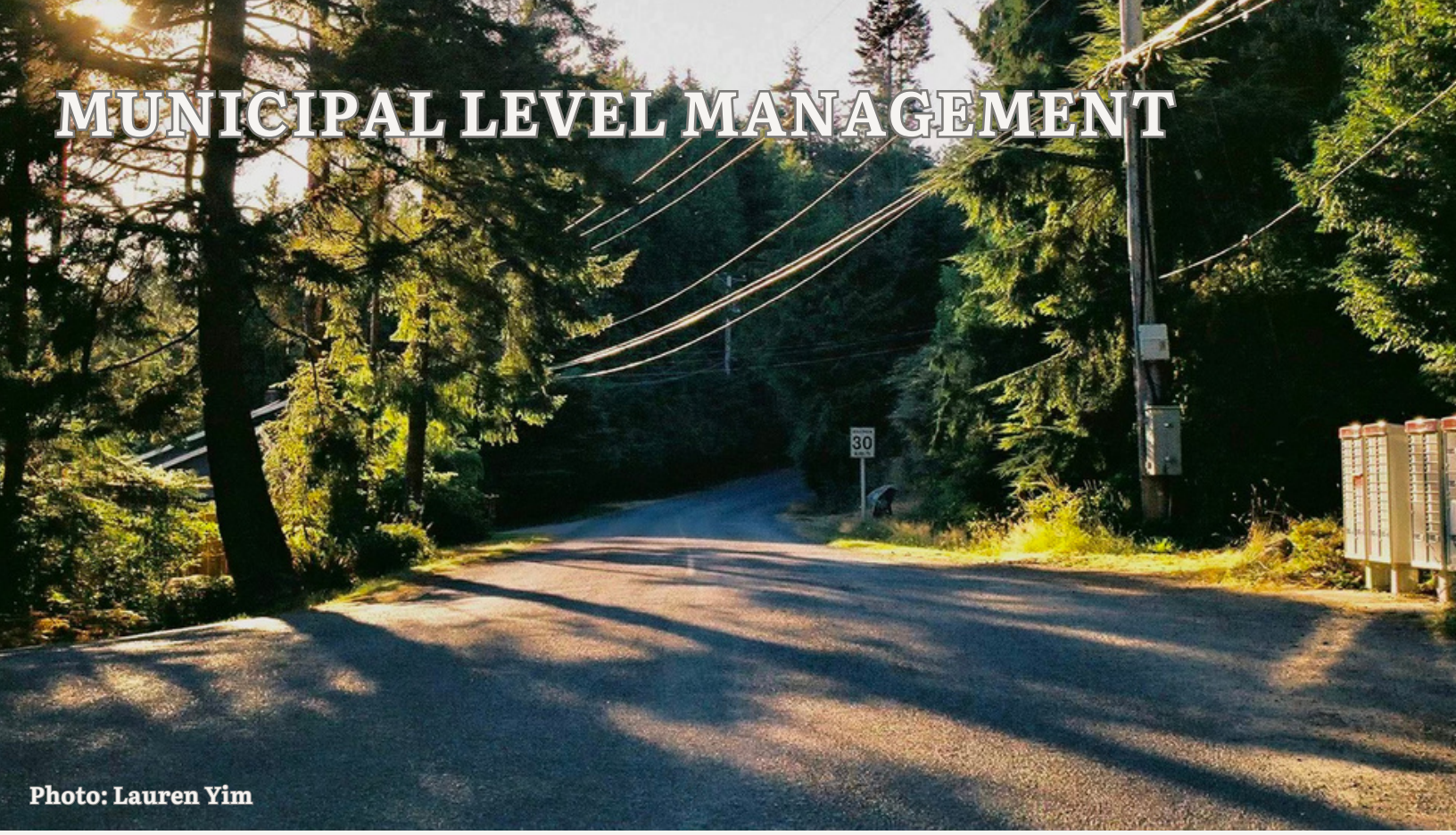

Photo: Lauren Yim

While actions that attract the presence of bears are typically performed by individual people (e.g., placing bird feeders and garbage in accessible areas), it is still important for wildlife conflict mitigation strategies to be implemented at the municipal level. This includes creating wildlife feeding by-laws that coincide with proper enforcement, creating educational programs to inform citizens about human-wildlife conflict and coexistence, and maintaining the vegetation in natural forest areas to support natural food supply for black bears. Here, an analysis on the geographical and social factors of five communities in BC that consistently had a high number of black bear deaths is performed. More specifically, communities that were among the top ten communities with the highest numbers of bear killings by the BCCOS four times or more between 2015-2021 were examined to determine potential reasons to help explain these trends. Coquitlam was also analyzed due to its consistently high number of black bear deaths while also having Bear Smart status.

MUNICIPAL LEVEL MANAGEMENT

Table 2. A list of attributes of five communities in BC that had consistently large numbers of black bears killed by the BCCOS between 2015-2021.

	PRINCE GEORGE	BURNS LAKE	QUESNEL	KAMLOOPS	COQUITLAM
Population size (2021)	76, 708	1,659	9,889	97,902	148,625
Geographical classification	Urban	Rural	Urban	Urban	Urban
Key topographical feature(s)	Located between the Nechako River and Fraser River	Located in the middle of a network of lakes (e.g., Decker Lake, Burns Lake)	Located between Fraser River and Quesnel River	Located by confluence of the North and South Thompson Rivers	Located by the confluence of the Coquitlam River and Fraser River
Number of black bear deaths by BCCOS (2015-2021)	231	103	102	82	69
Bear smart certification	No	No	No	Yes (since 2009)	Yes (since 2017)
Permittance of hen-keeping on residential properties	No	Yes	Yes	Yes (if property size is at least 370 m2)	No
Bylaws related to garbage maintenance	Yes	No	No	Yes	Yes

MUNICIPAL LEVEL MANAGEMENT

Prince George

The Prince George area has recorded the highest number of black bears killed by the BCCOS between 2015-2021 among communities in BC. Most reported black bear sightings occur around the boundary of the city, which is bordered by the Nechako River and Fraser River, and forested areas with diverse vegetation. These factors, along with the presence of accessible garbage and fruit trees in neighbourhoods and parks, makes Prince George an attractive passageway for black bears who are trying to find food and new habitat (Ciarniello, 2019). Although bylaws that relate to the responsible management of garbage are in place, enforcement is limited and unreliable (Ciarniello, 2019). While the Northern Bear Awareness Society, an educational non-profit organization based in Prince George, releases informative annual reports and sighting maps (among other data), it appears that there is not enough effort at the governmental level to save and protect black bears in the area (e.g., Northern Bear Awareness Society, n. d.). For instance, bear-resistant garbage cans are not provided in Prince George after a three-year trial in Hart Highlands Croft neighbourhood resulted in too many inconveniences for homeowners, such as malfunctioning locking mechanisms (Williams, 2022).

References

Ciarniello, L. M. (2019). *Bear Occurrence Reports and Mortalities for Prince George, BC, 2011-2017*. Northern Bear Awareness Society. https://www.northernbearawareness.com/Bear%20Occurrence%20Reports%20and%20Mortalities%20for%20Prince%20George,%20BC,%202011-2017.pdf

Northern Bear Awareness Society. (n. d.). *About Bears in Prince George*. https://www.northernbearawareness.com/bears-in-pg

Williams, A. (2022, October 5). Bear-proof garbage cans a bust, Prince George city council hears. *Prince George Citizen*. https://www.princegeorgecitizen.com/local-news/bear-proof-garbage-cans-a-bust-prince-george-city-council-hears-5913632

Burns Lake

Although the Burns Lake area has recorded a significant number of black bear deaths by the BCCOS (103 bears) between 2015-2021, limited information regarding black bear management and conflict is available to the public. Based on the Wildlife Alert Reporting Program Map of reported black bear sightings near the Burns Lake area between 2015-2021, it appears that many black bears traverse along Yellowhead Highway, which runs near the surrounding network of lakes as well as through Burns Lake itself (British Columbia Conservation Foundation, 2023). Moreover, there are no bylaws for the management of garbage or wildlife attractants such as bird feeders and fruit trees. This means that Burns Lake would be an attractive stop or even potential home for wild black bears. Additionally, the permittance of backyard chickens and beekeeping within certain areas of the municipality adds further incentive for bears to travel through this small urban city (Village of Burns Lake, n. d.).

References

British Columbia Conservation Foundation. (2023). W.A.R.P. *Wildlife Alert Reporting Program*. https://warp.wildsafebc.com/#

Village of Burns Lake. (n. d.). *Bylaws and Policies*. https://burnslake.ca/mayor-and-council/bylaws-and-policies/

MUNICIPAL LEVEL MANAGEMENT

Quesnel

The Quesnel area comprises of a confluence of the Fraser River and Quesnel River that surrounds a small urban city which had 102 black bears killed by the BCCOS between 2015-2021. According to the 2015 and 2021 WildSafeBC Cariboo Regional District Annual Reports, actions such as educational presentations, increasing conflict awareness on social media platforms, placing warning stickers on residential garbage bins, and installing wildlife signs in neighbourhoods have been undertaken by the staff of WildSafeBC (Traer, 2021; Conlin, 2015). Despite this, bylaws relating to the responsible management of wildlife attractants (e.g., garbage, compost, fruit trees, etc.) are not present in Quesnel, and backyard chickens are permitted to be kept on residential properties (Traer, 2021). These factors likely attract black bears into the area, which may lead to conflict and thus their deaths by the BCCOS.

References

Conlin, L. (2015). *WildSafeBC Quesnel Anuual Report 2015*. WildSafeBC. https://wildsafebc.com/wp-content/uploads/2017/08/WSBC2015AnnualReportQuesnel.pdf
Traer, T. (2021). *WildSafeBC Annual Report 2021 Cariboo Regional District*. WildSafeBC. https://wildsafebc.com/wp-content/uploads/2021/12/WildSafeBC-Cariboo-Annual-Report-2021.pdf

Kamloops

Despite having Bear Smart status since 2009, numerous black bears have been killed by the BCCOS between 2015-2021 in the Kamloops area. Being Bear Smart implies that Kamloops has an active education program relating to conflict with bears, bylaws promoting responsible management of bear attractants, and bear-proof waste management systems (British Columbia Conservation Officer Service, n. d.). However, the overall landscape and location of Kamloops seems to be attracting black bears in spite of these actions. For instance, wildfires and drought in the Thompson-Okanagan region cause low natural food abundance for bears, which may potentially be driving black bears into the city for anthropogenic sources of food and habitat (Mcalaster, 2021). There is also no bylaw regarding responsible fruit tree management, and backyard chickens are allowed to be kept on residential properties if the property meets a specified size requirement (Mcalaster, 2021; City of Kamloops, n. d.). Together, these factors are likely contributing to the high number of bears visiting the area, and thus the high number of bears killed as well.

References

British Columbia Conservation Officer Service. (n. d.). *Bear Smart Communities*. https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/conservation-officer-service/bearsmart_brchr.pdf
City of Kamloops. (n. d.). *Urban Hens*. https://www.kamloops.ca/our-community/community-initiatives/food-urban-agriculture/urban-hens
Mcalaster, R. (2021, August 24). Drought, fires may be why more bears are being seen in city. *Kamloops This Week*. https://www.kamloopsthisweek.com/local-news/drought-fires-may-be-why-more-bears-are-being-seen-in-city-4449411

MUNICIPAL LEVEL MANAGEMENT

Coquitlam

Like Kamloops, the Coquitlam area has noted a significant number of bear deaths between 2015-2021 by the BCCOS despite also having Bear Smart status. Furthermore, proper enforcement of bear-proof garbage bylaws through the issuing of tickets and increased patrolling seems to have been occurring, as news reports have noted (e.g., Balzer, 2022; Balzer, 2022b). However, mismanaged fruit trees continued to be an ongoing issue that attracted black bears (Balzer, 2022). Notably, the city of Coquitlam has a designated staff member with the title "Urban Wildlife Coordinator" whose role is to help mitigate human-wildlife conflict by organizing education workshops, handing out warnings and fines, and working alongside the BCCOS to promote safe management of urban wildlife (Strandberg, 2016).

To further explain the high incidence of black bear deaths in the area, local geographical features that may promote large black bear populations should be considered. For example, Coquitlam is located by Coquitlam Mountain, Pinecone Burke Provincial Park, Coquitlam River, and Fraser River. Such a landscape likely offers ideal food and habitat, which would sustain high numbers of black bears in the area (e.g., Government of British Columbia, 2022). A potential hypothesis for increased black bear activity in Coquitlam may be that younger, less dominant bears as well as mothers with cubs may be curious or driven out of the surrounding wilderness, thus pushing them into the urban Coquitlam area where there are potential sources of food (Lamb et al., 2020).

References

Balzer, K. (2022, April 6). Coquitlam issued 105 tickets in 2021 to those that left food scraps out for bears — even if it was unintentional. *Tricity News*. https://www.tricitynews.com/local-news/coquitlam-issued-105-tickets-in-2021-to-those-that-left-food-scraps-out-for-bears-even-if-it-was-unintentional-5239409

Balzer, K. (2022b, February 28). Bear watch: Coquitlam residents asked to secure garbage as city staff set extra eyes on local neighbourhoods. *Tricity News*. https://www.tricitynews.com/local-news/bear-watch-coquitlam-residents-asked-to-secure-garbage-as-city-staff-set-extra-eyes-on-local-neighbourhoods-5109514

Government of British Columbia. (2022). *Pinecone Burke Park*. BC Parks. https://bcparks.ca/pinecone-burke-park/

Lamb, C. T., Ford, A. T., McLellan, B. N., Proctor, M. F., Mowat, G., Ciarniello, L., Nielsen, S. E., & Boutin, S. (2020). The ecology of human–carnivore coexistence. *Proceedings of the National Academy of Sciences - PNAS*, 117(30), 17876-17883.

Strandberg, D. (2016, March 3). A passion for saving bears and wildlife. *Tricity News*. https://www.tricitynews.com/local-news/a-passion-for-saving-bears-and-wildlife-3028459

CONCLUSION

Photo: Lauren Yim

British Columbia's expansive wilderness often causes urban cities to become corridors for wildlife. Thus, it is vital for municipalities to adopt bear-smart strategies with sufficient education and enforcement to ensure that their city does not become an attractive rest area or home for black bears, as this may increase the incidence of conflict. Recommended management approaches include regular vegetation maintenance in wild forest areas to create a buffer between urban areas, focusing on modifying human behaviour through education and awareness instead of attempting to alter bear behaviour, creating wildlife attractant bylaws that coincide with adequate enforcement, prohibiting backyard bee and chicken keeping, and remaining adaptive to accommodate seasonal patterns within wildlife management. With this, however, it is important to recognize that the local landscape can limit the effectiveness of municipal bear-smart strategies by consistently sustaining surrounding large black bear populations. Regardless, it is crucial for municipalities to minimize the frequency and duration of black bear visits in urban areas by adopting such management plans. In all, we must be mindful of the fact that we are the ones encroaching on the lands of wildlife–not the other way around. It is our responsibility to be respectful and adaptable to promote coexistence and appreciation for the life that surrounds us.