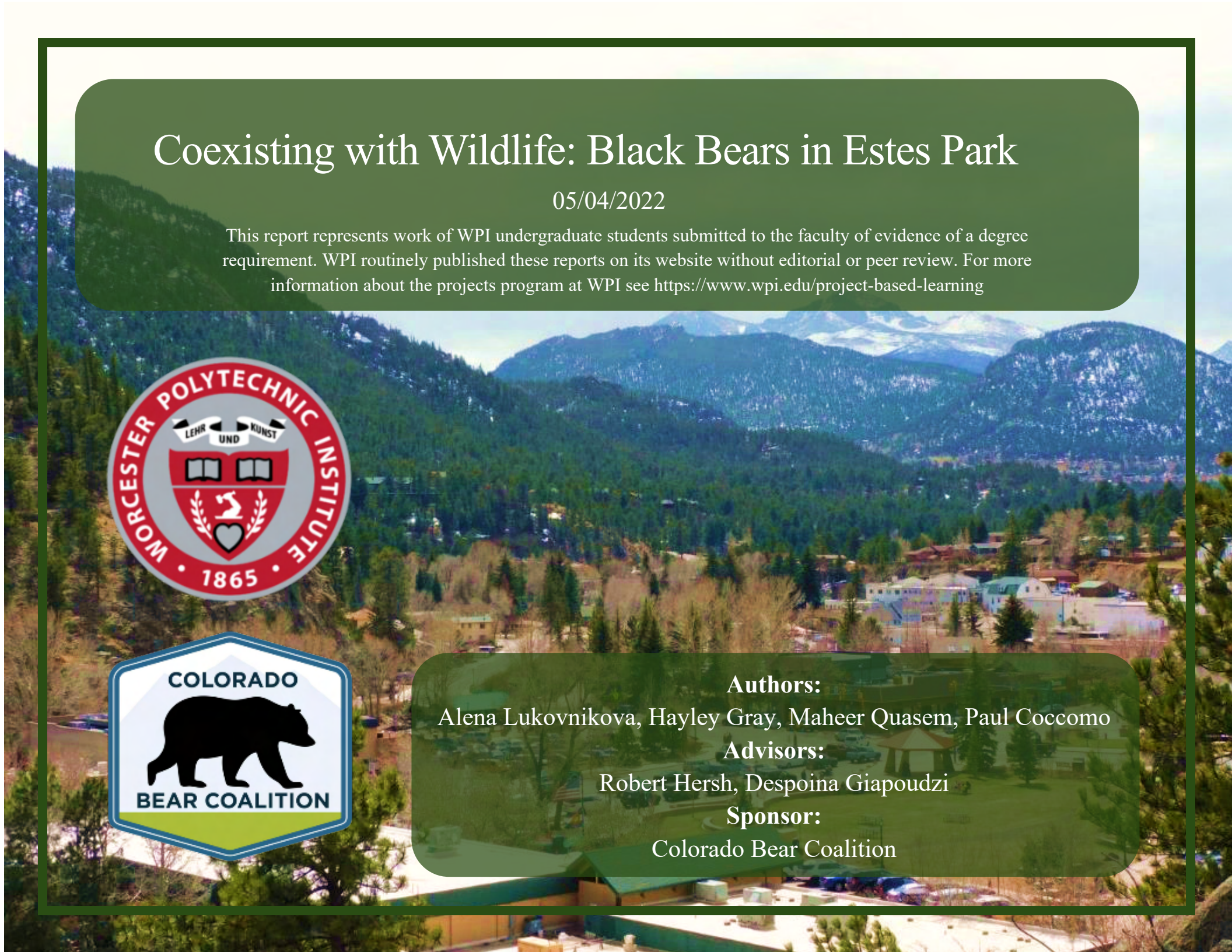
Coexisting with Wildlife: Black Bears in Estes Park

05/04/2022



Authors:
Alena Lukovnikova, Hayley Gray, Maheer Quasem, Paul Coccomo
Advisors:
Robert Hersh, Despoina Giapoudzi
Sponsor:
Colorado Bear Coalition

Abstract

The Colorado Bear Coalition has worked since 2021 to mitigate human-black bear interactions all across the state. We have been assisting the Coalition by investigating bear attractants in the town of Estes Park and by identifying possible mitigation strategies to utilize at the YMCA of the Rockies. We interviewed different restaurants in the area, evaluated the bear interactions that have occurred at the YMCA, and interviewed various YMCA employees. From our findings, we recommend that the YMCA should implement an “unwelcome” window system and conduct further research on the feasibility of planting foraging areas on its campus.

Acknowledgements

We would not have been able to accomplish our work without the generous time and valuable help dedicated by our sponsors, our advisors, the staff at the YMCA, wildlife experts, and many more Estes Park residents. As a team, we are very grateful for all of the wonderful people around us who made our project possible. We would like to offer a special thank you to the following:

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- Brenda Lee – Colorado Bear Coalition
- Rachel and Andy Ames – Estes Park Watershed Coalition
- Ginny Hutchinson – Estes Park Wildlife Protection

Our Advisors:

- Robert Hersh – Worcester Polytechnic Institute
- Despoina Giapoudzi – Worcester Polytechnic Institute

YMCA Staff:

- John Cordsen – Head of Security
- Donovan Colegrove – Program Director
- Kelly Wilkerson – Head Groundskeeper
- Troy Husler – Building Supervisor
- Joe Pullen – Assistant Grounds Supervisor
- Jim Boyd – Guest Service Director
- Chris Daubin – Former YMCA employee

Bear Container Certification Informants:

- Patti Sowka – Bear-Resistant Trash Can Certifier
- Kathy Carroll – Bear-Resistant Trash Can Certifier

Wildlife Experts:

- Stacy Lischka – Conservation and Agricultural Social Scientist
- Chase Ryland – Local CPW officer
- Chris Clatterbuck – RMNP bear technician
- Kristen Cannon – CPW regional manager

Estes Park Residents:

- Tim Nicholson – Wildlife Advocate
- Ann Schonlau – Wildlife Advocate
- Corey Pass – Police Captain
- Restaurant and Hotel Mangers

And many, many more!

Meet the Team

Hayley Gray

Hayley is a third-year mechanical engineering major from Potsdam, New York. She hopes to one day work in the research and design field. Her favorite memory from IQP is hiking and spending time with new friends!

Paul Coccomo

Paul is a junior at WPI studying aerospace engineering. He hopes to one day work in the space exploration field. He loves painting, the outdoors, and model rocketry in his free time.

Alena Lukovnikova

Alena is a third-year biomedical engineering student on the pre-med track, hoping to become a physician someday. She loves spending time outdoors and felt very lucky living in Colorado and working with wildlife.

Maheer Quasem

Maheer is a third-year student at WPI studying chemical engineering. He wants to study and work in the field of energy after graduating. He loved the time being outdoors in a new environment.

Authorship

Section	First Draft	Second Draft	Final Revisions
Abstract	Quasem	ALL	ALL
Executive Summary	ALL	ALL	ALL
Chapter 1. Introduction	Gray, Quasem	Gray, Quasem	ALL
Chapter 2. Background	ALL	Lukovnikova, Gray, Quasem	ALL
Chapter 3. Methods	Lukovnikova, Coccomo, Gray	ALL	ALL
Chapter 4. Findings	ALL	ALL	ALL
Chapter 5. Conclusion	Coccomo, Quasem	ALL	ALL

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Executive Summary

Due to its geographic location, specifically its proximity to Rocky Mountain National Park, Estes Park, Colorado is a hotspot for a variety of wildlife, including elk, mule deer, and black bears. For years, residents and businesses of Estes Park have had difficulties with bears getting into trash containers, homes, and vehicles; issues typically attributed to the town's highly transient population. The YMCA of the Rockies experiences a large volume of tourists who can often be unprepared or uninformed regarding black bear safety practices. With its location between Rocky Mountain National Park (RMNP) and the town, the YMCA likely serves as a natural pathway for their movement into Estes Park. In addition, the downtown area is filled with many restaurants, the food and cooking oil waste of which constitutes main attractants for bears.

Additionally, climate change plays a role in driving human-black bear interactions. As the planet experiences events such as changing temperatures, droughts, and reduction of biodiversity, resources that are naturally occurring for bears are altered or significantly diminished (Abrahms et al., 2021; Ostrom, 2009). A study conducted in 2009 investigating factors that impacted black bear behavior and populations in RMNP found that climate change could produce hot, dry seasons which would cause the black bear population to decrease. In order to counteract this decrease in population, black bears may become food-conditioned; dependent on human-related food resources (Baldwin, 2009). Food conditioning can lead to an unsustainable black bear population that is forced to enter human habitat to survive.

During the fall, before black bears hibernate, they must stock up on calories and fat to survive the winter. At this time, known as hyperphagia, bears will spend up to 20 hours each day eating, and some sources state that they may consume up to 20,000 calories a day. (Colorado Parks & Wildlife*)*. During poor food years, when naturally occurring food sources are scarce, they look elsewhere for survival, typically in residential areas. While they are considered to be timid animals, black bears are known to enter homes, vehicles, and trash containers in their search for food. This is due to a variety of factors, including hyperphagia, their acute sense of smell, and learned behaviors.

There have been many efforts to mitigate human and black bear interactions in Estes Park. Educating the public is a common strategy utilized by wildlife agencies and local groups to promote bear safety practices, however it relies heavily on community involvement and participation (Marley et. al., 2017).

Another key factor in mitigating human-bear interactions is the development of bear-resistant trash containers. The main goal of these garbage containers is to prevent bears from accessing human food and food waste. While these bear-resistant cans are an important part of mitigating interactions, oftentimes their use is not enforced, they are used improperly, or in some cases are even opened by

determined bears. In fact, a bear resistant trash can ordinance was introduced to the town of Estes Park in 2017, mandating residents and business owners to use bear resistance trash containers. This ordinance was an effective way to reduce human – bear interactions as it led to fewer and fewer bear-interaction reports.

Figure 1. A bear-resistant garbage container example. It utilizes latches to prevent bears from breaking in (Bear-Resistant Trash Containers | Bear Smart Durango, n.d.)

One wildlife organization that advocates for black bears is the Colorado Bear Coalition, a non-profit organization composed of groups that work to protect the welfare of black bears. It has made strides to mitigate human-black bear conflicts across Colorado through innovative and proactive efforts. Our project's aim was to apply similar strategies to the Estes Park region by investigating black bear attractants in town and identifying potential mitigation suggestions at the YMCA of the Rockies. We used data obtained from its security team to create an interactive map assessing the variables and trends affecting human-bear interactions in the area. We also investigated current mitigation strategies utilized by the YMCA along with employee perspectives on black bears. Lastly, we aimed to the impact of attractants for black bears in town, specifically restaurant cooking oil waste. Through these objectives, we strived to mitigate human and black bear conflicts in Estes Park, Colorado.

Our initial investigation in Estes Park focused primarily on the use of bear-resistant garbage containers. Through preliminary informal interviews with multiple restaurants and businesses in town, it became apparent that garbage waste disposal practices were not as huge an issue as we had originally estimated. This came as a result of the 2017 trash ordinance requiring residents and businesses to secure waste in bear-resistant containers. After these initial interviews, our investigation shifted to focus on restaurant cooking oil waste and its role in attracting black bears into town.

We surveyed nine different restaurants in town to assess the impact of cooking oil waste on human and black bear interactions in the Estes Park region. Our focus was on informal interviews with restaurant managers who were able to provide a variety of perspectives on human-black bear interactions and cooking oil waste. The restaurants in Estes Park were selected based on geographic location. We chose to survey restaurants from the busy downtown to the outskirts of town. These interviews were analyzed and sorted based on key themes among responses.

One of the main trends that appeared from these interviews was the impact of cooking oil storage practices on the frequency of bear interactions. Specifically, restaurants that stored their used cooking oil in bear-resistant containers, sheds, or other types of enclosures seemed to have fewer interactions and issues with bears. Restaurants that did not use bear-resistant containers to store their cooking oil seemed to have more issues with attracting bears.

Using black bear interaction data recorded by security staff, we catalogued black bear incidents on the YMCA property for the years 2019 and 2020. After inputting all of the report data into one central spreadsheet, we used Google Reports to plot this data onto a map of the YMCA of the Rockies property. We created the maps with the ability to be filtered by year, allowing users to see annual changes in bear activity and movement to different cabins. In addition, we created graphical models to analyze factors related to human and black bear interactions at the YMCA.

The bear incident map displays each interaction along with other characteristics that provide context on each incident. Of all bear interactions in 2019-2020 at the YMCA, approximately 56% of them were at repeating locations. This information indicates that bears are significantly more likely to return to locations where they have previously received a food reward, and highlights the importance of securing food. The frequency of interaction indicated that there was a factor which drew the bear to come back to the location. These factors may be the availability of food, frequently left open windows and doors, and proximity to a potential wildlife corridor. It was mainly when there were poor conditions for natural vegetation growth (bad food year), that bears would enter human settlements and forage on human food. Due to this information, we believe that if increased natural vegetation was available to bears, then they would be more likely to stay in their natural habitat.

Figure 2. Map of 2019 and 2020 black bear interactions at the YMCA of the Rockies.

We found from 2019 to 2020, there were 54 cabin entries, 41 attempted entries, 2 vehicle entries, 27 trash entries, and 21 sightings, with the majority of the damage being done to window screens and screen doors. In both 2019 and 2020, over 50% of all cabin entries, attempted entries, trash entries, and vehicle entries resulted in damage done to YMCA property. In 73% of the cabin, trash, and vehicle entries, the bear had gained a food reward. This indicates that food is the main attractant when encountering a human-bear interaction.

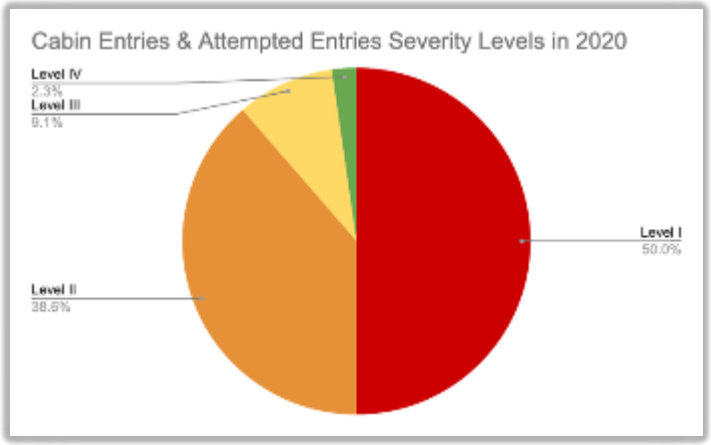


Figure 3.Pie chart showing the percentage of cabin and attempted entries that were classified under each severity level. Level I is most severe while level IV is the least severe.

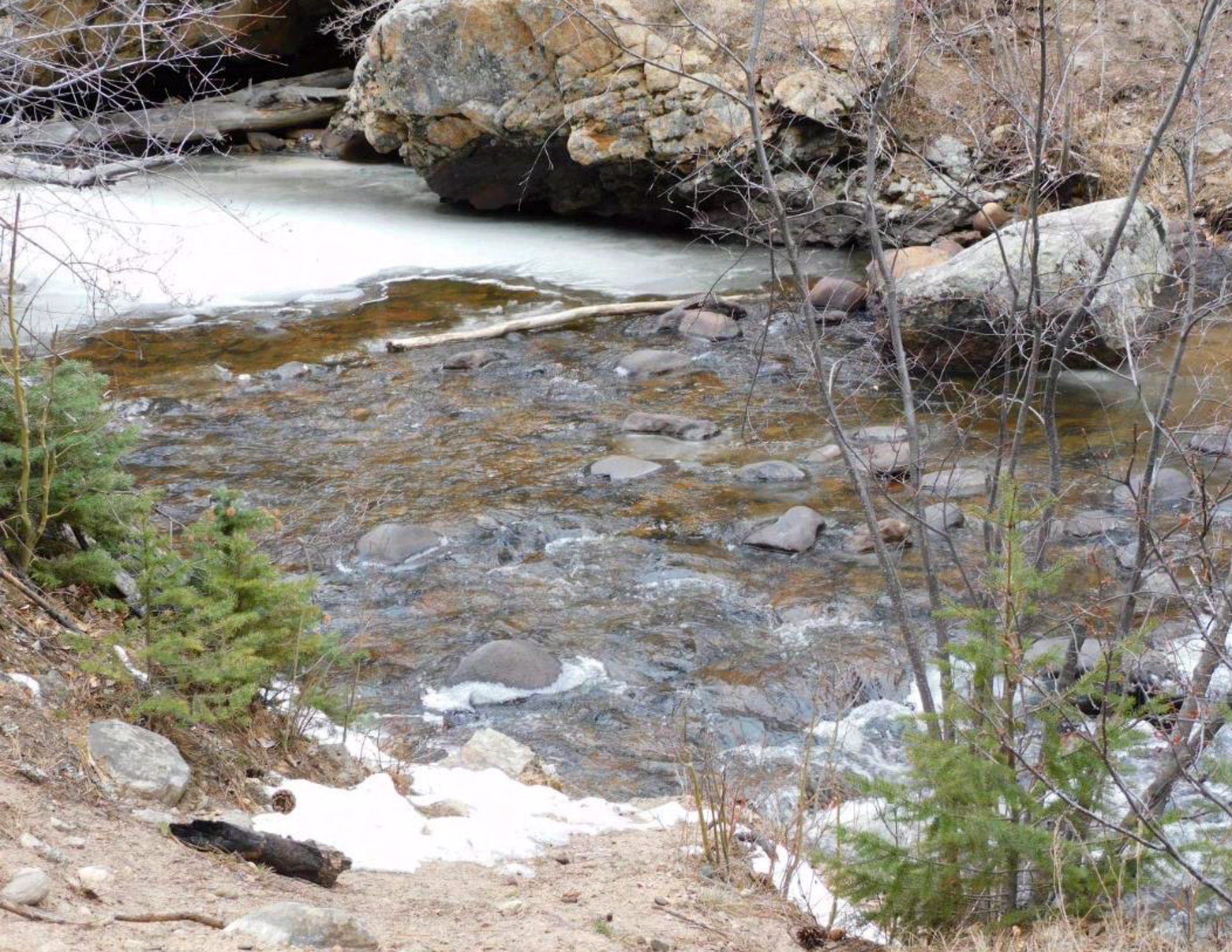
For the 2020 incident data, we performed a hazard analysis to determine the severity of cabin entries and attempted entries occurring at the YMCA. We found that 50% of the total cabin entries & attempted entries involved interactions where cabins were both occupied and the bear successfully entered, which is considered the most dangerous situation for both a person and the bear. Based on our interviews with YMCA staff, we learned that many of these dangerous interactions were due to one specific bear within the span of a month. Due to the dangerous behavior being exhibited by the bear, CPW became involved and ultimately trapped and killed the bear. By decreasing bear attractants, euthanizing bears could be avoided.

Additionally, we conducted semi-structured key informant interviews with the YMCA staff. During these interviews, we identified current efforts to mitigate human-bear interactions on the YMCA campus. We interviewed John Cordsen, the head of security of the YMCA, who oversees and handles black bear incident reports. We also spoke with Chris Daubin, who was the previous head of security of the YMCA campus. During these interviews, we focused on broad themes such as black bear interactions, methods of mitigation, and potential innovative solutions. From our interviews, we identified variables that may be influencing human-bear interactions and incidents reported at the YMCA. We also gained insight on the perspectives of YMCA staff on bears entering the property and identified current mitigation strategies in place.

Through the identification of wildlife corridors on the YMCA property, we have made recommendations on ideal locations to place foraging opportunities for black bears, to distract them on their way to the YMCA campus. These locations take into account a few factors: they are along potential wildlife corridors, they are near a water source, they

are accessible for people to water them, and they are relatively far from cabins and hiking trails so that the bears are not attracted to an unwanted area.

From key informant interviews with CPW, we have learned that the use of electric unwelcome mats, electric fencing, and tasers have been an extremely effective mitigation strategy. Based on anecdotal evidence from these interviews, only one bear that was shocked by a taser had ever been seen again in the town of Estes Park. Using electricity as a form of hazing bears is reliable and may be an effective strategy for the YMCA to implement to mitigate human-bear interaction and deter bears from breaking into cabins, which could be done via electric fencing or electric unwelcome mats enter a cabin. However, there may be concerns with this method regarding the safety of YMCA guests and staff.



Introduction

The wildland-urban interface has been expanding rapidly, increasing by 38% between 1990 and 2010 (Mockrin et al., 2022). In addition, a changing climate has led to drastically changing temperatures, droughts, and late spring frosts (Abrahms et al., 2021). These changes have impacted black bears' ability to access naturally occurring foods, forcing them to enter towns that have encroached on bear habitat in search of other food sources (Ostrom, 2009). When bears have access to anthropogenic foods, they can become reliant on them, leading to more interactions and conflicts (Braunstein et. al., 2020). Conflicts between humans and bears can have negative effects, and may result in threats to the safety of both species.

For years, residents and businesses of Estes Park, Colorado have had issues with bears getting into trash containers, homes, and vehicles. According to local officials, there are typically two to three bears that enter cars in the area each week ("Colorado Bear Drives Car after Getting Stuck Inside," 2017). Some of the key factors behind this issue involve Estes Park's highly transient population. The YMCA of the Rockies is one of the sites that experience a high volume of tourists who can often be unprepared or uninformed regarding bears and bear safety practices. Noncompliance with strategies such as using bear-resistant trash cans can result in bears entering cabins and buildings in search of food, increasing their reliance on human foods, and increasing conflict. With its location between Rocky Mountain National Park and town, the YMCA acts as a wildlife corridor for bears.

Thus, it serves as a natural pathway for their movement into Estes Park and to its many restaurants producing food and cooking oil waste, which are main attractants for bears.
The Colorado Bear Coalition is a non-profit organization composed of groups that work to protect the well-being of black bears. It has made strides to mitigate human-black bear conflicts across Colorado through innovative and proactive efforts. Our project's aim was to apply similar strategies to the Estes Park region through investigating black bear attractants in town and identifying potential mitigation strategies at the YMCA of the Rockies. We used data obtained from its security team to create an interactive map assessing the variables and trends affecting human-bear interactions in the area. We also investigated current mitigation strategies utilized by the YMCA along with employee perspectives on black bears. Lastly, we analyzed the impact of restaurant cooking oil waste as an attractant of black bears in town. Through these objectives, we aimed to mitigate human and black bear conflicts in Estes Park, Colorado.

Background

2.1 Human-Black Bear Interactions

2.1.1 Factors Influencing Human-Black Bear Interactions

One of the most prevalent drivers of human-wildlife interactions relates to sprawl and expansion of residential areas into wild territories. Between 1990 and 2010, the United States experienced a rapid increase in wildland-urban interface. This interface refers to areas where homes reside in or near wild territories. Researchers have discovered that during these two decades, the area of wildland-urban interface increased by 38% and experienced a 42% increase in housing. By 2010, the wildland-urban interface accounted for 9.5%of all land in the United States, and 33% of all housing resided in these areas (Mockrin et al., 2022). This expansion into wild territories is one of the main drivers of forest loss in the United States, with areas surrounding national parks acting as hotspots for increasing housing densities (Fitts et al., 2021; Mockrin et al., 2022). Researchers also argue that Colorado has the highest probability of forest conversion. An expanding population and growing wildland-urban interface threaten to encroach on these wild areas (Fitts et al., 2021).

Housing developments are often built on land that black bears and other wildlife may cohabit. For example, humans tend to settle in valley bottoms, which is prime black bear habitat (Marley et. al, 2017). In a study conducted in Missoula, Montana, researchers created a spatial distribution model to predict and find which factors played important roles in the frequency of human-black bear interactions (HBI). The study found that as distance from large forest patches, major rivers, and streams increased, the probability of human and bear interactions decreased (Merckle, 2011). The researchers also found that intermediate housing density was most correlated with higher rates of HBIs (Merkle, 2011). The study was able to apply its results to larger scale models in other towns as well. Factors such as proximity to forest and streams along with housing density play an important role in the frequency of HBIs in residential areas.

2.1.2 Black Bear Population Trends and Behavior

Ecological factors like climate change play a significant role in the frequency of human and bear interactions. As the planet experiences events such as changing temperatures, droughts, and reduction of biodiversity, resources that are naturally occurring for bears are altered or significantly diminished (Abrahms et al., 2021; Ostrom, 2009). For example, a 2012 late spring freeze in Durango, Colorado caused a widespread food shortage throughout the region. The frost severely hindered nut and berry production, both of which are crucial natural food sources for black bears. This significant food shortage forced bears to rely on entering human developments for food (Ostrom, 2009). Researchers discovered that as bears in the Durango area increasingly relied on entering human areas for alternative food sources, there were elevated frequencies of human and black bear conflicts. These conflicts were linked with a 57% decline in female black bear abundance in the area due to human-caused bear mortalities such as vehicle collisions, lethal removal, and hunting (Laufenberg et al., 2018).

Climate change models suggest the frequency of droughts and late spring frosts are expected to increase. These events will likely cause more poor food years for bears in the future, forcing bears to rely more heavily on anthropogenic foods (Johnson et al., 2015). In addition, warmer temperatures are associated with an increase in bear's active season spent foraging for food (Laufenberg et al., 2018). Johnson et al., (2018) argue that for everyone degree increase in the minimum winter temperature, bear hibernation periods can be expected to decrease by six days. They suggest that in 28 years, bear hibernation periods could experience a 15 to 39 day reduction (Johnson et al., 2018). These factors, coupled with increased foraging tendencies during hyperphagia, are expected to increase the frequency of HBIs, conflict, and bear mortality in the near future (Johnson et al., 2015).

Many factors have played into changes in black bear population and behavior within Rocky Mountain National Park (RMNP) and Estes Park. As mentioned previously, climate change has had an impact on black bear behavior. In 2007, a report analyzing bear demographics and conditions in RMNP found that bear dens have shifted to be closer to areas with higher human activity and influence (Baldwin, 2007). This shift may be attributed to a higher dependence on human food. A study conducted in 2009 investigating factors that impacted black bear behavior and population in RMNP found that climate change would produce hot, dry seasons which would cause black bear population to decrease. In order to counteract this decrease in population, black bears may become food conditioned; dependent on human-related food resources which may stabilize the population (Baldwin, 2009).

2.1.3 Personal Values and Perception of Bears

An individual's values can be abstract, dictating what a person aims to achieve in life along with how they wish to be perceived by others. Moral beliefs and values govern not only how people act, but also the way events are evaluated, such as human-wildlife interactions (Kesberg 2018). For example, according to Siemer et. al, beliefs in the benefit of wildlife have proven to predict attitudes towards hunting and fishing or even intentions to do so, acting as a forecast for perception of wildlife amongst those individuals. In Siemer et. al's study, individuals in Kentucky who valued hunting tended to be more likely to have a positive attitude regarding wildlife, specifically black bears, as they were likely to admit that "bears are an important part of our ecosystem". In a similar manner, individuals who saw less value in wildlife tended to have a more negative perception of bears. Residents who fall into this category view bears as a nuisance, can see them as dangerous, or feel they can cause damage to their property (Liu, 2019).

In a study conducted in Durango Colorado, researchers found that satisfaction in management of bear-related mitigation agencies played a role in the probability of reporting interactions, illustrating that with a decrease in satisfaction in management, there tends to be an increase in reporting (Wilbur, 2018). Often, respect for black bears comes from a combination of fear of the harm that they could potentially cause and appreciation for the fact that no harm

usually occurs. In fact, there have only been four documented deadly black bear attacks in Colorado since 1971 (Zajac et al., 2012). Viewing bears as cohabitors rather than invaders makes it easier to understand and appreciate their place in the ecosystem.

2.2 Black Bear Biology

2.2.1 Basic Biology

The description of a “black bear” focuses on the species and not the color, meaning that “black” bears can also have a brown, blonde, or cinnamon color (Schmidt et. al). A black bear can be identified by having shoulders in line with its back, having a rump higher than its shoulders, ears that are taller and more oval shaped, and are about 3ft tall when standing on all fours (U.S. Department of the Interior). Bears are also known for their great sense of smell, which is about 7 times better than a bloodhound (U.S. Department of the Interior). Black bears have a very large nose and their mucosa area (inner lining of the nose) is about 100 times larger than a human's (“Senses and Abilities,” 2008). Based on these factors, bears are very skilled at sensing food and can often smell it from miles away. This means even a small trace of food can attract a black bear.

Figure 4. Image of black bear and cubs (Photo by Kalen Kemp on Unsplash).

The population of black bears residing in Rocky Mountain National Park has been consistently low. According to Baldwin & Bender (2009), the population has remained between 20 and 30 black bears over the decades. This is partially due to black bears’ relatively low reproductive output and cub survival rates. The mating season for black bears occurs between late May and early July, and the age of first reproduction for black bears is typically approximately 5.5 years old (Baldwin & Bender, 2009; “Quick Black Bear Facts,” 2009). Cubs are born in the middle of the winter hibernation period, around January, and stay with the mother for about 18 months before they go off on their own (U.S. Department of the Interior). Additionally, poor food years due to climate change and other natural events also have an impact on the black bear populations remaining low (Laufenberg et al., 2018; Ostrom, 2009).

2.2.2 Hibernation

Hibernation is an adaptation to seasonal low temperatures and shortages in food sources (U.S. Department of the Interior). Bears are often labeled as “super-hibernators” due to the fact that their body temperature only drops 12 degrees lower than usual during hibernation, allowing them to react faster to threats or danger. During this time, bears are able to cut their metabolic rate by 50%-60%, only take about one breath during every 45 seconds, and lower their heart rate to about 8-19 beats per minute. Black bears are able to hibernate in part due to a layer of fat they acquire during the fall season during a period known as hyperphagia, or excessive eating. The waste products produced during hibernation are recycled,

allowing bears to lose 15-30% of their body fat and actually increase lean body mass through a process of nitrogen recycling. When temperatures warm up in the spring, males are usually the first to emerge from their dens, followed by females (U.S. Department of the Interior).

Bear hibernation is a unique process that is of interest to researchers because of its ability to help bears overcome extreme physiological challenges, such as freezing temperatures and lack of food or water. For example, bears do not lose any bone mass or skeletal muscle during hibernation, which leads to retained bone strength throughout that period (Miyazaki, 2019). It is hypothesized that energy and metabolism mechanisms are altered in skeletal muscles of bears during hibernation, allowing them to overcome physiological challenges that come with hibernation (Mohr, 2020). The bear's liver even secretes a chemical that dissolves gallstones without any invasive treatment. The adjustments that the bear's body must overcome span further than just the reduction of body temperature, but must also adjust molecular and cellular processes in order to accommodate the new conditions (Mohr ,2020).

2.2.3 Diet and Foraging Behavior

The black bear's diet varies seasonally and geographically, depending on the types of foods available to them. Typically, their diets consist of mainly vegetative material, representing 57.3% of its annual food consumption. Grasses and berries make up for 28.9 and 16% of this vegetative material, respectively. Black bears typically live in large forests with the capacity to provide them with the naturally occurring vegetation necessary for their diet ("Food and Habitat," 2008). When there is less vegetative material available for bears, they will consume animal matter in order to obtain the needed amount of energy, fat, and protein. This animal material accounts for 28.9% of the bear's annual diet. The remaining portion of the black bear's diet consists of nonfood items and garbage, representing 8.2 and 5.2% of its diet annually. Additionally, the percentage of anthropogenic foods that black bears consume has been increasing over time. According to Baldwin & Bender (2009), "scat containing anthropogenic food sources were 15.2 times more common in contemporary bear diets". However, this statistic may be even higher, since these anthropogenic foods are difficult to discern as they often appear in the form of meat thrown away by humans (Baldwin & Bender, 2009). Black bears do prefer their own food, but will eat human-provided food if necessary. ("How Timid Are Black Bears?," 2007).

During the fall, before the black bears hibernate, they need to stock up on calories and fat to survive through the winter. At this time, bears will spend up to 20 hours each day eating, attempting to consume up to 20,000 calories a day. Many human-bear conflicts can be explained by an available food source for the bears, and while they are not aggressive creatures, their need to consume food can overcome potential fear for humans (Colorado Parks & Wildlife*)*.
Black bears are often regarded as extremely cautious creatures. In fact, bears are governed by fear rather than food, in that order. They have been known to retreat from a variety of smaller animals, including mice, squirrels, birds, and ducks.

("How Timid Are Black Bears?," 2007) While they are considered to be fearful animals, black bears frequently enter homes, vehicles, and businesses in their search for food. This is due to a variety of factors, including hyperphagia, their acute sense of smell, and learned behaviors.

During poor food years, where naturally occurring food sources are scarce, bears look elsewhere for survival, typically residential areas. Whether or not bears forage on human food depends highly on whether there is a natural good food year, or a natural bad food year. A good food year can be determined if there is a lot of natural vegetation for bears to forage on and a bad food year can be determined if there is not a lot of natural vegetation for bears, likely due to poor weather conditions that hinder vegetation growth. According to a study done by Colorado Parks and Wildlife, after a few bears were tracked over a period of several years, it was determined that during a good food year, the bears stayed almost entirely in their natural habitat, foraging on vegetation. In Figure 5 in the 2011 map, the bear that was tracked spent the entire summer in its natural habitat. This year was also identified as a good food year by ecologists. In the other map, the same bear was tracked the following year (2012) and can be seen traveling down to Durango to forage on human trash. This year was identified as a bad food year by ecologists, suggesting that when there are natural foraging opportunities available for a bear, they will stay in their natural habitat.

Social learning also contributes to bear foraging behavior as bears can learn from their mothers the best ways to acquire food. A study conducted at Yosemite National Park investigated the relationship between pairs of bears to determine genetic influence and social learning of foraging habits. The results of the study suggest that the primary method for learning black bear foraging habits is via mother to offspring teachings. This was identified as the main mechanism which results in human-food foraging in the national park. It was also noted that bears were also able to learn foraging behaviors independently if they needed access to food. There were no genetic components identified in foraging behaviors (Hopkins 2013).

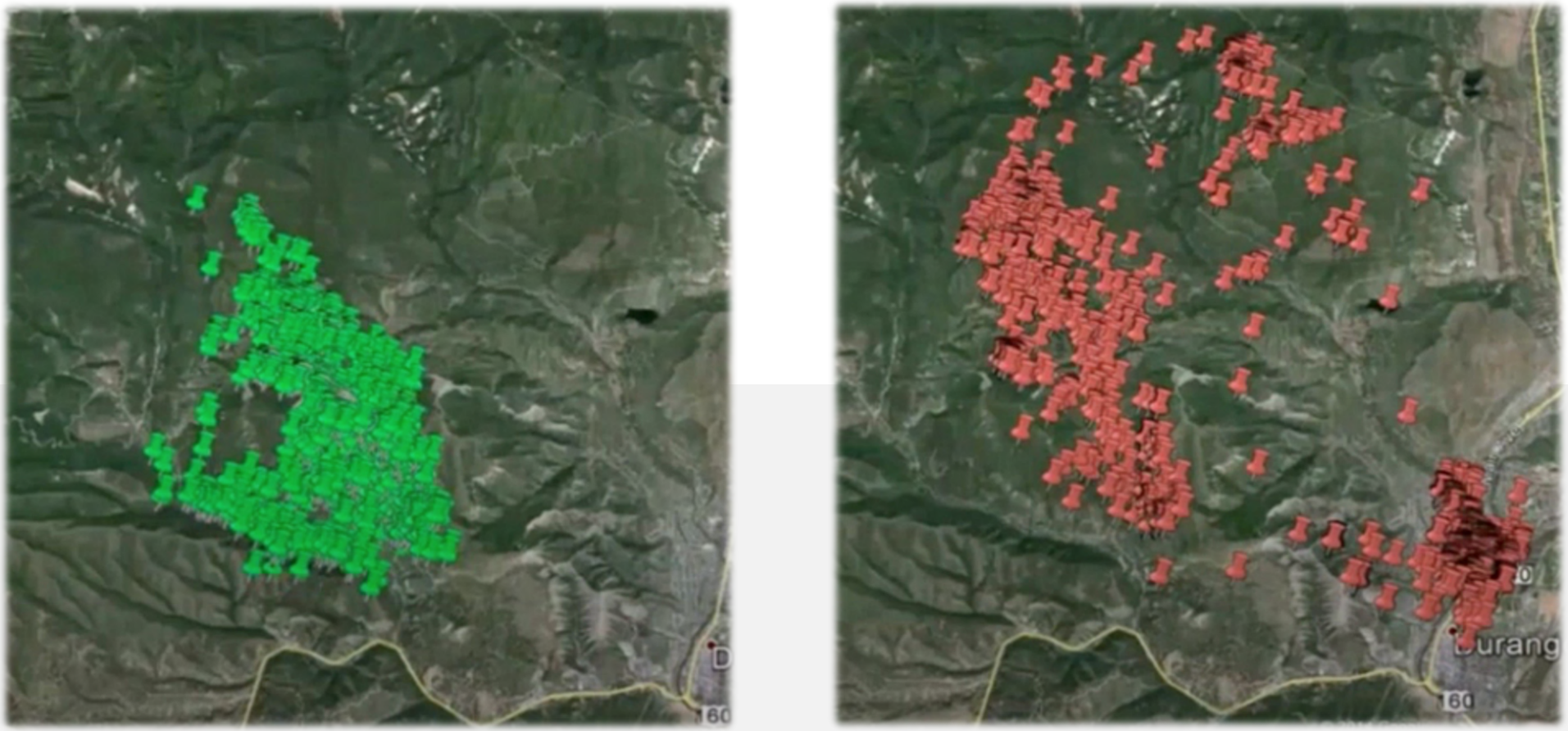


Figure 5. The two images above show the same bear tracked in 2011 (green) and 2012 (red) over the course of the year.

2.3 Current Policies in Place

2.3.1 “Nuisance” Bear Management Techniques

In Colorado, black bears that repeatedly enter neighborhoods to search for food have been labeled as “nuisances" (Treves et. Al, 2010). Colorado Parks and Wildlife (CPW) issued a management directive in 1994 to decrease conflict between humans and black bears. The directive allows for a policy that is referred to as the two-strike policy in most communities. A first strike refers to when CPW has to handle a bear exhibiting dangerous behavior. CPW monitors the bears by tranquilizing and then tagging them on the ear with a distinct number sequence to distinguish the different bears in the area. If a bear is caught engaging in another safety concern, such as entering a house or car, the bear is then euthanized by CPW. When a bear poses a considerable threat to the residents and community, many wildlife managers will skip to the second step if they feel that an extreme amount of danger is present (Boonman-Berson et al., 2016).

2.3.2 Educational Outreach Efforts

Educating the public is a common strategy utilized by wildlife agencies to attempt to mitigate human-black bear conflict. A 2011 experiment in Aspen, Colorado aimed to understand the impact of education on the amount of human and black bear interactions. Researchers studied 64 communal housing complexes and 42 construction sites that were provided with educational material on bear safety practices. The study aimed to determine if there was an impact on the frequency of black bears interacting with garbage containers in the areas. The results of both the communal housing experiments and construction site experiments showed an insignificant decrease in the probability of proper safety practices. As shown from this experiment, proactive enforcement through the use of education alone has not been able to be an effective method to mitigate interactions with black bears (Baruch-Mordo, 2011).

While one study has shown that educational outreach efforts can have an effect on decreasing human-bear interactions, it is often a minor impact that requires extensive time and effort to achieve. As shown from studies such as the one conducted in Aspen, Colorado, the different educational resources that were provided to the locals did not show significant change in the human behavior surrounding bear safety practices. Unfortunately, mitigating human-black bear interaction is reliant on a community's participation in bear safety strategies. If residents do not accept and learn from educational materials, there may not be a significant change in their participation in bear-safe practices and frequency of human-black bear interactions. This demonstrates the need for the community as a whole to play a part and commit to these strategies (Marley et. al., 2017).

2.3.3 Bear-Resistant Containers and Ordinances

When bears have access to anthropogenic foods, they can become food-conditioned and rely on it as a major food source, especially during poor food years or times of heightened foraging like hyperphagia (Ostrom, 2009). In order to prevent bears from becoming reliant on anthropogenic foods, bear-resistant trash containers have been developed. The

main goal of bear-resistant garbage containers is to keep bears from having access to human foods and food waste. These cans are typically made of metal and feature some sort of locking mechanism to keep bears from prying them open (Bear-Resistant Trash Containers | Bear Smart Durango, n.d.).
One common method used to engage residents to take part in bear safety strategies is the placement of an ordinance. Many counties have placed ordinances in effect that apply to the use of bear-resistant garbage containers. They require residents to use these containers with the threat of being fined if they do not comply. Larimer County currently has a trash ordinance in place since 2017 that applies to the town of Estes Park. Homeowners must utilize bear-resistant containers during non-pick-up hours. Business owners must use bear-resistant containers at all times, and restaurants are required to store their cooking oil and grease waste in these containers as well.

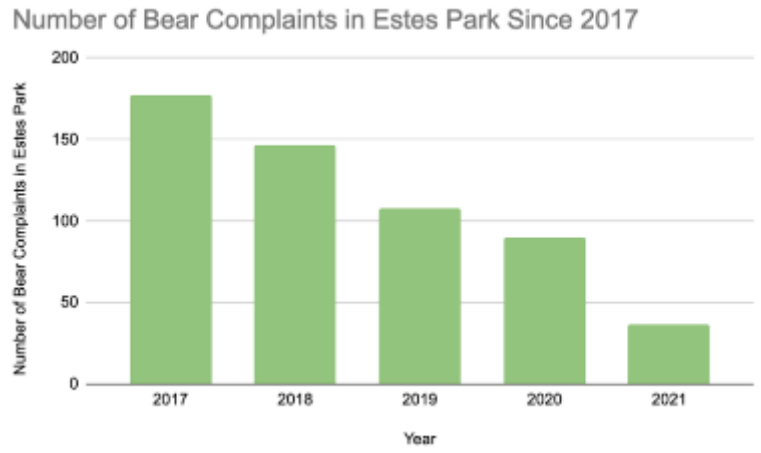


Figure 6. Estes Park's number of complaints of black bears from 2017-2021.

According to complaint data obtained from the Estes Park police department, in 2017, there were 177 complaints related to black bears, in 2018 there were 147 complaints, and in 2019 there were 108 complaints. In 2020, there were 90 complaints, and in 2021 there were only 37 complaints. Based on Figure 6, whether a coincidence or not, there appears to be a correlation between when the trash ordinance was put in place and the decrease in bear-related complaints; the number of black bear complaints the police department has received has been steadily decreasing since 2017.

Residents and business owners may obtain a certified bear-resistant trash container from their local waste management company or through a private manufacturing company. Currently, the Interagency Grizzly Bear Committee (IGBC) recognizes almost 500 products from over 100 manufacturers as being bear-resistant, including coolers, grease traps, food storage lockers, and garbage containers of varying sizes (Bear-Resistant Trash Containers | Bear Smart Durango, n.d.). An example of a bear-resistant garbage container that features a latching mechanism can be seen below in Figure 7. Additionally, some companies construct enclosures designed to protect waste from animals as well as the elements. One example of such a design is the CanShed, a large enclosure that features wood paneling and a metal cover. An image of the CanShed can be seen below in Figure 8.

Figure 7. A bear-resistant garbage container example. It utilizes latches to prevent bears from breaking in (Bear-Resistant Trash Containers | Bear Smart Durango, n.d.)

Figure 8. CanShed enclosure designed to protect waste from wildlife and the elements (CanShed Outdoor Trash Cart Enclosure, n.d.)

2.3.4 Limitations to Common Mitigation Strategies

Trash container usage ordinances are typically a good method to reduce frequency of human-bear interactions, however are not always effective. According to Braunstein et. al, in Gatlinburg, Tennessee in 2000, an ordinance was placed

requiring all residents and business owners to use bear-resistant garbage containers. Despite that fact, the town experienced a rise in bear conflicts. While it was not clear how well the residents complied with the ordinance, it became apparent that an ordinance of bear-resistant garbage cans alone was not sufficient in reducing human-bear conflict (Braunstein et al., 2020).

One complication that arose during a bear-resistant experiment conducted in Durango, Colorado was the improper use of the bear-resistant garbage containers. Researchers discovered that 34% of the residents who received bear-resistant trash containers did not properly use and lock them (Lischka et al., 2020). Another study, conducted in Aspen, Colorado calculated that out of 384 garbage bins randomly selected, 76% of them were bear-resistant. However, out of that 76%, only 57% of those bear-resistant containers were locked properly (Lewis et al., 2015). Both of these studies illustrate that a significant number of bear-resistant containers were not properly used, impacting their effectiveness on reducing human-bear interactions.

While many mitigation strategies have shown effectiveness in reducing human and black bear conflict, some have moral complications that result in the strategies being less effective. One example of this can be seen within the compliance model of the Durango, Colorado bear-proofing experiment discussed previously, where residents were provided with bear-resistant garbage containers. The study determined that with increased trust in wildlife agencies, individuals were less likely to partake in proper usage of the garbage containers. Researchers suggest that as humans build more trust towards a wildlife agency, they will have increased reliance on the agency and believe that the agency has the power to reduce conflict. These individuals may believe that their actions will not make as much of an impact as the agency would be able to (Lischka et al., 2020). Reduced compliance in these mitigation strategies due to increased trust in wildlife agencies directly impacts their success in decreasing human-black bear interactions. An individual's trust level in wildlife agencies can also impact rates of reporting interactions, which may cause the report data to become biased and sway the future management plan for decreasing interactions (Wilbur et. Al, 2018).

2.4 Bears in Estes Park

2.4.1 Location of Bears in Estes Park

Due to its proximity to the National Park, there is ample wildlife in Estes Park that is generally accustomed to and not afraid of humans. Bears specifically tend to come down into town during poor food years to forage for human food to achieve their desired calorie amount.

As seen in Figure 9, bears inhabit all areas surrounding Estes Park, which leads to a high human-black bear conflict rate in the area. The region highlighted with a darker yellow depicts areas where humans and black bears are most likely to come into contact. According to Colorado Parks and Wildlife, this zone encompasses most parts of Estes Park, including main routes such as Highway 66 and Route 34, as well as the center of town which is full of restaurants meant to attract tourists (Colorado Parks and Wildlife).

2.4.2 Impact of Tourism on Human-Bear Interactions in Estes Park

In the center of Estes Park, as well as areas around town, there are many restaurants that produce waste that attracts black bears. In general, most human-bear interactions occur when there is food available, whether it be from bird feeders or trash containers. Since most of the waste produced by restaurants is food waste, they become hotspots for bear activity. In town, there have been several instances of bear interactions where a bear has entered a restaurant to gain access to food. In one establishment, a bear wandered into the back room and was not even noticed by the employees and guests during its time inside. It was only until the owner looked at security tapes that they noticed the black bear in close proximity to the guests. Some restaurants cite bear activity as often as every day in the summer, but very few report all interactions to CPW. Most restaurant owners leave the bears be until they leave, which can be problematic as it teaches the bears that trash containers are a safe place to get food (Restaurant managers, personal communication, 2022).

Estes Park sees a high volume of tourism each year, with 4 to 5 million visitors annually and over 3,000 vacation rental homes in town (Estes Park, CO Vacation Rentals from $93 | HomeToGo, n.d.). Tourists typically visit town during the summer and fall, which also happen to be seasons of peak activity for bears. Often, visitors can be uneducated or uninformed regarding bears and the safety practices necessary to avoid conflict. This can create an unsafe environment for both the bears and the humans in the area.

The unique amount of wildlife in Estes Park constitutes a main tourist attraction in the area. During the fall and spring season, elk can be seen in the center of town grazing on grass, mule deer wandering around town, and even bears coming down to forage on food. Unfortunately, tourists are not always well versed in wildlife safety and the importance of maintaining their natural habitat. What escalates the issue is that tourist locations tend to take advantage of their desire to see wildlife; some restaurants or hotels have been known to bait animals, specifically bears, to attract them to the property, and thus attracting customers. This further habituates the bears to human food and increases the danger for a bear getting

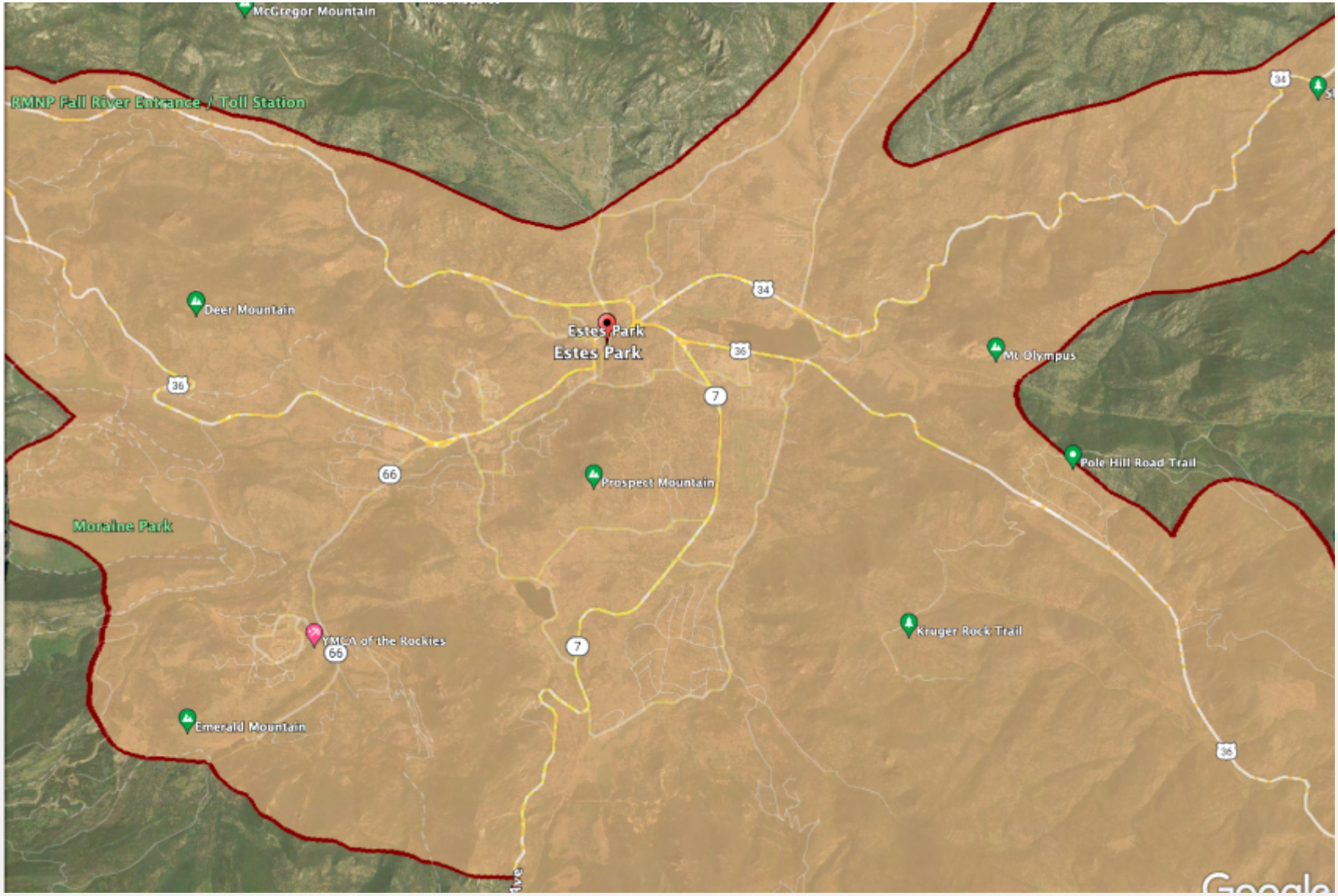


Figure 9. Data provided by Colorado Parks and Wildlife that illustrate black bear range (all of the area) and the outlined area illustrating human-black bear cohabitation/conflict.

reprimanded, or even put down, for its natural foraging behaviors.

2.4.3 Local Resident Perspectives of Black Bears

In areas where bear populations are high, people are typically more accepting of cohabiting with black bears, likely due to a greater understanding of the animal (Zajac et al., 2012). The residents in Estes Park are no exception; based on interviews with longtime Estes Park residents, it has been made clear that most have a passion and respect for wildlife, and hate to see it treated poorly by the transient community.

In an interview with a local candy shop in town, which was broken into by a bear 10 years ago, we learned that bears are often not viewed as perpetrators. The owner of the shop emphasized that "bears were here first" and did not expect them to adjust to the human population. After the bear entry occurred, instead of reporting the bear to CPW, the shop raised money to further bear education in the area and emphasized that the bears should not suffer because of their natural instinct for foraging. Another employee at a chain restaurant in town emphasized the difference in wildlife perspective between Estes Park residents and other, less wildlife appreciating areas. While in Estes Park, black bears are generally left alone, "... In Louisiana, we shoot to kill" he stated, illustrating the appreciation Estes Park residents have for wildlife.

2.4.4 Local Resident Perspectives on Colorado Parks and Wildlife

Colorado Parks and Wildlife (CPW) is a government organization that is responsible for managing the national parks and wildlife in the area. In our initial research, we investigated the viewpoints and perspectives about black bears in relation to CPW. While speaking with locals in town, we discovered that many tend to not report black bear interactions, due to a variety of reasons. Some Estes Park locals have a negative perspective of CPW, believing that they do not have the best interests of bears at heart. Some residents feel that reporting even a minor bear incident will equate to the bear being euthanized. Many townspeople have a profound respect and understanding of black bears, with the perspective that since the bears were here before humans, residents should not report them.

Through interviews with CPW wildlife manager Chase Rylands, we learned about the general trends and behaviors of black bears in the Estes Park area. We were informed that typically, bears entering town and residential areas in search of food will first break into bird feeders and garbage containers due to their frequent availability and relatively easy accessibility. If a food reward is obtained, the bear will learn that this location is a prime spot for food and will tend to return to this spot multiple times. The bear will continue this behavior and will eventually progress to more serious types of interactions such as breaking into cars and houses to obtain even greater food rewards. This habituation process causes bears to begin to lose their fear of humans, increasing the frequency of interactions even more. When a bear poses a serious threat to public safety, by entering a home, for example, CPW is required to take necessary action to protect the well-being of residents, typically resulting in the death of the bear.

Due to many resident's hesitancy to report minor black bear conflicts, such as bird feeder or trash entries, CPW is often not involved until it is too late to correct the bear's behavior. During our interviews, Chase Rylands emphasized the need for residents to report even minor bear conflicts to CPW. This would allow CPW officers to haze the bear (through loud noises, rubber bullets, or tasers) and ideally keep the problem from escalating into a dangerous situation for both residents and the bear. From Chase's perspective, if people are not willing to report minor conflicts, CPW officers are put in a position where they have no choice but to euthanize the bear.

2.4.5 YMCA of the Rockies

The YMCA (Young Men's Christian Association) of the Rockies is a popular lodging spot in Estes Park. During peak seasons of summer and fall, the YMCA sees a high volume of visitors, as it offers many opportunities for educational and nature-based recreational activities. With over 250 cabins on its property, the YMCA is able to house high volumes of visitors during its peak season in the summer.

The YMCA is located on the southwestern part of town bordering Rocky Mountain National Park. Due to its proximity to the Park, the Y is a stomping ground for a lot of wildlife that have acclimated to humans. Its relatively remote location allows the YMCA to serve as one of the main corridors for wildlife to take into the town of Estes Park, making it a crucial checkpoint for human-wildlife interaction mitigation. Bears especially have been known to forage around the YMCA campus, and have been known to frequently attempt to get into the bear-resistant trash cans or cabins with open windows or doors. In October of 2020, a bear even entered a large lodge and wandered the halls until he was escorted out by the YMCA staff. Decreasing human and bear interactions at the YMCA is an important step for the mitigation of all human-bear interactions in the town of Estes Park.

2.5 Efforts for Change

2.5.1 Colorado Bear Coalition

The Colorado Bear Coalition (CBC) is a non-profit organization composed of groups that work to protect the well-being of black bears. Not only does it make strides to deter bears from communities, but it also works to find creative ways to protect bears and act as a voice for them. Some responsibilities the CBC takes on include working with and educating town officials to explore potential legislation changes, finding innovative strategies to mitigate interactions, and advocating on the behalf of the bears (Lee, n.d). While the city of Boulder has had success with raising awareness and understanding the patterns of bear behavior, the CBC wishes to expand this experience towards other parts of Colorado, as well.

Members of the Colorado Bear Coalition have previously achieved multiple accomplishments regarding protecting the safety of black bears. One of their accomplishments involved promoting an ordinance zone in Boulder, CO, where all residential and commercial properties on the Western edge of town were required to use bear resistant trash containers. In addition, they encourage residents to use the Boulder Inquire app to report trash violations, allowing law enforcement officers and researchers to focus their efforts on areas where bears are getting into trash. In addition to leftover trash, the bears in Boulder were interested in fruit trees that are abundant in the area. In order to prevent bears from entering town to eat from the fruit trees, the CBC, along with 4 other local groups, organized neighborhood fruit harvests. The Coalition also created a Bear Buffer Zone, working with Boulder Open Space to plant native food in bear habitats. The CBC also frequently meets with stakeholders in order to expand the community of residents looking to protect the welfare of black bears in Colorado (Lee, n.d).

2.5.2 Wildlife Groups in Estes Park

Estes Park has several wildlife advocates that help to mitigate human and black bear interactions. One of these groups includes Colorado Parks and Wildlife (CPW). CPW officials are called upon when a bear interaction has occurred and are required to take measures to ensure that the community is safe. This group focuses on conflict mitigation through a strategy referred to as hazing, and if needed, putting down the black bears. Hazing a bear takes many different forms, ranging from making loud noises to shooting it with rubber bullets.

Another group that helps to mitigate interactions in the town of Estes Park is the Estes Park Bear Education Taskforce. This group came together to educate the residents and tourists in town about bears, and provide information on bear safety precautions via their Facebook page and the distribution of educational material. Many of their members are residents of Estes Park, and are dedicated to protecting bears; they worked to get the Estes Park Wildlife Ordinance passed in 2017. One member would frequently patrol town to ensure all businesses were following this ordinance, alerting police to reprimand any violators. Their efforts have been largely successful in assuring restaurant and business compliance. Another member would regularly table-sit at the local farmers market and pass out educational pamphlets to residents. However, much of this material has not had an everlasting impact on the town. This is likely due to the large transient population and them having the vacation mindset and ignoring the educational material.

Our Approach

The goal of our project was to assess and identify mitigation strategies for human-black bear interactions in the town of Estes Park and at the YMCA of the Rockies. Specific objectives that we focused on included mapping bear interactions from 2019-2020, assessing current mitigation strategies at the YMCA, and investigating bear attractants in the town of Estes Park. We aimed to identify and assess mitigation strategies of human-black bear conflict at the YMCA through conducting interviews and creating an interactive map categorizing human-bear interactions that have occurred on its campus. This map also allowed for the identification of potential wildlife corridors that bears may be accessing to enter the town of Estes Park. Additionally, we investigated factors that may be acting as bear attractants in town. We achieved our goal by assessing current efforts to reduce conflicts at the YMCA, analyzing trends in human-black bear interactions at the YMCA, and investigating cooking oil as a black bear attractant in Estes Park.

OBJECTIVES:

1. Analyze trends in human-black bear interactions at the YMCA through data analysis and a mapping system.
2. Assess current efforts to reduce human and black bear interactions at the YMCA.
3. Investigate black bear attractants in the town of Estes Park.

3.1 Analyzing Trends in Human-Black Bear Interactions at the YMCA

3.1.1 Data Collection

During the years of 2019 and 2020, the YMCA of the Rockies documented reports on black bear incidents that occurred on its property. We collected the reports via John Cordsen, the Head of Security of the YMCA, who is in charge of handling black bear incident reports. These reports included the date, location, a description of the interaction, whether the cabin was occupied, and whether the bear got a food reward out of the interaction. We collected the handwritten reports and converted them into one Excel sheet. During the process, we assigned categories to each report that allowed us to determine the most frequent types of interactions. These categories include sighting, trash container entry, attempted cabin entry, and cabin entry. Within the central Excel sheet, we designated latitude and longitude coordinates for each location by finding the location on Google Maps. This Excel sheet was used within the mapping software Google MyMaps.

3.1.2 Mapping Software

Using the data collected from the YMCA security team, we plotted the black bear incidents on YMCA property for the years 2019 and 2020. After inputting all of the report data into one central spreadsheet, we used Google Reports to plot this data onto maps of the YMCA of the Rockies property. We created the maps with the ability to be filtered by year, allowing users to see annual changes in bear activity and movement to different cabins. In addition, we created graphical models demonstrating the frequency of specific factors that may be causing bear incident reports. These maps and graphical models can be found in our Findings Chapter below.

3.1.3 Identification of Wildlife Corridors

Using information from the map of black bear interactions at the YMCA, we identified potential wildlife corridors that black bears could be using to enter and travel through the YMCA property. This was done through analyzing the incident reports and observing areas of the YMCA that are frequented most by bears. Additionally, some of the data collected on interactions detail individual bear movements throughout the year. Tracking individual bear movement over time may help identify these wildlife corridors. The identification of potential wildlife corridors was further supported by key informant interviews and field observations.

For example, during our interview with John Cordsen, he identified locations he viewed as wildlife corridors. These corridors ran along the southern and northern outskirts of the YMCA property. Through an interview and field excursion in Boulder with Brenda Lee, our team was informed on how to identify these wildlife corridors based on natural landscape features. Afterward, our team traveled around the YMCA and applied this knowledge to support our analytical observations.

3.2 Assessing Current Efforts to Reduce Bear Conflicts at the YMCA

3.2.1 Key Informant Interviews with YMCA Staff

We conducted semi-structured key informant interviews with the YMCA staff to identify current efforts used

in order to mitigate human-bear interactions on the YMCA campus. During our interview with John Cordsen, we focused on broad themes such as black bear interactions, methods of mitigation, and potential solutions. The questions asked can be found in Appendix B.1. We also interviewed Chris Daubin, who was the previous head of security at the YMCA. From our interviews, we identified variables that may be responsible for affecting human-bear interactions and incidents reported at the YMCA; these are presented and discussed in the Findings Chapter. We also identified the perspectives of YMCA staff on bears entering the property and current mitigation strategies in place.

3.2.2 Interviewing Ecology Experts

In our interviews with wildlife ecology experts, CPW officials, and representatives of wildlife organizations, we asked questions regarding their experiences with black bear interactions and factors they think attract bears into Estes Park. We also inquired about any mitigation strategies currently used, including educational outreach and the use of bear-resistant trash containers, their effectiveness, and any compliance issues they notice with them. Detailed lists of interview questions for wildlife officials and experts can be found in Appendix B.1.

3.3 Investigating black bear attractants in downtown Estes Park

Our initial investigation in Estes Park focused primarily on the use of bear-resistant garbage containers. Through preliminary informal interviews with multiple restaurants and businesses in town, it became apparent that garbage waste disposal practices did not pose as significant issue as originally thought. This came as a result of the 2017 ordinance requiring residents and businesses to secure waste in bear-resistant containers. Prompted by statements made during these initial interviews, our investigation shifted to focus on restaurants' cooking oil waste and its role in attracting black bears into town.

3.3.1 Key Informant Interviews with Restaurants

We utilized key informant interviews to assess the impact of cooking oil waste on human and black bear interactions in the Estes Park region. Our focus was on informal interviews with restaurant managers who were able to provide a variety of perspectives on human and black bear interactions and cooking oil waste. The restaurants in Estes Park were selected based on geographic location, specifically on how secluded the restaurant was. We interviewed a total of nine restaurants, with some being in the downtown area and others lying on the outskirts of town in more remote areas. All restaurants surveyed were plotted on a map that can be seen in Figure 10. A map of restaurants selected for interviews can be found below.

Through interviews with restaurant managers, we inquired about their experiences with black bears along with their cooking oil use and disposal practices. We also distributed paper surveys to restaurants that were unable to take the time to speak with us. These surveys consisted of the same questions asked during interviews, which can be seen in Appendix E.3.

3.3.2 Data Collection and Analysis

During each interview, group members took detailed notes on responses and shared these transcriptions with each other via a shared document. Through analyzing trends between interviews, we identified different practices among restaurants' use and disposal of cooking oil that may be influencing the frequency of black bear interactions in and around these businesses.

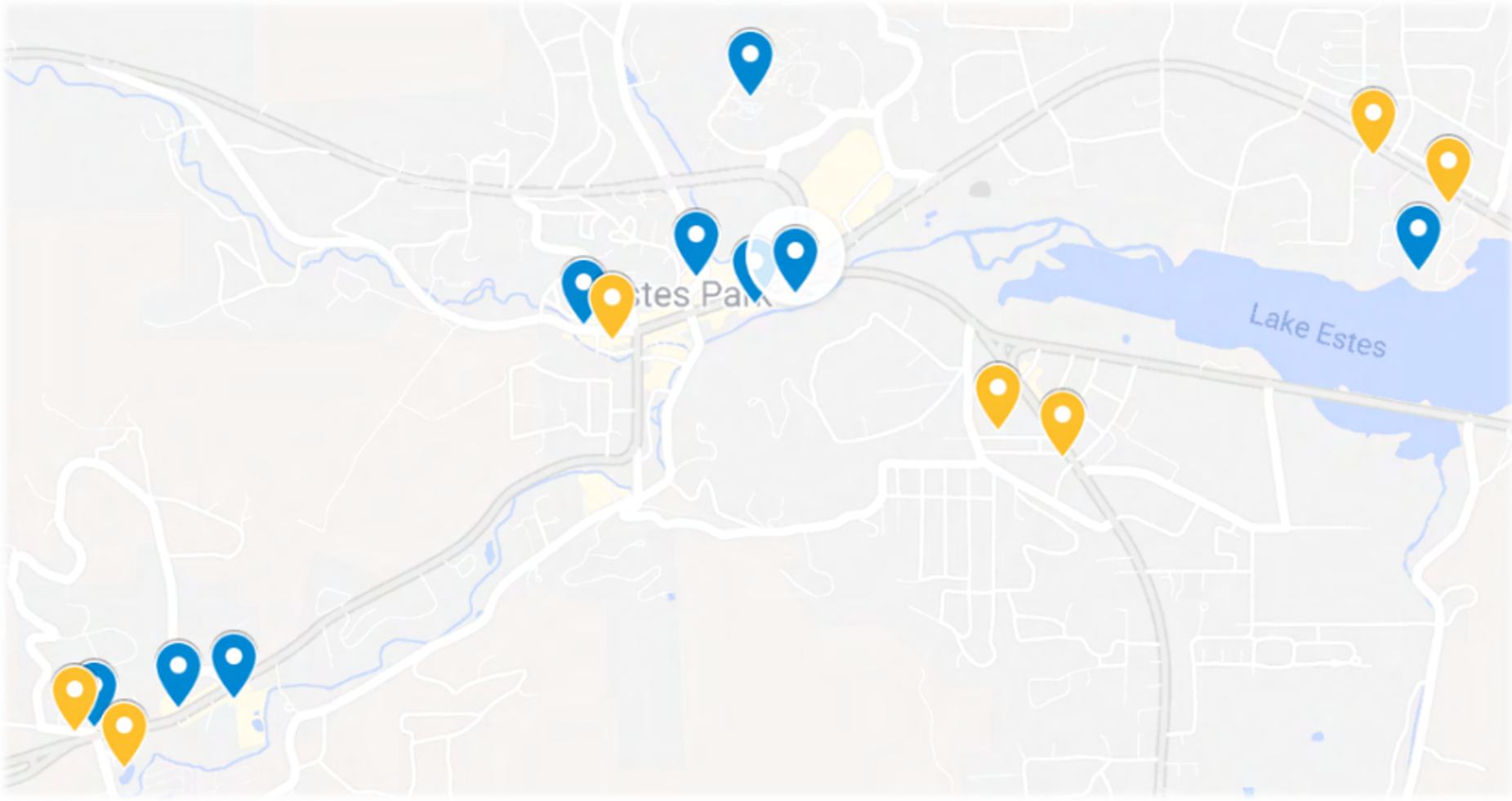
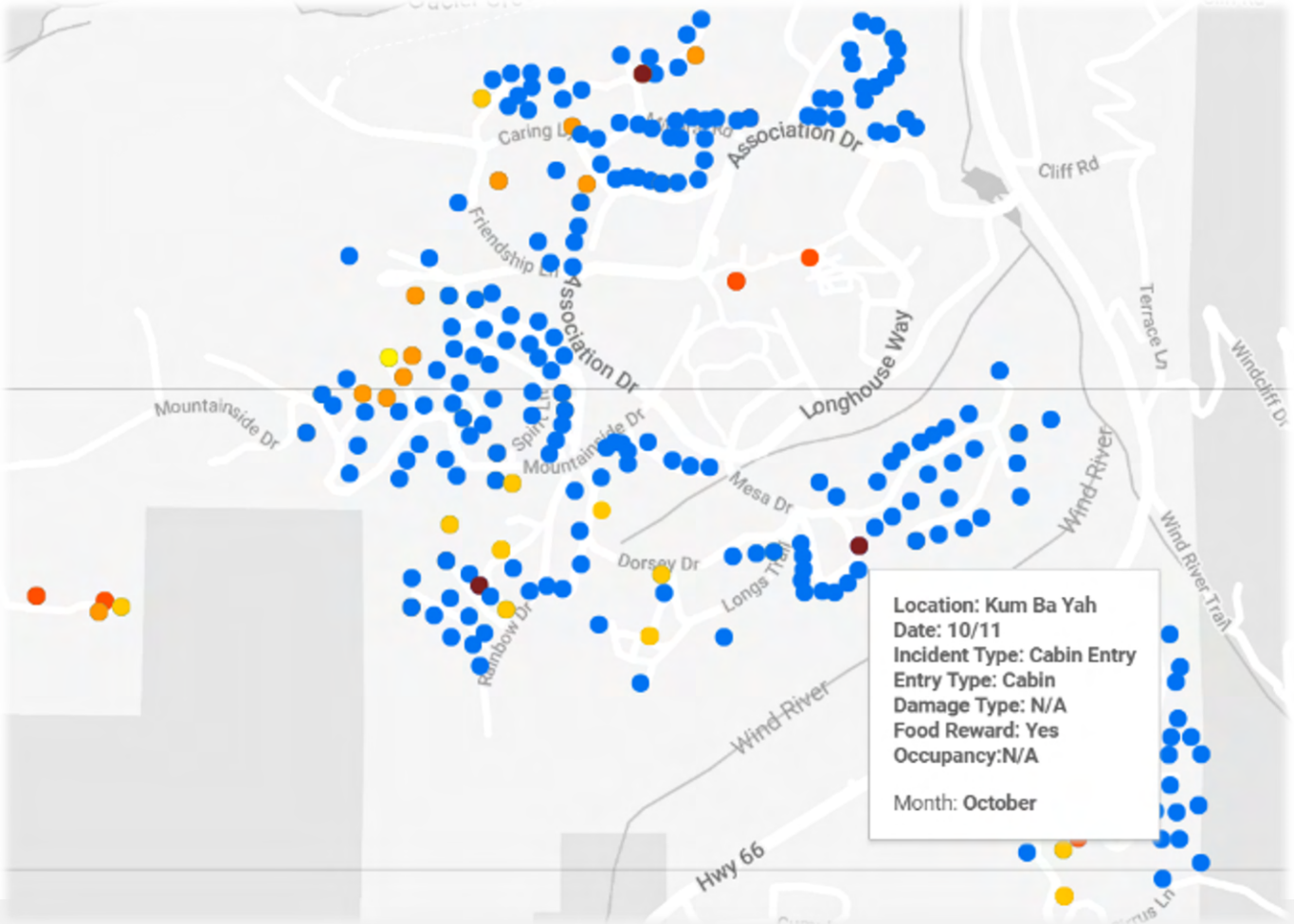


Figure 10. Map of restaurant interviews. Blue pins mean we had a successful interview and yellow means it was an unsuccessful interview.

Findings

4.1 Mapping Human-Black Bear Interactions at the YMCA of the Rockies

In order to be able to analyze trends in black bear behavior and interactions at the YMCA, we utilized data obtained from the head of security, John Cordsen, to construct an interactive online map of incidents that have occurred during 2019 and 2020. The map displays each human-black bear interaction that occurred and was reported during these years. When a cursor is hovered over a dot, additional information about the interaction is shown to the user. This additional information includes the date of the incident, any damage that occurred, points of entry, if a food reward was obtained, and if the cabin was occupied. In Figures 11 and 12, incident reports based on month were mapped, where most interactions occurred during the summer month.



LEGEND FOR FIGURES 11 & 12

- June
- July
- August
- September
- October
- No incident occurred at this location.

Figure 11. Map of black bears interactions that have occurred in 2019 with each interaction being colored coded based on the month of the interaction.

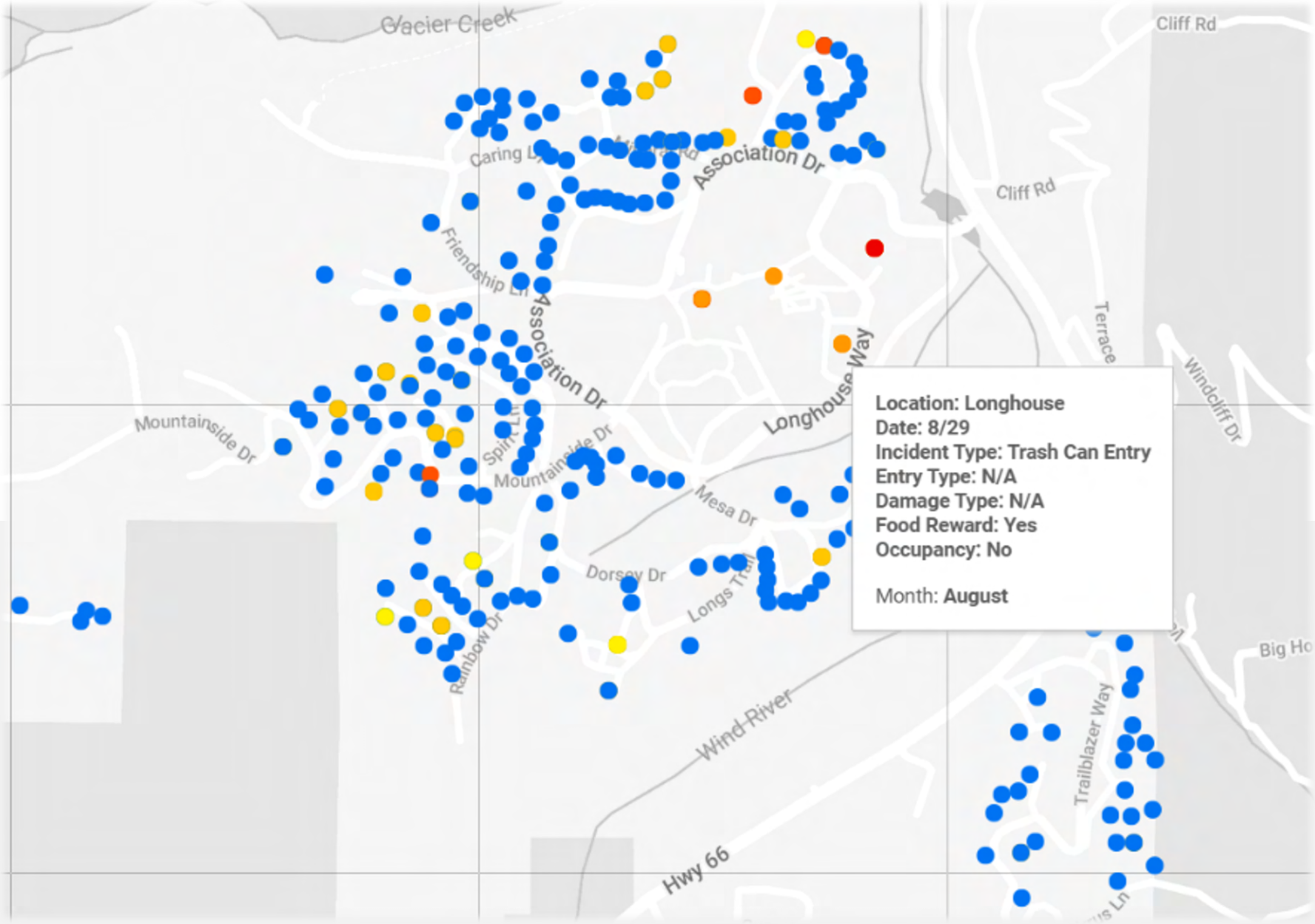


Figure 12. Map of black bears interactions that have occurred in 2020 with each interaction being color coded based on the month of the interaction.

The majority of black bear interactions at the YMCA occurred in repeat locations.

Of all bear interactions in 2019-2020 at the YMCA, approximately 56% of interactions were at repeat locations This information indicates that bears are significantly more likely to return to locations where they received a food reward, highlighting the importance of securing food. In addition, there were several instances when a bear obtained a food reward in a cabin, and returned in 1-2 days in order to try and feed again. In 2019, there were two instances where a bear came back to the same location two days in a row, and in 2020, there were 5 instances where a bear came back to the same location two days in a row. Several cabins were broken into three or more times from 2019-2022. During these interactions, the bear got a food reward 73% of the time or was attracted to the smell of food in the cabin's kitchen. This data aligns with and supports our previous background research on bear behavior and our conversations with wildlife experts which indicated that food rewards are the main motivator for human-black bear interactions.

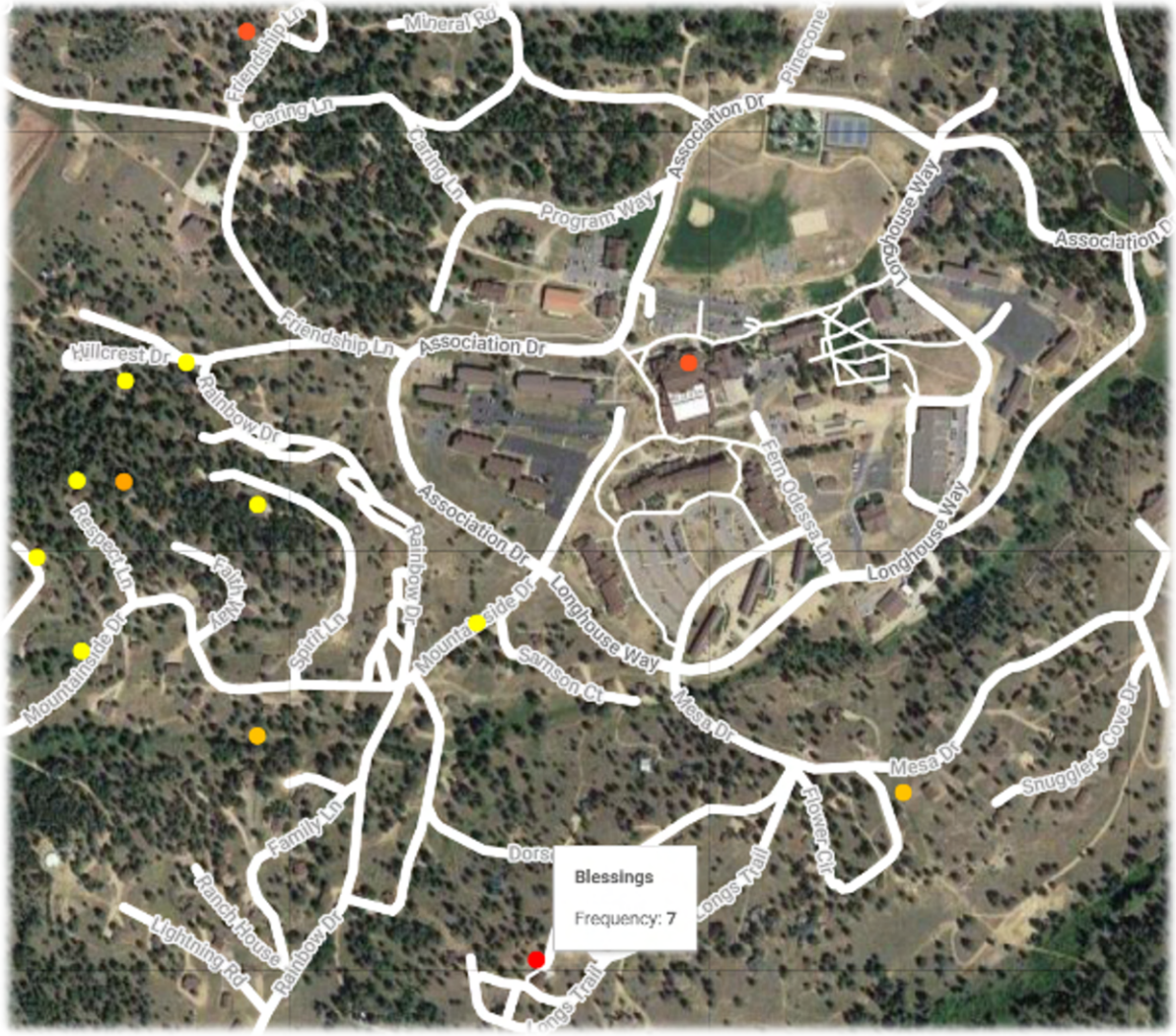


Figure 13. Map of the YMCA grounds with the most frequent cabins with black bear interactions (red = 7, light red = 6, orange = 5, light orange= 4, yellow = 3).

The main wildlife corridors at the YMCA wrap around the southern side of the property and across the northern side.

The high rate of repeat incidents may also suggest that certain cabins are in a convenient spot for a bear emerging from its foraging route. In Figure 13, it can be seen that the repeat locations tend to be located on the southern side of the YMCA and span across Mountainside Drive. John Cordsen has confirmed this as a location of high incident reports, suggesting that the cabins that are more frequently broken into result in a food reward or exist along a bear wildlife corridor. The most frequently visited location was the Blessings Retreat Cabin (Figure 13), located on the southern part of the YMCA campus. As shown in Figure 14, its larger size and location on the edge of campus most likely make it a target for bear activity. In addition, six out of eight of the interactions resulted in a food reward for the bear, encouraging it to come back again.

Figure 14. The cabin above "Blessings", has had the most bear visits in 2019-2020 combined.

The second most frequently visited area was the YMCA kitchen, which is consistent with bears looking for food rewards as well (Baldwin & Bender, 2009). Other cabins that were frequently visited were situated across the southern and western borders of the YMCA. This is consistent with our hypothesis that bears follow a wildlife corridor from the forest and national park into the YMCA. In Figure 15, we indicate a possible path that bears may take into the YMCA. These locations were chosen as possible paths due to being close to Rocky Mountain National Park and being located near sources of water which would allow them easy access to the YMCA. Based on conversations with the Boulder Bear Coalition, experts indicated that black bears tend to follow water corridors into town.

Figure 14. In this image, the cabins with the most black bear interactions have been recorded (red = 7, dark orange = 6, orange = 5, light orange = 4, yellow = 3). In light green, potential black bear wildlife corridors have been located.

4.2 Understanding Human-Black Bear Interactions at the YMCA

Cabin entries comprise the majority of bear conflict reports.

We found that in 2019, there were 28 cabin entries, 22 attempted entries, 2 vehicle entries, 12 trash entries and 17 sightings. From the 2020 data, we found 26 cabin entries, 19 attempted entries, 0 vehicle entries, 15 trash entries, and 4 sightings.

In 2019, 81 total interactions were reported compared to 68 in 2020, indicating a decrease in black bear incident reports. There were zero vehicle entries in 2020 as compared to 2019, when there were two. The number of sightings reported from 2019 to 2020 decreased significantly from 17 to 4. Both the number of cabin entries and attempted entries decreased, as well.

However, the number of trash entries increased in 2020. This rise in trash entries can be attributed to one specific bear nicknamed Chuck by the staff at the YMCA. Chuck is one of the largest bears staff have seen, weighing over 400 pounds. The bear-resistant trash containers placed all over the YMCA campus are normally difficult for black bears to break into, but if a bear is large enough and uses enough force, the cans can be pried open. Chuck has learned how to break into these cans, and based on interviews with security staff at the YMCA, he is responsible for many of the reported trash can entries in 2020.

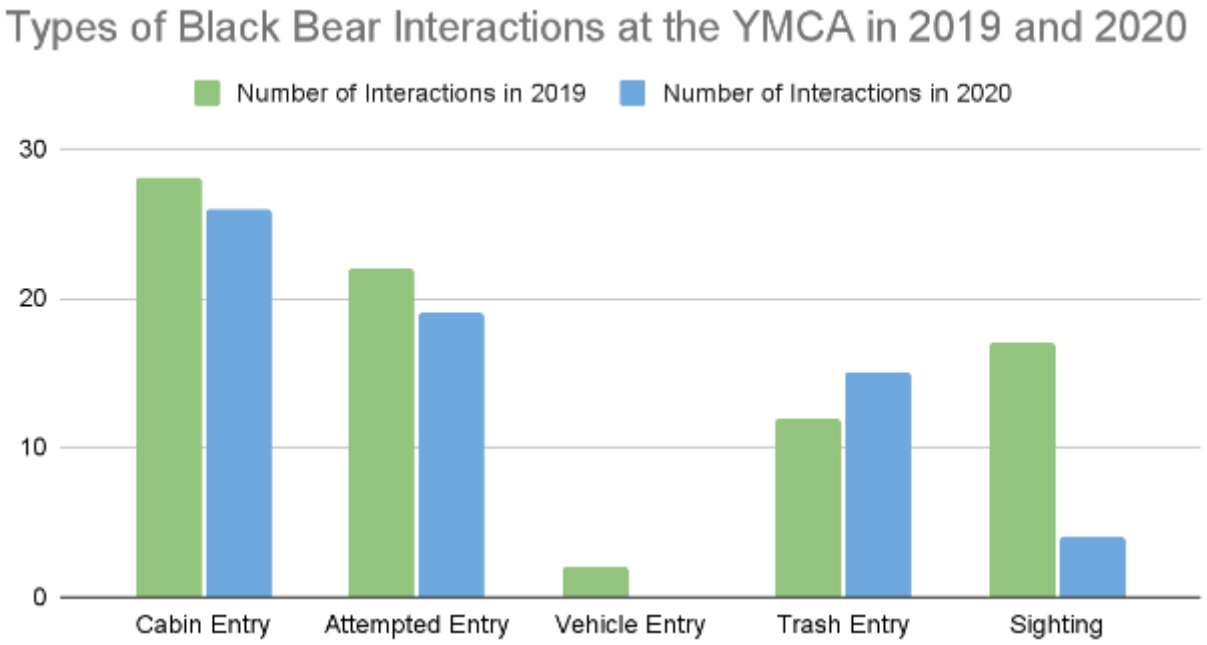


Figure 15. The various types of black bear interactions that have occurred in 2019 (green) and 2020 (blue).

The majority of the interactions that occurred were the most dangerous for both the bear and the people involved.

We performed a hazard analysis to determine the severity of cabin entries and attempted entries occurring at the YMCA. We classified each report into four categories based on severity. The categories are ranked here in order of severity, from highest to lowest: occupied & successful entry (I), occupied & attempted entry (II), unoccupied & successful entry (III), and unoccupied & attempted entry (IV). Occupied is defined in the Y reports as a person physically being in the cabin at the time of the bear entry. A hazard analysis was performed for only the year 2020 due to that year's data being more standardized than 2019. 2019 data did not reliably mark whether or not the cabin was occupied, so unfortunately we could not draw conclusions for that year.

We found that there were 22 interactions at the most severe level. This means that there were 22 instances in 2020 where a black bear successfully entered a cabin, and it was occupied by at least one person at the time. There were 17 interactions at a severity level of II in which the bear attempted entry into a cabin while the cabin was occupied. There were 4 interactions at a severity level of III and 1 interaction at a severity level of IV.

In 2020, 50% of the total cabin entries & attempted entries were classified as having a level I severity. This means that most of these interactions, when a cabin is both occupied and the bear successfully entered, were the most dangerous situation for both the bear and the people. A person may be hurt in that situation if they get between a bear and its exit path. The bear would most likely have to be put down by CPW for exhibiting such a behavior since they consider it to be extremely dangerous.

Table 1. This table shows the classification of severity of interactions, with red being the most severe (I) and green being the least severe (IV).

	Successful Cabin Entry	Unsuccessful Cabin Entry
Occupied Cabin	I	III
Unoccupied Cabin	II	IV

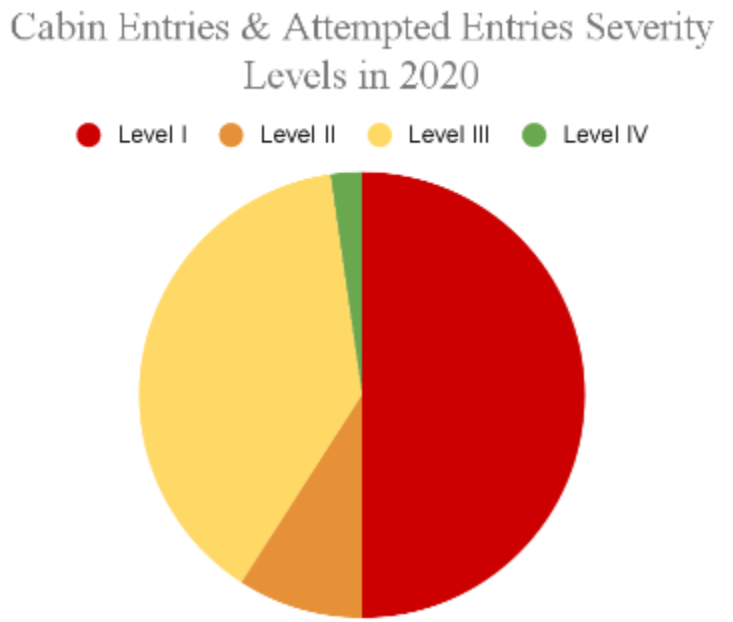


Figure 16. Pie chart showing the percentage of cabin and attempted entries that were classified under each severity level.

Many severe interactions that occurred on YMCA property in 2020 can be attributed to one bear.

Based on our interviews at the YMCA, we learned that many of these dangerous interactions were due to one specific bear within the span of a month. Due to the dangerous behavior exhibited by the bear, which entered cabins repeatedly, CPW became involved and ultimately trapped and euthanized the bear in July of 2020.

As seen in the figure to the right, after July, the number of dangerous interactions steeply dropped. This was after the bear exhibiting dangerous behavior was put down at the end of July. After that, most of the black bear interactions reports consisted of trash entries. This specific bear most likely became habituated to human food and learned how to break into cabins. According to staff at the YMCA, this was the only bear they have encountered whose behavior "actually scared" them. After this bear was put down by CPW, the number of dangerous interactions dropped steeply in the following months.

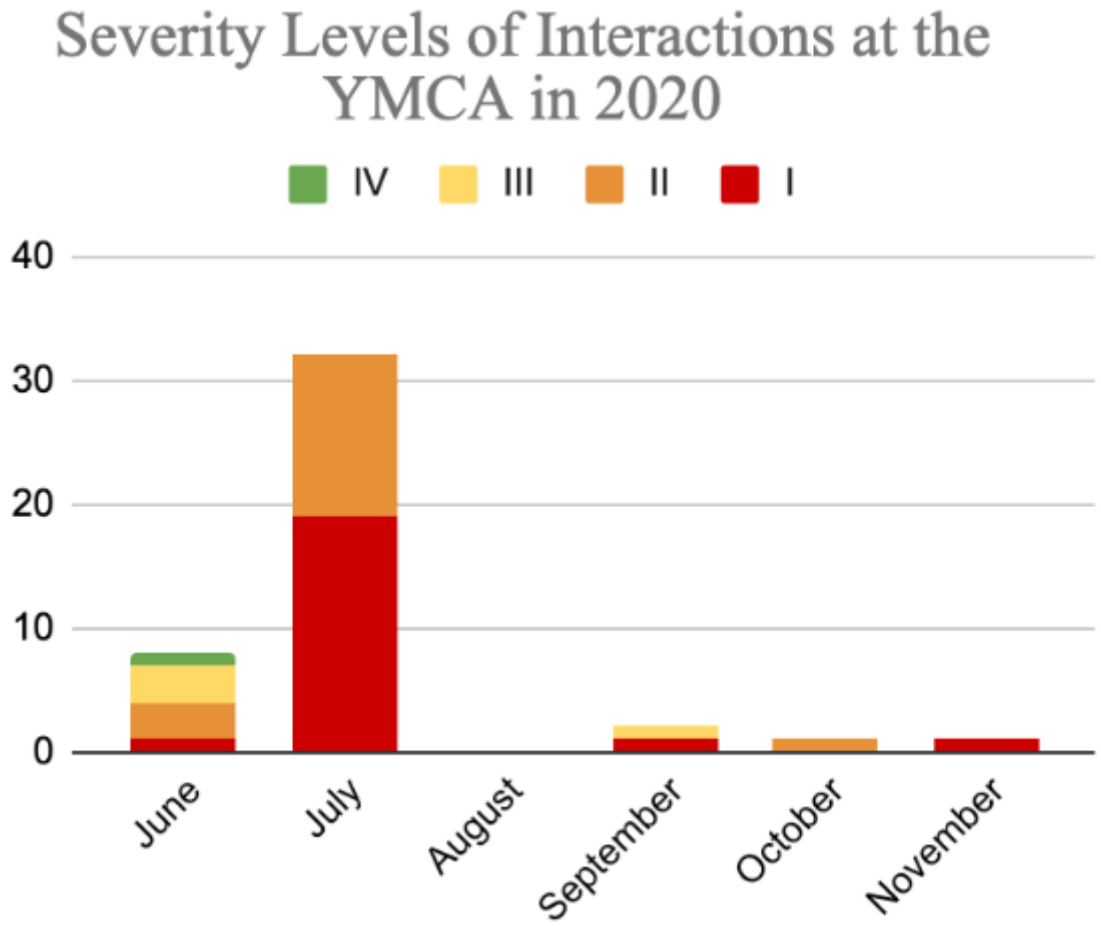


Figure 17. Graph displaying the severity levels of interactions at the YMCA over the course of 2020. This graph covers June through November, which is the timespan of data given to us.

In many of the interactions recorded in 2019 and 2020, black bears caused significant damage to screen doors and windows.

Our team assessed the damage done by black bears in the years 2019 and 2020. We found that most of the damage done in both years was to window screens and screen doors. If a black bear did damage to YMCA property, our team classified them into five different categories: screen, interior, window, vehicle, and trash damage. In 2019, there were 27 instances of screen damage, 4 instances of interior damage, 9 instances of window damage, 2 instances of vehicle damage, and 6 of trash can damage. In 2020, there were 25 instances of screen damage, 5 instances of window damage, and 1 instance of interior damage.

In 2020, the number of damages reported decreased overall. However, screen damage remained consistently high between both 2019 and 2020. In some of these instances, multiple screens were damaged. For example, on July 17, 2020, a bear attempted to get into a cabin and tore down and damaged seven window screens before successfully entering the building. Damage incurred during these black bear interactions requires repairs and payment from the YMCA. In both 2019 and 2020, over 50% of all cabin entries, attempted entries, trash entries, and vehicle entries resulted in damage done to YMCA property.

Repairing damage caused by bear entries can be a large expense for the YMCA. According to its groundskeepers, the YMCA may experience several thousands of dollars' worth of damage associated with damage caused by bear interactions each season. During interviews with groundskeepers, we were informed that an entire cabin window costs approximately $2000 to replace, including the labor to install it. A cabin window screen costs about $100 to replace, and a screen door may cost up to $1700 to replace. From the 27 cases of screen damage in 2019, the total cost of damage just from that one type totals up to about $2700. From the 25 cases of screen damage in 2020, the total cost of damage totals up to about $2500, leading to a total over $5,000 in just two years. This money could certainly be directed towards applying innovative bear mitigation strategies instead, decreasing the frequency of interactions and thus the cost of repairs.

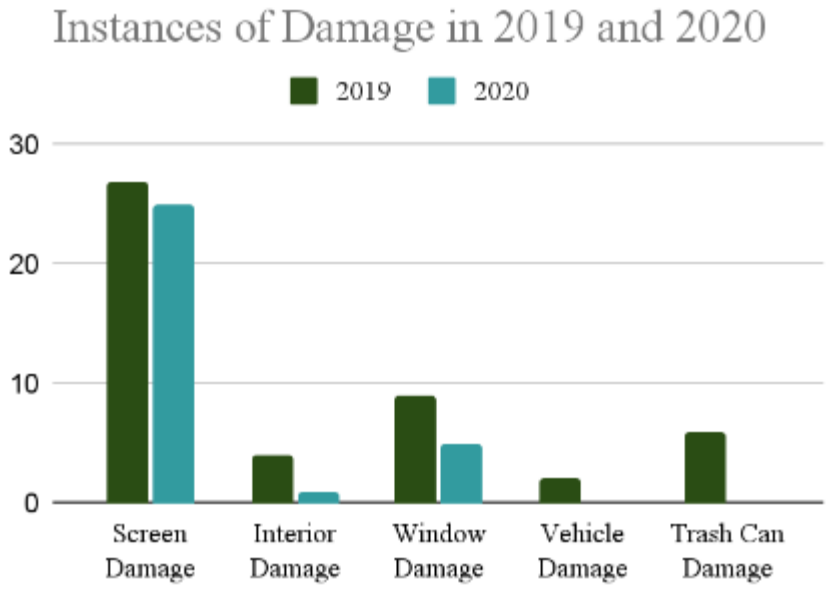


Figure 18. Different types of damage that were from different bear interactions between 2019 to 2020.

The majority of interactions that occurred resulted in the bear obtaining a food reward.

Most of the black bear incident reports in 2019 and 2020 detail whether the bear gained a food reward. In 2019, there were 26 instances where a bear gained a food reward and in 2020, there were 25 instances of food rewards. For 73% of cabin, trash, and vehicle entries the bear gained a food reward. This indicates that food is the main attractant when encountering a human-bear interaction. Bears managed to obtain food ranging from brownies, peanuts, Rice Krispies Treats, milk, and to flour. It should also be noted that in some cases, there may have been a food reward that the bear received without being noticed.

According to security staff at the YMCA, in many of these incidents a window or door was left open and food was out on the counter and easily accessible to bears. At the YMCA, none of the cabins have air conditioning and that combined with the clean air in Estes Park, tempts guests to open their windows in order to avoid the heat. Bears possess a sense of smell seven times better than a bloodhound (U.S. Department of the Interior), so improperly stored food can be easily identified by them. If a window is left open, the bear will likely enter the cabin in order to get the food reward. Air conditioning in every cabin is unmanageably expensive, and asking tourists not to open their windows is not a reasonable request, leaving the YMCA staff in a conundrum.

4.3 Perception of Estes Residents and Mitigation Strategies at the YMCA of the Rockies

Security at the YMCA mainly utilizes hazing to deter bears on property.

When security officers encounter a bear on the YMCA campus near guests or engaging in nuisance behavior (such as eating trash, attempting to break into a cabin, etc.), they perform a strategy referred to as hazing. In one extreme case, a bear was hazed by being shot with orange paintballs and has yet to return to the YMCA campus.

John Cordsen recalled a particular incident where there was a sow and two cubs stuck in a tree on YMCA property during the day. These bears were nicknamed Betty, Thing 1, and Thing 2 by security staff. At the time there were several large groups of children and guests nearby. John and other members of security were responsible for making sure the bears did not come down from the tree and possibly endangering the nearby people. They used hazing tactics such as making large amounts of noise and using paintball guns to ensure the bears stayed up in the tree until people were able to leave the area so the bears could leave safely.

This tactic has been employed elsewhere and is considered effective by many. Chase Rylands discussed hazing bears in town that are attempting to enter cars, trash cans and possibly buildings. Additionally, if a black bear was in a tree near a location with a large amount of people like a school or a park, bear-sitting would be commonly employed. Bear-sitting refers to the practice of volunteers appearing at the location of the bear and making noise to ensure that the bear will stay in the tree and will not endanger itself or nearby people, until the area is cleared of the people and the bear can safely leave. Bear-sitters go to the location of the bear and make noise to ensure that the bear will stay in the tree and will not endanger itself or nearby people, until the area is cleared of the people and the bear can safely leave.

Hazing has been used to deter bears from staying on YMCA property many times. Paintball guns and making a loud amount of noise is sufficient to scare the bears off. Hazing often proves unnecessary however, as John Cordsen informed us that the bears remember the sound the security trucks make, and will escape the entry location before security staff gets there.

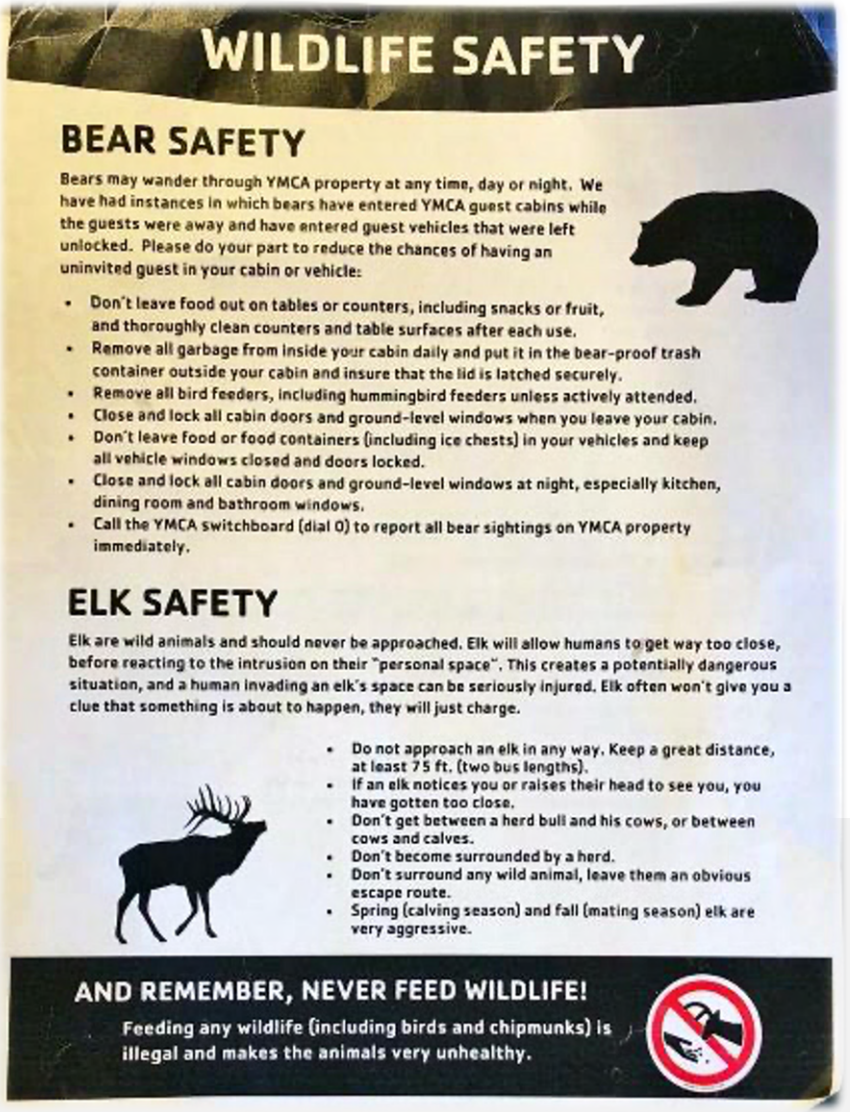
One of the most common drivers of human and black bear interactions at the YMCA relates to visitors and their noncompliance with bear safety strategies.

The YMCA provides its guests with some educational material in the form of magnets displaying bear safety tips. In addition, the YMCA provides bear talks to guests, for free during the week, where they provide information on general bear facts and bear safety protocols. However, it is common for visitors to disregard these necessary safety measures. Neglecting to secure trash properly and lock windows and doors grants black bears easy access into cabins and the ability to obtain food rewards.

From our interview with YMCA program director, Donovan Colegrove, we learned that when guests check in at the YMCA, they are greeted with informational guides, which include bear safety measures. However, he clarified that many of these guests do not look at these guides. He believes that many of the guests do not listen or read this educational material due to ignorance about the wildlife in the area. While some YMCA groundskeeping staff made it clear that they thought education was the answer to bear conflict mitigation, others have said that education is not the most effective strategy for mitigating conflict. Guests may read the educational material provided by the YMCA and other organizations around the area, however it may not resonate as the individuals are on vacation and could come from a less wildlife heavy area.

Figure 19. Educational magnet provided by the YMCA describing precautions to take to follow bear safe practices. It should be noted that not all cabins have this magnet.

Figure 20. Educational material provided by the YMCA to guests during check-in. It includes proper precautions on how to be safe with wildlife.



4.4 Possible Foraging Areas on the YMCA

When speaking with YMCA staff, they informed us of a few locations where vegetation could be planted in order to deter bears from entering cabins and encourage them to stay in their own habitat. Donovan had provided possible locations that could have foraging be done and would be a great location for bears to interact. In addition, we met with other YMCA staff members, to confirm that this location would be an ideal location for the foraging areas.

From the map, we observed an area along Glacier Creek that might provide an ideal spot for the bears to consume food from the foraging areas. This location contains a north facing slope, is near water, and is near a natural corridor for bears to move through. These characteristics would help to grow different vegetation that would attract the bears to the location and possibly deter them from approaching the YMCA and interacting with guests. We investigated the site to see if there were any other characteristics to identify. We noticed that many of the trees were dying and would need to be cut to make room for the planting areas. We also observed that there was a hiking route in the locations which would make it difficult to plant the foraging sites.

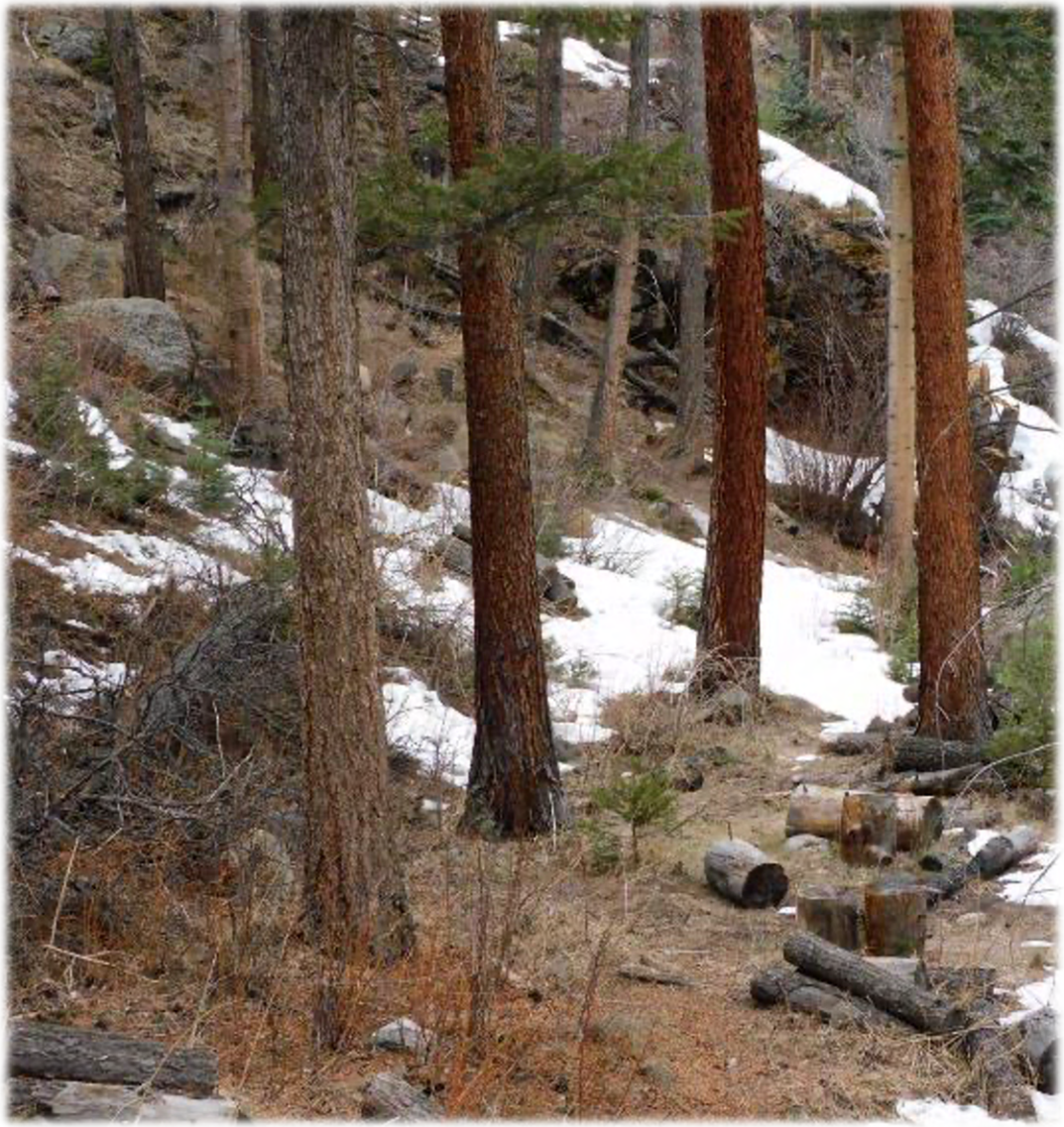


Figure 19. Possible foraging location on Glacier Creek on YMCA property we visited and observed.

4.5 Attractants for Black Bears into Estes Park

When traveling to the town of Estes Park, the bears utilize specific corridors. The bears will tend to travel from RMPC and go through the YMCA and Route 66 to end in the town. YMCA staff members had also identified that the bears will also come from Prospect Mountain and end in town to find food sources. There are a few main attractants for black bears coming into Estes Park, including bird feeders, trash, and cooking oil waste containers. If stored improperly, black bears can easily access human refuse. As mentioned previously, this has been a large problem for the town of Estes Park which resulted in it passing a wildlife ordinance mandating the use of wildlife-resistant containers. Below are some figures that show containers of various effectiveness.

Figure 20. This is an example of a dumpster and enclosure being used incorrectly. The dumpster is overflowing in the top and the fence enclosure would not be effective at keeping bears out since there is no top to it.

Figure 22. A bear-resistant dumpster that compacts and stores trash in a way making it difficult for bears to enter and retrieve refuse.

Figure 21. In this picture, cooking oil containers and trash dumpsters are locked inside a large enclosure. This is an effective way to prevent bears from being able to reach the containers at all. The cage is both locked and enclosed on all sides.

If used improperly, cooking oil waste containers are a main attractant for black bears into Estes Park.

The impact of cooking oil storage practices on the frequency of bear interactions showed that there is a negative correlation between them; the less attention paid to these practices the more the bear will be attracted to the area/restaurant. We noticed that restaurants that stored their used cooking oil in bear-resistant containers, sheds, or other types of enclosures had fewer interactions and issues with bears. Restaurants that didn't use bear-resistant containers to store their cooking oil had more issues with attracting bears. For example, one restaurant in downtown Estes Park utilizes a bear-resistant cooking oil waste container as seen in Figure _. This container is both chained to a building and heavy enough where a bear would have difficulty pushing it over. The manager recalls not having many issues with black bears in the past five years. The manager stated that they are aware of bear activity in the area where they store their restaurant's waste, but their restaurant hasn't had any issues with bears breaking into their waste since they implemented these bear-resistant containers.

On the contrary, one restaurant on the outskirts of town has had many issues with black bears breaking into their cooking oil containers. One of the employees toured us around their facilities and showed us the cooking oil waste container they use which can be seen in Figure 21 above. The employee we spoke to explained to us that bears often break into those containers and spill the oil around it, indicated by the green arrow. This is most likely because the lid for these containers is plastic and they are on wheels, making it easy for them to be pushed around and tipped over by bears.

Figure 23. This is a cooking oil waste container that is not bear-resistant. It has a plastic lid without a lock and could be pushed over. Additionally, there is grease all over the ground around the oil container.

Figure 24. A bear-resistant cooking oil waste container manufactured by ClearEcos. In this case it is also chained to the building behind it, making it difficult for a bear to push it over and spill any oil.

4.6 Individual and Community Engagement is Crucial When Advocating for Black Bears.

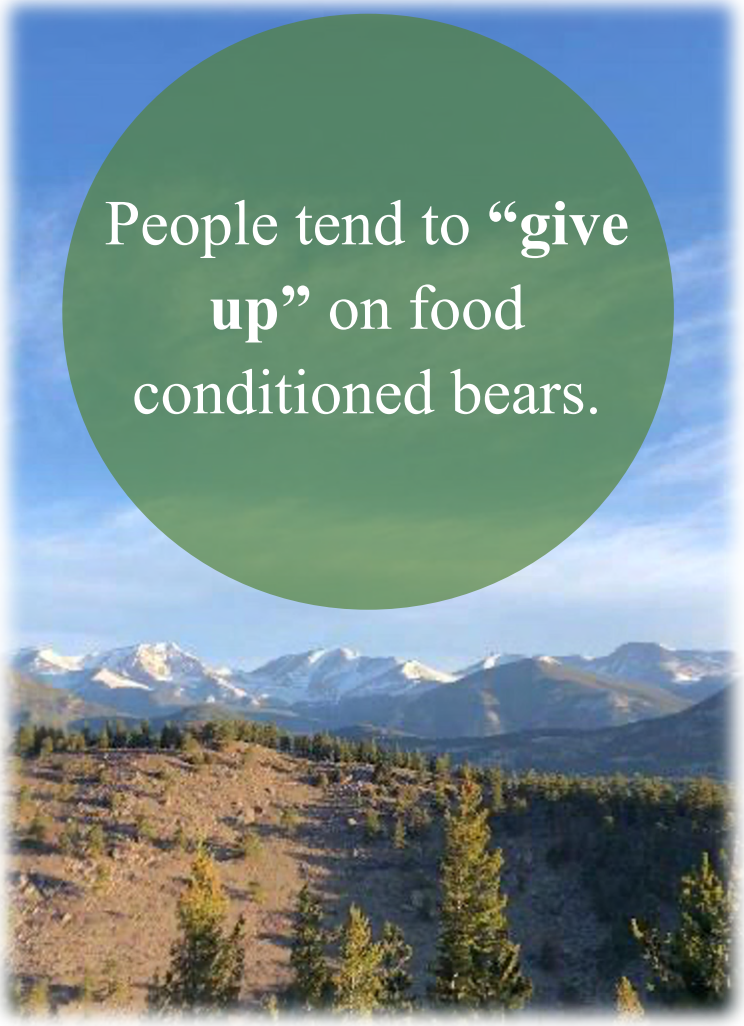
While having tangible mitigation techniques is crucial in order to mitigate human-bear interactions, individual and community engagements aid in enforcing and inspiring residents to be an active part of the solution. When the bear-resistant can ordinance was introduced in Larimer County, it was the community efforts that led to its successful passing. During an interview with a local bear activist, she explained the large efforts her and a wildlife protection group had to go through in order to pass the ordinance. It took multiple trips to town hall, many compromises, and certainly committed individuals to persistently demand change in trash storing practices. Additionally, during an interview with a CPW regional manager, we found that in Colorado towns that have trash storing ordinances, they are almost always brought forth by the community, and if there is no community support, then there is no legislature passed. She explained that the priorities of the townspeople are what govern change. If black bears are not a priority of the local residents, then there will be no change when it comes to human-black bear interaction mitigation.

In Estes Park, we found several community groups responsible for both enforcing and initiating widespread community change. Groups such as the Bear Education Taskforce, Wandering Wildlife Society, Estes Park Watershed Coalition, and the Estes Park Wildlife Protection Group all work towards a similar goal of protecting the wildlife in Estes Park from both the transient and resident population. While the methods to protect the wildlife of the groups are slightly different, sometimes leading clashes between the groups, it is ultimately the combination of community approaches that leads to change. Some groups push towards a militant and aggressive approach, enforcing ordinances and passing laws, while others may focus more on the social side, providing education and trying to shift the perspective of residents on the wildlife in town.

Even individual contributions can be crucial when enforcing new regulations in communities. Speaking to many wildlife advocates, they mentioned that while ordinances are a great first step to eliciting change in a community, they must be enforced. Precise details, such as keeping a bird feeder out of reach, can be easily overlooked and therefore attract bears anyways. Keeping the community accountable is just as important as placing the ordinance in the first place. When speaking to the managers of several restaurants, many pointed to a single individual who was known for reporting non-compliance amongst businesses in town. When noticing improperly stored trash, this individual would report the restaurant to the police, resulting in a fine for the business. Over time, the restaurants learned that if they did not comply, they would have to pay fines and eventually, most if not all restaurants in town began properly storing their trash.

4.7 Common Misconceptions Influence Local Perspectives on Black Bears

When it comes to black bear education, it is difficult to inform and educate the residential and transient populations, partially due to pre-existing or widespread misconceptions. These "myths" are information that has been spread through different communities and sources and which has not been fully supported by facts. One common misconception we discovered through our research is that many individuals believe that bears eat 20,000 calories every day they are not in hibernation. While bears can eat up to 20,000 calories during eating intensive periods such as hyperphagia, but there is no evidence that they consume this amount every single day. Blindly believing such information leads to consequential misconceptions, which may influence the way in which officials or wildlife officers react to human-bear interactions. For example, many of our key informants held the viewpoint that if a bear consumes trash even once, they will be habituated to this trash for the rest of their lives due to a high calorie reward. One of our informants, who previously worked in human-bear conflict mitigation in Estes Park, stated that they tended to "give up" on bears that began breaking into cabins. This belief that bears cannot "unlearn" these types of behaviors has been spread through the grapevine yet has no study to prove that it is true. In fact, there have been studies that show that if a bear has natural vegetation available, it will stay in its natural habitat. Due to these misconceptions, many have a misinformed view on the animal, ultimately changing their perspective on black bears.



In addition to misinformation, the language used to describe black bears and interactions can influence widespread perception on the issue. When describing interactions between black bears and humans, many jump to using “conflict” as a description word. Since the word “conflict” has an inherently negative connotation, described as a “serious disagreement”, it labels the interaction as negative and shapes the narrative right from the start. Bears are in reality timid and docile creatures, and at the YMCA there has never been an injury to a guest or staff member by a bear on the property. Instead of jumping to conflict-centered language, using terminology such as “interaction” removes this negative connotation. Additionally, during our assessment of interactions at the YMCA, we noted the importance of straying away from reciting phrases such as “break-in” when assessing cabin entries. By labeling an interaction as a break-in, this immediately puts the bear at fault, since breaking into something is typically considered a negative action, yet typically when a bear enters a cabin, there is no actual breaking in. Oftentimes there is simply an open window and the bear does not engage in any aggression; it simply follows its natural instinct and incredible sense of smell to obtain a food source. Through conscientious selection of vocabulary used to describe bears and their behavior, perspective and attitudes surrounding the black bears can be changed.

4.8 A disconnect between community driven and government sponsored wildlife protection agencies disrupts efforts for black bear advocacy.

In Colorado, there are several different wildlife protection agencies, ranging from a local, community driven effort, to agencies run by the United States government. While ultimately these groups have the same goal to support peaceful human-wildlife coexistence, disconnects between the groups can lead to a hindered progression of achieving their goal. Between wildlife experts at Rocky Mountain National Park, Colorado Parks and Wildlife (CPW), the YMCA, and even the Colorado Bear Coalition, there tends to be a lack of communication and collaboration to protect the black bears in Colorado.

CPW, for example, has a responsibility to not only protect the wildlife from humans, but also to advocate for human safety. When talking to a regional manager from CPW, they made it clear that human safety was their number one concern. Even if a human-bear interaction was the fault of the human, the bear will still get reprimanded. While putting human safety first is crucial, an increased line of communication between Colorado residents and CPW would allow for disciplinary measures for bears to be taken before one has to be put down due to safety concerns. Speaking with residents in the area, very few report bears to CPW, often with the fear that reporting the bear will lead to it being euthanized. When residents did report bears, even for minor interactions, the officers of CPW could take disciplinary actions against the bear as a precautionary step, before the problem gets out of hand and the bear's life is placed in danger. A CPW officer explained that if only people would report bears more often, he could haze the bears before they become habituated to a human food source and avoid the need to put the bear down.

Another disconnect we observed, occurs between CPW and other researchers attempting to access data to mitigate human-bear interactions. Due to its connection to the government, CPW has access to a lot of data regarding bear interaction reports yet seems to lack the resources or motivation to analyze and provide the data to the public. During efforts to get incident data from CPW, many researchers run into trouble acquiring the information needed to complete necessary studies. For example, bear reports can be crucial in identifying areas with high black bear concentrations in order to determine feasible mitigation techniques, yet the data seems to be inaccessible. While there may be some issues regarding privacy if certain addresses were released, there is still a barrier between researchers and CPW. If there was more collaboration between bear-experts doing research and CPW, there could be an increase in productivity implementing effective human-bear interaction mitigation techniques.

Even at the YMCA, where the head of security frequently updates the local CPW officer, there is a lack of collaboration regarding the mitigation efforts. They update each other and may work together to mitigate interactions involving a specific bear, but CPW does not work with the YMCA to preemptively lessen interactions in Estes Park.

4.9 Limitations

Although we were able to analyze data from the years 2019 and 2020, we did not have access to any recorded black bear incidents from the YMCA prior to 2019 and no incidents were recorded in 2021. The lack of this data limited our ability to track changes at the YMCA over the years. Additionally, the 2020 data was more standardized than the 2019 data. The 2020 data clearly states whether the bear obtained a food reward and whether or not the cabin was occupied. This only allows us to perform hazard analyses for the year 2020. In future years, it would be ideal to have a standardized form for YMCA staff to fill out so that data remains consistent and is not lost or misplaced.

Although we had the opportunity to talk to 17 restaurants around Estes Park, 8 of the interviews were not successful. Many restaurants did not have time to speak with us. Our team created an online survey and printed out QR codes and links for the businesses to complete when they had availability, however, there was not a single online response from those restaurants that received the online survey. This limits our data set that we can pull from for restaurants.

While many residents have been here for numerous years and know the town well, some of the people living in Estes Park are a transient population. As a result, when interviewing a few restaurants, it was difficult to gain insight of past interactions. A few of the staff at restaurants we interviewed had recently moved to Estes Park and been living here one year or less. This resulted in them not being able to give us a full insight of previous black bear interactions at that business.

Additionally, we interviewed many restaurants about their cooking oil disposal practices and how it may impact their interactions with black bears. Although we are attempting to better understand cooking oil as an attractant so we can help both the restaurants and the bears, some businesses may not fully understand our motives. They may feel as though we are trying to uncover which restaurants are not following the wildlife ordinance, which may lead to them not sharing accurate information with us. Apprehension in revealing the full details of their practices may lead to some of the interview being somewhat untrue. There is no way for us to confirm the validity of all the data.

The most important, yet hardest aspect of mitigating human and bear interactions is encouraging human compliance. At the YMCA, all visitors are educated about the importance of keeping food locked away and practicing proper bear safety protocols. However, many of the tourists do not pay attention to these reminders, which may result in bears entering their cabins and lodges. In addition, tourist's cars are a significant issue for attracting bears to the YMCA. When tourists drive to the YMCA, many of them forget to lock their doors and leave food in their car. As a result, the bears will open the door and infiltrate the car in search of food which may result in major vehicle damage and safety threats to both the visitors and bears. Our findings go on to support our initial research and have learned that the best way to encourage compliance is to have a multitude of methods to mitigate interactions.

5.0 Conclusion

Estes Park and the YMCA are embedded within black bear territory. Black bears are a normal part of residents' lives and our project focused on mitigating potential conflict between the two and encouraging positive coexistence. Although the town of Estes Park has made beneficial progress in black bear mitigation in the past decade, there are still cases of people and businesses not practicing bear safe strategies. During our time in town, we spoke with wildlife ecologists and experts, staff at the YMCA of the Rockies, businesses and restaurants, and residents, learning what perspectives locals have on black bears in town. Additionally, we learned about bear conflict mitigation strategies and analyzed data collected by the YMCA of the Rockies from the past few years. We encourage the YMCA of the Rockies to continue and analyzing black-bear interaction reports to determine the main attractants on the campus as the climate and conditions change. Additionally, we hope our sponsor, the Colorado Bear Coalition, will be able to use our research in their future projects aimed to mitigate human-black bear interactions in Colorado.

5.1 Mitigation Strategy Recommendations to the YMCA

5.1.1 Foraging

Through the identification of wildlife corridors on the YMCA property, we have made recommendations on ideal locations to place foraging opportunities for black bears. These locations take into account a few factors: they are along potential wildlife corridors, they are near a water source, they are accessible for people to water them, and they are not too close to cabins and other areas the YMCA does not want high bear activity near. These locations can be visualized in Figure 22, where the highlighted areas are potential foraging locations.

Figure 25. Potential foraging area on the YMCA estate.

Once a potential foraging location is selected and approved by the YMCA, they will then need to plant the starters at the appropriate time of year and establish a watering service so that the vegetation has the necessary nutrition to survive. After the plants have had the time to fully mature and produce food for black bears, it will ideally provide an abundant and natural food source for black bears on the outskirts of YMCA property. Since this food source will be distanced from nearby cabins, it will hopefully deter bears from heading further into the Y to rely on human refuse as a food source.

5.1.2 Window Prevention System

Using electricity as a form of hazing bears is reliable and could be an effective strategy for the YMCA to implement and deter bears from breaking into cabins. Placing electric fencing or unwelcome mats under windows may prevent bears from even having the chance to break into cabins. However, this recommendation does come with some difficulties. Implementing electric fencing and unwelcome mats may lead to guests being harmed by them. Although there would not be any permanent harm, it may make guests uncomfortable if there is the possibility to step on or touch these electric fences or unwelcome mats.

Another window prevention system that could be used to mitigate bears from entering cabins would be the implementation of window bars. These bars would be installed onto the windows so that bears would not be able to squeeze through them. This can be visualized in Figure 23 where the green bars would be made from the same material as the frame. This recommendation is more feasible than electric window system due to liability concerns, but it is possible that guests

may find this aesthetically unappealing, leading YMCA donors to not support this change.

Figure 26.The bars in light green indicate suggestions where metal bars can be places of the same color and material as the existing window.

5.1.3 Bear Reporting System

When speaking with staff members at the YMCA of the Rockies, we learned that the current method of documenting bear interactions is through writing down the details of the incident into a notebook. The downside of this system is that it is difficult to visualize where these interactions take place and then share the information with others. We plan to help create a reporting system that would allow staff to easily report each interaction and graph this interaction onto a map. Utilizing Google Forms, we can create a simple and easy-to-use form that YMCA staff can fill out to track black bear interactions. This form will include key information such as location, date, type of interaction, incident details, and any damage done. One of the features of Google Forms allows all the input information to be exported to a Google Sheet which can then be connected to Google Reports. The Google Report will then map this interaction with all the information given. This map will be able to provide insight into the interaction hotspots at the YMCA and help the staff and guests be aware of bear behaviors and movement.

Closing Remarks

At the end of our stay in Estes Park, black bear hibernation season ended, and bears began to wake up. We hope that our discussions with restaurants and the YMCA of the Rockies encourage the continued and improved use of bear safe practices so that we can have a year without a bear being needed to be put down or relocated.

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Appendix A - Interviews with Wildlife Experts

Appendix A covers the different interview questions we asked with different wildlife experts. These experts include members of the Colorado Parks and Wildlife and people who have studied bears and their behavior for years.

A.1- Stacy Lischka - Wildlife Ecologist

Interview Questions:

1) Could you tell us a bit more about your previous experience with black bears in Colorado?
2) What past experience do you have with interviewing residents and other key informants about issues surrounding black bears?
3) What do you believe are the main reasons residents do not comply with ordinances?
4) Do you think it is possible to increase compliance?
    a) If so, what are possible solutions?

A.2 - Chase Rylands - CPW Wildlife Manager

Interview Questions:

1) How long have you been a CPW wildlife manager?
2) Have you interacted with any black bears in Estes Park?
    a) Could you provide details about those interactions?
3) What are some key factors that attract black bears into town?
4) Do you believe that there are any resources the bears are attracted to?
    a) If so, what are some of these resources?
5) Have you seen a change in bear numbers and bear behavior over the years that you have been a CPW wildlife manager?
6) Could you provide information on current guidelines the CPW has to follow for black bears?
7) What role does the community play in reducing human-bear conflict?
8) How can the community do a better job at reducing human-bear conflict?
9) If one thing could be done in Estes Park to reduce human-bear conflict, what would that be?

A.3 – Chris Clatterbuck - Head Bear Tech at Rocky Mountain National Park

Interview Questions:

1) Could you tell us a bit about any interactions you have had with black bears?
2) What are some key factors or resources that attract black bears to the Park?
3) Could you explain a bit about the steps that Rocky Mountain National Park has taken to mitigate black bear and human interactions?
    a) Are there specific guidelines that the Park must follow regarding bear-proofing and limiting attractants?
    b) What are some challenges that the park faces in adhering to these policies?
4) What kind of educational material does the Park provide to its visitors?
    a) Have you found educating visitors on bear safety strategies to be sufficient in reducing interactions?
5) Is there a database that is used for recording instances of human and black bear interactions in the Park?
    a) Is there a way we could potentially access this data?

A.4 – Tim Nicholson - Local Wildlife Advocate

Interview Questions:

1) Could you tell us a little bit about your background and experience with wildlife with wildlife advocacy?
2) What have your experiences with black bears been like?
3) What do you feel are the main driving factors from human-black bear interactions?
4) What strategies do you feel lead to successful black bear mitigation?
5) Do you report black bears to CPW when you do see them?
6) Do you view restaurants as the main problem when it comes to black bear attractants?
7) We conducted an interview with the Stanley Hotel and they mentioned that they feel cooking oil and grease are a large attractant. Have you noticed this with other restaurants?
8) If you could solve one black bear attraction or mitigation issue, what would it be?

Appendix B - Interviews with YMCA Staff

Appendix B covers the different interview questions we asked staff at the YMCA of the Rockies. The staff includes the head of security, a program director, guest service director, a team from the buildings and grounds office, and a past employer of the YMCA.

B.1 – John Cordsen - Head of Security at the YMCA

Interview Questions:

1) Have you interacted with any black bears at the YMCA?
    a) Could you provide details about those interactions?
2) What are some key factors that attract black bears to the YMCA?
    a) Do you believe that there are any resources the bears are attracted to?
        i) If so, what are the possible resources?
3) Has any database been created for recording black bear interactions at the YMCA?
4) Could you provide information on past guidelines the YMCA had to follow for black bears?

B.2 – Chris Daubin - Past Security Officer at the YMCA

Interview Questions:

1) Have you interacted with any black bears at the YMCA?
    a) Could you provide details about those interactions?
2) What are some key factors that attract black bears to the YMCA?
    a) Do you believe that there are any resources the bears are attracted to?
        i) If so, what are possible resources?
3) Has any database been created for recording black bear interactions at the YMCA?
4) Could you provide information on past guidelines the YMCA had to follow for black bears?

B.3 – Donovan Colegrove – Program Director

Interview Questions:

1) Have you interacted with any black bears at the YMCA?
    a) Could you provide details about those interactions?
2) Would foraging on the YMCA work as a mitigation strategy?
3) Could you identify possible black bear corridors on the YMCA property?
4) Is there a system in place to track bear interactions/incidents?

B.4 – Jim Boyd – Guest Service Director

Interview Questions:

1) Have you interacted with any black bears at the YMCA?
    a) Could you provide details about those interactions?
2) What are some key factors that attract black bears to the YMCA?
3) What work have you done for CPW?
4) Would foraging on the YMCA work as a mitigation strategy?
5) Would electric fencing be a feasible option as a mitigation strategy?
6) Has any database been created for recording black bear interactions at the YMCA?
    a) Would a reporting system be a feasible and helpful tool for the YMCA?

B.5 – Kelly Wilkerson, Troy Husler, Joe Pullen

Kelly Wilkerson – Head Groundskeeper, Troy Husler – Buildings Maintenance Supervisor, Joe Pullen – Assistant Grounds Supervisor
Interview Questions for Kelly:

1) Have you interacted with any black bears at the YMCA?
    a) Could you provide details about those interactions?
2) Would foraging on the YMCA work as a mitigation strategy?
3) Based on the locations of possible foraging sits, would plants be able to grow there?
    a) What plants would be able to grow at these locations?
4) Could you identify possible black bear corridors on the YMCA property?

Interview Questions for Troy:

1) Have you interacted with any black bears at the YMCA?
    a) Could you provide details about those interactions?
2) Could you provide us details on general costs for building damages from bears?
    a) What is the cost to replace window screens that were damaged by bears?
    b) What is the cost to replace screen doors that were damaged by bears?
3) How often do damages caused by bears occur in the year?
4) What is the estimated time to replace these damages?

Interview Questions for Joe:

1) Have you interacted with any black bears at the YMCA?
    a) Could you provide details about those interactions?
2) Have you found possible corridors at the YMCA?
3) How did you determine how to set up your cameras?

Appendix C - Interviews with Bear-Resistant Can Companies

Appendix C covers the different interview questions we asked different bear-resistant container company representatives. These representatives include an employee of Western Disposal, a trash-collecting company that utilizes bear-resistant containers, and a member of the Interagency Grizzly Bear Committee who certifies grizzly bear-resistant containers.

C.1 – Kathy Carroll - Community Relations Manager at Western Disposal

Interview Questions:

1) Could you tell us more about the current design Western Disposal uses for bear-resistant garbage containers?
2) What are some of the standards the Interagency Grizzly Bear Committee requires for bear-resistant containers?
3) What are some of the desirable qualities of bear-resistant garbage containers from the garbage collector's perspective?
4) What system does Wester Disposal use for trash collection?
    a) Do you use automated trucks?
    b) How do the automated trucks work with the bear-resistant features on the cans?
5) How did Western Disposal distribute the containers throughout town?
6) How did the ordinance in Boulder impact your company?

C.2 – Patti Sowka - Interagency Grizzly Bear Committee Certifier

Interview Questions:

1) Do you feel that the bear-resistant garbage containers are effective?
2) What is your experience with bear-resistant garbage containers?
    a) Were the containers properly locked?
    b) Were the containers fully intact and not damaged?
3) What is your experience with black bears?
4) What features in a bear-resistant garbage container would make it easier for use?
    a) Are there any features you can think of that would make it easier for residents to use on a daily basis?
5) What is considered when trying to certify a can?
    a) Are there specific regulations the cans need to meet?
    b) Could you go over the certification process?

Appendix D - Interview with Corey Pass

Appendix D covers the different interview questions we asked the Police Captain of Estes Park.
Interview Questions:

1) Did you have any black bear interactions that occurred on the resident's properties?
    a) If so, could you describe what happened?
2) Could you describe some of the ordinances and regulations on black bears that are in effect in Estes Park?
    a) How do these regulations impact your job?
3) Have you noticed any complaints about black bears in certain regions of Estes Park?
4) From your experience and knowledge, do you think bear-resistant containers help residents diminish interactions?
5) What bear safety measures do you find most effective?

Appendix E - Interviews with Local Businesses and Restaurants

Appendix E covers the different interview questions we asked local businesses and restaurants in Estes Park. These businesses include the Stanley Hotel and Rocky Mountain Chocolate Factory which had experienced bear interactions. We have created a survey to interview different restaurants in the town to find out more about their experience with black bears and determine if cooking oil has been an attractant for the bears. Below is the consent form we had provided for the restaurants.

We are students from Worcester Polytechnic Institute located in Worcester, Massachusetts. Our goal is to investigate the relationship between cooking oil storage and bear interactions in Estes Park. We are looking to gain insight and learn more about the different types of interactions between black bears and the community. This survey will take 10 minutes and your participation is completely voluntary. Unless consent is given by the volunteers, all information about the volunteer will be kept confidential and not be included in our report.

Contact: gr-RM_D22_Wildlife@wpi.edu

Thank you so much for your participation. We greatly appreciate the feedback. If you have any questions or concerns please contact us. Once again thank you.

E.1 – Stanley Hotel

Interview Questions:

1) Could you provide us with any information on past interactions with black bears?
2) What was the hotel's response to these interactions?
    a) What mitigation strategies are currently in place at the hotel?
3) What do you feel are the main attractants for the bears?
4) Does the hotel provide any educational material to its visitors?
    a) Have you found this strategy to be successful in mitigating human and black bear interactions?

E.2 – Rocky Mountain Chocolate Factory

Interview Questions:

1) Could you provide us with any information on the past interaction with the black bear from 2012?
2) What was the response to these interactions?
3) What do you feel are the main attractants for the bears?
4) Do you report the black bears in the area?

E.3 - Local Businesses and Restaurants Surveys

We visited 17 different businesses and restaurants to ask and learn about their experience with black bears in town and learn if cooking oil had an impact on black bear interactions.

Interview Questions:

1) Have you had any black bear interactions occur at the restaurant?
2) Have you ever had any incidents where a black bear has broken into cooking oil containers?
3) How do you store your cooking oil for disposal?
4) How often are you able to dispose of your cooking oil?
5) How much cooking oil do you produce in a given week?
6) Do you believe that cooking oil was an attractant in any of your black bear interactions?

Appendix F – Tables

Appendix F shows different tables that we had created to show additional information. These tables cover repeat interactions that occurred in 2019 and 2020 at the YMCA. These tables show the dates of the interactions, the locations, the types of interactions that occurred, and if a food reward was gained or not.

Dates	Location	Interaction Type	Food Reward
6/24: 6/25	Eagle's Nest	Trash Can Breach	Yes, Yes
7/5; 7/6	Ranch House	Cabin Break In	Yes, No

Table 3. This figure shows two repeat interactions within 1-2 days of each other in 2019. Denoted in commas were the dates the cabin was visited and whether or not a food reward was received during that date.

Dates	Location	Interaction Type	Food Reward
7/1; 7/2	Holdmore	Trash Can Breach	Yes, Yes
7/16; 7/17	Eastwood	Cabin Break In	Yes, Yes
7/15; 7/17	Blessings	Cabin Break In	Yes, No
7/22; 7/23; 7/24	Columbine	Cabin Break In	Yes, No, No
7/23; 7/24	Everhart	Cabin Break In	Yes, No

Table 2. This figure shows two repeat interactions within 1-2 days of each other in 2020. Denoted in commas were the dates the cabin was visited and whether or not a food reward was received during that date.

Appendix G - Photos

Figure 27. Image of a trash disposal area behind a local business.

Figure 28. Image of a bear-resistant trash can in downtown Estes Park.

Figure 29. Image of air vents at a local business where grease was dripping from and creating a trail below.

Figure 30. Image of grease trail created from the air vents in Figure 27.