Understanding black bear- human conflict in the South Okanagan Similkameen

Summerland/Naramata comparison 2011 /2013

Cailyn Glasser
5/5/2014

Understanding black bear- human conflict in the South Okanagan Similkameen

Cailyn J Glasser

Abstract: The bear hazard assessment report completed in 2009 (Peat, Siderius & White) provided evidence based recommendations to reduce the number and intensity of black-bear human conflicts in the South Okanagan Similkameen, however no monitoring of any actions taken as a result of these recommendations has been carried out. Using negative binomial regression models in an information theoretic approach I found that community of Naramata has been successful in reducing the number of problem bear reports by implementing Bylaw 2325, 2010 as a result of the 2009 recommendations, while the community of Summerland did not take any action following the bear hazard assessment and subsequently did not see a reduction in black bear-human conflict. Spearman's correlations between problem wildlife occurrence reports and the number of days before garbage pick-up day indicated a strong correlation between the number of garbage related problem bear reports and the number of days before pick-up, with most reports occurring the day before pick-up. Using the Getis-Ord hot-spot analysis tool on all problem bear reports for Naramata and Summerland found that conflicts tended to be concentrated in denser urban areas than predicted. Using negative binomial regression and the information theoretic approach found that the most important explanatory variable for habitat selection by black bears in the Summerland area is proximity to the unfenced landfill. This study provides an update on black bear-human conflict and insight into the root causes of it in order to improve black bear management and reduce conflict, thus insuring better safety for humans, their property and black bears.

Introduction

Between 140 000 and 160 000 black bears (*Ursus americanus)* inhabit British Columbia (Gyug 2006) and every year hundreds of them are destroyed as a result of coming into conflict with people (http://www.env.gov.bc.ca/wld/bearsmart/). Communities in the South Okanagan Similkameen are particularly susceptible to bear-human conflict due to the large human population, plentiful agriculturally derived food sources for bears and wildlands leading into and through many communities. Human populations are expanding into once wild areas in the SOS with residential and agricultural developments influencing their access to natural food sources as well as providing new anthropogenic food sources. This can attract and direct bears through and into communities, creating conflict between bears and people as wild resources become blocked or overtaken by human development and anthropogenic food sources become available.

This study was conducted in response to the Bear Hazard Assessment report written in 2009 as part of the South Okanagan Similkameen (SOS) Bear Smart Project, in which prioritized recommendations were made to address the root cause of human-bear conflicts in local communities with the goal of diminishing the rate and intensity of human-bear conflicts, increasing public safety and reducing the number of black bears killed (Peatt, Siderius &White 2009). The high priority recommendations in the Bear Hazard Assessment Report are as follows:

- Encouraging a change in the local approach to attractant management.
- Evaluating the current waste management approaches in local communities and identifying opportunities for improvement. This includes introducing bylaws to address bear attractants like compost, birdseed, commercial and residential garbage, and fencing landfills.
- Reducing human-bear conflict associated with garbage by implementing a program to make bear proof bins available in local areas.
- Working with monitoring experts, stakeholders and invested local governments to establish long term monitoring protocols.

As a result of the recommendations made by the 2009 bear hazard assessment report, Naramata implemented curbside Bylaw no. 2523, 2010. The bylaw states "for all properties within electoral area E (Naramata), as established by Bylaw 2190, 2003, household garbage must be placed within a wildlife proof enclosure or be placed out after 5:00 am on the day designated by the chief administrative officer for collection in the area"(Okanagan-Similkameen Fees and Charges bylaw no.2523, section d, 2010). This bylaw addresses proper storage of waste on private property, but does not address commercial storage of waste, restaurant grease barrel design and storage, commercial fruit management or fruit tree management on private property. Bylaw no. 2523 took effect on July 1, 2011. Bear resistant bins were made available to residents for a free three month trial (Kirk 2013).

The district of Summerland Wildlife Act bylaw does restrict the presence of garbage on the curb from 7am to 7pm on the day of pick-up, but the bylaw does not address proper storage of waste on private property, commercial storage of waste, restaurant grease barrel design and storage, commercial fruit management or fruit tree management on private property (Peatt, Siderius, & White 2009). The District of Summerland council does not support or facilitate the use of bear resistant bins by residents (Peatt, Siderius, & White 2009).

Unfenced landfills can attract bears from long distances and act as first points of contact between the bear and anthropogenic food sources (Peatt, Siderius, &White 2009). Naramata residents take garbage to the Campbell Mountain Landfill in Penticton, which has electric fencing to exclude wildlife. Landfills are typically situated on the outskirts of communities near wildland interface zones, as are the landfills in the SOS (Peatt, Siderius, & White 2009).

The Summerland landfill is identified as an attractant in the bear hazard assessment and recommendations to fence it, preferably electrified, were made. Summerland has not fenced the community landfill, and it continues to be used by bears. It is speculated that this may encourage bears to travel further into residential areas (Peatt, Siderius, & White 2009). No monitoring of the community's efforts to reduce human-bear conflict has been undertaken since the recommendations were made in the 2009 Bear Hazard Assessment report.

The community of Summerland which is located at the North end of the SOS has been rated as a high priority area for conservation officers because of the number of problem wildlife occurrence reports (PWORs) (Peatt, Siderius& White, 2009). The trend in human-bear conflict

in Summerland increased between 1991 and 2007. Available data indicates calls from the community increasing from 3 in 1991/92 to 221 in 2006/07(Peatt, Siderius & White 2009). Similarly other communities in the SOS show an increase in bear-human conflicts between 1991 and 2007; in the city of Penticton PWORs rose from 12 complaints in 1991/92 to 77 in 2006/07, in the community of Naramata complaints increased from 3 in 1992/93 to 96 in 2006/07. No community has seen as great an increase in bear complaints as Summerland in the SOS (Peatt, Siderius & White 2009, Kirk 2011).

There are two basic explanations for bears foraging on anthropogenic food sources: wild food scarcity or availability of high quality, calorie rich anthropogenic food sources (Merkle et al. 2013). Anthropogenic food sources like fruit trees and garbage are generally higher in energy than natural food sources and as such most studies have found that bears tend to prefer anthropogenic food sources regardless of the availability of wild food sources (Merkle et al. 2013; Peatt, Siderius, & White 2009; Breck, Lance, & Seher 2009; Greenleaf et al. 2009). Habitat modeling for the Okanagan suggests that black bear habitat surrounding Summerland is of relatively low quality compared to the rest f BC, especially in the fall months (Peatt, Siderius & White 2009). The abundance of high energy, highly available anthropogenic food sources provided by orchards, vineyards and poor waste management practices is likely influencing movement in and out of the town and interface areas, creating conflict between people and bears. These additional anthropogenic food sources could also be supporting a larger black bear population than would naturally occur in surrounding habitats (Peatt, Siderius & White 2009; Merkle et al. 2013).

Evidence from other communities indicates that reducing the availability of human food sources results in fewer human-bear conflicts and fewer destroyed bears. (Kirk 2013; Biosphere Institute of the Bow Valley 2012; Greenleaf et al. 2009; McCrory 2004)

Many communities have taken initiatives to reduce the number of human-bear conflicts to increase public safety and the safety of bears (Kirk 2013, Biosphere Institute of the Bow Valley 2012, Greenleaf et al. 2009, McCrory 2004)

Study Objectives

This study is intended to improve our understanding of whether actions taken to reduce human-black bear conflicts have been successfully implemented using enforceable bylaws by comparing Naramata and Summerland. Subsequently I hope to understand the impact of anthropogenic features on bear occurrences relative to topographic features around interface zones of communities, using Summerland as a model.

The main objective of the study is to identify whether the difference in action taken between Summerland and Naramata since the 2009 Bear Hazard Assessment Report affected the number of problem bear occurrences and destroyed bears. I also wanted to determine whether a correlation exists between the number of PWORs and garbage pick-up day. The PWORs were spatially mapped to identify hot spot areas in both communities.

The second objective is to identify occurrence patterns of black bears in the interface zones around Summerland relative to anthropogenic and topographic features and to provide recommendations for better black bear-human conflict management in the SOS. I predict that the interface zones will have the greatest number of problem bear occurrences.

Methods

Study Area

The study area is located in the Southern Interior Ecoprovince and includes the District of Summerland and the Community of Naramata in the Okanagan Valley. The study area consists of seven biogeoclimatic subzones (Iverson et al. 2008): Okanagan very dry hot bunchgrass variant (BG xh1), Okanagan dry cool interior Douglas-fir variant (IDF dk1), Okanagan dry mild interior Douglas-fir variant (IDF dm1), Okanagan very dry hot interior Douglas fir variant (IDF xh1), and Okanagan very dry hot ponderosa pine variant (PP xh1) (Gyug 2006).

The District of Summerland is located at the North end of the SOS, extending from the lakeshore to Meadow Valley and from Trout Creek to Garnet Lake, hosting a human population of 11,776 (http://www.summerland.ca/departments/economic/profile_population.aspx) See (Fig. 1) on following page:

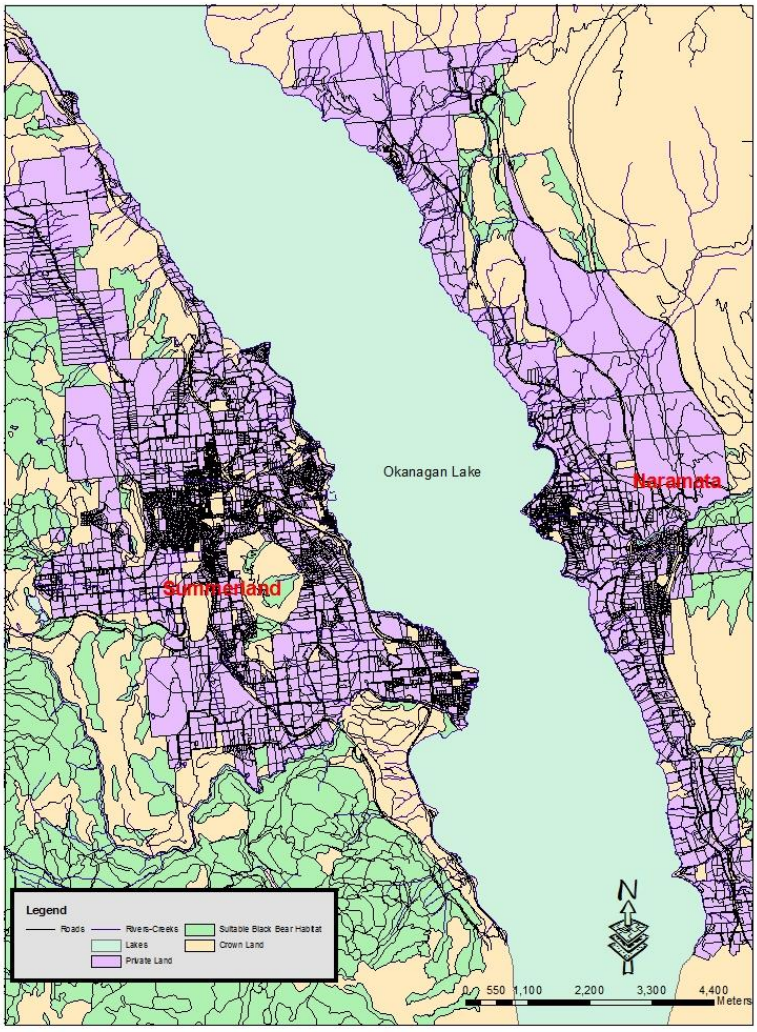


Figure 1- The location of the District of Summerland and Community of Naramata.

Located directly across Okanagan Lake from Summerland, Naramata is a small community on the lakeshore with a population of approximately 2000 and an extensive rural population extending along the Naramata Bench both north and south from the town site. Problem wildlife occurrence data was collected for the entire Naramata area (Electoral area E). Fig. 1 shows the location of Summerland and Naramata relative to each other. Naramata was used as a case study to test the effect of a bylaw on reducing PWORs for black bears. This assumed that attractant types and quantities were relatively similar among and between years for each of the communities prior to implementation of the bylaw.

Data Collection

Three separate types of data were collected for this study: problem wildlife occurrence data and kill data from the Ministry of Environment and black bear occurrence data collected from remote wildlife cameras. Problem wildlife occurrence data was collected from the Ministry of Environment for both Naramata and Summerland in the form of PWORs. All recorded PWORs and kills for both communities between 2009 and 2013 were provided and used to evaluate the relative success of the two communities in any action taken to reduce bear-human conflict since 2009. To avoid pseudoreplication, multiple reports from the same neighbourhood on the same day were eliminated. I did not try to standardize data based on the human population size or the geographic size differences between Naramata and Summerland.

Field methods for collecting black bear occurrence data in and around the interface zones of Summerland involved the use of remote wildlife cameras. A 500 meter buffer zone around all private land on the south end of the community of Summerland was used to generate approximately 80 random points with a minimum of 100 meters between all locations (Fig. 2). The study area was split into 5 separate zones to accommodate the available wildlife cameras available for the study. Locations of randomly generated points were found using a GPS; field staff mounted a remote wildlife camera at the nearest appropriate location to the random point. An appropriate location was defined as a game trail, human trail, old road or off highway vehicle trail or any other location where signs indicated the presence of black bears. Time, date, coordinates and habitat characteristics were recorded on a data collection sheet and cameras were left in place for 4 to 6 weeks. After 4 to 6 weeks field staff dismounted the camera, changed batteries, exchanged the memory card for en empty one and remounted the camera at the next location. Memory cards were loaded onto a computer and images stored for later analysis.

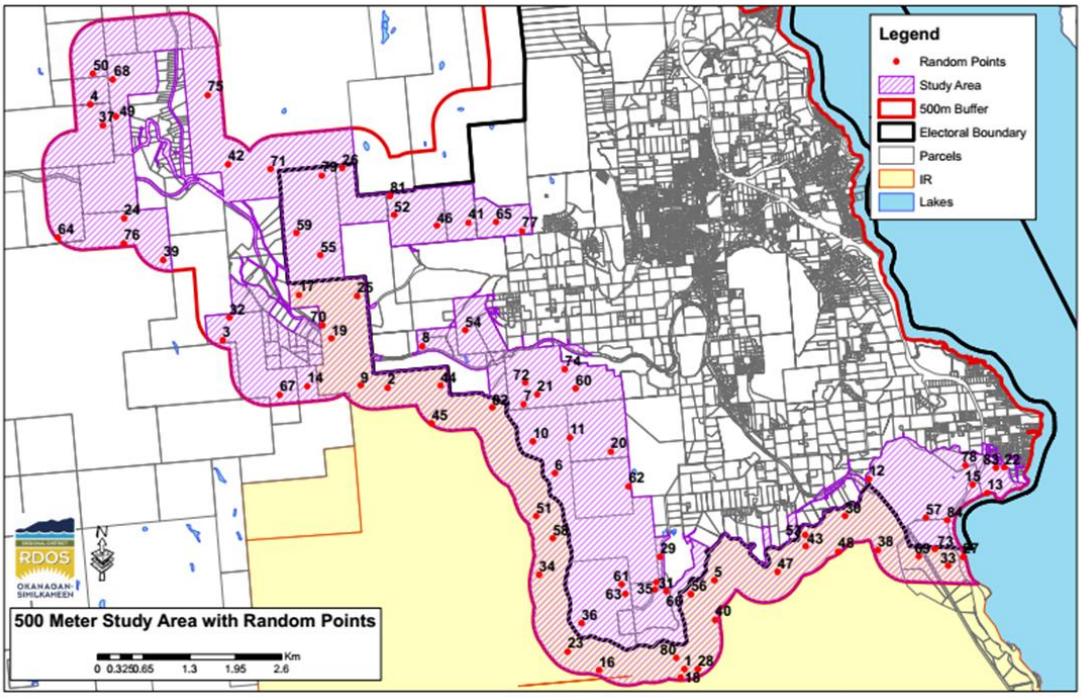


Figure 2- Randomly generated locations in a 500m buffer zone surrounding the District of Summerland in 2013.

Analysis

To determine whether the implementation of a bylaw in Naramata had a significant effect on the number of PWORs and kills I used negative binomial regression models in an information theoretic approach (Burnham and Anderson 2002) to compare counts of PWORs and bears killed as a result of coming into contact with people from 2009 to 2013. These counts were summarized by year, season and municipality and included the bylaw effect in the case of Naramata. Seasons were included to determine if there was any seasonal effect on PWORs. Three seasons were included; spring (March, April, May), summer (June, July, August) and fall (September, October, November). Winter was omitted on the basis that black bears hibernate in the winter months. Using the information-theoretic approach I evaluated a suite of models with different combinations of explanatory variables for both kills and PWORs. I used Municipality, year, season and bylaw as explanatory variables and used corrected Akaike's Information Criterion (AIC_c) for small sample sizes because of the relatively small number of samples (n) relative to the number of parameters (k) (i.e. $n/k < 40$) for ranking models (Burnham and Anderson 2002). The lowest AIC or AIC_c value in a model set indicates the model that achieves the best trade-off between bias in the number of parameters and amount of variance captured in the model. The model with the lowest AIC_c and the highest AIC weight (w_i) indicated the best fit model. The w_i were used to choose the best model by providing an estimate of the relative probability that the top model was the best from the other models. The w_i in a model set sum to one and provide a measure of the weight of evidence in favour of one model over the others. I

determined the predictive ability of the ranked models by using Spearman's rank correlation coefficient (r_s) of the PWORs with the predicted value for each sample determined from the coefficients of each explanatory variable in the respective model. *P*-values were determined for r_s to document the model's level of significance.

To analyse PWOR hotspots in Naramata and Summerland, locations for each call were mapped. This required a conversion from the address format in the original data provided by the Ministry of Environment to latitude-longitude coordinates. Each address was searched using Google Earth™, coordinates were taken from the center of the property and were used to replace the address in the original data to eliminate privacy issues (Merkle, Krausman & Jonkel 2011). Data for each year was then compiled into a single data set for each community and mapped in ArcMap9.3. I then applied the Getis-Ord G clustering statistic available in the ArcMap toolbox to identify hotspots of activity for each community (Alberta tourism, parks and recreation, 2010).

To determine whether there was a correlation between garbage pick-up day and garbage related black bear complaints, I counted the number of days before garbage day of each individual event and used Spearman's rank correlation coefficient (r_s) (Johnson & Kuby 2000) to measure the dependence between the two. *P*-values were determined for r_s to document the level of significance of the relationship.

To describe the number of black bear occurrences on the remote cameras randomly placed around the District of Summerland in relation topographic and anthropogenic features I again used negative binomial regression and the AIC information theoretic approach (Burnham and Anderson 2002). Using ArcMap 9.3, I built a terrain model for the study area from which I extracted elevation, slope and aspect for each randomly generated point. Aspect was categorized as north (316^o-45^o), east (46^o-135^o), south (136^o-225^o), west (226^o-315^o) or no slope. Other explanatory variables included distance to anthropogenic food source, distance to landfill and habitat type. Habitat type was categorized as forested, which included any habitat in which the canopy cover was approximately 30% or more; and open, which included any habitat with approximately less than 30% canopy cover. Forested habitat type tended to include riparian zones, conifer stands such as ponderosa pine and fir, while open habitat type was generally characterized by open grasslands. I again ran a suite of models and ranked them according to AIC and AIC_c for small sample size and w_i, where the model with the lowest AIC_c and the highest w_i were indicated as best fit models.

Results

Problem Wildlife Occurrence Reports and Kills

For both the number of problem black bear occurrence reports and the number of black bears killed in both communities, the model with the highest w_i and lowest AICc was the town model, indicating that location, had the greatest effect on the numbers of PWORs and kills. Only the models developed to explain problem bear reports were able to significantly predict the number of occurrences in Summerland and Naramata during the study period. The town where

problem bears are reported was the most effective way to explain the number of PWORs, which may be attributed to the difference in population and geographic size of the towns. The Town + Bylaw model ranked second, indicating that apart from the location, the bylaw had the greatest negative effect on the number of PWORs and kills. No models were able to significantly predict the number of bears killed although after the bylaw was created and enforced in Naramata the number of bears killed dropped from 6 to 2 over equivalent time frames.

Table 1- The relative rank of models used to describe Problem Wildlife Occurrence Reports (PWORs) for black bears around the District of Summerland and Community of Naramata between 2009 and 2013. * indicates a *P*-value of < 0.05.

Model	**Likelihood**	***k***	**AICc**	**Δ AICc**	w_i	r_s
Town	-107.5	3	222.0	0.0	0.747	0.478*
Town + Bylaw	-107.3	4	224.1	2.2	0.249	0.527*
Town + Bylaw + Season	-106.8	7	232.6	10.6	0.004	0.540*
Town + Bylaw + Season + Yr	-103.4	12	249.1	27.1	0.000	0.653*

Table 2- The relative rank of models used to describe black bears destroyed around the District of Summerland and Community of Naramata between 2009 and 2013. * indicates a *P*-value of < 0.05.

Model	**Likelihood**	***k***	**AICc**	**Δ AICc**	w_i	r_s
Town	-36.5	3	80.0	0.0	0.758	0.263
Town + Bylaw	-36.3	4	82.3	2.3	0.317	0.281
Town + Bylaw + Season	-36.3	7	91.7	11.7	0.003	0.287
Town + Bylaw + Season + Yr	-33.4	12	109.1	29.1	0.000	0.480*

Hot Spots

Hot spot maps for each community tended to show PWORs concentrated in residential areas rather than rural interface areas in Summerland. This was contrary to expectations. Naramata showed hot spots both in the dense residential and commercial area of town as well as in more rural interface zones. Figures 5 and 6 show hot spots rendered on maps for all PWORs between 2009 and 2013.

Summerland hot spots were concentrated in the upper town, around and including the downtown area and surrounding residential area, as well as lower town which lines the lakeshore. In Naramata hot spots showed a similar pattern of concentrating around the main town and in dense residential areas. There was also a concentration on the upper bench above the main town which is characterized mostly by commercial vineyards and orchards. This contradicts our prediction that hot spots would tend to concentrate near interface zones in more rural areas, despite the hot spot in the interface zone in Naramata, most hot spots occurred in or

around the town centers and residential areas.

Figure 3- The distribution of Problem Wildlife Occurrence Reports (PWORs) hot spots for black bears around the District of Summerland, 2009-2013.

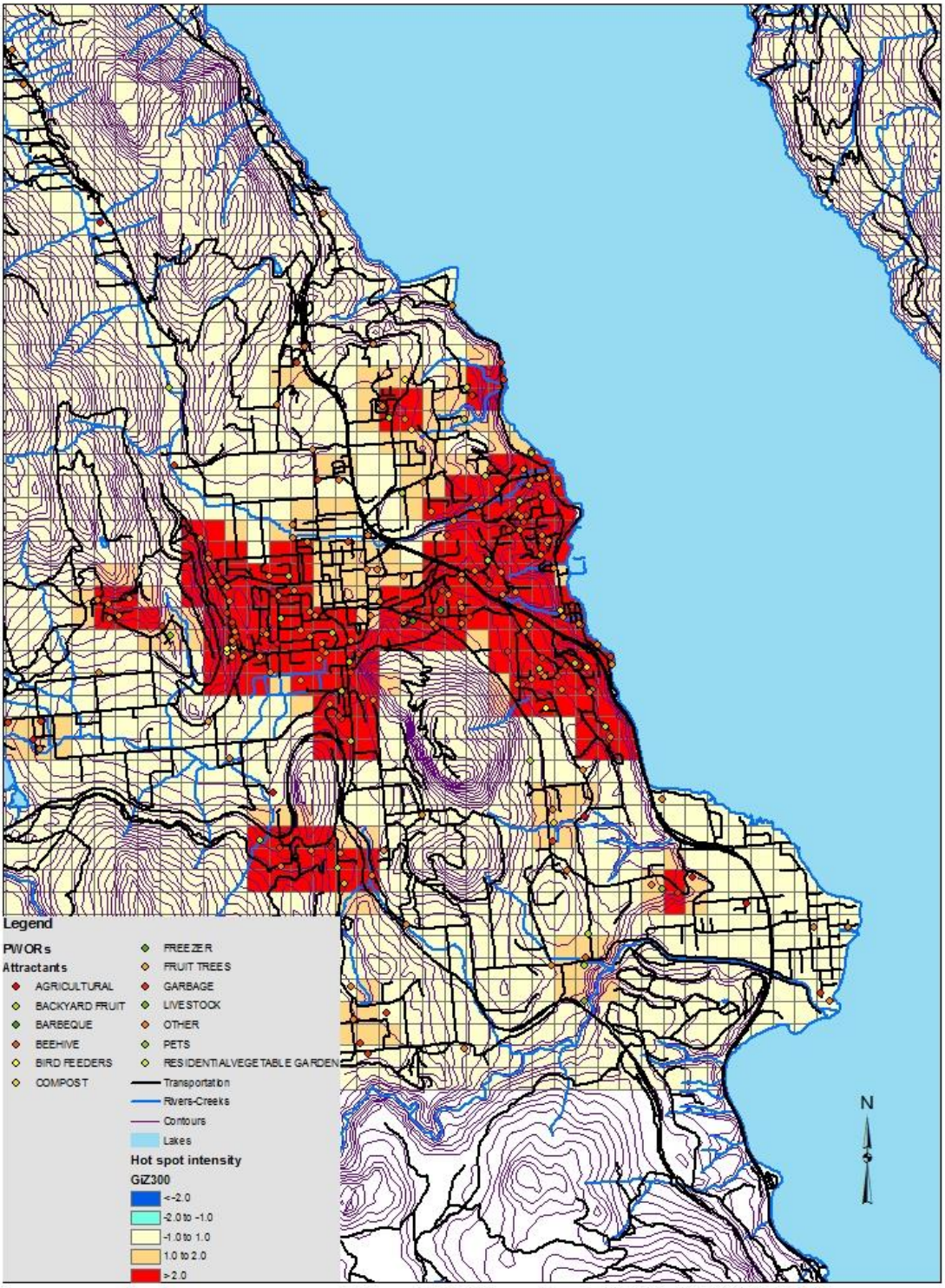
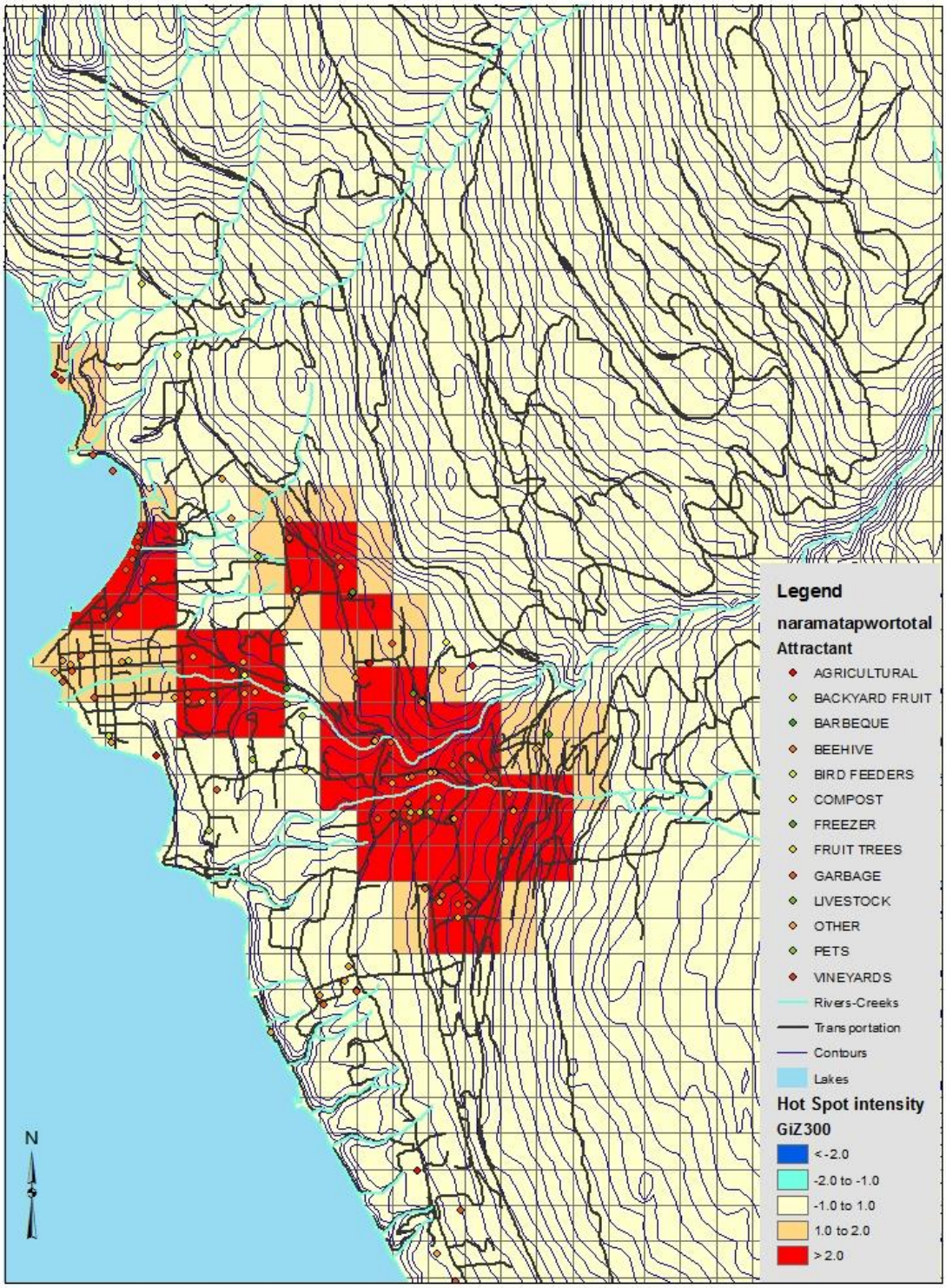


Figure 4- The distribution of Problem Wildlife Occurrence Reports (PWORs) hot spots for black bears around the Community of Naramata, 2009-2013.



Days to Garbage pick up

As I predicted, the data suggests that garbage related problem bear reports occurred most often the day before garbage pick-up in both communities before bylaw no.2523, 2010 was implemented in Naramata, however, after the bylaw was in place the number of problem bear reports was not related to garbage pick-up day. The number of problem bears reported relative to the number of days to pick-up was similar between Naramata before Bylaw no. 2523, 2010 and Summerland, with r_s of -0.813 (P = 0.021) and -0.750 (P = 0.044) respectively. The trends between Summerland and Naramata before the bylaw are almost identical, with the highest number of PWORs occurring the day before garbage pick-up (Fig. 5). Once the bylaw came into effect the trend in problem bear reports in Naramata and days to garbage pick-up was not apparent with r_s of -0.214 (P = 0.641). The change in trend in Naramata after the bylaw was implemented suggests that bears had been using garbage as source of high quality food when it was available, and that implementing the bylaw effectively reduced the availability of this food source and hence reduced the number of garbage related bear-human conflicts. The general downward trend in PWORs post-bylaw suggests that much of the conflict pre-bylaw was garbage related and that reducing the availability of garbage greatly reduced the number of PWORs.

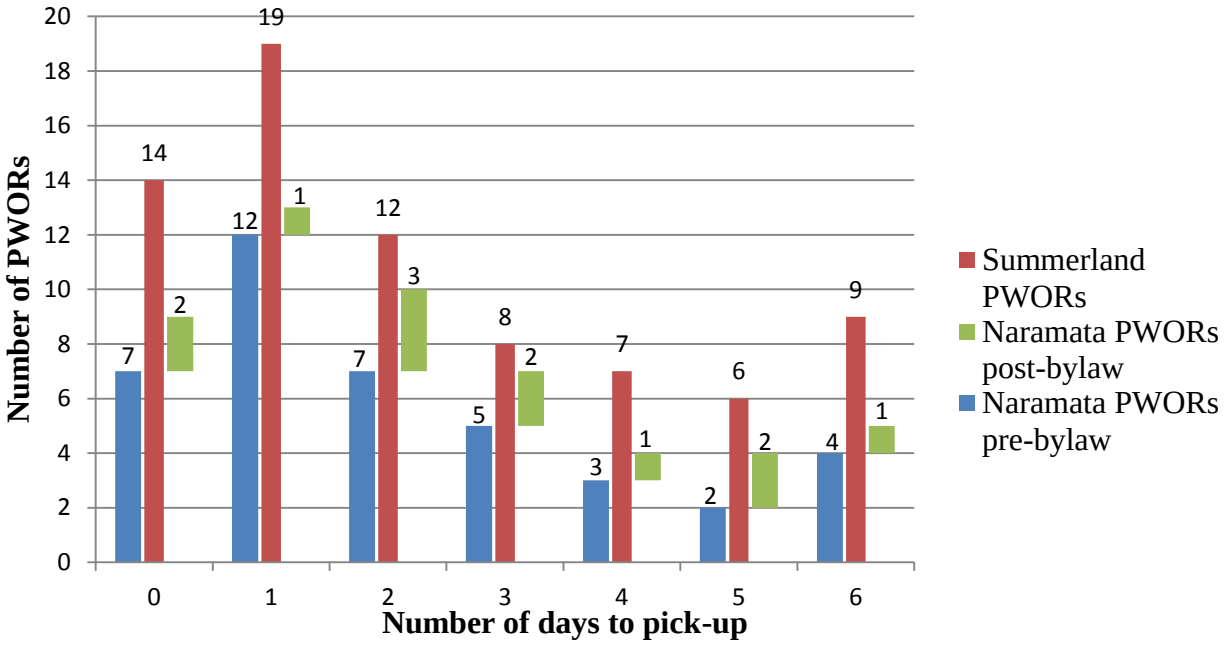


Figure5 – The number of Problem Wildlife Occurrence Reports (PWORs) for black bears in the District of Summerland and Community of Naramata before and after implementation of bylaw 2325, 2010 (effective July 2011), relative to the number of days before garbage pick-up, 2009-2013.

Black Bear Camera Occurrences

Black bear occurrences around Summerland were best described by distance to landfill using the randomly placed remote wildlife cameras, however no variables were significant predictors of the number of black bears observed around the outskirts of Summerland (Table 3). The distance to landfill + distance to anthropogenic food sources model had the second highest w_i at 0.222, suggesting that bears may have had an increased propensity for being close to human food sources. Natural habitat type, slope, aspect and elevation had very little effect on habitat selection in the area.

Table 3 – Relative rank of models describing the occurrence of black bears around the District of Summerland between 2009 and 2013. * indicates a *P*-value of < 0.05.

Model	**Likelihood**	***k***	**AICc**	**Δ AICc**	w_i	r_s
Dist Landfill	-39.0	2.0	82.5	0	0.739	0.103
Dist Landfill + Dist Anth Food Src	-38.8	3.0	84.6	2.1	0.259	0.130
Dist Landfill + Dist Anth Food Src + Asp	-37.8	7.0	94.9	12.4	0.002	0.185
Dist Landfill + Dist Anth Food Src + Asp + Elev	-37	8.0	97.1	14.6	0.001	0.280
Dist Landfill + Dist Anth Food Src + Asp + Elev +Slp	-36.5	9.0	100.5	18	0.000	0.383*
Dist Landfill + Dist Anth Food Src + Asp + Elev +Slp + Hab	-36.2	11.0	109.9	27.4	0.000	0.406*

Discussion

PWORs and Kills

The bear hazard assessment report outlined high priority recommendations to communities in the South Okanagan Similkameen to reduce the number and intensity of human-bear conflicts, specifically to increase the safety of both bears and people (Peatt, Siderius & White 2009). Relevant to this study were recommendations to implement bylaws to manage garbage and other attractants, as well as to make bear proof bins available to residents, especially in rural interface zones (Peatt, Siderius & White 2009). Naramata has acted on both of these recommendations, while Summerland has not. This report is the first to monitor problem wildlife occurrence reports and black bear kills since the bear hazard assessment recommendations were made.

Of the models I ranked, the single most important variable explaining the number of PWORs and the number of bears dispatched by conservation officers was the communities themselves. I attributed this to the difference in size of the two communities, as Summerland is considerably larger than Naramata in both human population and area, hence biasing the likelihood a bear could encounter people and be reported or destroyed because of the increased

availability of Summerland. The second most important variable for explaining PWORs and kills was the bylaw, indicating that Naramata has been successful in reducing the numbers of human-bear conflicts. Although not a significant predictor of the number of bears killed, following the curbside Bylaw 2523, 2010 the number of bears destroyed decreased by approximately 60% over equivalent time periods. This study reiterated the importance of enforceable bylaws that prohibit non-bear proof bins on the curb before the day of pick-up, and requirements to store garbage in bear proof containers or structures. Continued long-term monitoring will provide more conclusive evidence to the bylaws effectiveness.

Other studies have shown that reducing the availability of anthropogenic food sources leads to a reduction in human-bear conflict, a more balanced and sustainable black bear population and increased safety for black bears, people and their property (Merkle et al. 2013; Kirk 2012; Breck, Lance & Seher 2009; Greenleaf et al. 2009; Peat, Siderius & White 2009). Recommendations to implement enforceable bylaws to reduce human-bear conflict and continued monitoring of bylaws should be done for all communities that host a bear population.

Hot Spots

Hot spot concentrations were contrary to our prediction, and tended to be most intense in urban areas and close to downtown centers, as opposed to interface areas or rural properties. This may be influenced by the increased concentration of homes and people with available food sources, possibly biasing the analysis of problem bear reports from the public. Other studies have found that bears living near urban areas that have become food conditioned have completely changed their foraging dynamics to capitalize on high quality foods available in urban areas, such as garbage and fruit trees (Merkle et al. 2013). This behaviour of selecting high energy anthropogenic food sources can be passed down through generations of bears. If this is the case, certain bears may know nothing other than foraging for anthropogenic food sources. The availability of high energy food sources found in urban areas, coupled with generations of bears becoming food conditioned from a very early age may contribute to the increased intensity of problem bear occurrences in urban areas.

Despite the location and intensity of hot spots, the number of conflicts has been reduced in Naramata since the implementation of Bylaw 2523, 2010. Implementing similar bylaws in Summerland, and other communities in the South Okanagan, may result in a reduction in human-bear conflict in those areas. Although interface zones may provide a first point of contact for bears with anthropogenic food sources (Peatt, Siderius & White 2009), it seems many bears have had this contact already and have become food conditioned and very comfortable foraging in urban areas. Contrary to what the bear hazard assessment report suggested, concentrating on more urban areas to eliminate the availability of anthropogenic food sources to already food conditioned bears would be beneficial. Monitoring and enforcement should be carried out in interface zones as well, as a measure of preventing more bears from becoming food conditioned. Reducing the number of urban bears already food conditioned by reducing the availability of anthropogenic food sources is presently a more pressing issue.

Days to Pick up

In 2009 Peatt, Siderius and White found that there was an inconclusive correlation between the number of days from garbage pick-up day and the number of PWORs related to garbage (2009). They found that the highest number of calls occurred on garbage day, decreasing until 3 days before garbage day and then increasing again. Our results show a strong correlation between the number of days before pick up day and the number of garbage related PWORs, with the highest number of calls occurring the day before garbage pick-up day. However, this trend disappeared in the PWORs from Naramata after Bylaw 2325, 2010 was implemented, indicating that problem bear reports post-bylaw were not as related to garbage as they were pre-bylaw and in Summerland. The data suggests that garbage has been available on days other than pick up day in both communities, with calls decreasing in general in Naramata after July 2011. It must be recognized that the number of PWORs occurring the day of garbage pick-up may be underrepresented, as pick up times vary and availability of garbage to bears is limited to before pick-up time. Garbage is a high quality food source for black bears, and they tend to seek it out if it has been historically available, despite the availability of natural food sources (Merkle et al. 2013). Reducing the availability of garbage the day before pick up day reduces the number of PWORs related to garbage.

Camera Occurrences

Landfills are often the first point of contact for bears and anthropogenic food sources, and the Summerland landfill remains unfenced (Peatt, Siderius & White 2009). Although the model was the best amongst the others the occurrence of black bears around Summerland could not be significantly explained by any of the explanatory variables used. The highest number of different bears at any of the random sights were always in close proximity to the landfill. No natural features could explain the number of black bear occurrences. Although the single year's worth of data is inconclusive the availability of anthropogenic food sources in Summerland may be supporting a larger population of black bears than would otherwise be sustainable, especially considering the unfenced landfill (Peatt, Siderius & White 2009). Other studies have also found that black bears will forage on anthropogenic food sources despite the availability of natural food sources (Merkle et al. 2013, Greenleaf et al. 2009). Given the low quality of black bear habitat in the Summerland area (Gyug 2006; Peatt, Siderius & White 2009), and the availability of anthropogenic food sources, the local black bear population may be larger than is naturally sustainable. Reducing the availability of these anthropogenic food sources may help manage the population back down to a naturally sustainable number.

Evaluating the current waste management system and seeking better management for attractants was a high priority recommendation made in the bear hazard assessment. The Summerland landfill was also identified as an attractant in the bear hazard assessment report and recommendations were made to electrically fence it (Peatt, Siderius & White 2009). The occurrences of black bears identified in this study using the remote wildlife cameras reaffirm the propensity for black bears to occur near anthropogenic food sources, especially the landfill.

Without mitigative measures, like electrified fencing, the Summerland landfill will continue to be a utilized as a food source for black bears.

……

Literature Cited

Alberta Tourism, Parks and Recreation. 2011. Eastern Bow Valley wildlife corridor study: wildlife camera study report. Parks Division, Canmore, AB.

Baruch-Mardo, S., Breck, S.W., Wilson, K.R. and Theobold, D.M., 2008. Spatiotemporal distribution of black bear-human conflicts in Colorado, USA. Journal of Wildlife Management, 72(8):1853-1862.

Beckman, J.P., and Berger, J., 2003. Rapid ecological and behavioural changes in Carnivores: The responses of black bears to altered food. Journal of Zoology, London. 261:207-212.

Burnham , K.P., and Anderson, D.R. 2002. Model selection and multimodel inference: a practical information-theoretic approach. 2nd ed. Springer-Verlag, New York, New York, USA.

Biosphere Institute of the Bow Valley. 2010. *Canmore Community Monitoring Plan 2010.*Unpublished document. Canmore, AB.

Breck, S.W., Lance, N., and Seher, V. 2009. Selective foraging for anthropogenic resources by black bears: Minivans in Yosemite National Park. Journal of Mammalogy, 90(5):1041-1044

Fescke, D.M., Barrg, R.E., Precht, F.L., Quigley, H.B., Bittner, S.L. and Webster, T. 2002. Habitat use by female black bears in Maryland. Southeastern Naturalist, 1(1):77-92.

Greenleaf, S.S., Matthews, S.M., Wright, G.R., Beecham, J.J. and Leithead, H.M., 2009. Food habits of American black bears as a metric of direct management of human-bear conflict in Yosemite National Park, California. Ursus, 20(2):94-101.

Gyug, L. 2006. *SOSCP Species Account. Black Bear.* Unpublished document created for the purposes of the SOSCP Bear Hazard Assessment. Penticton, BC.

Herrero, S. and A. Higgins. 1995. Fatal injuries inflicted to people by black bear. Pages 75-82 In J. Auger and H.L. Black, editors, Proc. 5th Western Black Bear Workshop, Brigham Young University Press, Provo, Utah, USA.

Immel, D., Jackson, D.W., and Boulay, M.C. 2013. Denning ecology of American black bears in the Cascade Mountains of western Oregon. Ursus, 24(1):1-12.

Iverson,K.; Curran, D., Fleming, T. and Haney, A. 2008. Sensitive ecosystem inventory Okanagan Valley: Vernon to Osoyoos 2000-2007: Methods, ecological descriptions and conservation tools. Pacific and Yukon region 2008, Canadian Wildlife Service: Environmental stewardship branch.

Johnson, R & Kuby, P. 2000. Elementary Statistics, Eighth Edition. Brooks/Cole: Pacific Grove, CA.

Koehler, G.M. and Pierce, J.D. 2003. Black bear home range sizes in Washington- Climatic vegetative and social influences. Journal of Mammalogy, 84 (1) pg.81.

Kirk, Z. 2011. RDOS bear aware annual report 2011. Regional District of the South Okanagan Similkameen & the British Columbia Conservation foundation: Penticton, BC.

Kirk, Z. 2013. Naramata Bear Smart application 2013. Regional District of the Okanagan Similkammen: Penticton, BC.

McCrory, W. 2004. Preliminary Bear Hazard Assessment of Resort Municipality of Whistler (RMOW). McCrory Wildlife Services LTD, New Denver, BC.

Merkle, J.A., Robinson, H.S., Krausman, P.R. and Alaback, P. 2013. Food availability and foraging near human developments by black bears. Journal of Mammalogy, 94(2): 378-385.

Merkle, J.A., Krausman, P.R, and Jonkel, J.J. 2011. Predicting spatial distribution of human-bear interactions in urban areas. Journal of Wildlife Management, 75(5): 2212-1127

Morrison, M.L., Block, W.M., Strickland, M.D., Collier, B.A. and Peterson, M.J. 2008. Wildlife study design. Springer: New York, New York, USA.

Mueller, C., Herrero, S. & Gibeau, M.L. 2004. Distribution of subadult grizzly bears in relation to human developments in the Bow Valley river shed, Alberta. Ursus, 15(1):35-47. 2004.

O'Connell, A.F., Nichols, J.D. and Karanth, K.U. 2011. Camera traps in animal ecology: methods and analysis. Springer: New York, NYork, USA.

Peatt, A., Siderius, J.A. and White, B. 2009. South Okanagan-Similkameen bear smart project: Bear hazard assessment report. Regional District of the Okanagan Similkameen: Penticton, BC.

Peatt, A., Siderius, J.A. and White, B. 2009. South Okanagan-Similkameen bear smart project: Conflict management plan. Regional District of the South Okanagan Similkameen: Penticton, BC.

Rawcliffe, J.M and Carbone, C. 2008. Surveys using camera traps: are we looking to a brighter future? Institute of Zoology, Zoological society of London: Regents park, London, UK.

Swann, D.E, Hass, C.C, Dalton, C.D and Wolf, S.A. Infrared triggered cameras for detecting wildlife: and evaluation and review. Wildlife Society Bulletin, 32(2):357-365.