

Meadow Creek Bear Education and Management Project Report 2011-2015

Prepared for Fish and Wildlife Compensation Program

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FISH AND WILDLIFE COMPENSATION PROGRAM

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Executive Summary

The Meadow Creek Bear Education and Management Project integrated bear research, education and bear management to reduce people-bear conflicts and associated grizzly bear mortalities in the community of Meadow Creek BC. The location of the Meadow Creek Spawning Channel (MCSC) created a complex human-bear management situation. The Duncan River was dammed in 1967 and MCSC was built by BC Hydro to compensate for effect of the dam on fisheries. Meadow Creek brings Kokanee to MCSC from Kootenay Lake and runs within 20m of residences and within 200m of Jewett School (grades K-5), and MCSC is <1km from the community.

The education link between wildlife research and local residents (including increased understanding of bear biology, ecology, and population dynamics) was a key aspect of this project towards changing human attitudes and behaviours through direct participation with local solutions. Community values were key considerations in the development or this project as an extension of the North Kootenay Lake Bear Smart Program's attractant management work. This project is a result of recommendations from the project coordinator's masters thesis that identified barriers and improvements to grizzly/human coexistence in this area (Sanders, 2013). This research also identified coexistence as being significant to the linkage function of this area between the Central Purcell and Central Selkirk grizzly bear population units (GBPU). Conflict between residents and grizzly bears near the spawning channel resulted in minimum 2-3 grizzly bears shot annually from 1967-2007, likely resulting in an attractant sink and possibly contributing to depressed numbers of grizzly bears in the Central Purcell GBPU.

The need to include community members in the project was recognized from its beginning, as introduced conservation measures without community support can result in increased mortality of target species. Community members have increased their understanding of local grizzly bears through educational outreach of radio collaring and DNA hair snagging efforts. The inclusion of local residents was a key factor in this project's success towards creating coexistence.

The project successfully met all goals and objectives. The kokanee collapse (1% return of spawning fish to MCSC in 2015) presented a challenge to this project's success, though there were remarkably few conflicts in Meadow Creek in 2015 under the circumstances. There are at least 23 individual grizzly bears using the Meadow Creek area, as determined by DNA analysis, from genetic overlap of Central Selkirk and Purcell GBPUs. The project used non-lethal management on six research bears with varying levels of success, success mostly dependant on the availability of anthropogenic food sources. It is recognized that less-lethal management of bears (including activities such as hard releases, hazing, and aversive conditioning) may increase bear wariness but will not prevent conflicts with people if foods such as garbage, fruit, and other attractants remain available to bears. A guiding principle of this project was to not attempt less-lethal management techniques if anthropogenic attractants cannot be managed. However, through the attractant management efforts of this community, Meadow Creek provides an excellent landscape to try non-lethal management of bears.

Keywords: Grizzly bear, Ursus arctos, Meadow Creek BC, Kootenay Region, non-lethal bear management, less-lethal bear management, bear education, linkage area, and community involvement

Acknowledgements

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Introduction

Human-bear conflicts are largely responsible for the decline and extirpation of grizzly bear (*Ursus arctos*) populations across their former range in North America (Mattson & Merrill, 2002). Mattson and Merrill (2002) attribute the presence of foods such as salmon with hastening the demise of grizzly bears by bringing them into conflicts with people in low-elevation riparian habitats. Areas of excellent grizzly bear habitat may not actually be productive for grizzly bear reproduction and survival if these habitats draw bears into conflicts with humans (Nielsen et al., 2004; Nielsen, Stenhouse, & Boyce, 2006).

Attractant sinks

Grizzly bear mortalities are often associated with attractant sinks, or ecological traps, where bears are attracted to food sources that overlap with high rates of human encounters and/or conflicts (Nielsen et al., 2006; Northrup, Stenhouse, & Boyce, 2012). Attractant sinks may become population sinks if they are the cause of high female grizzly bear mortality (Knight, Blanchard, & Eberhardt, 1988; Nielsen et al., 2006). Private lands in rural areas can become attractant sinks because low-elevation habitat is attractive for spring and fall foraging and provides anthropogenic foods such as garbage and/or agricultural foods such as fruit trees and livestock (Mace & Waller, 1998; Northrup et al., 2012).

Meadow Creek Spawning Channel and the community of Meadow Creek

In 1967, the Duncan River was dammed to form the Duncan Reservoir, as part of the greater Columbia River hydro-electric system. Meadow Creek Spawning Channel (MCSC) was constructed in the same year to partially compensate for the dam's interruption of spawning Kokanee from Kootenay Lake to the Duncan river system. To reach MCSC, Kokanee swim up Meadow Creek from Kootenay Lake along the west side of the Duncan River floodplain, then directly through the community of Meadow Creek and within 200m of Jewett School (Grades K-5). Each August - September the creek and channel are full of spawning Kokanee and then the carcasses float downstream, primarily in October. In addition, the Meadow Creek flats provide excellent spring habitat for grizzly bears. The juxtaposition of prime spring and fall grizzly feeding areas and the rural residents of Meadow Creek has led to conflict between humans and bears for decades, at a rate of minimum 2-3 grizzly bear mortalities each year (Sanders, 2013). There are many small farms or homesteads in the area raising pigs, sheep, goats, chickens and other poultry. Len Butler, Conservation Officer to the area from 1993-2010, reported that the biggest cause of grizzly bear conflicts (and mortalities due to conflicts) in this remote area are related to livestock (L. Butler, pers. comm. Aug 4, 2010). Bears that come into conflict with livestock are usually shot by residents or by the Conservation Officer Service (COS).

Bear education efforts began in this area in 2006 with a presentation and apple harvesting with schoolchildren from Jewett school. Electric fencing began in fall 2007 to protect pigs and chickens from a mother grizzly bear with 3 cubs in Howser. Electric fencing has proven effective to preventing conflicts in 33 locations in the Meadow Creek area. As attractants are managed, conflicts are prevented, which has contributed to an increase of tolerance for grizzly bears in this remote rural community (Sanders, 2013).

The potential for human-bear conflict at MCSC has been made more complicated by the public's desire to view grizzly bears. Though times for public access to MCSC are were limited in 2014 to hours between 10:00-14:00, bear viewing activities could serve to habituate grizzly bears to human presence while the bears are feeding on Kokanee. Bears that have lost their wariness of people often are not tolerated around human settlements and can be more likely to

come into contact with bear attractants. This makes attractant management even more important to prevent bears from being drawn to anthropogenic food sources at residences. It also increases the need for less-lethal management tools to create boundaries near human settlements (Herrero, Smith, DeBruyn, Gunther, & Matt, 2005; Nielsen et al., 2004), and amplifies the need to work with local residents.

Need to work with local residents

Researchers and managers recognize the need to work with local residents when attempting to reduce human-wildlife conflicts (Madden, 2004). On the Eastern Front of the Rockies Mountains in Montana, models showed a high likelihood of conflicts with livestock producers in some areas where there were in fact no recorded mortalities (Wilson et al., 2006). Researchers hypothesize that mortalities were occurring but were unreported because of intolerant attitudes towards grizzly bears, potential distrust of state managers, or perceptions related to personal privacy on private property (Wilson et al., 2006). On public lands, Mattson, Herrero, Wright, and Pease (1996) found that when restricting human road access, successful conservation of core habitat depends on the level of support and acceptance for grizzly conservation from local residents. Proctor et al., (2012) showed that historic mortality associated with human settlement has been, and likely continues to be, a primary cause of fragmentation for grizzly bears. Primm and Wilson (2004) suggest that people who live with recovering and expanding populations have insight and practical knowledge that is valuable when considering conservation projects that encompass private lands, especially in linkage areas.

Linkage areas

Linkage areas connect larger 'core' areas of habitat and frequently span human developed areas to provide for the movement of animals (Proctor et al., 2008). Linkage areas are not simply travel corridors, but are habitats that support feeding and behavioural activities in intervening spaces between these core habitats (Proctor et al., 2008). Proctor et al. (2012) found that dispersal of grizzly bears from core populations is difficult through human-dominated linkage areas, where their reputation as dangerous carnivores often leads them to experience higher rates of human-caused mortality than can be sustained. For linkage areas to be effective in reducing population fragmentation they require some level of tolerance towards bears and the support of local human residents to manage properties to avoid conflicts and/or associated grizzly bear mortality is necessary (Proctor et al., 2012).

The Central Purcell Grizzly Bear Population Unit (GBPU) to the east of Meadow Creek is depressed (Proctor et. al. 2007), but the Central Selkirk GBPU to the west appears healthy (Mowat et al. 2005). Connectivity between these two grizzly bear populations has not been particularly strong (Proctor et al. 2012). This is likely because of historic and ongoing human settlement and human-bear conflict in the Duncan and Lardeau valleys, particularly in and around Meadow Creek and MCSC.

Connectivity between these GBPUs seems to be improving through this project's efforts to decrease grizzly bear mortality in Meadow Creek and lower Lardeau River through attractant management, community education, and less-lethal management of bears when they do come into conflict with residents.

Less-lethal management

In many jurisdictions of western North America, the destruction of 'problem' grizzly bears, while at times necessary, is being replaced with less-lethal management techniques which are more consistent with society's goal to sustain viable grizzly populations (Honeyman, 2008; Matt, 2009). If less-lethal management was used in the past it usually meant simply trapping and

re-location (within home range) or translocation (out of home range) of grizzly bears. Because bears often returned to the site of conflict, moving them was largely ineffective unless it was accompanied by diligent management of bear attractants and use of other less-lethal tools.

Less-lethal management of bears works to teach both bears and people where the socially accepted boundaries are near people's homes. Preventing conflicts through attractant management is the primary tool for coexistence, as less-lethal management actions often are not effective if food rewards remain available (Homstol, 2011). Less-lethal management of bears has been used by wildlife managers for the past 10 to 25 years in Alberta, Alaska, Manitoba, Montana, Idaho, and Washington where hard releases, hazing, and aversive conditioning are employed to teach black, grizzly, and polar bears to stay out of human-use areas. In BC, Michael Proctor has been working with the COS over the past 13 years, and has managed 21 grizzly bears using these methods (M. Proctor, personal communication, August 28, 2015). Proctor has shown that non-lethal management methods result in almost no female grizzly bears being killed, which is an important step in recovering populations.

Less-lethal management provides options to move a bear away from an area without necessarily having to trap or shoot it. After managing attractants (anthropogenic and natural foods), and giving bears no reason to approach residences, clear boundaries around houses and neighbourhoods can be established to teach bears to stay away from people (Honeyman, 2008), while still allowing them safe access to Kokanee at MCSC.

Less-lethal management activities also provide excellent educational experiences for residents. Many times the resident experiencing conflict is invited to be present after a bear is tranquilized (when is it safe and appropriate) and they may never have seen a live bear up close. When people experience the dedication shown by bear managers to try to keep bears alive, it can help to inspire them to change attitudes and behaviours to prevent conflicts (M. Proctor, personal communication, March 30, 2013). Less-lethal management is about teaching bears and people to coexist, resulting in the project goal of safe access for bears to important natural food sources, little or no conflicts with humans, and increased community tolerance of bears near the community.

Objectives

To meet the above project goal, project objectives were:

1. To use community education and a variety of less-lethal management tools to reduce human-bear conflicts;
2. To use several research tools, such as DNA analysis through hair snagging and GPS and VHF telemetry of management bears to monitor and inventory grizzly bear activity in and around Meadow Creek and at the Meadow Creek Spawning Channel, particularly toward meeting objective 1;
3. Promote education and community stewardship of grizzly bears by integrating local residents in the management process;
4. Monitor and evaluate the effectiveness of less-lethal management actions designed to teach bears to avoid human residences; and
5. Provide project results to the COS and other government agencies on effective and ineffective management strategies aimed at promoting human-grizzly bear coexistence.

Study Area

The focus community of this research, Meadow Creek BC, is located between the Central Selkirk and Central Purcell mountain ranges at the north end of Kootenay Lake and at the confluence of the Duncan/Lardeau River Valleys.

Methods

DNA

DNA hair snags were monitored in Meadow Creek between 2011-14. In 2014 there were three study areas for DNA collection: Meadow Creek, lower Lardeau River, and Hill Creek Spawning Channel. DNA hair snags were monitored every 7-10 days in season. All sites were identified and installed by the project coordinator, and were monitored by the project coordinator unless otherwise specified.

Meadow Creek: Each year from 2011-14, DNA was collected from existing barbed wire fencing along John Creek on the west side of the Meadow Creek flats from April through June. Eight hair snag sites were installed at MCSC on bear trails and 2 mark trees and are monitored from mid-July through October 2011-14. The 2 mark trees are also checked in the spring season. Five hair snags on bear trails on private property between Meadow Creek and the community on the east side of the flats were monitored by the project coordinator in 2011-12 and by Peter Jonker (landowner of sites) from August – October 2012-14.

Lower Lardeau River: DNA was collected from 11 hair snag sites along the lower Lardeau River from Sept 15-Oct 26 in 2014. These sites were on bear trails and two mark trees and were monitored by river raft to reach the far side of the river opposite from Hwy 31.

Hill Creek Spawning Channel: DNA was collected from six hair snags on bear trails at the Hill Creek Spawning Channel in 2014. These sites were monitored by the Hill Creek fisheries technician, Brian Barney.

Nelson Wildlife Genetics lab analyzed samples to estimate the number of bears that forage at the channel and the Meadow Creek flats, and to identify conflict bears. Individuals were analyzed to 22 loci including sex to identify relationships and parentage. Analysis related to populations was run at 15 loci (existing database for Central Selkirk bears is 15 loci).

GPS collars

GPS collars were used to track bear's movements after management actions.
2011: one GPS Telonics collar on a young female grizzly bear (Bear 222). One Telonics GPS collar on a young male black bear, and one VHF collar on an adult black bear.
2012: no collars were deployed
2013: no collars were deployed
2014: one GPS Iridium collar was deployed on a young male grizzly bear, and one Telonics 'store on board' GPS collar deployed on a young male black bear.
Note: black bears trapped in this project who qualified for non-lethal management were collared and monitored. These bears were deemed likely to find any unsecured attractants and indicated where these efforts are needed, thereby also reducing human-grizzly bear conflicts.

Telemetry

Telemetry was used in 2011, 2012, 2014, and 2015 to track bears to monitor activity levels in the community. If signals were from in or near the community, bears were checked at least 2x daily.

Ear-tags

Ear-tags provided accurate identification of research bears when sighted by people or by remote camera pictures.

Remote cameras

Two remote cameras were used at conflict and/or trap sites and at mark trees at MCSC.

Bear management

COS makes public safety decisions and retains control over whether a bear should be managed, how it should be managed, and if/when a bear should be destroyed.

Capture protocol and standards of care for live capture

Black and grizzly bears that were thought to be good candidates for less-lethal management were captured and fitted with radio collars. Capture occurred using culvert traps and bears were anesthetized with the drug combination Telazol and Xylazine. During the procedure we fitted and put on a radio collar, took a DNA sample (hand pulled hair from the upper torso), put on ear tags, and weighed and measured the animal for various characteristics. These handling procedures followed the protocols established in: 'A Manual for handling Bears for Managers and Researchers', J.J. Jonkel, 1993; and 'Handbook for Wildlife Chemical Immobilization', T.J. Kreeger, 1997. These procedures were also reviewed and modified by the University of Alberta so that the standards of the Canada Council on Animal Care Standards where included. Trapping and radio-collaring of bears was done by COS or by Grant MacHutchon, who has 25 years of experience trapping and radio-collaring both black and grizzly bears.

Suitably safe capture sites were chosen based on safety to bears and humans. Safe sites have good visibility of trap door from a safe location and provide adequate shade to keep animals cool. Traps were checked early each morning but on hot days were checked more often to minimize potential heat exposure.

A weight estimate guided the drug dose which was administered intramuscularly by a jab stick. The bear's level of anaesthesia was constantly monitored. During handling the bear was placed sternal, slightly downhill, with their arms pulled beside their head to ensure comfortable breathing. We gave all bears a physical exam to look for injuries, monitored their temperature constantly, and applied non-steroid eye-lubricating ointment before closing and covering the eyes. Bottled oxygen was applied through the nose, and a pulse-oxymeter attached to the tongue measured heart rate and the amount of dissolved oxygen in the blood. We also monitored the position of the eyes every 5 minutes or when other physiological signs suggest a change in the level of anaesthesia was occurring. We periodically checked for capillary refill time to assess the circulatory system function. We also kept thermal insulation and water available in case warmth or cooling was required during handling. Bears were weighed using a weighing blanket to minimize any internal body stress during lifting.

Radio collars have an automatic drop-off mechanism on a predetermined date and a cotton "rot-off" as a back up to ensure removal of collar from the bear.

Results

This project met its goal of creating a model of human/grizzly bear coexistence and met all objectives from 2011-16. The project's community education approach worked to change human attitudes and behaviours towards stewardship of local grizzly bears. A variety of non-lethal management tools were used to reduce human-bear conflicts and grizzly bear mortalities. The project coordinator was able to monitor bear activity and track outcomes of all known bear conflicts, and heard about four unreported grizzly bear mortalities in 2015. Management activities were analysed as to effectiveness of changing bear behaviour. It seemed that it is possible to change habituated behaviour but not food conditioning if that food is available. The most effective means to create coexistence is by attractant management tools such as bear resistant garbage bins and electric fencing installed to protect livestock and agricultural attractants from bears. The collapse of kokanee at MCSC in 2014 and 2015 likely contributed to increased conflicts and resulting grizzly bear mortalities in 2015.

Project results in 2015-16 related to each project objective are as follows:

Objective 1. To use community education and a variety of less-lethal management tools to reduce human-bear conflicts and grizzly bear mortalities.

- Community education was consistent through 2015-16, which was a difficult year due to the collapse of kokanee at MCSC (1% return of spawning kokanee). There was a total of 10 electric fences installed in this funding cycle, and all fences have been effective to prevent conflicts with bears.
- Less-lethal management of bears did not occur in 2015-16, though the COS set a trap for a young grizzly bear who was seen at a residence near MCSC a total of five times, three of which were daytime sightings and the bear did not seem to avoid people. However, this bear did not enter the trap, so the trap was pulled after five days of no activity. This bear seemed to stay out of conflict for the remainder of the season.
- There was a rumour of a family group of grizzly bears (mother with two cubs of the year) shot by a resident after the bears had killed poultry at a residence. This rumour is unconfirmed, but this family group was not sighted after the rumoured shooting in fall 2015 or spring 2016.
- Bear 340 was not sighted after it was known to be near Cooper Creek in spring 2015, which was unusual for a bear which had been sighted repeatedly the year before. It is rumoured that this bear was also shot by a resident but not reported.

Objective 2. To use several research tools, such as hair snagging and DNA analysis and GPS and VHF telemetry of management bears, to monitor and inventory grizzly bear activity in and around Meadow Creek and at the Meadow Creek Spawning Channel, particularly toward meeting objective 1.

- There was no funding for DNA hair analysis in 2015, so this activity did not occur.
- Grizzly bear activity at MCSC was monitored with remote cameras and there were at least 12 individuals identified on cameras (this is a conservative number as the author only counted bears confirmed to be different but there may have been more individuals at MCSC)
- Bear 230 was shot in the spring of 2015 by the COS as it had become food conditioned at

a residence where garbage was being stockpiled.

Objective 3. Promote education about and community stewardship of grizzly bears by integrating local residents in the management process

- Residents have adopted methods of community stewardship of grizzly bears and are integrated in the bear management process, with improved relationship to calling the COS to manage grizzly bears conflicts.
- Residents of Meadow Creek have demonstrated their interested in less-lethal management and there has been great community support for the project.
- Program coordinator lived and worked in the community, enabling quick response to conflicts and ongoing support for residents to work towards solutions through various funding sources.
- Residents called in sightings of ear-tagged bears, and of other bears in the valley.
- Attractant management was good except for the identified residence where garbage was stockpiled for months. The project coordinator asked for COS help, but the situation was difficult as the resident was physically disabled. This resident moved from the area in summer 2015.
- There was a community meeting in Meadow Creek in May 2015 (see attached poster) with a good turn-out of 22 residents and COS was also present.
- The MCSC Open House was held in 2015 and this project had an educational booth for visitors. This outreach was very well received and there were many interested participants.

Objective 4. Evaluate and monitor the effectiveness of management actions designed to teach bears to avoid residences.

- Bear 230 completely avoided conflicts after hard release in 2014 but the garbage stockpiling situation in spring 2015 was this bear's downfall. This was the best source of food in the area in early May, but led to the bear being garbage conditioned and habituated to people. The bear was dispatched by COS on May 24, 2015.
- Bear 340 had completely changed behaviour in fall 2014 after the sibling was dispatched by COS, but 340 was rumoured to have been shot in spring 2015.
- See full analysis of results of Bear 230 and 340 below in project's 5-year evaluation of management actions.
- The management team met as necessary to evaluate project activities as needed.

Objective 5. Provide project results to the COS and other government agencies on effective and ineffective management strategies aimed at promoting human-grizzly coexistence.

- Low sample sizes of management bears cannot provide conclusive results that can be applied universally to other areas
- The project coordinator presented this work of coexisting with grizzly bears in Meadow Creek at the 22nd International Conference on Bear Research and Management Sept 15-20, 2013 in Provo Utah, USA.
- The project coordinator will present a project poster at the 24th International Conference on Bear Research and Management Jun 12-16, 2016 in Anchorage, Alaska.

Overall project results (2011-16) are listed below as they relate to each project objective:

Objective 1. To use community education and a variety of less-lethal management tools to reduce human-bear conflicts and grizzly bear mortalities.

- Community education effort was consistent, patient, friendly, and made easily accessible to all residents. This approach was successful in reducing conflicts, primarily through attractant management tools such as bear resistant garbage bins and electric fencing to protect livestock and agricultural attractants from bears.
- Less-lethal management is the now first option of grizzly bear conflict management in Meadow Creek, if appropriate to the bear and the situation. The project tried non-lethal management (collaring and hard release) on six bears that were deemed appropriate. Two of these bears are still alive (this mostly depended on availability of anthropocentric food and consistency of attractant management).
- See Objective 2 below for results of non-lethal management actions.

Objective 2. To use several research tools, such as hair snagging and DNA analysis and GPS and VHF telemetry of management bears, to monitor and inventory grizzly bear activity in and around Meadow Creek and at the Meadow Creek Spawning Channel, particularly toward meeting objective 1.

GPS and VHF Collars:

- 4 GPS collars were deployed between 2011 and 2014. In 2011 one male black bear **(Bear 188)** and one female grizzly bear **(Bear 222)** were collared with GPS collars. In 2014 one male black bear **(Bear 230)** and one male sub-adult grizzly bear **(Bear 340)** were collared.
- 1 VHF collar was deployed in 2011 on a male black bear **(Bear 225)**. This collar lasted at least until August 2012 and then fell off the bear and was not retrieved.
- Collars from bears 188, 222, and 230 were retrieved by the project coordinator.
- Bear 340's collar malfunctioned on Sept 9 when the transmitter box detached from the collar itself and this bear could no longer be monitored with GPS or VHF signals. However, this bear stayed out of conflicts with people for the remainder of the season after collar malfunction.

DNA:

The project has now identified 37 individual grizzly bears from 2011-14. These come from three study areas; Meadow Creek, lower Lardeau River, and Hill Creek.

Meadow Creek: DNA analysis revealed a total of 25 individual grizzly bears using the Meadow Creek area in 2011-2014. Twenty of these bears utilized the rich habitat of the Meadow Creek flats and MCSC and did not come into any conflicts with people. Of the five conflict bears, two had come into conflict prior to 2014 (Bear 001 and Bear 222). The three sub-adult bears that came into conflicts in 2014 had been snagged at MCSC in 2012 and 2014.

Bears in the Meadow Creek area appear to come from both the Selkirk and Purcell GBPUs (See Figure 5). DNA shows most of these bears are intermediate between the genetic signals from each range, suggesting there is likely genetic interchange between the Mt Ranges. This is what one would expect from an area that is only mildly fragmented by the valley, and the valley has something that attracts bears from each range.

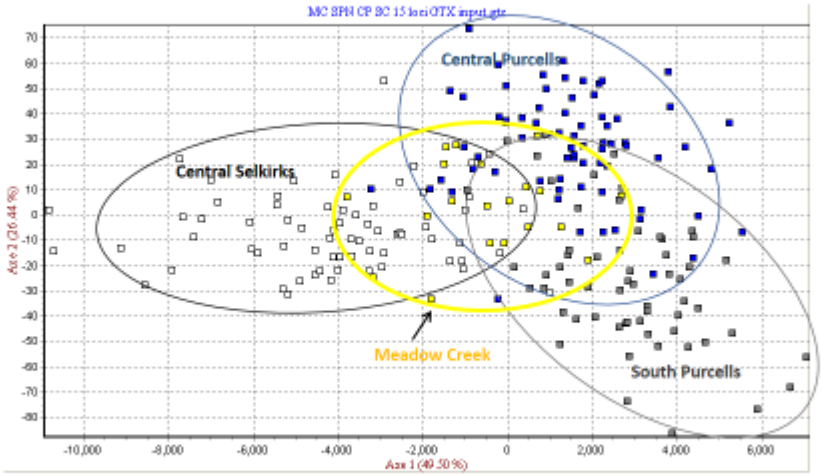


Figure 1. DNA analysis to 15 loci shows relatedness of project bears to both Central Selkirk and Central Purcell GBPUs, suggesting genetic interchange through the Meadow Creek area.

Lower Lardeau River: 2014 collection identified nine individual grizzly bears, four of which were female. Eight of these bears were new to the dataset, though we also snagged hair from Bear 222 (who was trapped, collared, and hard released at site of conflict in 2011). One of the new bears was identified to be the mother of Bear 222. None of the nine lower Lardeau River bears were in conflict in 2014.

Hill Creek: 2014 collection identified four grizzly bears at the Hill Creek Spawning Channel. Three of these bears were female, and none of these bears were known to come into conflict with people.

Eartags:

Bear 001 was positively identified by eartags two times in 2011 and 8 times in 2012 in the Meadow Creek area. Bear 225 was identified by eartags one time at 2 - 3km on Duncan Rd. Bear 340 was identified by eartags three times after collar malfunction; each of these sightings was at MCSC.

Remote Cameras:

Three remote cameras were used at conflict sites and at MCSC. Remote video footage of electric fencing working to deter bears is a good tool to encourage use of fencing to protect livestock, fruit trees, and other attractants. Some of this footage was incorporated into the "How to Electric Fence for Bears" video, produced by the project coordinator for HCTF. This video will be available on the internet for sharing on social media. Various videos of bears at the mark trees at MCSC were also captured, which are great fun for school education at Jewett School and public presentations. This footage could be made available to FWCP upon request.

Objective 3. Promote education about and community stewardship of grizzly bears by integrating local residents in the management process

- Residents have adopted methods of community stewardship of grizzly bears and are integrated in the bear management process, with improved relationship to calling the COS to manage grizzly bears conflicts.
- Residents of Meadow Creek have demonstrated their interested in less-lethal management and there has been great community support for the project.
- This support may have in part been generated because this project originated with consultation with community members about how to coexist with grizzly bears through the project coordinator's master's thesis research.
- Program coordinator continues to live and work in the community, enabling quick response to conflicts and ongoing support for residents to work towards solutions through various funding sources.
- Residents helped to collect bear DNA on their private property.
- Residents called in sightings of ear-tagged bears, and of other bears in the valley.
- Attractant management was good with the exception of three identified residences. These residents either moved from the area or adopted appropriate attractant management.
- Reduced residential bear conflicts increased tolerance, which in turn has increased residents' willingness to work towards less-lethal solutions.
- A Focus Group of local residents was held at the project coordinator's house each year of the project from 2011-14. There were between nine to fourteen local residents, with Conservation Officer Jason Hawkes and Michael Proctor also attending. This meeting was very successful to share project results with interested community members.
- Three community meetings were held at the Lardeau Valley hall; one in May 2011, one in May 2012, and one in May 2015 (see attached poster). The COS was present at all these meetings.
- The MCSC Open House was held each year of project delivery and this project had an educational booth for visitors. This outreach was very well received and there were many interested participants.

Objective 4. Evaluate and monitor the effectiveness of management actions designed to teach bears to avoid residences.

- All management bears left the area of conflict and avoided people after management actions.
- 3 of 6 bears completely avoided conflicts after release.
- 2 bears stayed out of conflict for the remainder of the season but ended up back in conflict the following season. This mainly had to do with availability of anthropocentric foods.
- The above five bears experienced a hard release on site of the conflict.
- 1 bear (Bear 340) did not avoid conflicts after release, but this bear did not have a hard release from the trap.
- The management team met to evaluate project activities as needed.
- Management actions proved effective in 2011-15, but this research needs to be long-term (preferably 10+ years) and/or a greater sample size to evaluate effectiveness of this

management.

Bear 188: (3 year old male black bear) Prior to management in 2011 this bear was very habituated; not moving from people yelling or from dogs and foraging in resident's yards in the middle of the day. This bear was not human-food conditioned, and was seen eating grass and fruit. After GPS collaring (Aug 30), hard-release with dog, rubber bullets, yelling, and noise makers (Aug 31), and 2 follow up hazing events with dog and yelling (Sept 2 & 3), this bear disappeared from the community (Sept 4) though there was still fruit and fish available. GPS collar shows a large 2-day migration to the remote Lake Creek drainage, 27 kms away (see Figure 1), where telemetry signal was lost. Bear seems to show fidelity to Greyhorse Ridge, as he is shown to leave Lake Creek to travel 25kms directly to his den site.
In 2012 this bear became active April 11th, and spent the first 3 weeks of May around the area of Meadow Creek. Bear was not seen and no GPS points show up in people's yards (see Figure 2). Bear seemed to avoid residences and went back to Greyhorse Ridge, where he was legally hunted on May 25. Collar was retrieved June 21.

Evaluation:

This bear's response to conditioning was a success. Less-lethal management proved to be effective to change this habituated bear's behaviour to avoid people and residences. Fifteen person-hours went into trapping, collaring and releasing this bear, 6 hours tracking and hazing after release, 25 hours spring tracking and collar retrieval.

It is important to note that part of this success was because even though very habituated to human activity, this bear was not human-food conditioned (except for domestic fruit). It is possible that if this bear had been alive in August 2012, he may have been attracted back to fruit near residences.

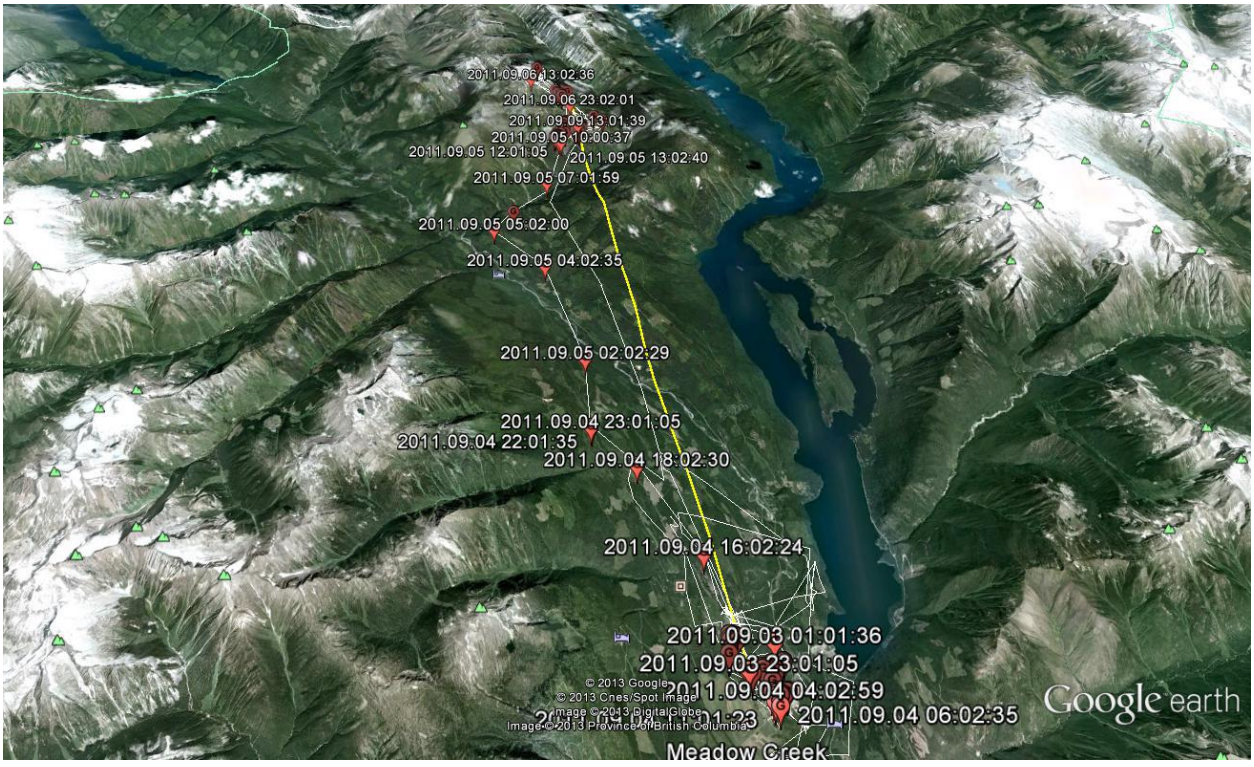


Figure 2: Bear 188 post-management path Sept 4 - 6, 2011. Line distance 27 kms from Meadow Creek to the remote Lake creek drainage.

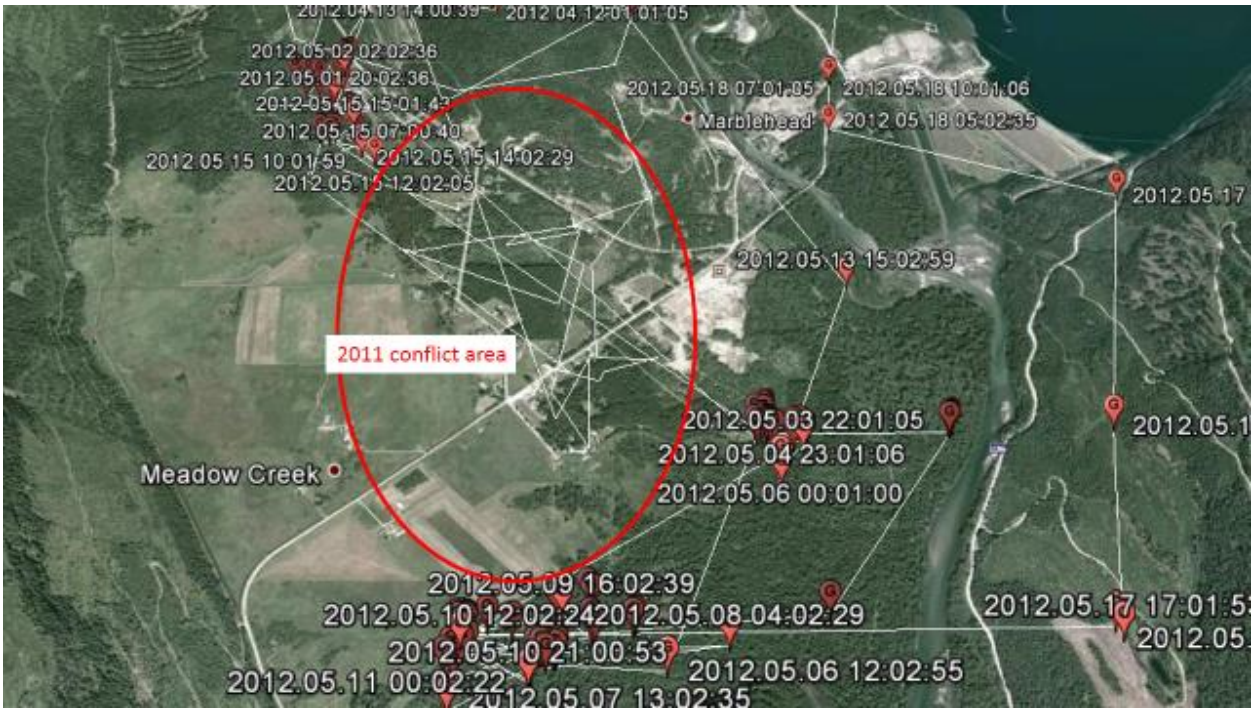


Figure 3: Bear 188, 2012 spring movements around Meadow Creek. Note use of area while avoiding residences and area of 2011 conflicts. Bear was not seen throughout this period (May 1 - 18, 2012).

Bear 222: (1.5 year old female grizzly bear) Prior to management in 2011 this bear was foraging near a farm on the Lardeau River with her mother and 2 siblings. The bear(s?) received pig and dog food at the farm near the house. After attractant management, GPS collaring (Oct 23), and hard release with dog, yelling, paintballs and noisemakers (Oct 24), the bear (and family group) stayed out of conflict and denned on Howser Ridge on Oct 28 (see Figure 3). The bear did stay in cover near the area of release for one day before leaving the valley but was not seen.

On April 16 2012 this bear left her den and came into no known conflict, though did utilize clearcuts ~1km from conflict site (see Figure 4) but was never seen at the site and no GPS points show her closer than 1km from site. She returned to Howser Ridge July 15, collar dropped off July 18 and was retrieved Oct 6. This collar was intended to drop off early as this bear was still growing when collared.

Evaluation:

This bear's response to conditioning was a complete success. It may have also helped to teach her mother and siblings to avoid conflicts (none of these bears were seen near the conflict site throughout 2012). Twenty-five person-hours went into trapping, collaring, releasing, and tracking this bear in 2011, with an additional 35 hours tracking and collar retrieval in 2012. The project coordinator also did a telemetry flight to locate this collar before retrieval.

In 2014 Bear 222 and her mother were detected by DNA hair snag analysis on the lower Lardeau River in 2014. This confirms both these bears are still alive and neither has been in any human conflicts since fall 2011. At the time of this report, Bear 222 is six years old and has likely become part of the reproductive population of grizzly bears in this area.

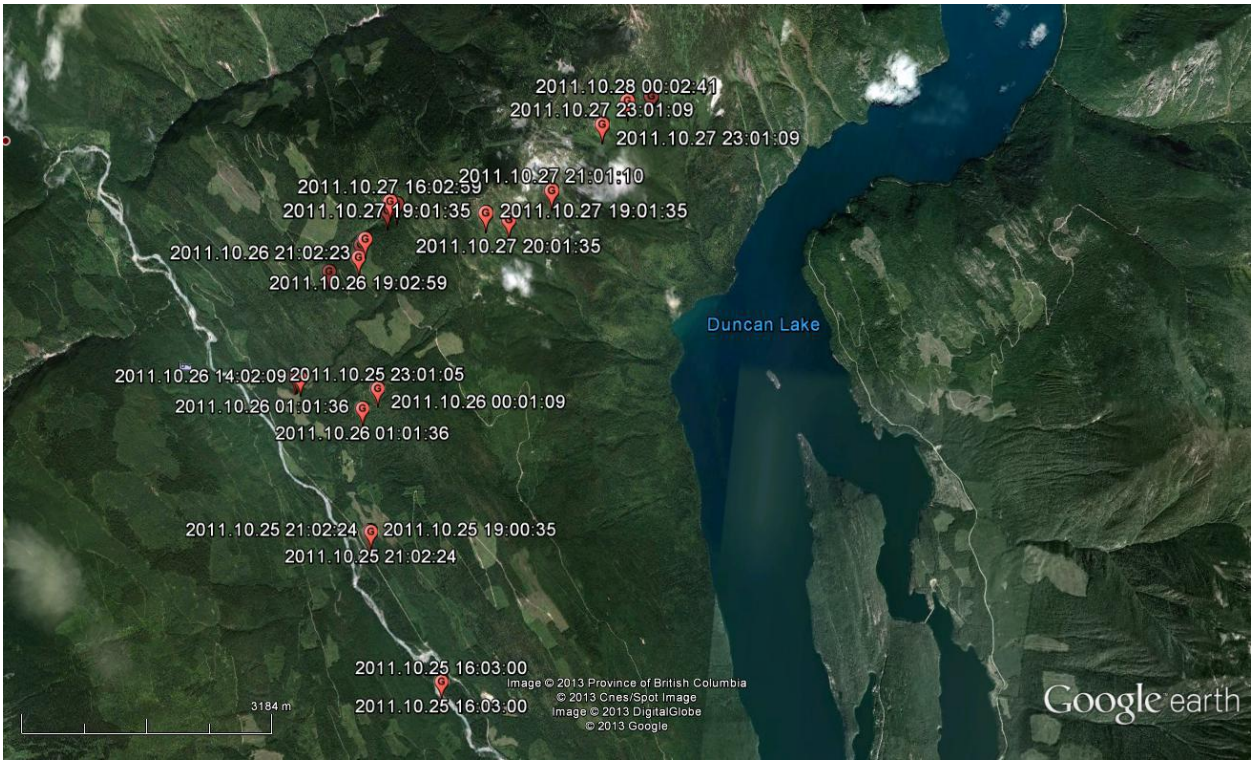


Figure 4: Bear 222 after release and going to den up Howser Ridge.



Figure 5: Bear 222 utilizing spring growth in clearcuts but avoiding site of conflict.

Bear 225: (6-8 year old male black bear) Prior to management in 2011 this bear was entering yards and was seen at dusk. After VHF collaring (Oct 6), hard release with dog and yelling ~ no projectiles or noise makers as this bear was in low level of conflict~ (Oct 7), this bear was not seen again in 2011. Telemetry shows that he was active in the area of the community but did not get into conflict. Bear denned up Hamill Creek late October.
In 2012 this bear's signal was heard in Meadow Creek Aug 12-16 near the creek on the west side of the flats (bear had access to Kokanee here). His signal was not heard again past this date, but the VHF collar's battery was known to be old when collar was deployed. This bear has avoided any known conflicts since the release.

Evaluation:

This bear's conditioning was a success. Though in low level of conflict prior to management, this bear had been seen multiple times near residences. After management, this bear was not seen again in 2011. He was identified one time by ear-tags on the Duncan Rd in August 2012, but he ran away from the truck and avoided people. Ten person-hours went into collaring and managing this bear, with an additional 20 hours for tracking. As far as we know, this bear is likely to be still alive.

Bear 001: (6-8 year old male grizzly bear) Prior to management in 2011 this bear was thought to have killed a domestic goat in Howser, just north of Meadow Creek. It was unclear as to whether the bear had killed the goat or had taken over the carcass as the bear was trapped 5 days after the predation event. After trapping and hard-release with dog, yelling, rubber bullets, and noise makers (May 15), this bear left the area of conflict for 6 months. He returned in the fall to kill another goat, as confirmed by DNA found at kill site. Tracking this bear was difficult as no GPS or VHF collar was available for this bear in the early spring of 2011. Bear was ear-tagged before release. This bear was responsible for the grizzly kill of a domestic sheep on Nov 11 in Meadow Creek. His DNA was also found near the site of a shed break-in for dog bones near Hamill Creek. He was known to be active in this neighbourhood throughout November 2011, and may have been capitalizing on deer carcass remains in 2 gravel pits in the area.
2012: Bear stayed out of conflict until Sept 19 when he killed a domestic pig at a farm on the Lardeau River. Bear's ear-tags showed clearly on remote camera for 2 nights following predation. Electric fence was installed to protect remaining pigs (3 adults and 14 piglets) with no further predation, though the bear returned at least 5 times through the fall 'to check if the fence was still hot'. Bear was seen near other farms throughout October and November, though with appropriate attractant management did not seem to receive much food reward (at one house he got some walnuts and at another he turned over a burn barrel to get charred old dog bones). The bear was eventually shot by a resident on Dec 2, at a location further north on the Lardeau River. The project coordinator was told afterward that the bear had been frequenting this site for weeks and had received dog food and livestock feed. He was breaking into a structure to get grain when he was shot.

Evaluation:

When first captured, the bear's history was unknown. It seems probable that this bear had learned to kill livestock prior to spring capture event in May 2011, as stories of predation on sheep and goats in the Lardeau Valley became clear over time after initial management and release. Livestock conflicts in Meadow Creek area from May 2011 – Nov 2012 resulted from Bear 001, as confirmed by DNA and ear-tags. As Bear 001 made rounds to small farms in the

area, he respected electric fencing and seemed to avoid metal fencing in general (this was apparent in three different locations). I speculate that he learned to avoid metal fencing through his contact with electric fencing. After electric fencing was installed, he did not predate again at that location. His respect for electric fencing helped to educate and motivate residents to install or upgrade their fencing. Now that this bear is gone from the population, it is our hope that residents will have learned how to protect their livestock and no new bears learn this behaviour.

Bear 230: (3-4 year old male black bear). Prior to management this bear was seen spring 2014 along Hwy 31 just north of Meadow Creek and seemed to be fairly habituated to allowing people to view him as he was foraging on roadside vegetation. He found garbage outside at a rental property where the resident was unable to manage their attractants. The bear was sighted repeatedly at the campground behind the Lardeau Valley Community Hall, and was reported to be walking by people at distances < 30m. We had set the trap for the young grizzly (Bear 340), but this black bear went into the trap so we collared and hard released him on site behind the community hall. The bear stayed away from the site of conflict and was not seen by anyone for the rest of 2014, though his VHF signal indicated that he was in the valley bottom in the forested/brushy habitat near the creek at the edge of the residential area.
This bear spent the vast majority of time on wild foods outside of the people's yards, and was not seen by anyone after hard release until May 20. After May 20 the bear was known to have received garbage and a bag of cat food outside of at least two homes, and had possibly learned to break open structures in its search for food. This bear was dispatched by COS on May 24.

Evaluation: This bear's management was a success. Bear 230 avoided residences and ate wild foods (Figure 7) for the remainder of 2014 after hard release. The bear completely changed its behaviour from being comfortable walking near people in broad daylight to avoiding people and residences. Though the bear was active in the community in spring of 2015, it avoided being seen by people until it had found anthropogenic foods again when it found garbage available near a residence. It seemed that it only took Bear 230 a couple of food rewards and he became less wary and daytime active in the community. However, he continued to avoid being seen by people. Most of all, this bear showed the project coordinator where attractant management action was needed. Figure 8 shows this bear's home range as it overlaps the community of Meadow Creek and how the majority of activity was outside of the community.

There were 15 person hours in trapping, collaring and hard releasing this bear, with additional time for on-going tracking efforts.



Figure 6: Bear 230 at mark tree two days after hard release at good location away from people and residences (remote camera pic).

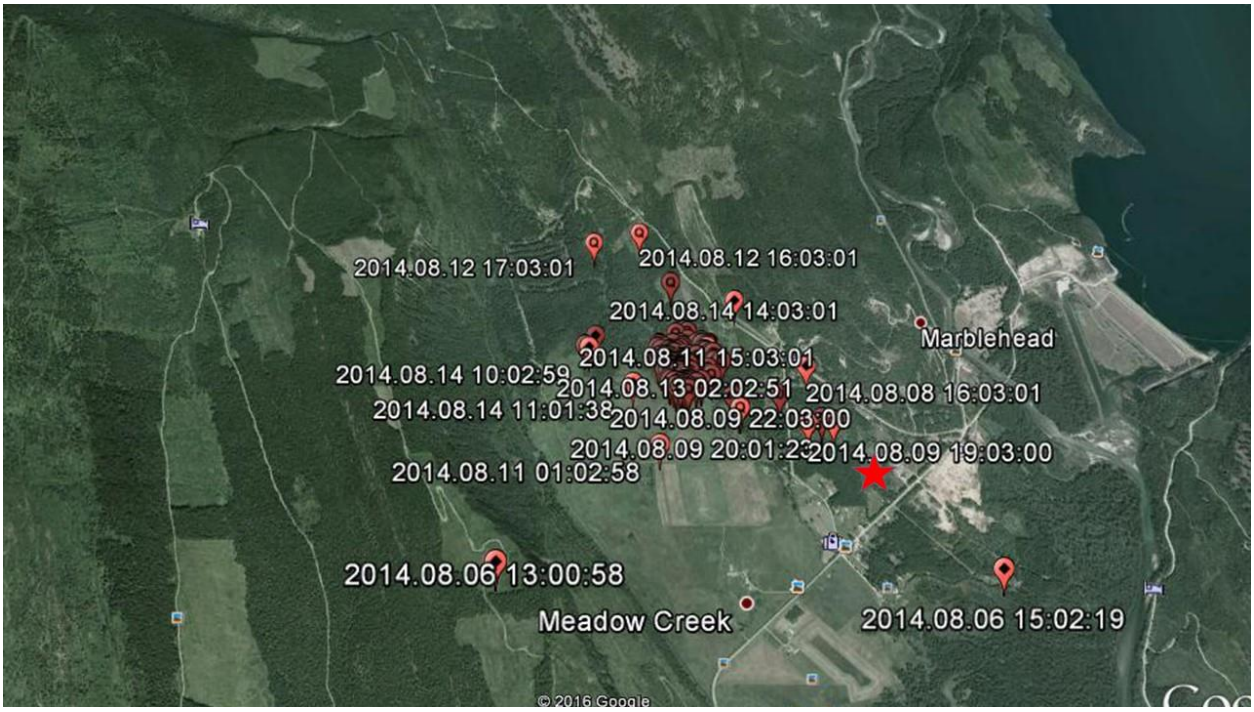


Figure 7: Bear 230 first week after hard release. The star indicates conflict and release site.

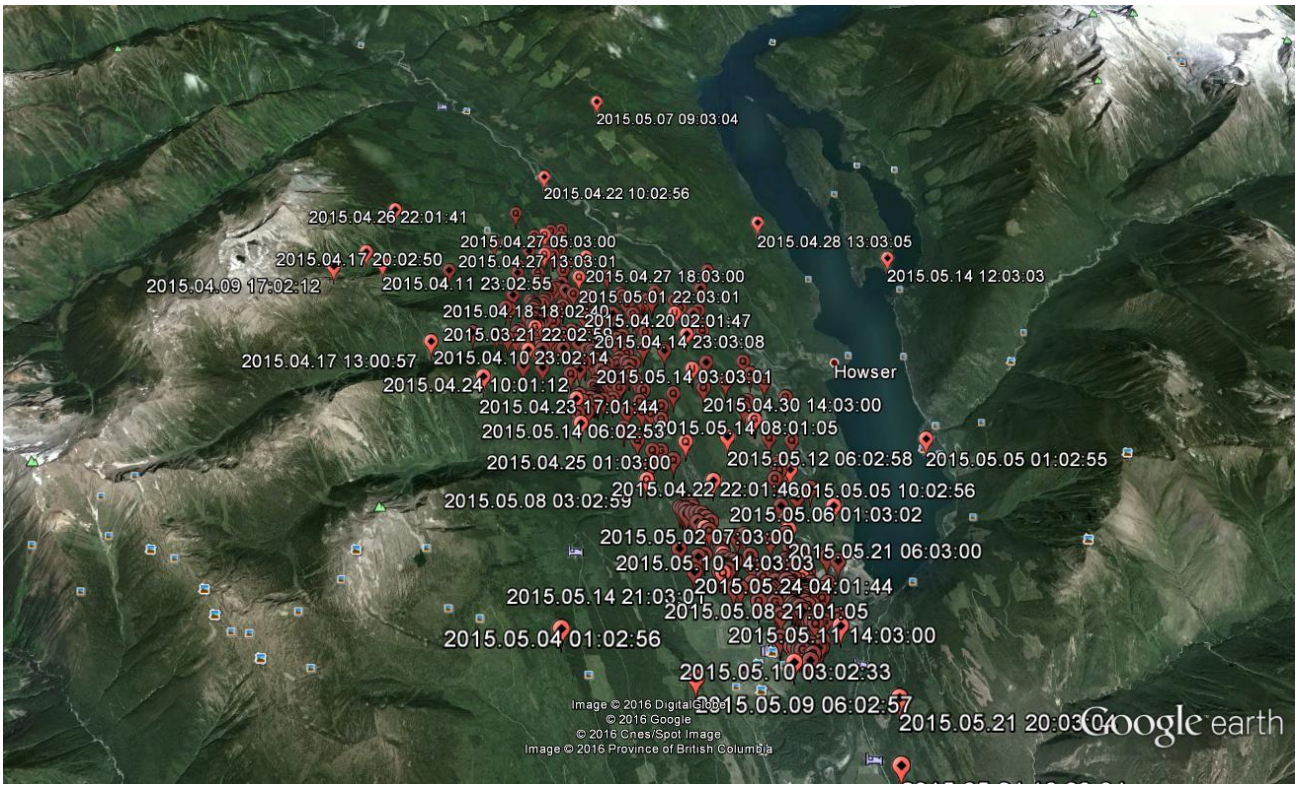


Figure 8: Bear 230 spring 2015 using home range of ~150km overlapping with Meadow Creek.

Bear 340: (Three year old sub-adult male grizzly bear). Prior to management this bear was seen repeatedly near the community hall and the residence where garbage was not being managed. This bear was trapped and collared. The morning after trapping this bear was rejoined with his male sibling, and it seems likely that prior sightings may have been of either bear as they were dispersing from each other. It is likely that stress related to trapping pushed Bear 340 to rejoin with his sibling for security reasons (young sibling bears often travel together in the first year or two after dispersing from their mother). We suspect these bears were also the same two young siblings sighted often in the spring of 2014, both near residences and on the Meadow Creek flats.

As two young bears were very habituated to people from early spring, we speculate if these bears were part of the grizzly bear family group that were consistently monitored at MCSC in fall 2013 as part of a behavioural thesis by a visiting masters student. These bears' DNA was detected often at MCSC in 2013, and their extreme habituation in spring 2014 indicated that they were already very comfortable near people. The age of these bears is consistent with the offspring of the studied family group.

After collaring and rejoining with his sibling, Bear 340 frequented apple trees in Meadow Creek. The two young male bears together became somewhat 'pushy' in their search for food, frequenting properties and the school yard in daylight hours and acting like the top trophic species that they were. After two interactions with people where the bears made people quite nervous, the decision was made to 'break up the gang'. The project did not have the resources available at the time to relocate one of the bears, so the decision was made to shoot the sibling bear so that the project could continue to monitor the collared animal. It was in essence a choice between killing one or two bears. The un-collared sibling was shot on Aug 16 by the COS. Bear

340 became much warier after his brother was killed, avoiding people generally and especially in daylight hours. He found an excess of unmanaged fruit in Cooper Creek, which he fed on until the Kokanee started spawning on Sept 9. He was monitored by GPS iridium network and by VHF signal consistently on a daily basis until his collar malfunctioned on Sept 10.

Evaluation: This bear's management was a success. Though we were not able to do a hard release on this bear to teach him to better avoid people, the shooting of his sibling seemed to make him significantly warier and not seen often. This bear moved into the rich habitat of Cooper Creek and his activity there indicates more need for attractant management, especially of excess unmanaged fruit trees. There were reports of a grizzly bear on porches eating dog food in Cooper Creek in late fall 2014, and it was speculated that it might be Bear 340. This indicated more need for detailed attractant management. This bear was seen in multiple locations in Cooper Creek, Meadow Creek and Hamill Creek in spring 2015, when he disappeared and was rumoured to have been shot by a resident.

There were 24-person hours in trapping and collaring this bear, with additional time for ongoing tracking efforts via VHF telemetry combined with GPS Iridium locations.

Objective 5. Provide project results to the COS and other government agencies on effective and ineffective management strategies aimed at promoting human-grizzly coexistence.

- This objective is long-term and more insight will be gained over time as the project continues.
- Low sample sizes of management bears cannot provide conclusive results that can be applied universally to other areas
- The project coordinator presented this work of coexisting with grizzly bears in Meadow Creek at the 22nd International Conference on Bear Research and Management Sept 15-20, 2013 in Provo Utah, USA.
- The project coordinator will present a project poster at the 24th International Conference on Bear Research and Management Jun 12-16, 2016 in Anchorage, Alaska.

Discussion

2015-16

In 2015-16 the project's previous efforts of attractant management were put to the test due to the collapse of kokanee at MCSC. There were two residences where bears were known to access anthropocentric foods. One of these was a disabled resident who was not able to bring her garbage to the transfer station and was also seemingly a 'hoarder' who didn't want help (perhaps thinking that someone would take her belongings). The bear resistant bin loaned to the resident was quickly filled with garbage and sat full for weeks. Despite the project coordinator's repeated offers of help to take the garbage away, the situation became worse as more bears were attracted to the residence (including Bear 230). When the COS spoke with the landlord, he built a small shed for the garbage at the residence in question, however this shed was made from ½ inch cedar siding. The shed made the yard look tidier as the resident filled it with garbage, however the shed did nothing to make the garbage inaccessible to bears! When the project coordinator discussed the situation with COS, she was told that because the resident was disabled and there had been an effort to put the garbage away, there would be no charge under the Wildlife Act. This was a frustrating situation that directly resulted in the mortality of two bears: Bear 230 and another black bear. Both bears were dispatched by COS on May 24, 2015 after being sighted repeatedly getting into garbage at this residence and being determined as 'garbage conditioned'. The

resident in question moved from the community in summer 2015, which ended the cycle of garbage conditioning.

The other residence was one where the people were leaving domestic poultry outside at day and night, relying on their two large livestock guardian dogs to protect the poultry from predators. However, a family group of grizzly bears (mother with two cubs of the year) killed 25 birds on Oct 25, 2015. The resident called the project coordinator and she helped to catch the remaining 35 birds and put them inside one of the coops. The project coordinator then installed electric fencing around the coop and caught the bears on remote camera the following night. The camera showed both cubs getting shocked on the electric fence and the bears did not return. However, this family group was rumoured to have been shot at a different residence two weeks later, possibly because of the learned poultry-killing behaviour.

An interesting point of discussion is related to relying on dogs to deter bears. Two or more large working dogs can be an excellent deterrent for black bears or a single grizzly bear. However, it seems to be a different situation for family groups of grizzly bears. The resident who relies on their dogs to protect the poultry said that after the first night the dogs refused to engage with the bears and hid when the bears showed up. The project coordinator suspects that the dogs may have tried to push the cubs away and then the mother bear went into full attack to protect the cubs. After facing a defensive mother grizzly bear, the dogs lost heart and chose to hide under the porch when the bears arrived rather than face a similar attack.

For this reason, the project coordinator recommends electric fencing in combination with working dogs to deter grizzly bears for two lines of defence in protecting livestock from bears.

2011-16

Through the project's efforts from 2011-16, the project has been successful in creating a culture where it is unacceptable to feed bears and social norms have changed to support attractant management as a community effort. Though anyone can make a mistake, residents are consistently choosing the ease of preventing conflicts over the hassle of leaving attractants available and dealing with bears in the yard. One single residence that had serious attractant management issues resulted in a minimum of five bears learning to find food being seen around people in 2014 and early 2015. Four of these five bears were eventually shot, indicating how just one resident can create an attractant sink in a relatively short amount of time.

The 10% return of Kokanee to MCSC resulted in less food for bears in 2014, and the 1% return of spawning salmon in 2015 amounted to a collapse of the population. This reduction in Kokanee was likely the main factor in a food-stressed young female grizzly bear being shot by a resident in early November 2014 as she was digging into an unsecured poultry pen, and a starving (literally) 2-3 years old male grizzly that was put down by COS in early December 2015.

It is possible that in years of abundant fish that a bite of dog food here or something on the porch over there might not attract bears. However, the collapse of the kokanee populations in MCSC and the Lardeau River means that every bit of available food in the late fall is of higher value, even if it means that bears need to approach houses to get it. This creates the need to be almost perfect in efforts to manage attractants.

Grizzly bear mortality due to conflicts was decreasing

Historical (1967-2007) grizzly mortalities due to conflicts were thought to be at a rate of 2-3 (or sometimes more) bears per year in the Meadow Creek area, though most of these

mortalities were unreported to the COS (Sanders, 2013). From 2007-2014, the known rate of mortality seems to be dropping: two male grizzly bears shot by COS in 2007, one male grizzly bear shot by a resident in 2010, one male grizzly bear shot by a resident in 2012, one male grizzly bear shot by COS in 2014 and one female grizzly bear shot by resident in 2014, for a total of six known mortalities over these eight years. It is possible there could have been unreported mortalities in 2008 and/or 2009.

However, in 2015 there was one known mortality by COS and four unreported mortalities by residents. On the heels of two grizzly bear shot in 2014, this year reverses the trend we were seeing towards fewer mortalities, showing that the loss of kokanee stocks proves the need to continue with project activities is greater than ever.

Year	Confirmed grizzly bear mortality	Unconfirmed grizzly bear morality	Known total grizzly bear mortality	Resident	COS
2007	2		2		2
2008	0	unk	0	unk	
2009	0	unk	0	unk	
2010	1		1	1	
2011	0		0		
2012	1		1	1	
2013	0		0		
2014	2		2	1	1
2015	1	4	5	4	1

Table 1. Known grizzly bear mortality in the community of Meadow Creek. Project years are highlighted.

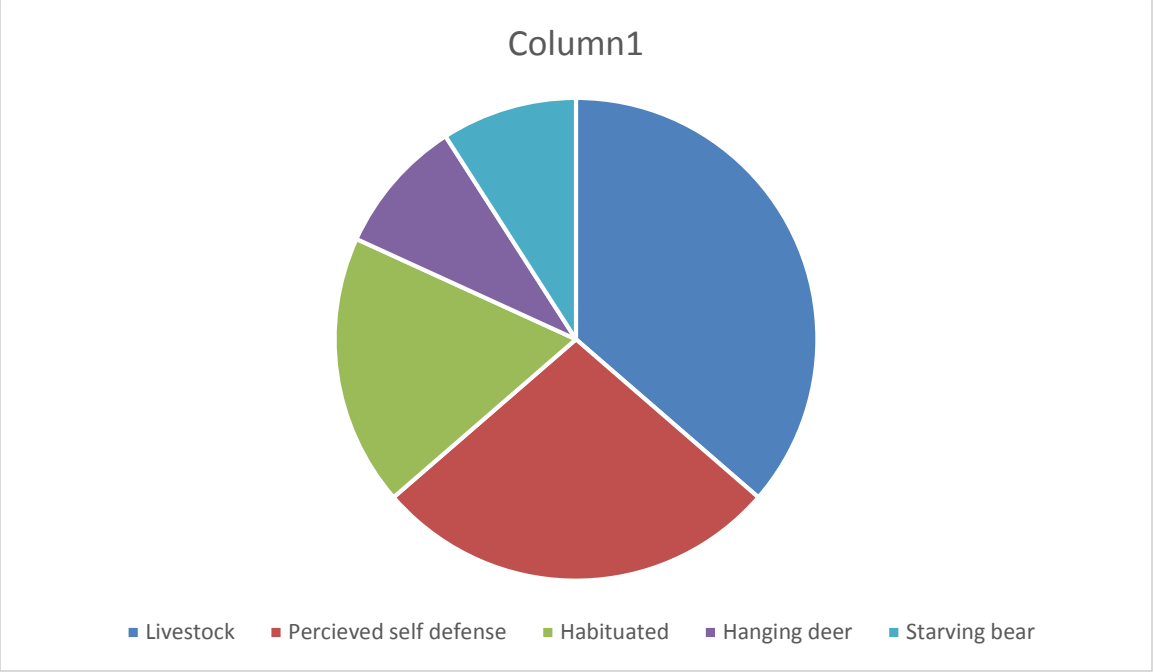


Figure 9: Cause of mortality graph. Four grizzly bears were known to be shot because of conflicts with livestock between 2007-15.

In 2011 a female grizzly was collared with GPS collar (**Bear 222**), a male black bear with GPS collar (**Bear 188**), and a male black bear with VHF collar (**Bear 225**). A male grizzly (**Bear 001**) was trapped and ear-tagged, but we did not have a collar for him early spring 2011. These 3 collared bears were monitored by telemetry in 2011-12 and did not come into further conflicts with people. **Bear 001** was shot by a resident in 2012. **Bear 340** (grizzly) and **Bear 230** (black bear) were collared in with GPS collars in 2014 and both were shot in spring 2015.

Research Bear	Species	Sex	Collar	status	Continued conflicts?	Outcome?
188	Black	M	GPS	retrieved, downloaded	No	Mortality: legally hunted
222	Grizzly	F	GPS	retrieved, downloaded	No	Alive
225	Black	M	VHF	rot off, no signal	No	Alive
001	Grizzly	M	Ear-tags	N/A	Yes	Mortality: shot by resident
340	Grizzly	M	GPS	N/A	Yes	Mortality: Rumoured shot by resident
230	Black	M	GPS	N/A	Yes	Shot by COS

Table 2. Research bear status 2015

DNA results

Through the relatedness (father-mother-offspring triads) of the 25 individual grizzly bears identified through DNA analysis, it seems likely that we sampled most of the bears utilizing the habitat of the Meadow Creek flats. There was one male bear ("Big Daddy") that was identified as the father of 11 offspring through mating with five female bears (offspring are confirmed products of these mating as we were able to sample both parents). It would seem that "Big Daddy" is dominating mating activity in this area, as is common in other areas where a male bear becomes successful (M. Proctor, pers. comm. April 29, 2013). Only four individuals were not identified as the potential parent or offspring of any other individual in the dataset. Research Bear 001 was not related to any other bear sampled. Research Bear 222 was related to one other male bear from Meadow Creek (not "Big Daddy"); possibly her father or brother.

Analysis suggests that potentially three bears from each population are distinct to that population, but most sampled bears (13) are products of mixed ancestry from both Selkirk and Purcell populations (Figure 1).

There were nine grizzly bears detected along the lower Lardeau River, one of which was a research bear in 2011-12 (Bear 222). Detecting this bear and her mother in 2014 shows these two female bears are still alive and part of the breeding population (this mother bear is the second most prolific breeder in this sample set). Neither of these bears has been in conflict since fall 2011. Another bear of interest in the Lardeau Valley was a female that had DNA analysed in 1996 in a previous study, indicating that this bear is at least 19 years old.

We can make inferences to the home range sizes of these bears through research in these same mountain ranges to the south. In the Central Purcell/South Purcell and South Selkirk GBPUs male grizzly bears have a home range of about 1700km2, and female ranges are typically approximately 300km2 (MacHutchon & Proctor, 2013). This means that a male grizzly

bear can move 50-60 straight-line kms over his home range. Extrapolated to Meadow Creek, this could bring male movements west across the Selkirks to near Nakusp, and across most of the Purcell range to the east. We do not know the exact shape or direction of movements as related to Meadow Creek (ie. Meadow Creek is not necessarily in the center of bears' home range).

It is important to note that though most of the bears using this area are likely to have been sampled; additional bears may be using this habitat. Bear 001's ear-tags identified him on remote camera at MCSC on Oct 01, 2012, but we did not get DNA samples from his visit here.

Less-lethal management results

Discussion of management results is included under Objective 4: Evaluate and monitor the effectiveness of management actions designed to teach bears to avoid residences.

Education and coexistence

Through individual conversations with community members who have experienced on-going conflicts with bears, it was determined that those who may be most likely to shoot bears are not interested in attending a management workshop or public meeting. However, it was also determined that these residents are open to talking with the program coordinator on an individual basis. The attitudes of some residents towards bears in the Meadow Creek area has changed through program activities. Residents generally now accept living in coexistence with bears, as opposed to just shooting them on sight. Part of the reason for improved attitudes towards coexistence is that as residents manage their bear attractants they experience less conflicts. Bear resistant bins, electric fencing, and bear spray are effective tools for promoting coexistence.

Bear resistant bins

The loan of bear resistant bins to store residential garbage has been well received in the community of Meadow Creek and area, as the cost of these bins (~$300/each) is a deterrent for people. Some residents live in trailers or small homes without room in their residence to store garbage until they can take it to the transfer station for disposal. Loaning the bins to local residents has been effective in reducing garbage available to bears and has raised appreciation and positive association for responsibly managing bear attractants.

Electric fencing

Electric fencing is the only tool known to effectively deter bears each and every time a bear tries to breach an area to reach livestock. It has been used effectively for decades to protect honeybee hives from bears, and is now being used to protect other livestock such as sheep, goats, pigs, chickens and other poultry, calves, donkeys, fruit trees and any other type of attractant, including garbage landfills. To be effective, electric fencing needs to be installed properly to deter bears and to be maintained regularly. The use of electric fencing has increased in Meadow Creek and area through a cost share program to assist residents in the cost of the fence. As residents experience the effectiveness of this tool, they are willing to give the time and attention required to maintain their fence.

When bears kill livestock, it is also scary for residents as they come out in the morning to find mutilated carcasses lying in their yard. People may feel violated as well as scared, and may be wondering if the bear would come to kill them or their family next. There is also an emotional response to predation on small farms as the farm animals are well known, and caring for a few animals is more intimate than caring for a large herd. As residents see that properly installed electric fencing works to prevent these conflicts, they are motivated by not having the impact of

predation as well as protecting against financial or emotional loss associated with losing livestock.

Bear spray

We now live in a culture where the use of firearms in less prevalent and bear spray is being recognized across North America as an effective deterrent to black, grizzly, and polar bears (Smith, Herrero, DeBruyn, & Wilder, 2008). Bear spray could help residents when they feel uncomfortable recreating in the Meadow Creek area as an easy-to-use deterrent that provides a safe option should they encounter a bear at close range. Another point around the use of bear spray is that while it gives people a safe option to defend themselves against a bear attack, it cannot be used to kill a bear that simply happens to be in the area; therefore, it provides the person and the bear time to leave the situation safely (in most incidences without having to be deployed).

Management Implications

DNA analysis suggests that there is currently only mild fragmentation between Central Selkirk and Central Purcell GBPUs (Proctor et al., 2012). Because we have no reference for genetics from previous years, we do not know if more or less bears are accessing the area. However, we do know that a total of at least 20 grizzly bears used the Meadow Creek flats without conflicts with people in 2011-2014, as identified through DNA analysis. There were at least 10 individual grizzly bears at MCSC in 2015, identified by sightings from Murray Pearson, fish technician who lives and works at MCSC. It is likely that most of the 2015 bears were detected previously through DNA.

It is expected that bears who access Kokanee would return to such a high quality food source each year, and that mother bears would teach their cubs to forage here. The five known reproducing female bears seem to know how to access this area safely and we can presume that they teach their cubs to follow their example of 'good' behaviour. However, when cubs leave their mother and learn their own way in the world, they are known to be more likely to come into conflict with humans. Newly independent sub-adult bears may be somewhat 'naïve' in their learning. They may also be the easiest age class to teach, and have been shown to be responsive to less-lethal management actions in Meadow Creek and other areas. As new human residents move into the area, new bears become sub-adults and may need new teaching to avoid residences. Both people and bears may need support to coexist in Meadow Creek for years to come.

As coexistence has improved in Meadow Creek since 2007, there was likely safe access for bears to access kokanee at MCSC until the collapse in 2014. Both the creation of safe access and collapse of kokanee stocks may create additional management considerations of people management at MCSC and the interface between MCSC and the community of Meadow Creek.

People management at MCSC

Bear viewing is a growing phenomenon in BC. In recent years, local residents from the Meadow Creek area and people from farther away have been coming to MCSC and the Lardeau River in hopes of viewing grizzly bears while they feed on Kokanee.

Effective management of people who come to MCSC to view bears is important for minimizing the potential for conflicts at MCSC and increasing coexistence with grizzly bears in Meadow Creek. There have been multiple sightings of females with cubs at MCSC in recent years and mother bears can become defensive if they feel they or their cubs are threatened. Lines

of sight at MCSC are very tight due to the lay-out of the channel, which increases the likelihood of surprise encounters if people were to walk around on foot.

In 2014 the project coordinator and Grant MacHutchon wrote a risk management plan for MCSC (MacHutchon and Sanders, 2014), which included recommendations for visitation to the channel and other safety precautions. These recommendations have been incorporated into channel management and include visitation hours between 10am-2pm daily through September – mid October when Kokanee are spawning. In addition, there are two local monitors hired to be on site on September weekends to provide ecological education and safety information, while monitoring visitor activity. This provides people with opportunity to view Kokanee and possibly bears, while also providing bears with 20 hours per day of uninterrupted feeding time in years when there are fish present. We hope that this management will help to not habituate bears to people at MCSC.

If a bear has frequent interactions with people and there is no negative consequence to the bear, then it often will habituate to people (Knight & Temple, 1995). Efforts should be continued to prevent habituation of bears near the community, as happened the case of the two sub-adult male grizzly bear siblings (Bear 340 and sibling) that were destroyed as a result of habituation to people. Habituated bears tolerate people at closer distances, which make interactions between bears and people more likely and also make it more likely that people will approach bears, but it also reduces the likelihood these bears will act aggressively toward people unless pushed too far (Herrero et al., 2005). Such an incident occurred in Yellowstone National Park in 1986 when a photographer intentionally approached a habituated female grizzly bear with cubs. She initially tolerated his approach until he got too close for the bear's comfort and she killed the photographer (Herrero et al., 2005). In addition, people who are not knowledgeable about bear behaviour could also encounter curious bears that approach people and these people may react inappropriately by running away or shooting the bear (Herrero et al., 2005). The closer interactions are between people and bears, the more likely someone, either bear or human, will get hurt or killed. If this happened, it could seriously harm the acceptance for and tolerance of grizzly bears that has formed in Meadow Creek in recent years.

Interface between MCSC and residents of Meadow Creek

While research participants unanimously accepted bears eating Kokanee at MCSC, some residents are uncomfortable with grizzly bears in people's yards and want bears to respect peoples' space around homes and especially near Jewett School. Bears that are habituated to viewing (or even non-habituated bears) may or may not approach people or residences, depending on a variety of environmental, bear, and human-related reasons (Herrero et al., 2005). However, the primary cost/benefit analysis of each bear is primarily driven by the need to find food; therefore, attractant management of anthropogenic and natural foods near residences is paramount to ensure that the benefits of the rich food source of Kokanee at MCSC outweigh any benefit of being near residences.

It is possible that in years of abundant fish that a bite of dog food here or something on the porch over there might not attract bears. However, the collapse of the kokanee populations in MCSC and the Lardeau River means that every bit of available food is of higher value, especially in the hyperphagia stage, even if it means approaching houses to get it.

It is possible that habituated bears can differentiate between locations and understand that being near humans at MCSC is different than being near residents of Meadow Creek (Grant MacHutchon, personal communication, February 28, 2013), even though the locations are only

five hundred meters apart. However, making this distinction is made difficult because some of the more tolerant residents want to see grizzly bears on their properties and do not mind bears foraging on natural foods near their homes, so bears may be potentially receiving mixed messages from residents. On-going education is necessary to help all residents understand that they live in a community setting and some of their neighbors are very uncomfortable with bears who do not avoid people.

Consistency on the part of community members, most importantly in attractant management, but also in levels of tolerance of bears near people's homes, will make it easier for bears to learn where human boundaries are and promote human-grizzly bear coexistence.

Conclusion

Grizzly bears are dependent on human tolerance for survival in low elevation habitat that includes agricultural lands or is adjacent to rural residents and communities. Long term grizzly bear use of the Meadow Creek area depends on the local social carrying capacity for grizzly bears using private properties in the valley bottom. It is important to support local human-bear coexistence initiatives for this area to function as safe habitat that connects the larger core habitats of the Central Selkirk and Central Purcell GBPUs. Connectivity between these populations is improving through the efforts of the Meadow Creek Bear Education and Management Project to decrease grizzly bear mortality in Meadow Creek through attractant management, community education, and less-lethal management of bears when they do come into conflict with residents. Through this project's efforts, the community of Meadow Creek has adopted attitudes and behaviours that support coexisting with grizzly bears.

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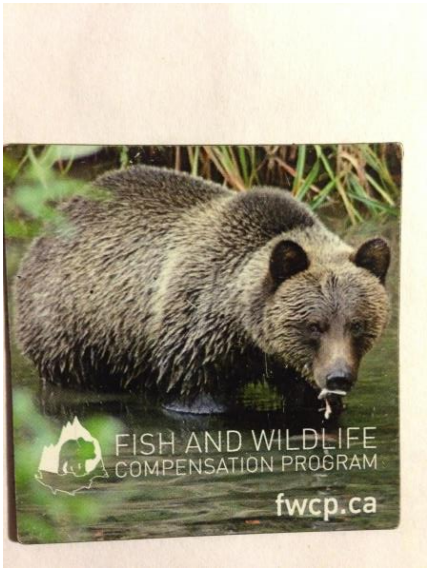
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Confirmation of FWCP Recognition



Project Coordinator Gillian Sanders with the project display at the Meadow Creek Spawning Channel Open House on Sept 12, 2015. FWCP logo is prominently on display in three locations of the display.



FWCP promotional magnet with grizzly bear at MCSC. G. Sanders photo



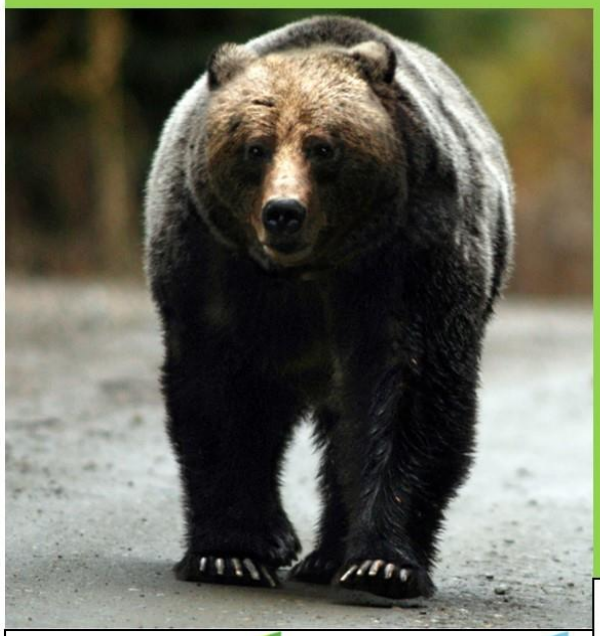
Project display at Summit Lake Toad Fest, Aug 12, 2015, with FWCP logo featured. Booth was shared with the WildSafeBC New Denver program.





MEADOW CREEK BEARS

Do we have too many bears?
How do we live with reduced Kokanee returns?
Come out and learn more, discuss, and meet our Conservation Officers



Friday May 8
7:00-8:00pm
Lardeau Valley Hall
Meadow Creek

For more info contact Gillian:
250-353-1137 or email
grizzlybearsolutions@gmail.com

Columbia Basin trust

FISH AND WILDLIFE COMPENSATION PROGRAM

Poster for Meadow Creek community meeting to address low kokanee returns and bear conflicts.

Appendix A: Glossary of terms (from Bear-People Conflicts Workshop).

Aversive conditioning (AC): a form of *operant conditioning* in which an aversive agent is systematically applied to an animal as it performs a behavior in order to reduce the frequency or performance of the behavior. In bear conflict management, AC is a structured program to systematically apply an aversive agent (e.g. treating with noisemakers, projectiles, dogs, vehicles) when a bear approaches or has entered an area of human activity followed by removal of the aversive agent when the bear retreats to suitable habitat or area. See also *hazing.*

Bear human conflict: includes *interactions, encounters* and aggressive interactions which people perceive or experience a threat to life or property.

Deterrence: the act of dissuading a bear from reaching a goal that people doesn't want it to reach.

Food-conditioning: form of operant conditioning in which bears learn to associate sources of food with humans or their infrastructure.

Habituation: type of learning in which bear no longer responds to presence of a stimulus; ―learned indifference.

Hazing: application of aversive agents (e.g., noisemakers, projectiles, dogs, vehicles) to a bear that is approaching or has approached a conflict situation. May consist of one or many such events, but, in contrast to *aversive conditioning,* the goal is to remove the bear from the immediate conflict situation and not necessarily to modify the bear's behaviour. Further application is not implied nor necessarily consistently applied every time.

Interaction: when a person(s) and bear(s) are mutually aware of one another. Bears may react with seeming indifference, by leaving the area, or approaching the person. Synonymous with *encounter.*

Less-lethal: a type of deterrent, mostly used in the context of projectiles fired from a firearm, that if used properly will not injure or kill the animal, but has the potential to be lethal or injurious if used improperly.

Non-lethal: a type of deterrent (e.g., pepper spray or stationary noise-makers such as air horns) that will not injure or kill a bear even if misused.

On-site release (OSR) or hard release: capture and release of a management bear in the same location or very near to site of capture, usually with intensive hazing associated with the release. Often, but not necessarily always, includes immobilization and marking individual.