
Photo by Jakob Dulisse

Meadow Creek Bear Education and Management Project Report 2013-14

Prepared for Fish and Wildlife Compensation Program

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by Gillian Sanders

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FISH AND WILDLIFE COMPENSATION PROGRAM

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Table of Contents

List of Figures:

Executive Summary

This project integrated bear management, research, and education 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) has 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 30m 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 increasing understanding of bear biology, ecology, and population dynamics) is a key aspect of this project towards changing human attitudes and behaviours through direct participation with local solutions. Community values were key considerations in developing 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 outreach of ongoing radio collaring and DNA hair snagging efforts. The identification of potential conflict areas has also increased the stewardship efforts of local residents.

The project successfully met all goals and objectives in 2013. In 2012, one grizzly bear was killed for repeatedly predating on livestock (that were not protected by electric fencing but now are). The 2 live research bears from 2011 stayed out of conflicts after management actions and have not been in seen since. There are at least 21 individual grizzly bears using the Meadow Creek area, as determined by DNA analysis, from genetic overlap of Central Selkirk and Purcell GBPUs. 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 is to not attempt less-lethal management techniques if anthropogenic attractants cannot be managed.

Keywords: Grizzly bear, Ursus acrtos, Meadow Creek BC, Kootenay Region, non-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 spring and fall foraging areas 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 hundreds of thousands 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 who come into conflict with livestock are usually shot by residents or by the Conservation Officer Service.

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 28 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 the MCSC has been made more complicated by the public's desire to view grizzly bears. Though times for public access to MCSC are now limited to between 10:00-14:00, 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) is depressed (Proctor et. al. 2007), but the Central Selkirk GBPU appears healthy (Mowat et al. 2005). Connectivity between these two grizzly bear populations is not 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 may 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, Proctor has been working with the COS over the past 8 years, and has managed 16 grizzly bears using these methods, 13 of which are still alive (M. Proctor, personal communication, February 26, 2013).

Less-lethal management provides options to move a bear away from an area without 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 are:

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 every 7-10 days in season. 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. The 2 mark trees are also checked in the spring season. 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 were 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. 2 Telonics 'store on board' GPS collars were deployed in 2011 and retrieved after drop off in 2012.

Telemetry

Telemetry was used in 2011-12 to track bears to check activity levels in the community. If signals were from in or near 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 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 torso), put on ear tags, 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 M. Proctor and team. Proctor has a provincial permit to live capture bears in the region since 2004. He was trained over a period of 4 years by an individual with over 25 years' experience in trapping

grizzly bears, and attends an annual refresher workshop on bear capture and handling led by a USFWS veterinarian.

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-steriod 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 locations occurred from satellites every 4 hours during the non-denning season and typically remained on the bear for 2 seasons. 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 and objectives in 2013. It seems that residents of Meadow Creek have adopted attractant management behaviours and prevented bear conflicts. There were minimal grizzly bear conflicts in Meadow Creek and area, though there were black bear conflicts in nearby Cooper Creek and Argenta. Overall conflicts in 2013 may have been reduced because of a plentiful huckleberry (Vaccinium spp.) crop.

Results 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.

- One grizzly bear (Bear 001, a confirmed livestock predator) was killed due to conflict in 2012.
- In 2013 there was one encounter of perceived conflict where a mother grizzly bear with two yearlings walked through a property adjacent to Meadow Creek. The resident was very upset and agitated by this event, but the bears were not seen again at that location.
- There was report of a grizzly bear in Hammill Creek and electric fencing was installed to protect chickens and temporarily around grease barrels. A bear trap was set by Conservation Officer Service. Remote camera identified two brown coloured black bears at this location but no bears entered the trap.
- No additional grizzly or black bears were known to come into conflict in 2013.

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:

- No collars were deployed in 2013 because there were minimal bear conflicts.
- 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 a 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.
- The 3 collared bears were monitored by telemetry in 2012.
- These 3 research bears did not come into conflict with people in 2012.
- GPS collars were retrieved.

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

Table 1. Research bear status 2013

DNA:

DNA analysis revealed a total of 23 individual grizzly bears using the Meadow Creek area in 2011-2013. Twenty-one of these bears utilized the rich habitat of the Meadow Creek flats and MCSC and did not come into any conflicts with people. Bears 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.

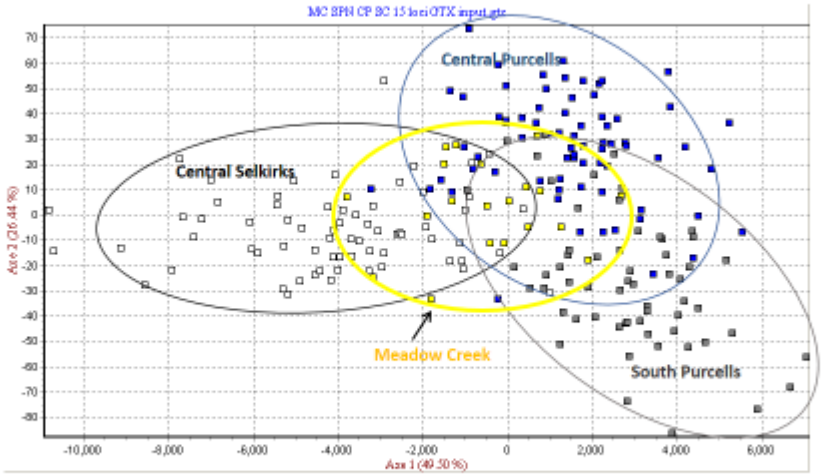

Figure 1. DNA analysis to 15 loci shows relatedness of project bears to both Central Selkirk and Central Purcell GBPUs, suggesting genetic interchange through this area.

Eartags:

Bear 001 was positively identified by eartags 2 times in 2011 and 8 times in 2012 in the Meadow Creek area. Bear 225 was identified by eartags 1 time at 2 - 3km on Duncan Rd.

Remote Cameras:

3 remote cameras were used at conflict sites and at MCSC. Pictures showed what was thought to be a grizzly bear at grease barrels in Hammill Creek as actually two brown coloured black bears frequenting the site. 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.

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

- Residents of Meadow Creek are interested in less-lethal management and there has been great community support for the project.
- This support may be in part because this project originated with consultation with community members about how to increase coexistence through the project coordinator's master's thesis.
- Program coordinator lives and works in the community, enabling quick response to conflicts and ongoing support for residents to work towards solutions.
- Residents help to collect bear DNA on their private property.
- Residents calling in sightings of ear-tagged bears.
- Attractant management was excellent with only one perceived conflict that did not involve attractants

- Reduced conflicts increases tolerance, which increases willingness to work towards less-lethal solutions.
- A Focus Group of local residents was held at the project coordinator's house on Aug 7th, 2013. There were 12 local residents attending, with Conservation Officer Jason Hawkes, grizzly bear biologist Michael Proctor and FWCP representative Irene Manley also attending. This meeting was very successful to share project results with interested community members.
- The MCSC Open House was held on Sept 8th and the project had an educational booth for visitors. This outreach was very successful.

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 after management actions.
- 3 of 4 bears avoided conflicts after release.
- The management team met to evaluate project activities as needed.
- Management actions proved effective in 2011 and 2012, but needs long-term (min 5 years) monitoring 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, fruit, and fish. 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 to fruit near residences.

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 (Oct 28) (see Figure 3). The bear did stay in cover near the area of release for one day before leaving the valley.

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.

Evaluation:

This bear's response to conditioning was a 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. I also did a telemetry flight to locate this collar before retrieval.

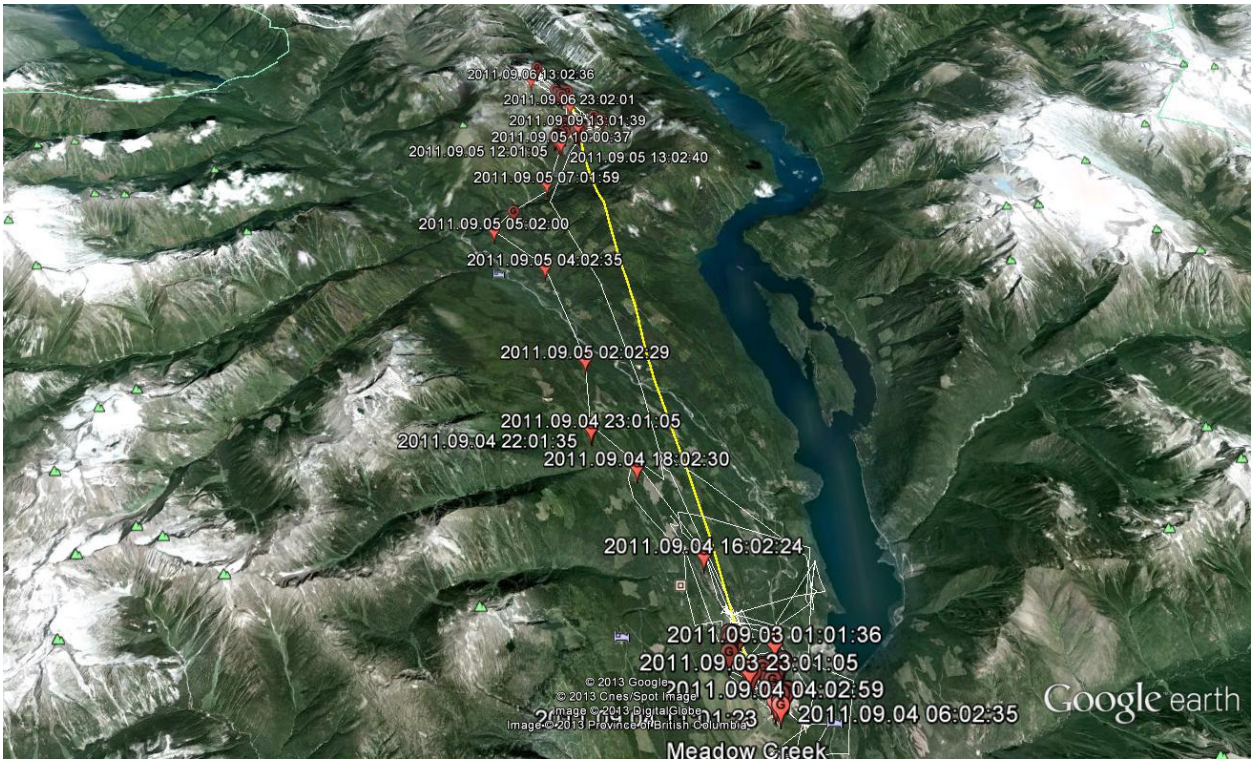

Figure 2: Bear 188 post-management path Sept 4 - 6, 2011. Line distance 27 kms from Meadow Creek to the remote Lake creek drainage.

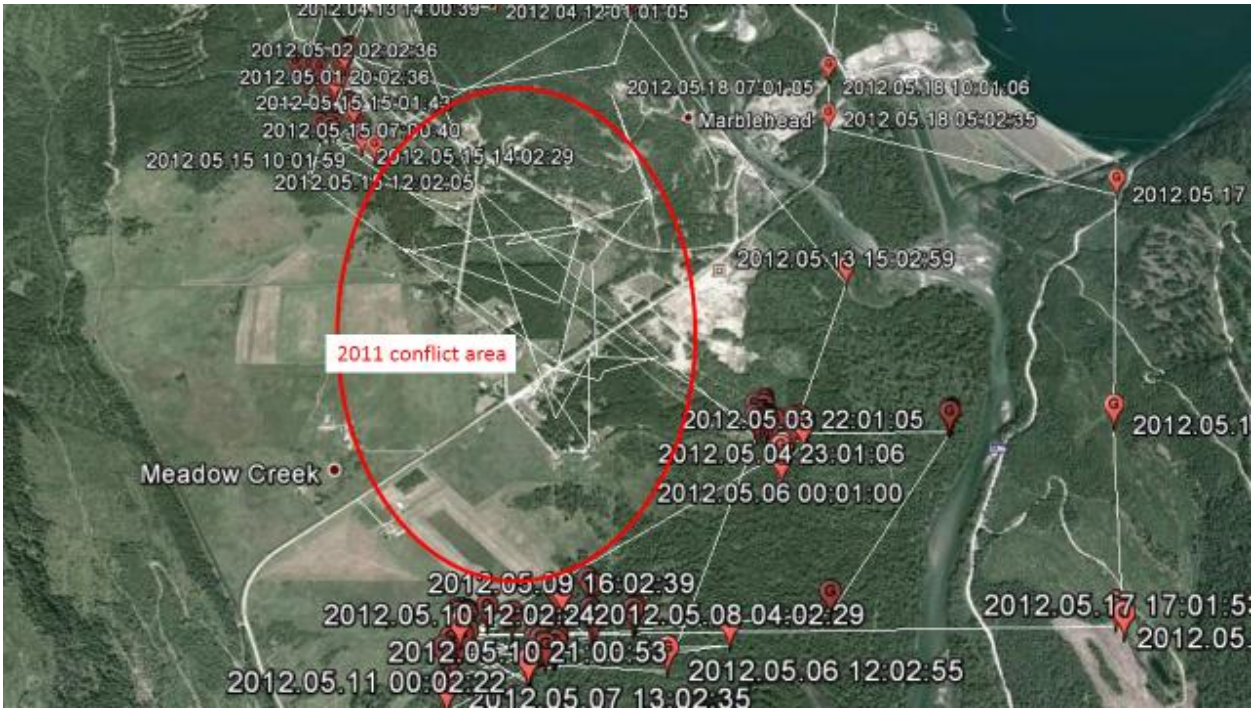

Figure 3: Bear 188, 2012 spring movements around Meadow Creek. Note use of area while avoiding residences and area of 2011 conflicts. Bear was not seen throughout this period (May 1 - 18, 2012).

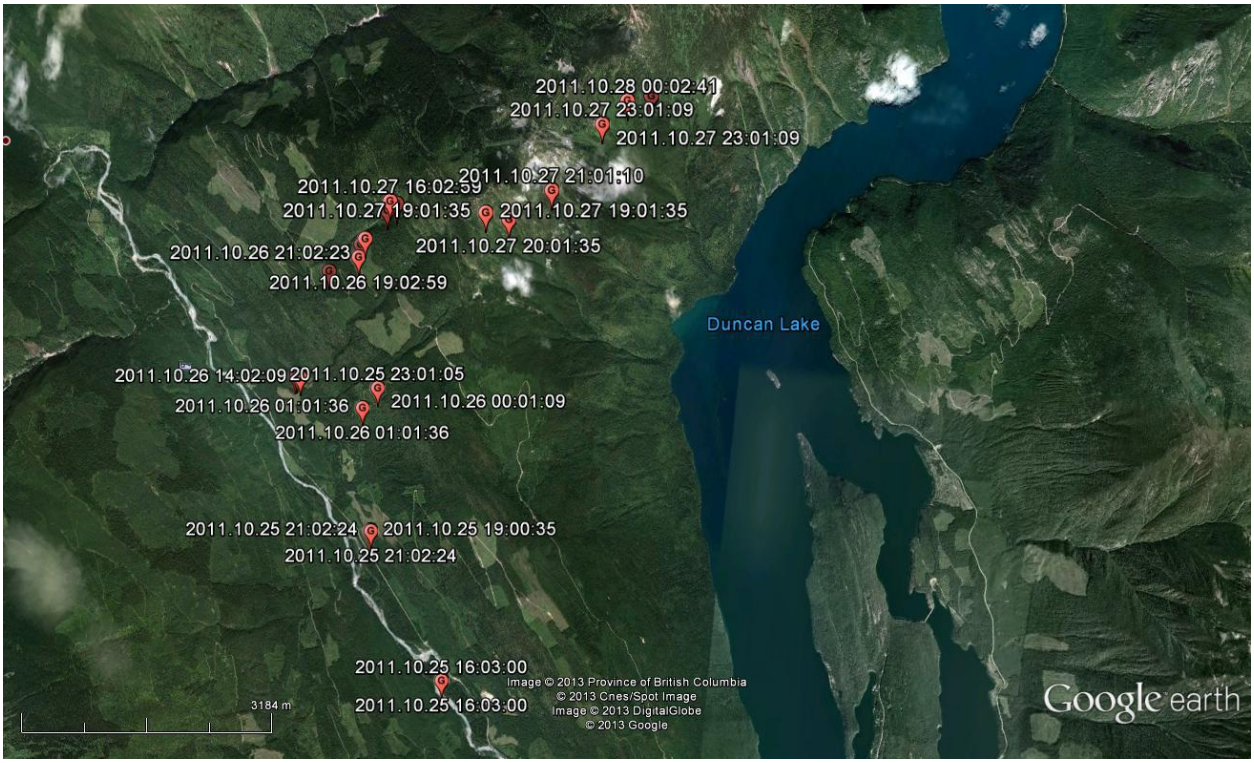

Figure 4: Bear 222 after release and going to den up Howser Ridge.

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 1 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.

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. It seems that he 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 on the Argenta Flats. 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. I 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 (except for the 1 unknown sheep killer, who is thought to have been this bear). 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 3 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 my hope that residents will have learned how to protect their livestock and no new bears learn this behaviour.

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

- This objective is long-term and more insight will be gained over time.
- Low sample sizes of management bears may not 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 in Provo, Utah, USA.
- This project report will be made available to COS and other government agencies
- A Final Project Report in the project's fifth year will evaluate the project's successes and failures and make recommendations on less-lethal management techniques for wildlife management agencies.

Discussion

Grizzly bear mortality due to conflicts is decreasing

Historical (1967-2005) grizzly mortalities due to conflicts are 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). Since 2007 the known rate of mortality seems to be dropping; 2 male grizzly bears shot by COS in April 2007, 1 male grizzly bear shot by resident in Oct 26, 2010, 1 male grizzly bear shot by resident Dec 2, 2013, for a total of 4 bears over 6 years. The 2007 bears and 2013 bear were shot due to conflicts with livestock.

DNA results

Through the relatedness (father-mother-offspring triads) of the 23 individual 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 matings with 5 female bears (offspring are confirmed products of these matings 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 4 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 (not "Big Daddy"); possibly her father or brother.

Analysis suggests that potentially 3 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 5).

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 are included on pg. 14 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 also to be maintained regularly. The use of electric fencing has increased in Meadow Creek and area through a cost subsidy 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 hassle 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 which 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 21 grizzly bears used the Meadow Creek flats without conflicts with people in 2011-2013.

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 5 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. Sub-adult bears are newly independent and 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 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, there could also be more bears gaining safe access to Kokanee at MCSC. This 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 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 they can be aggressive if they feel they or their cubs are threatened. Lines of sight at MCSC are very tight due to thick brush on either side of the channel, which increases the likelihood of surprise encounters.

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). 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 more close interactions 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 participants were uncomfortable with grizzly bears in people's yards and want bears to respect peoples' space around homes and especially near Jewett School. It seems that bears are becoming and likely will become more habituated to humans at MCSC through increased bear viewing at this location. Bears that are habituated at MCSC (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 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 will be 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.

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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 behavior. 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.