Grizzly bear toe amputation due to seasonal overlap with furbearer trapping in southeast British Columbia

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Abstract

Science and adaptive management form crucial components of the North American model of wildlife management. Under this model, wildlife managers are encouraged to update management approaches when new information arises whose implementation could improve the stewardship and viability of wildlife populations and the welfare of animals. Here we detail a troubling observation of multiple grizzly bear toe amputations in southeast British Columbia and assemble evidence to inform immediate action to remedy the issue. During the capture of 59 grizzly bears in southeast British Columbia, we noticed that four individuals (~7%) were missing some or all their toes on one of their front feet. The wounds were all well healed and linear in nature. Further opportunistic record collection revealed that this pattern of missing toes occurred beyond our study area, and that furbearer traps were responsible for toe loss. We documented a problematic seasonal overlap between the active season for grizzly bears and the fall trapping seasons for small furbearers with body grip traps and for wolves with leghold traps. Instead of opening these trapping seasons on or prior to November 1, when more than 50% of bears are still active, we recommend delaying the start of these seasons until December 1, when most bears have denned. Innovative solutions, such as narrowing trap entrances to exclude bear feet while still allowing entrance of target furbearers, have the potential to minimize accidental capture of bears but the effectiveness of these approaches is unknown. Solutions that do not involve season changes will require monitoring of efficacy and compliance to ensure success.

Identifying an Issue

Grizzly bears (*Ursus arctos*) are wide-ranging mammals that are highly motivated to rapidly ingest high-energy foods in preparation for denning. This is especially true for females who give birth and lactate in the den. In the Rocky Mountains, grizzly bears occupy large home ranges (200-1300 km^2) where they search for mates and seasonal foods (McLellan 2011, Graham and Stenhouse 2014). Key natural foods for grizzly bears include high calorie fruits, abundant herbaceous vegetation, ungulates (killed or scavenged), ants, and roots (McLellan and Hovey 1995, Munro et al. 2006). In addition to these natural foods, grizzly bears are well known

to take advantage of poorly managed human foods such as residential fruit trees, garbage, roadkill, grain, and livestock (Craighead and Craighead 1972, Lamb et al. 2017, 2019, Morehouse et al. 2020). This food-motivated behaviour is generally adaptive and allows grizzly bears to increase their weight by about 35% in the 6-8 months of non-denning season (McLellan et al. 2012), but coexistence with bears can be challenging when bears are attracted to, and allowed to feed on, human-sourced foods (Lamb et al. 2020).

The challenges to human-bear coexistence are exacerbated when high-density grizzly bear populations co-occur in human settled areas with abundant natural foods and accessible human-sourced foods. One area that fits this description well is the southeast corner of British Columbia (BC), Canada. This region is home to high-density grizzly bear populations, productive habitat, and growing rural and urban communities. In response to observed grizzly bear population declines, ecological trap dynamics, and high mortality rates in this area (Lamb et al. 2017, 2019, 2020), we initiated a radio collaring project to better understand sources of grizzly bear mortality and examine how animals' use of the landscape influenced population dynamics. Between 2016 and 2020, we captured and radio collared 59 grizzly bears in the Elk Valley (near Fernie, BC, see Fig 1A). Here we focus on a particular observation from this live capture work that has important animal welfare ramifications: several of the bears we caught were missing toes. This observation is important because ethics and values have a major role in wildlife management in British Columbia and resulted in closing a decades-long sustainable grizzly bear hunt in 2018, despite a large and viable population (Auditor General 2017, McLellan et al. 2017, Hatter et al. 2018).

Like humans, grizzly bears have twenty digits. While capturing bears, we noticed that multiple bears were missing some or all the toes on one of their front feet (Fig 2). Of the 59

individual bears we captured, 4 (~7%) were missing digits. In all cases, the toes lost were adjacent and terminated in a linear plane, and the amputation had healed. Based on radio collar telemetry data, these animals moved in a similar fashion to bears with all their digits, and the loss of digits did not appear to impact their locomotion. However, it may have influenced conflict behaviour, which was common in these animals; 75% of the animals that were missing toes were involved in human-bear conflicts. One of these four bears was killed shortly after capture while breaking into a rancher's calf pen, another was likely involved in an attack on a human, and a third was captured by conservation officers in late fall after complaints of bear issues on a farm. While the sample size for this conflict behaviour is small, less than 30% of the toe-bearing sample (n=55) died or were involved in conflict during the time they were collared. While we had identified a concerning trend of missing bear digits, the healed wounds left us little evidence of the cause of the lost toes.

Searching for Cause

Southern British Columbia is fortunate to have a long history of people interacting with grizzly bears through grizzly bear research, human-wildlife conflict work, hunting, guide outfitting, and trapping. After identifying the missing toe issue, we spoke with First Nations, scientists, conservation officers, wildlife managers, guide outfitters, and trappers, all with lifetimes of experience on this land. A common topic in these discussions was grizzly bears being incidentally caught in baited traps set for furbearers, particularly in traps set for marten (*Martes americana*) and wolves (*Canis lupis*).

We were aware that grizzly bears could become stuck in leghold traps set for wolves, given that in recent years several bears have been either killed in, or required release from, wolf

traps in southern British Columbia. However, we were less familiar with the role that body grip traps could play. Body grip traps are killing traps designed for small furbearers such as marten, skunk (*Mephitis mephitis*), fisher (*Pekania pennanti*), weasel (*Mustela sp.),* and muskrat (*Ondatra zibethicus*) (Fig 2). These size of body grip trap used to capture these species is commonly referred to as a 120 conibear; however, humane trapping requirements legislate the use of a variety of trap manufacturers and models for trapping in BC, which ensures the strongest and most reliable devices are used to ensure a humane kill (Province of British Columbia 2021), so we will collectively refer to this style of trap as a body grip trap. In our region of interest (Fig 1) these small body grip traps are most often used to capture marten and weasels and are set at the mouth of a baited wooden box that is affixed to a tree approximately 6 feet off the ground.

In the spring of 2018, we deployed four body grip traps, complete with their boxes and bait (usually a small piece of meat), on trees in grizzly bear habitat. These traps were wired in such a way that they could fire but not close and trap the bears. We monitored these traps with remote cameras for approximately two weeks to see if bears would visit and spring the traps. Grizzly bears visited all four traps and sprung two of them. Pictures and videos showed bears investigating the traps and manipulating the boxes with their paws (Fig 3). Video showed that one of the traps was set off with a bear's nose. The cause of the other trap being set off was not determined because we only had pictures of bears investigating the trap, but no video. Although this was a small-scale trial with low sample sizes, younger bears seemed to investigate and set off the trap more often than older bears. Even with the small sample, it was clear that baited traps attract bears and that bears will set off these traps as they try to get the bait.

We became more convinced that furbearer traps were the cause of the missing toes by accumulating anecdotes and photo evidence from the area of grizzly bear feet stuck in traps (Fig

2). Photos came from hunters, remote cameras on ranches, and conservation officers, and they all told a similar story—a body grip trap was affixed just behind the toes and amputation of the toes was underway. In addition to the records of body grip traps on bears' feet in southeast British Columbia, photos of a grizzly bear with a body grip trap on its foot were reported in Wyoming, USA in 2017 (McKim 2017). We were also aware of multiple reports of grizzly bears being caught in leg-hold traps set for wolves, and we believe this is another possible source of toe loss. At least five grizzly bears in southern British Columbia have been released by conservation officers and scientists from wolf traps in the fall between 2010 and 2020, and the bears were often caught right behind the toes. However, in the records we were able to collect, body grip traps were the most common trap on bears' feet where it was clear that the trap was the cause of toe loss. Beyond identifying a likely cause for the missing toes, the photo evidence and information from people out on the land revealed that bears with traps stuck on their feet and missing toes was an issue beyond the extent of our Elk Valley study. This was at least an issue across southeast BC (also known as the "Kootenays"), and perhaps beyond, as evidence by the Wyoming observation (Fig 1A).

We heard from some trappers that they would voluntarily delay the start of their marten trapping (which legally opens November 1, Province of British Columbia 2021) to avoid bears wrecking their trap sets, confirming that bears can be attracted to these common sets. In one case, it is suspected that a bear's foot became stuck in a body grip trap set on the ground for skunks on private property. However, given the near ubiquity of marten trapping with box traps across our area, and the broad occurrence of missing toes and traps on feet, we focus on marten and weasel trapping as likely sources of the majority of the body grip traps that end up on bear feet.

The bears we captured with missing toes had well-healed wounds. These animals were all 12 or fewer years old and were as young as 4 (ages: 12, 11, 8, and 4). The age of bears opportunistically found with traps on their feet was often unknown, but in one case the bear was still with its mother and likely less than two years old (Fig 2fi). We also observed young bears being especially curious around our trial traps, and a young bear (~2 to 3 years old and still with a sibling) set off one of the traps (Fig 3). Collectively these results suggest that the loss of digits likely happens early in life (1-5 years old).

Our study focused on capturing bears near human settlement, so we are unsure if the pattern we found is related to the animals' close proximity to people; however, the rate of toeless bears appears to be lower for adjacent research projects that capture bears in more remote areas. Collaring projects in the more remote southern Selkirk and Purcell Mountains (near Nelson and Creston, Fig 1A) between 2004 and 2018, and in the Flathead Valley (southeast of Fernie, Fig 1A) between 1978 and 2020, captured 72 and 206 grizzly bears respectively. One captured adult male bear of 20 (5%) captured in the Purcell Mountains fit the pattern of having well-healed missing toes, while none of the 52 bears captured in the Selkirk Mountains had missing toes. This pattern is consistent with the suspected trapping pressure in these areas, where trapping is more common on provincial lands in the Purcells, while most animals in the Selkirk work were captured on private agricultural or conservation land where trapping is less common. However, grizzly bears were accidently captured by trappers in leghold traps set for wolves on at least three occasions during the Selkirk/Purcell study. No evidence of toe loss because of incidental grizzly bear capture in legholds was reported. None of the bears captured in the Flathead Valley were known to be missing toes, but a hunter killed a bear just north of the Flathead study area with a body grip trap on its foot (Fig 2E). Although not related to toe loss, at least three grizzly bears in

the Flathead study and one in our Elk Valley study were caught around the neck with spring activated, cable snares set for wolves. Of these, one died, one was immobilized by conservation officers and released, and two broke away with the snare and a non-slip cable lock attached. Most bears in the Selkirk/Purcell and Flathead projects were caught in more remote areas, and those caught closer to people were in the Creston Valley which is largely converted to agriculture and private land where furbearer trapping is less common.

One explanation for the pattern we observed could be that trappers trap close to towns, when they can, such as in the Elk Valley, early in the season prior to fur quality being ideal. Although higher elevation areas would be more ideal to trap during this time, these areas are often too snowy to reach by quad/truck, but not quite snowy enough for a snowmobile. By the time trappers are utilizing more remote areas further from home the majority of bears have denned. The collared bears in the Flathead and Elk Valley use low elevation valley bottoms well into November prior to denning, increasing the potential for overlap with trapping activities in valley bottoms. Unsecured attractants such as apple trees, garbage, roadkill, and livestock may increase bear use of low elevation areas, delay denning (one Elk Valley female with cubs remained active in the valley bottom until Dec 11, 2020), and perhaps increase the chance of overlap with trapping activities. Finally, an additional piece of evidence supporting the idea that the fall active season for bears and trapping seasons are the main issue, is that we have not seen similar issues in black bears, which den several weeks earlier than grizzly bears and would thus be less exposed to traps.

Widespread observations of bears stuck in body grip traps and the occurrence of missing toes have mainly been in the last 10-20 years. This pattern could be related to the increase in grizzly bear research and monitoring, but the opportunity to identify such issues had been

abundant for many years prior as many bears were captured by conservation officers and harvested by hunters. It is possible that the increased use of stronger traps, as mandated by evolving human trapping standards, has created a situation where bears now have more difficulty extracting themselves from body grip trap when captured.

Honing a Solution

Most fur trapping is done in winter when underfur is dense and guard hairs are long. Given that grizzly bears hibernate for the winter, trappers should generally be able to avoid accidently catching bears. However, some trapping seasons open in late fall, such as the marten season in much of British Columbia which opens November 1 and extends to February 15. Reducing the overlap between the bear active season and trapping seasons is one solution to reducing the loss of bear toes and allowing trappers to not lose their traps and have their sets destroyed. This solution has been previously used in southeast British Columbia used to avoid catching and killing bears in neck snares set for wolves, an issue first documented by the Flathead project.

We summarized the den entry and exit dates for 61 animal-years in the Elk Valley to assess when bears were denning in the fall. We found that the median den entry date (i.e., the date when 50% of bears had denned) was November 06, and the 95th quantile of den entry was November 22, revealing a critical 3-week period of overlap between active bears and the trapping season. We found no overlap between den emergence and the end of the trapping season; thus we focus on fall trapping as the source of the issue. Shifting the start of most trapping that overlaps with, and could attract bears, to December 1 would essentially eliminate this overlap.

Indeed, such a change to the regulations was proposed in 2019 but was not implemented. Much of the trapped landscape within the Kootenays is in rugged mountainous terrain and many trappers, especially in the west Kootenays, reported that they were effectively unable to access their traplines for much of the winter beginning in early December due to high avalanche risk and associated safety concerns. The trappers reported they did most of their trapping in early December or before, and that shortening the season to December 1st would remove their ability to harvest marten from their trapline. As a result, provincial biologists implemented a condition on all active trapping licenses within the Kootenay region stipulating that, beginning in 2021, all body grip traps set for marten during the month of November must be enclosed in a box with an opening no larger than 3 ½ inches. This narrowed entrance was thought to be narrower than most bear paws. The updated licenses also recommended using these enclosed boxes when setting similarly sized killing traps for other species on dry ground prior to December 1st. The efficacy of the modified enclosure in eliminating bear toe loss has not yet been tested, but these modified marten trap boxes are believed to be sufficient to ensure grizzly bears are not able to access a set trap if implemented by all trappers. Given that there is more uncertainty in the effectiveness the modified enclosure approach compared to a change in seasons, we recommend that compliance and efficacy is monitored to ensure this intervention is effective and uptake is high. Such monitoring would allow for adaptive management and changes to the approach as needed and ensure a successful outcome for bears and trappers alike.

Taking evidence through to action is at the heart of the North American model of wildlife management. Further, the ethics of wildlife management practices is extremely important. Managers should prioritize the well-being of wildlife, target and by-catch, above commercial or recreational gain. Here we document a troubling animal welfare issue where grizzly bears are

facing toe amputation after becoming stuck in baited furbearer traps. The timing of furbearer seasons in the primary issue, whereby trapping seasons open weeks before all bears have denned, creating a problematic period of overlap between active bears and baited traps. We provide evidence of the issue, solutions to immediately remedy, and ultimately urge immediate action.

Data Availability

All analyses and supporting data can be found at https://github.com/ctlamb/Grizzly-MissingToes

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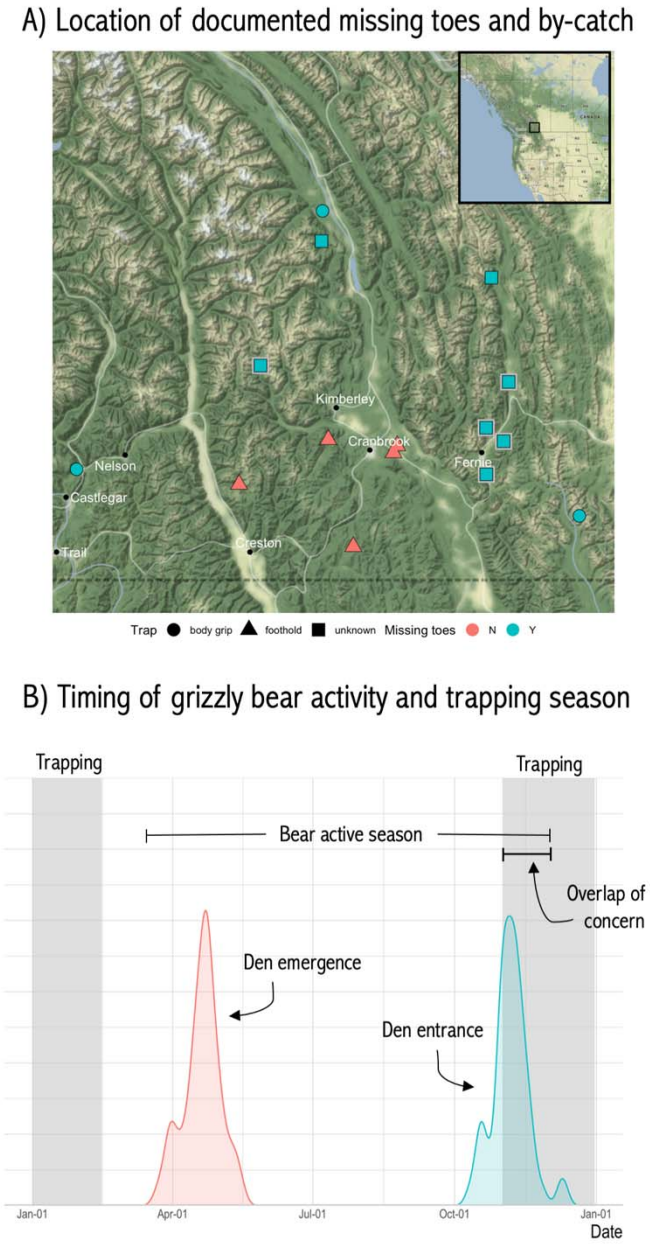


Figure 1. A) Location of missing toes and bears with traps on their feet detected through research (outlined in grey), and opportunistically gathered detections in southeast British Columbia (not outlined in grey). This area is part of the homelands for the Ktunaxa Nation, and is also referred to as the Kootenays. B) Grizzly bear active season, defined from 61 collared bear den emergence and entrance times. Marten trapping season (November 1- February 15) shown in grey. The 95th percentile of den entrance dates was November 22. We suggest that December 1 represents an evidence-based start date for trapping to reduce conflicts between bears and trappers.

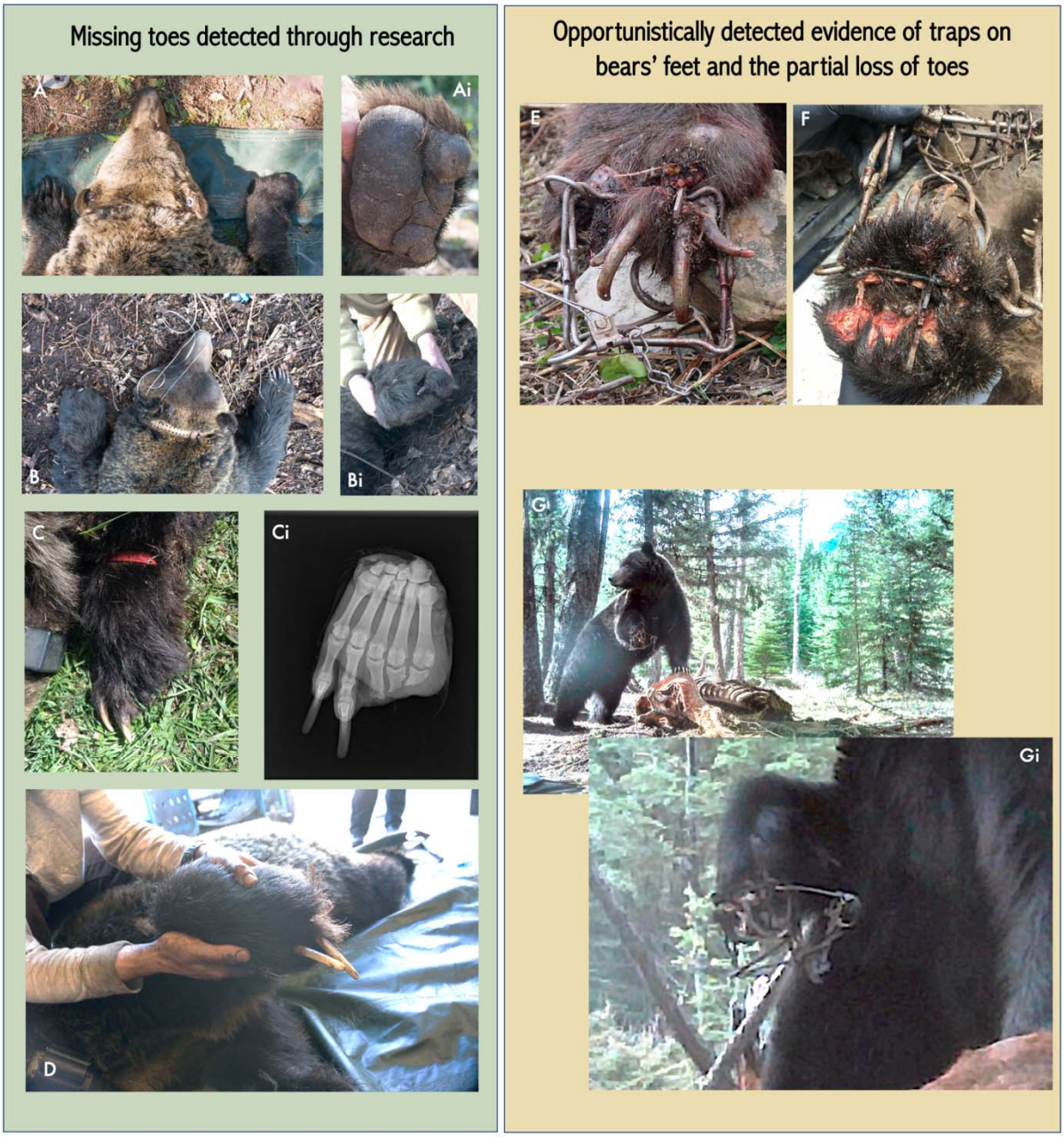
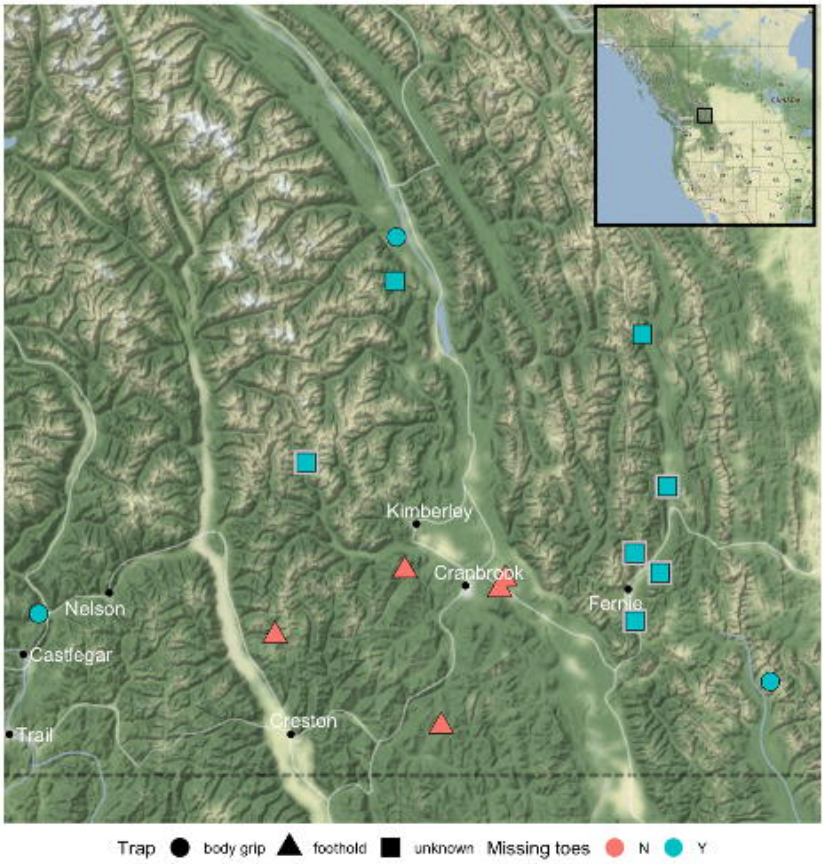


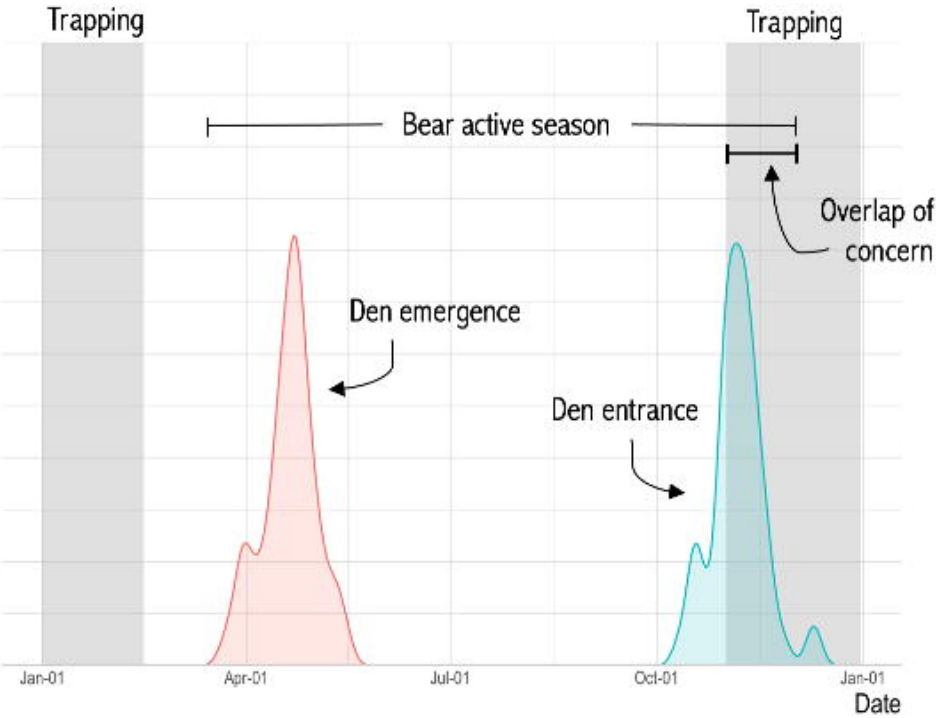
Figure 2. Animals detected with missing toes through research captures in the Elk Valley (A-D), and opportunistic evidence of bears with traps on their feet (E-G). Each letter in A-D represents one of the four unique individuals detected with missing toes. Ci shows an X-ray of the foot of EVGM55, who was killed in a conflict with a cattle rancher. E) a body grip trap on a hunter-killed grizzly bear foot from the Flathead Valley, F) paw of a 1-year-old grizzly bear stuck in a body grip trap captured by conservation officers near Pass Creek due to conflict behaviour from a mom and offspring. Significant infection was present, and the toes had nearly completely separated from the foot by the time of capture, G) a bear with a body grip trap on its foot detected by remote camera west of Invermere feeding on a cow carcass.

Figure 3. Grizzly bears detected at trial marten body grip traps set for two weeks in areas frequented by bears. Investigatory behaviour was common, and two of the four deployments were set off (wired so they could spring but not close on bears feet).

A) Location of documented missing toes and by-catch



B) Timing of grizzly bear activity and trapping season



Missing toes detected through research

Opportunistically detected evidence of traps on bears' feet and the partial loss of toes

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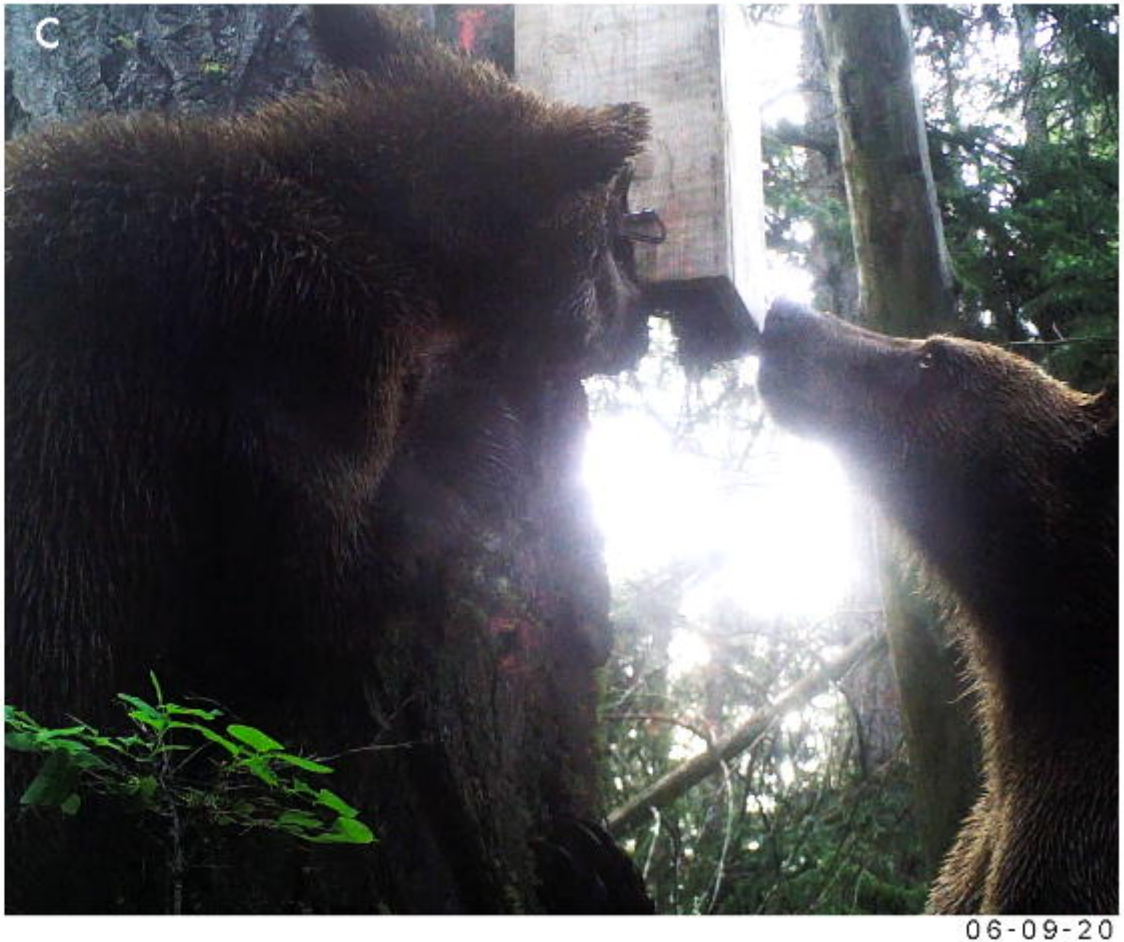
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