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 well-being of animals. Here we detail a troubling observation of toe amputations from several grizzly bears in southeast British Columbia and assemble evidence to inform immediate action to remedy the issue. During the capture of 59 grizzly bears, 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 (McLellan 2011). 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 (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 2011), 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 ramifications: several of the bears 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 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. At the time of their capture, these animals were all 12 years old or younger (ages: 12, 11, 8, and 4). Three of the four bears we captured with missing toes were male, while the larger collar sample had slightly more females (n=31) than males (n=28). The female with missing toes was captured with a yearling cub, suggesting that missing toes did not preclude reproduction. Based on radio collar telemetry data, these animals moved in a similar fashion to bears with all their digits. While the loss of digits did not appear to impact their locomotion, it may have influenced conflict behaviour, which was common in these animals; three of the four 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 lupus*).

We knew that grizzly bears could become stuck in leghold traps set for wolves, given that in recent years several bears had either been killed in, or required release from, wolf traps in southern BC; however, we were less familiar with the role that body grip traps could play. Body grip traps are killing traps designed for furbearers such as marten, skunk (*Mephitis mephitis*), fisher (*Pekania pennanti*), weasel (*Mustela sp.),* muskrat (*Ondatra zibethicus*), beaver (*Castor canadensis*), bobcat (*Lynx rufus*), and lynx (*Lynx canadensis*) (Fig 2). Trapping legislation in BC allows for the use of a variety of trap models made by different manufacturers, provided the devices reliably and humanely kill their target species (Province of British Columbia 2021). In our region of interest (Fig 1), small body grip traps (commonly referred to as 120 conibear traps) are most often used to capture marten and weasels, and they are typically set at the mouth of a baited wooden box that is affixed to a tree at a height of approximately 1.5 meters from 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 in the Elk Valley. We wired the traps in such a way that they could fire but not close and trap the bears. We monitored the 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, but the cause of the other trap being set off could not be determined because we only had pictures, not video, of bears investigating the trap. Although this was a small trial with low sample sizes, younger bears seemed to investigate and

set off traps more often than older bears. Even with the small sample, it was clear that baited traps attracted bears and that bears set off the traps as they tried to get the bait. We heard from some trappers that they voluntarily delayed the start of their marten trapping season (which legally opens November 1, Province of British Columbia 2021) to avoid having bears wreck their trap sets, further confirming that bears are attracted to these common sets.

We became more convinced that furbearer traps were the cause of the missing toes as we accumulated 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 suggested the same mechanism – a body grip trap was affixed just behind the toes and amputation of the toes was underway. 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. In addition to the records of body grip traps on bears' feet in southeast BC (also known as the "Kootenays"), photos of a grizzly bear with a body grip trap on its foot were reported in Wyoming, USA in 2017 (McKim 2017), and brown bears with body grip traps on their feet are observed almost every year in Finland (Kai-Eerik Nyholm pers. comm.).

We were also aware of multiple reports of grizzly bears being caught in leghold traps set for wolves, and we believe this is another possible source of toe loss. Between 2010 and 2020, at least five grizzly bears in southern BC were caught in wolf leghold traps (with the trap often closing right behind the toes) and had to be released by conservation officers and scientists. 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. 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, but 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.

We compiled data from collaring projects in adjacent areas to assess if a broader pattern of missing toes could be revealed. Collaring projects in the 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. Of the 20 bears captured in the Purcell Mountains, one adult male bear (5%) fit the pattern of having well-healed missing toes, while none of the 52 bears captured in the Selkirk Mountains had missing toes. However, grizzly bears were accidently captured by trappers in leghold traps set for wolves on at least three occasions during the study in the Selkirk and Purcell Mountains, but no evidence of toe loss due to incidental grizzly bear capture in legholds was reported. None of the bears captured in the Flathead Valley were known to be missing toes; however, a hunter killed a bear just north of the Flathead study area with a body grip trap on its foot (Fig 2E). Results from these adjacent studies did not reveal any general insights into the observed spatial distribution of missing toes. Such a pattern is not surprising given that traplines in British Columbia are distinct areas trapped exclusively by registered trappers. Variation in trapping intensity, target species, and timing creates variable exposure of bears to body grip traps across the landscape. Additionally, unsecured attractants such as apple trees, garbage, roadkill, and livestock may increase bear use of low elevation areas and delay den entry perhaps increasing the chance of overlap with trapping activities in these areas.

Observations of bears stuck in body grip traps and bears with missing toes have mainly been documented in the past 15 years and are not restricted to a single area or trapline, but rather

occur broadly at low frequency across the Kootenays and beyond. This increased prevalence could be related to an increase in grizzly bear research and monitoring; however, opportunities to identify these issues have been abundant for several decades as many bears were captured by conservation officers, harvested by hunters, and monitored for research purposes in the Flathead. It is possible that in recent years the increased use of stronger traps, as mandated by evolving humane trapping standards, has created a situation where bears now have more difficulty extracting themselves from body grip traps when captured.

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 the median den entry date (i.e. the date when 50% of bears had denned) was November 6, 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. More support for the idea that the concurrence of the fall active season for bears and the beginning of the trapping season is the main issue, is that we have not seen similar problems of missing toes in black bears, who den several weeks earlier than grizzly bears and would thus be less exposed to traps.

Honing a Solution

Most trapping of furbearers 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 begins November 1 and extends to February 15. Reducing the overlap between the bear active season and the trapping season is one way to

minimize the loss of bear toes and prevent trappers from losing their traps and having their sets destroyed by bears. Shifting the start of most trapping that coincides with the active bear season from November 1 to December 1 would essentially eliminate overlap between trapping and bears. This solution has been previously used in southeast British Columbia to avoid catching and killing bears in neck snares set for wolves, an issue first documented in the Flathead project.

Indeed, such a change to the regulations to address the missing toe issue was proposed in 2019 but was not implemented. Much of the trapped landscape in the Kootenays is 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 stated they did most of their trapping in November and early December, and that shortening the season by delaying the opening date to December 1 would largely remove their ability to harvest marten from their trapline. As a result, provincial biologists implemented a condition on all active trapping licenses in 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 constricted entrance was thought to be narrower than most bear paws. The updated licenses also recommended that, prior to December 1, trappers should use these same boxes to enclose similarly sized killing traps set for other species on dry ground. The efficacy of the modified enclosure entrance 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. Given there is more uncertainty in the effectiveness of the modified enclosure approach than there is in delaying the start of the trapping season, 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 to ensure a successful outcome for bears and trappers alike.

Trappers have a long history of supporting conservation efforts and are sentinels of changing landscapes and wildlife populations. However, trapping of furbearers in British Columbia has become an increasingly vulnerable policy amidst shifting sociopolitical trends in society. Therefore, bold and novel strategies will be required from trapping organizations to maintain public support while also recruiting and retaining the next generation of trappers. A tactful strategy to uphold public support is to proactively assess and react to emerging evidence that threatens social acceptance of trapping (e.g., grizzly bears missing toes), and where changes could help increase the well-being of animals. This approach is the backbone of the North American Model, and while emerging evidence or science can sometimes conclude no direct threat to wildlife populations — organizations must equally weigh social ramifications and understand that the future of trapping may be predicated more on social support than consensus over sustainability. Here we document a troubling issue where grizzly bears are facing toe amputation after becoming stuck in baited furbearer traps. The timing of furbearer seasons is the primary issue, with trapping seasons opening weeks before all bears have denned, which creates a problematic period of overlap between active bears and baited traps. We provide evidence of the issue, solutions to remedy it, 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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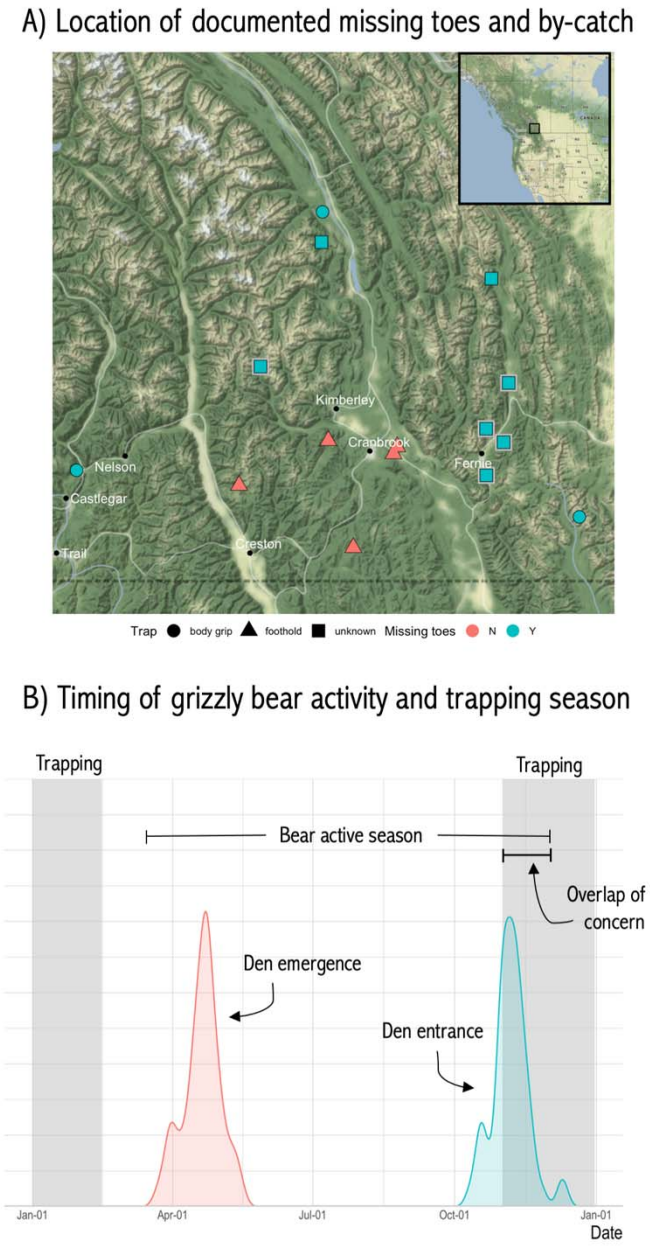

Figure 1. A) Locations of observations of bears with missing toes and bears with traps on their feet. Detections made through research are outlined in grey, while detections opportunistically gathered throughout southeast British Columbia are not outlined in grey. This area is part of the homelands for the Ktunaxa Nation, and is also referred to as the Kootenays. B) The grizzly bear active season, defined from 61 collared bear den emergence and entrance dates, with the marten trapping season (November 1 to 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.

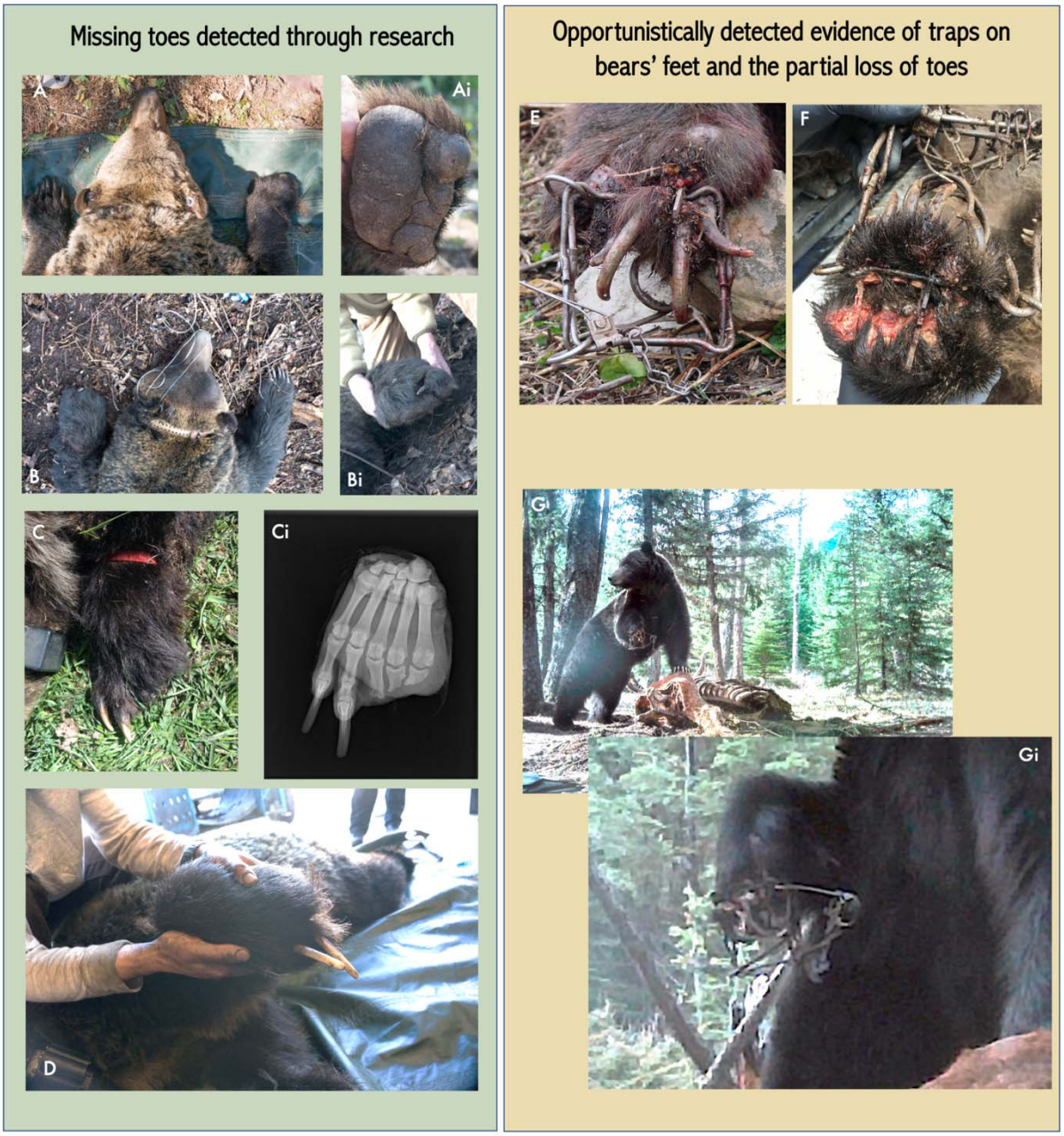

Figure 2. Animals detected with missing toes through research captures in the Elk Valley (A-D), and opportunistic evidence of grizzly bears with traps on their feet (E-G). Each letter in A-D represents one of the four unique individuals detected with missing toes. Ci shows an X-ray of the foot of EVGM55, who was killed in a conflict with a cattle rancher. E) a body grip trap on the foot of a hunter-killed grizzly bear from the Flathead Valley, F) the 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, and G) a grizzly bear with a body grip trap on its foot detected feeding on a cow carcass by a remote camera west of Invermere.

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