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Bucket Cable Trap Technique for Capturing Black Bears on Prince of Wales Island, Southeast Alaska

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Alaska Department of Fish and Game Division of Wildlife Conservation

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Bucket Cable Trap Technique for Capturing Black Bears on Prince of Wales Island, Southeast Alaska

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Abstract

American black bears *(Ursus americanus)* are commonly captured for research projects across North America. Various capture techniques are deployed depending on variables unique to a particular study. Researchers are continually developing improvements, modifications, or entirely new equipment to increase efficiency and maximize safety for both humans and animals. From 2009 to 2012, we captured 55 black bears on Prince of Wales Island in Southeast Alaska using a modified Aldrich M-15 bucket cable snare system. These captures were conducted in association with a larger research project investigating seasonal movements, home range, habitat selection and denning characteristics of coastal Alaskan black bears. We chose to use the M-15 system (bucket cable trap) based on cost, portability, and species selectivity. With gradual technique modifications, we increased our catch rate and efficiency from 214 trap days per bear, and 11% tripped traps resulting in a successful capture (success rate) to 2.9 trap days per bear and 88% success rate with the bucket cable trap. There were 2 capture mortalities (3.6%) over the course of the study. Factors which likely contributed to increased trapping efficiency were 1) securing the snare cable inside the bucket cable trap with self-adhesive clamps, 2) adequate buttressing of the trap, 3) removing protective plastic tubing from snare cable and 4) keeping the trap free of bait contamination except for the bait on the thrower arm trigger. Factors likely to decrease injuries are 1) minimizing the length of cable extensions, 2) using swivels at cable attachment points to keep cables from twisting and 3) eliminating any frayed cable ends. To eliminate cub mortalities, both trap height above ground and ensuring that there are no natural steps enabling them to insert their head into the bucket are critical. The results described here can serve to guide future researchers desiring safe and efficient methods for capturing black bears.

Key words: *Aldrich, black bear, bucket cable trap, capture, M-15, Prince of Wales Island, snare, Southeast Alaska, trap days, Ursus americanus*

Introduction

This paper describes the techniques we used to capture black bears (*Ursus americanus*) with a modified Aldrich M-15 system, hereafter referred to as a bucket-cable trap. We provide recommendations for increasing trapping efficiency and for reducing trap injuries and mortalities. Finally, through trapping efforts across 3 seasons, we describe what we found to be the best time of year to conduct black bear captures in Southeast Alaska.

Multiple methods for capturing black bears exist but few black bears have been captured for research purposes in Southeast Alaska despite their popularity as a sport and subsistence resource. Black bears are occasionally captured by biologists using culvert traps in urban areas to remove bears that pose a threat to humans. However, culvert traps are not practical for studies in remote locations that require capturing a large number of bears (Powell and Proulx 2003). The Aldrich-style foot snare has been the standard design used for bear captures in parts of North America (Johnson and Pelton 1980) including Southeast Alaska (Flynn et al. 2010, Schoen and Beier 1990, Schoen et al. 1994, Titus et al. 1999). Aldrich-style foot snares are favorable in remote settings because they are inexpensive, lightweight, and easily deployed. However, foot snares have important shortcomings, notably the potential for capturing nontarget species. Sitka black-tailed deer (*Odocoileus hemionus sitkensis)* are an important subsistence species which occur at high densities on Prince of Wales Island (Hasbrouck 2020) and have the potential for incidental catch with ground-set foot snares.

We explored alternative methods for capturing black bears such as the L-83 trap (R. Lemieux and H. Jolicoeur 1984) which can similarly capture animals that are not being targeted. We also considered using the RL04 trap (Lemieux and Czetwertynski 2006), a rubber-padded snare that is selective for bears; however, the RL04 incorporates a drag and spring system which we believed could compromise the safety of researchers in a heavily forested environment such as Prince of Wales Island.

When we began developing capture methods for this study in 2008, we were unaware of any other study primarily using bucket cable traps for black bear research; however, more recently, a few studies have been done (Pfander and Fairbanks 2018; M. Crabb, Arizona Game and Fish, personal communication; C. Westing, Wildlife Biologist, Alaska Department of Fish and Game, personal communication). Bucket cable traps were used for the lethal removal of black bears as part of a predator control program in Alaska during the time of our study (Peltier and Rinaldi 2014.) Bucket cable traps are also used outside of Alaska where lethal black bear trapping by the public is legal (Maine, Saskatchewan, Quebec, Manitoba, Newfoundland, Labrador, Nova Scotia).

Our objectives were to study the seasonal movements, home range, habitat selection, and denning characteristics of coastal Alaskan black bears on Prince of Wales Island (Fig. 1). This study was designed to complement several other species research projects in the same study area during the same time on Prince of Wales Island. All of these research projects were designed to learn more about predator-prey relationships and included research on wolves (Person 2012), black bears (Porter et al. 2020), and Sitka black-tailed deer (Gilbert 2015). Black bears are known predators of deer fawns in other areas (Ozoga and Verme 1982) but their impact on Sitka black-tailed deer is less understood. A method to capture and release healthy bears safely and efficiently that was suitable for research on Prince of Wales Island was needed.

Study Area

We captured black bears on the central portion of Prince of Wales Island in Southeast Alaska, the third largest island in North America. The study area encompassed approximately 1,050 km^2 (400 mi^2), mostly within the Tongass National Forest (Fig. 1).

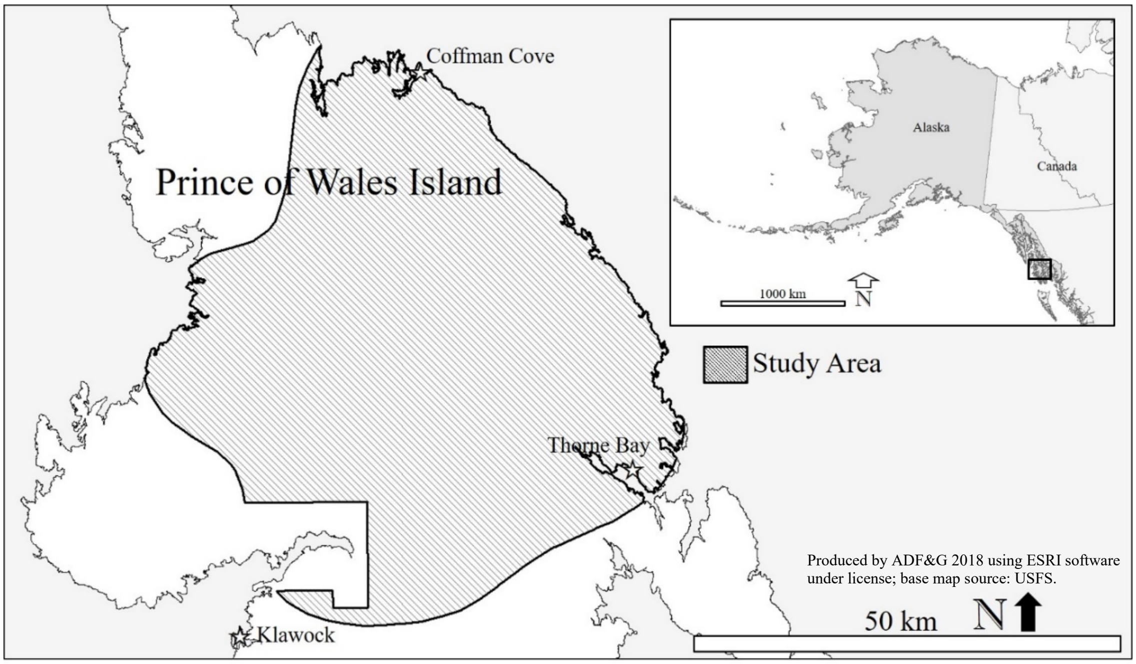

Figure 1. Black bear study area on Prince of Wales Island, Alaska.

Prince of Wales is part of the larger Alexander Archipelago in Southeast Alaska. The archipelago consists of more than 2,000 islands and contains the largest expanse of remaining temperate old-growth forest in the world. It has a maritime climate with mean temperatures ranging from a low of 33°F (1°C) in December to a high of 64°F (18°C) in August. Approximately 254 cm (100 inches) of rain falls in this region annually (Diebel et al. 2020). The dominant habitat type on Prince of Wales Island below 600 meters is temperate rain forest consisting of Sitka spruce (*Picea sitchensis*), western hemlock (*Tsuga heterophylla*), red cedar (*Thuja plicata)*, and Alaska yellow cedar (*Chamaecyparis nootkatensis*). The forest understory community includes blueberry (*Vaccinium* spp.), salal (*Gaultheria shallon*), devil's club (*Oploponax horridus*), and salmonberry (*Rubus spectabilis*; Alaback 1982). Other lower elevation habitats include muskegs, stands of red alder (*Alnus rubra*) and black cottonwood (*Populus balsamifera trichocarpa*) along riparian areas. Mountain hemlock (*Tsuga mertensiana*) dominates the subalpine forest, a timberline band between 500 and 750 meters. Black bears share the island with other large mammals including resident populations of Sitka black-tailed deer and wolves (*Canis lupus*).

The central portion of the island has an extensive system of roads associated with logging activities, creating access to black bear habitat for hunters. Clear-cut logging in this old-growth forest has created a patchwork of different successional stages.

Methods

Capture sessions were conducted during fall (September 2009, August/September 2010, and October 2012) and spring (mid-May to mid-June 2010–2012). The first capture session (September 2009) was a pilot session to determine feasibility. A fall session was not conducted in 2011 due to greater success in the spring sessions. The final capture session (October 2012) was conducted to improve spatial distribution of collared animals in the study area.

Pre-baiting was important for conditioning bears to a site and identifying areas that were likely to result in captures (Johnson and Pelton 1980). Bait sites were selected based on the following criteria: suitable trees to deploy the bucket cable trap, broad spatial coverage within the study area, fresh bear sign, and proximity to a concurrent fawn mortality study (Gilbert 2015). We avoided deploying traps along the most heavily travelled roads to both minimize exposure of captured bears to human disturbance, and for public safety. Bait sites not visited by bears within a few days were abandoned. Sites with regular bear visitation were used as capture sites (Fig. 2). Up to 30 sites were baited prior to the capture session.

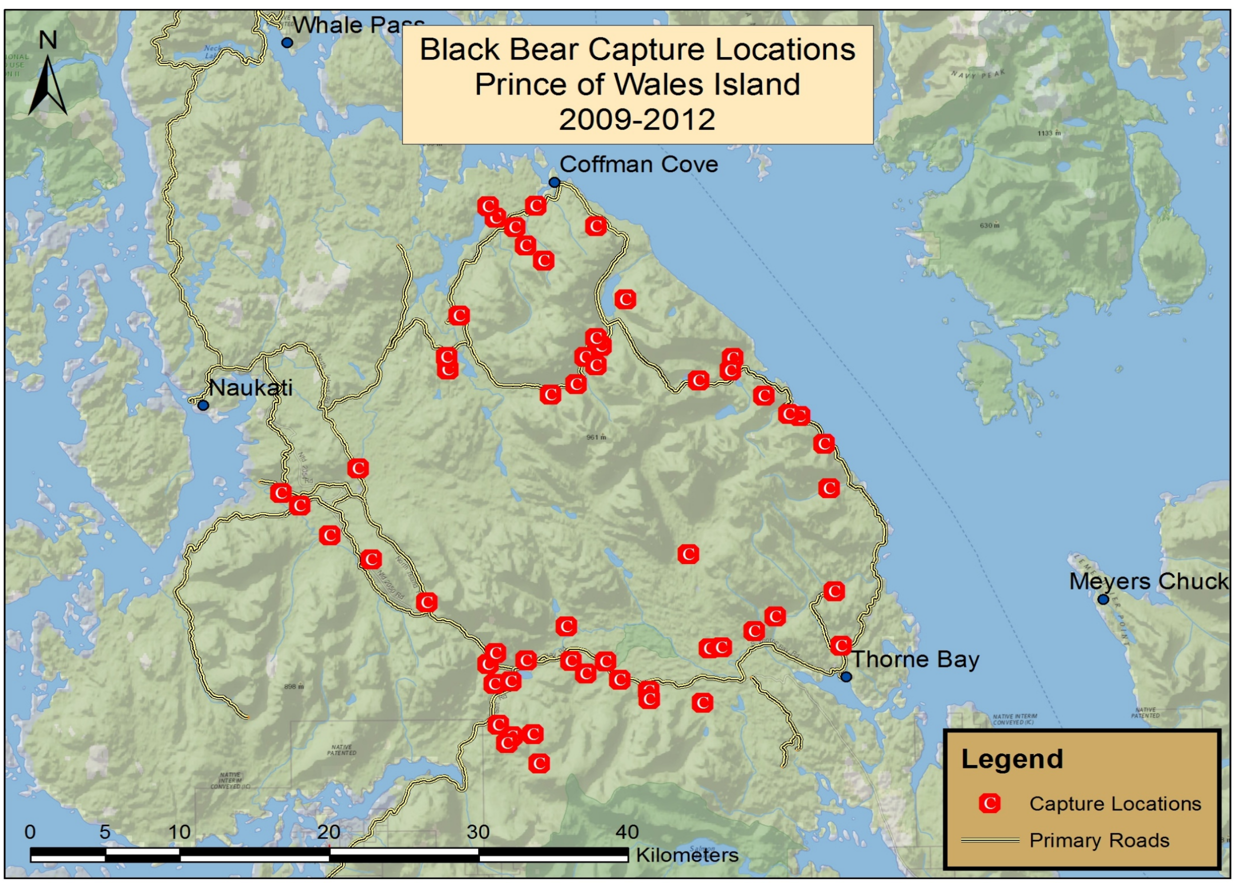

Figure 2. Black bear capture locations on Prince of Wales Island, Alaska, 2009–2012.

Bait consisted of dog food (dry kibble) mixed with frying grease and pancake syrup. Where possible the slurry was placed on top of a tree stump or tossed high on the side of a standing dead tree to better facilitate scent dispersal.

Trap setup and monitoring

Once a capture site was selected, we chose the most favorable tree configuration for a single modified Aldrich foot snare (M-15) 5-gallon bucket system. The preferred configuration was 2 trees that provided a v-notch or parallel support (Fig. 3) that held the bucket tightly (slightly squeezed). Ideal bucket height was approximately 1.5 meters (4.5–5.0 feet) above ground to ensure that cubs could not access the snare, and that average adult bears could reach the trigger mechanism by standing on their hind legs. Bucket sets were stabilized with a 1 × 3 (inch) pine board under the front lip and behind the bucket to reduce bucket flex or movement when bears began exploring the set. Deck screws were used to both fasten boards to trees and attach the boards to the bucket. The bucket was anchored to the support trees on each side with 2 screws going from the inside of the bucket, through the bucket, into each tree.

Figure 3. Bucket cable trap fully deployed and operational.

Figure 4. Hole for trigger assembly and duct tape reinforcement

Figure 5. Hole in bucket for snare cable.

We made several modifications to the bucket for better performance. A 13 cm (5 inch) diameter access hole was cut in the bucket lid for bears to access the trap. Reinforcing the lid with duct tape prior to cutting the hole reduced the plastic lid's tendency to shatter when being cut. This also strengthened the remaining thin brittle plastic. It was important to make the access hole in the bucket only large enough for an average bear's nose but not the entire head, ensuring that the bear could not reach the trigger with its nose, and so avoiding snaring around the nose or head. Trail camera photos suggest that once bears realized they could not reach the bait with their mouth or tongue they reached into the bucket with their front paw. When the thrower fired, it placed the capture cable in optimal position low on the front leg and behind the wrist. The M-15 spring mechanism was wired firmly in place with the trigger mechanism and retaining arm threaded through a small (approximately 2 × 4 cm) square hole cut from the bucket lid (Fig. 4) and the spring and snare thrower sitting on the top side of the bucket. We made small (<0.5 cm) holes on each side of the spring both fore and aft to thread the wire securing the spring to the bucket. Additionally, we secured the spring vertically by wiring the back of the spring to a tree branch or by placing screws in the anchor trees. We cleared all branches that could impede thrower motion which otherwise could result in incomplete tightening of the snare cable and a missed capture. The snare cable was threaded down from the thrower through another square hole in the bucket (Fig. 5) and secured inside the bucket around the perimeter of the hole with self-adhesive electrical cable fasteners (Gardner Bender Kwik Klips, New Berlin, Wisconsin, USA, Fig. 6) to keep it from being jostled out of place during early exploration by bears.

Figure 6. Self-adhesive cable clamps inside bucket lid holding snare cable.

Figure 7. Snare cable attachment to thrower arm.

Care was taken to position the snare cable so the cable would pull directly upward without becoming entangled in any part of the spring mechanism when the thrower was tripped (Fig. 7). The snare cable was attached by a swivel to an extension cable, and the extension cable was attached to one of the anchor trees. We used swivels at all locations where cables connected to avoid cable twisting, reducing possibility of injury. We recommend anchoring the extension cable to trees ≥20 cm (≥7.9 inches), as a captured bear will attempt to chew through the tree and could escape with the cable still attached to its leg. We loosely wired the end of the snare cable or swivel to the thrower arm to ensure that bears would not displace when exploring the trap which could result in a failed capture if the spring were to fire and the snare cable did not tighten. We triple checked that the safety hook was deactivated before leaving a set.

We initially added plastic tubing to the snare cable loop to provide padding similar to the RL04 design. However, this did not allow the snares to fully tighten on the bear's wrist and resulted in missed captures. We found some tripped sets with the snare loop fully tightened to the extent allowed by the plastic padding and hair on the snare. Based on this evidence and trail camera documentation we eliminated the protective sleeve. This reduced the number of times bears would have been able to slip out of the snare and escape.

Bait was placed on the trigger arm toward the back of the bucket. Bait must be placed as far back in the bucket as possible to ensure bears fully extend their paw through the snare loop. Hanging bait consisted of marshmallows and red licorice strips wrapped inside crab bait mesh generously coated with maple icing and was placed inside the bucket on the trigger. We found sweet baits to be most effective at luring black bears during an earlier mark-recapture pilot study (Porter et al. unpublished data). It was important to keep the bucket traps clean and free of bait smells, and to place bait only on the trigger inside the bucket. Bait consistency needed to be thick enough so that liquid did not drip into the bucket. Extraneous scents on the bucket were carefully avoided, as these could cause bears to explore the bucket more, potentially triggering the set while searching and prior to reaching into the bucket.

We installed very-high frequency (VHF) trap transmitters (Telonics, Inc., Mesa, Arizona, USA) at all active sets to indicate when a trap was tripped. Capture crews monitored transmitters throughout the day when within range of the frequency. All active sets were visually inspected at least once per day to mitigate the event of a trap transmitter failure. The use of VHF trap transmitters allowed us to monitor many sets concurrently and allowed us to better monitor remote sites. This reduced human presence at the trap and holding time when a bear was captured. Sets that were not visited by bears within a few days were removed. This concentrated trapping efforts to sites with regular bear activity and increased capture success.

We deployed motion-triggered trail cameras (Moultrie 990i, Calera Alabama, USA, and Reconyx Hyperfire™ HC600, Holmen, Wisconsin, USA) at each site to observe bear visits and bear behavior at the traps. Cameras were helpful in determining causes of capture failures (e.g., trap sprung but no catch). They also documented time of capture and if other bears, including cubs, were at the site.

ANIMAL HANDLING

Captured bears were darted from the ground using Palmer Cap-Chur (New England Firearms Co., Gardner, Massachusetts, USA) and Telinject Vario 1V (Telinject USA, Arleta, California, USA) projectors and darts with the appropriate dosage of Telazol according to estimates of the bear's weight (Telazol©, Fort Dodge, Iowa, USA; 3–5mg/lb; Taylor 2000). Bears were measured (overall length, neck and chest girth, weight), sampled (blood, tissue collected via ear punch, and premolar removed for aging; Willey 1974), and their response to the drugs monitored following standard veterinary procedures (Taylor 2000). Bears were marked with ear tags (Destron Fearing, Dallas, Texas, USA), and fitted with Telonics Global Positioning System (GPS, model TGW-3600, 3700 or 3790) and/or Telonics VHF (Standard TEA-1) collars. In the field, bears were aged as adults (<5 years), subadults (2–4 years), yearlings (1 year), or cubs (≤1 year; Schwartz et al. 1987). Live-trapping and radiocollaring protocols were approved by the Alaska Department of Fish and Game, Division of Wildlife Conservation Institutional Animal Care and Use Committee (IACUC) in accordance with the guidelines of International IACUC standards (ADF&G IACUC 09-17).

ANALYTICAL METHODS

We define a trap day as any part of a calendar day in which a bucket cable trap is operational. In some cases, it was unclear if a bear was captured before or after midnight which may have resulted in overestimation of trap days. However, because we were continually monitoring traps during the day with trap transmitters and with trail cameras documenting captures, any overestimation is thought to be minimal. We define trapping success as capturing and marking a bear. We consider any time a bear tripped the M-15 spring without being held as a miss. Trap days per bear is defined as the number of trapping days divided by the number of bears caught; trapping success is the number of bears caught, divided by the total number of catches and misses.

Results and Discussion

Between September 2009 and June 2012 we captured 55 black bears using bucket cable traps. As we gained experience and refined our trapping techniques, our catch rates improved from 214 trap days/capture in fall of 2009 to 2.9 trap days/capture in spring 2012 (Table 1).

Table 1. Summary of trap success for spring and fall sessions, 2009–2012, Alaska.

Session	Trap sites	Trap days	Captured bears	Misses	Trap days/ capture	Success rate
Fall 2009	27	214	1	8	214	11%
Fall 2010	8	41	5	10	8.2	33%
Fall 2012	7	25	3	3	8.3	50%
Fall Average	**14**	**93**	**3**	**7**	**31.1**	**30%**
Spring 2010	26	160	13	13	12.3	50%
Spring 2011	21	76	18	15	4.2	55%
Spring 2012	21	43	15	2	2.9	88%
Spring Average	**23**	**93**	**15**	**10**	**6.1**	**60%**

Overall, we found spring captures preferable for our study. Longer daylight hours, better weather conditions, high bear activity coinciding with breeding season, and personnel availability all contributed to our preference for spring captures sessions and the higher success in the spring. Spring sessions averaged 6.1 trap days per capture compared to 31.1 trap days per capture in the fall. Average spring success rates (60%) were double the fall rates (30%, Table 1).

Fall 2009 trapping results were affected by our inexperience and lack of prebaiting. However, even disregarding data from the 2009 fall season, the spring capture sessions outperformed fall sessions. Note that both fall and spring sessions had increased success rates each year. Far more trapping effort was conducted during the spring. It is possible that given more effort in the fall season (number of trap sites), fall results may have approached spring results.

MORTALITIES AND SERIOUS INJURIES

We had 2 capture mortalities; both were male cubs of the year (COY) and died as a result of being snared around the neck. Small staubs low on the trunk of the tree below buckets went unnoticed during the trap set up, allowing the cubs to put their heads into the bucket. Both ensuring that the bucket is of adequate height and that it is clear of natural steps, which would prevent a cub from reaching the lid, are essential to reducing cub mortalities. Although cubs are skilled climbers, we think the bucket opening protruding beyond the surface of the tree trunk made it impossible for cubs to hold the trunk with all 4 paws and extend their head into the bucket opening.

One male bear sustained a compound fracture of the right foreleg during capture. Trail cameras indicated other bears were at the capture site during this incident. As this bear was only 2 years old, we suspect the fracture occurred as a result of the bear getting the cable tangled in tree branches as he climbed to avoid intra-specific interactions with a more dominant bear. The leg was treated on site and the bear released. Short cable extension lengths that keep bears from excessive movement up and down the tree may have helped prevent this injury. Trap designs such as the RL04 (Lemieux and Czetwertynski 2006) which incorporate a spring in the cable may also help reduce this type of injury.

MINOR INJURIES

There were some minor injuries that occurred including abrasions, torn claws, and swelling of paws. We did not quantify these minor injuries. Our initial attempt to reduce the possibility of minor injuries was adding plastic tubing to the snare cable loop, however this resulted in reduced success (see above). We decided the risk of missed bears outweighed the possibility of some minor injuries and removed this padding. We also contacted the manufacturer of the snares and described how the cable fray at the ferrule was causing foot abrasions to restrained bears. They were able to modify the snare cables so the clipped wire ends did not protrude from the crimped ferrule (Fig. 8). This eliminated most minor injuries.

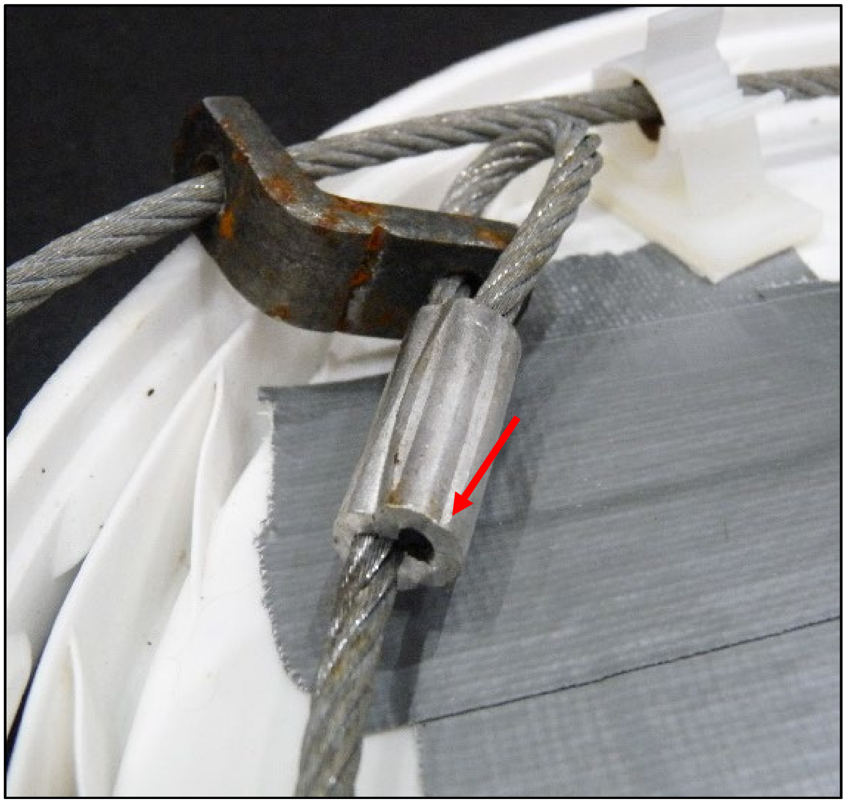

Figure 8. Ferrule with no cable fray ends protruding.

Conclusions

With gradual technique modifications, we found the bucket cable trap to be an effective technique for capturing black bears. This method met our requirements including being inexpensive (approximately $85 for complete set-up, https://www.snareshop.com/prodinfo.asp?number=BEARM15), being portable for remote field work in a heavily forested environment, having no potential for deer by-catch, and being highly effective for capturing and releasing black bears.

The final spring capture session had an 88% success rate with 2.9 trap days per capture. Key modifications that increased success rates were securing the snare cable inside the bucket lid with self-adhesive cable clamps, stabilizing the bucket with 1 × 3 (inch) boards, removing protective plastic tubing from snare cable, and keeping buckets free of bait contamination except for the bait attached on the thrower arm trigger. To reduce mortalities, we recommend insuring there are no staubs or branches below the buckets where cubs can gain purchase and reach their heads into the bucket. Size of lid opening must be small enough to prevent adult bears from reaching their heads inside.

We encourage researchers in the future to continue modifying this trap design to capture black bears more effectively and humanely. Researchers should consider the bucket cable trap in conjunction with elements of the RL04 trap design such as the drag system (though see our caution above) and shock absorbers to reduce injuries (Lemieux and Czetwertynski 2006). We found keeping extension cables short, use of swivels in connecting cables and snares and eliminating frayed cable ends helped reduce injuries. Although also likely to help reduce minor injuries, we found adding plastic padding to our snares reduced capture efficiency.

FUTURE WORK

As a result of this study, a paper on denning ecology of black bears has been published (Porter et. al 2020). Analysis of spatial data is currently being analyzed for a publication about habitat use by black bears on Prince of Wales Island.

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