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COMPARISON OF TWO CAMERA TRAP SYSTEMS FOR DETECTION OF AMERICAN MARTEN ON A WINTER LANDSCAPE

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Camera traps are commonly deployed to detect carnivores for a variety of research objectives and situations. However, having the correct camera model, type, and configuration is critical in order to detect the target species. We compared two camera models and configurations to detect the American marten in a montane coniferous forest during the winter. The Trailmaster® system did not detect marten and some landscape elements consistently compromised its effectiveness. Cuddeback™ systems, not vulnerable to these elements, successfully detected the target species.

INTRODUCTION

Camera traps are a common tool used by researchers for wildlife surveys and are especially useful in surveying for and detecting elusive carnivores. Various uses include abundance surveys of felids (Wallace et al. 2003, Wegge et al. 2004, Trolle and Kéry 2005), timing and feeding bouts of felids (Pierce et al. 1998), identification of individual felids (Heilbrun et al. 2003), general mammal diversity and abundance surveys (Yasuda 2004), capture/recapture analyses (Silver et al. 2004, Soisalo and Cavalcanti 2006), and fox vaccination monitoring (Hegglin et al. 2004). There are a variety of camera models and set-ups available on the market. Trailmaster® camera units are commonly used by researchers to detect wildlife in a variety of habitats and environments and are frequently used in California to survey for American marten, *Martes americana*, fisher, *M. pennanti*, and wolverine, *Gulo gulo* (Kucera and Barrett 1993a, b, Kucera et al. 1995, Zielinski et al. 1995, see also Foresman and Pearson 1998). Trailmaster® systems have been proven successful on many occasions in detecting rare mesocarnivores, however it is unknown if using a single camera trap system is consistently adequate in detecting mesocarnivores if present in an area.

Digital camera systems are slowly being incorporated into camera studies and may be commonplace within the next several years. More studies comparing various systems may be necessary to know which camera model and set-up can effectively detect target species.

We conducted winter camera station surveys for the occurrence of American marten and other forest carnivores in appropriate habitats within parcels managed by the California Tahoe Conservancy and the adjoining greater project study area during January and February 2006. Here we compare the two camera models and configurations we used to survey for the American marten in a montane coniferous forest during the winter.

STUDY AREA

The study area is located in the vicinity of the Lake Tahoe Airport within the South Lake Tahoe Basin, flanked on both sides by the Eldorado National Forest (38° 53.49'N, 119° 59.77'W; WGS84/NAD83). The predominant plant communities within the study area are montane coniferous forest (representative species include Jeffrey Pine, *Pinus jeffreyi*, lodgepole pine, *P. contorta*, and Douglas-fir, *Pseudotsuga menziesii*) and wet and dry montane meadow. Approximately 5% of the study area contains riparian forest and riparian scrub.

METHODS

Four sampling units were established, with two camera stations deployed within each sampling unit. The sampling unit used was a 2.6-km^2 area that aligned with section boundaries per the recommended standard survey protocol for forest carnivores (Zielinski and Kucera 1995[1]). This standard unit was used for simplicity, comparability, and ease of application using available maps. Camera stations were checked at 14-day intervals unless adverse weather conditions prevented access to the study site. Detection rates of American marten during the winter are potentially higher because of the lack of prey resources presumably makes martens more likely to take bait.

35-mm Camera Stations

The Trailmaster® TM1550 (Goodson and Associates, Inc., Lenexa, KS) active infrared trail monitor, consisting of an infrared transmitter and receiver, was used in conjunction with the Canon Sure Shot A1 (Canon USA, Inc., Lake Success, NY), an automatic, 35-mm camera. The systems were installed on January 3, 2006 and removed on February 21, 2006. One station was vandalized, which resulted in a loss of 16 trap days; therefore, the total number of trap days using this system was 384.

The camera was triggered when the infrared beam was broken; such an occurrence is termed an *event*. Infrared pulses emitted by the transmitter create an area of sensitivity of about 1 cm in diameter. The effective beam diameter of about 1 cm requires precise

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[1]Zielinski, W.J., and T.E. Kucera, editors. 1995. American Marten, Fisher, Lynx, and Wolverine: Survey Methods for Their Detection. General Technical Report PSW GTR-157. United States Department of Agriculture, Forest Service.

placement to intercept the target animal. The transmitter and receiver were placed ~30m apart.

Three trees were selected, 15 to 30 cm in diameter and 3 to 10 m apart, which lined up in a north-south direction with the middle tree slightly (15 cm) offset (per Zielinski and Kucera 1995[1]). The transmitter was attached facing south to the middle of the trunk of the northernmost tree, and the receiver was attached to the east side of the trunk of the southernmost tree with the receiving window pointing north. The camera was attached to the same tree as the receiver using an L-shaped metal bracket fitted at one end with a ball and socket. We positioned the camera so that the automatic focus frame in the viewfinder was on the target and not a distant background. This orientation is important to ensure that any animal climbing the tree to get the bait must pass through the beam (Zielinski and Kucera 1995[1]). Duct tape was used to secure the cable running from the camera to the receiver. The beam passed within 5 cm of the middle tree about 1.5 to 2 m above the ground. We trimmed any branches that could potentially blow into the beam or block the camera. We tested the system several times to ensure that when the beam was broken, a picture was taken (delayed 5 min). The reaction time of this system is from 0.33 to 1.5 sec (B. Goodson, pers. comm.).

During set up of the camera stations, one person handled the bait (raw chicken quarters and halves) and another the equipment, to prevent odors from the bait from being transferred to the equipment. We hung the bait in a chicken wire basket along the trunk of the middle tree so that it was at least 2 m above the ground to prevent canids from reaching it. In areas of heavy snowfall, the height of the bait was adjusted to accommodate changing levels of snow. A wick soaked in Caven’s Gusto Lure (Cumberland’s Northwest Trappers Supply, Owatonna, MN) was hung on a string nearby, and some scent was applied directly to the bait.

Digital Camera Stations

In addition to the Trailmaster® units, we also installed an accompanying digital camera unit. These digital cameras were installed on January 23, 2006 and removed along with the Trailmaster® units on February 21, 2006, for a total of 240 trap days. One Cuddeback™ Digital Scouting Camera system (Non Typical, Inc., Park Falls, WI) was installed at each 35-mm camera station, focused on the same bait. These Cuddeback™ cameras were attached to either a fourth tree, lending a good view of the bait, or to one of the trees containing the Trailmaster® transmitter or receiver. The Cuddeback™ system can detect heat from an animal up to 30.5 m; however, this detection range is dependent upon ambient air temperatures. The cooler the temperatures, the farther away the Cuddeback™ can sense an animal. A digital image is captured when something warm and in motion (bird or mammal) passes through the target zone. The camera delay was set for 5 min after an image was taken. Images were stored on Compact Flash cards (512 MB capacity). During each site visit, the Compact Flash card was replaced with an empty card, and the batteries were checked and replaced, if needed. The reaction time was measured as approximately 1 sec for the digital camera system.

RESULTS

For the Trailmaster® systems, 166 photo events were recorded on film during the second session (January 23 to February 21; first session not compared; Table 1). Of these, 106 (63.86%) were photos without wildlife, such as falling snow or moving branches. Wildlife events include 40 flying squirrel, *Glaucomys sabrinus* (24.1%), 17 Steller's Jay, *Cyanocitta stelleri* (10.24%), 2 bobcat, *Lynx rufus* (1.2%), and 1 Mountain Chickadee, *Poecile gambeli* (0.6%).

During the same time period, the Cuddeback™ systems recorded 34 photo events on the flash cards. Of these, 9 (26.5%) were photos without wildlife. Wildlife events include 6 flying squirrel (17.7%), 10 Steller's Jay (29.4%), 7 American marten (20.6%), and 2 bobcat (5.9%). The Cuddeback™, set with a 5 min time delay, took multiple images of marten. A series of consecutive photos were taken 5 min apart on four occasions. Each "occasion" was considered a single event to eliminate bias and over-represention of marten detection events.

DISCUSSION

Each camera set-up uses a different strategy to detect wildlife. The Trailmaster® system requires a beam to be broken before a picture is taken. A disadvantage to this mechanism is that objects other than wildlife may set off the camera, such as snow falling and branches moving during storm conditions. The high frequency of photos with falling snow and branches was apparently in large part a result of the extreme winter weather conditions in the Tahoe Basin during the survey. Multiple heavy snowstorms with high winds, including one storm officially classified as a blizzard by the National Weather Service, were interspersed with warming periods during which large clumps of snow melted off the trees during the warm, sunny afternoons.

The Cuddeback™ model we used required a moving target with a heat signature in order for a photo event to take place. Falling snow and moving branches will not usually activate the system, and therefore, in our study, few such events were recorded, and most (73.5%) of the events were triggered by wildlife. In contrast, the Trailmaster® system used a considerable amount of film on falling snow and branches (69.1% for both sessions) and at times the entire roll was spent with no wildlife hits. When a carnivore or other species eventually removed bait, the system was unable to record the event. Film development under these conditions can become rather expensive, whereas digital cards do not require development and can be reviewed in the field on a laptop computer or some other device.

Both systems successfully detected bobcat, a common forest mesocarnivore, and two non-target species. American marten, the target species, was detected only by the Cuddeback™ digital system. The Trailmaster® system did not detect martens in some cases because the film in the 35-mm camera was already depleted when the marten was present (confirmed by comparing date and time stamps from both camera systems). In other cases, the marten may have removed the bait from the top of the basket, thereby being out of the range of the beam and not triggering the 35-mm camera. Interestingly,

Table 1. Trailmaster® data are divided into two sessions. During the first session, the Trailmaster® system was not accompanied by a Cuddeback™ system and was not compared but included here for reference. During the second session, a Cuddeback™ system operated simultaneously.

Event			**Trailmaster®**				**Cuddeback™**	
	3 - 23 Jan Session 1		23 Jan - 21 Feb Session 2		Trailmaster® total		23 Jan - 21 Feb Session 2	
Flying squirrel (*Glaucomys sabrinus*)	34	17.00%	40	24.10%	74	20.22%	6	17.65%
Mountain Chickadee (*Poecile gambeli*)	1	0.50%	1	0.60%	2	0.55%	0	0.00%
Steller's Jay (*Cyanocitta stelleri*)	18	9.00%	17	10.24%	35	9.56%	10	29.41%
American marten (*Martes americana*)	0	0.00%	0	0.00%	0	0.00%	7	20.59%
Bobcat (*Lynx rufus*)	0	0.00%	2	1.20%	2	0.55%	2	5.88%
Sum of all wildlife triggers	53	26.50%	60	36.14%	113	30.87%	25	73.53%
Triggers without wildlife	147	73.50%	106	63.86%	253	69.13%	9	26.47%
Total events	200	100.00%	166	100.00%	366	100.00%	34	100.00%

at one camera station, a bobcat was detected by the Trailmaster® unit, but not by the Cuddeback™. The Cuddeback™ should have detected the bobcat, and it is unknown as to why no digital photo was taken. A possible reason is that passive infrared systems operate by detecting a temperature differential between a moving object and the surrounding environment (B. Goodson, pers. comm.). If the temperature of the bobcat differs only a few degrees from the ambient air temperature, a photo event will not be recorded. Further testing may be required to determine if cold weather may have an effect on digital systems in some circumstances.

CONCLUSION

The Trailmaster® system is commonly recommended and used for marten detection studies and has been proven successful. However, in this study, though the Trailmaster® system was set up as described in Zielinski and Kucera (1995[1]), it did not detect marten, and some landscape elements consistently compromised its effectiveness (i.e., falling snow and tree branches in large part due to winter storm events). Properly placed Cuddeback™ systems, not vulnerable to these elements, successfully detected the target species. The Trailmaster® system is labor intensive to set up properly, but can produce positive detection results. However, the system may not be the best choice in some circumstances. Wildlife managers should be aware of all options regarding camera systems and which ones are best to use in challenging landscapes. Further research may be needed to test other models of digital camera systems compared to traditional Trailmaster® units in a variety of habitats.

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