Evaluation of two covered track stations to detect forest carnivores

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Abstract

Numerous types of baited track stations have been used to detect forest carnivores. I compared the efficacy of wooden and plastic covered track stations to detect American Marten *Martes americana*, Fisher *M. pennanti*, and Northern Raccoon *Procyon lotor* in Michigan, USA, during 2002–2003. The number of sample units in which species were detected and mean latency to detection for each species was similar for wooden and plastic track stations. Also, the total number of detections for each species was similar for both track station types. Rain did not adversely affect either track station. Plastic covered track stations required more effort to set up and were more expensive, but weighed less than wooden track stations. Wooden covered track stations are most suitable when working in areas with vehicle access whereas plastic covered track stations are more suitable when working in remote areas.

Resumen

Numerosos tipos de estaciones de huellas con cebo han sido utilizadas para la detección de carnívoros de bosque. Compare la eficacia de estaciones de huellas cubiertas por plástico y madera para la detección de Martín americano *Martes americana*, Pescador *M. pennanti* y Mapache del Norte *Procyon lotor* en Michigan, EUA, durante el 2002 y 2003. El numero de unidades de muestreo en que las especies fueron detectadas y el promedio de latencia para detección para cada especie fue similar para estaciones de plástico y madera. A su vez, el número total de detecciones para cada especie fue similar para ambos tipos de estaciones. La lluvia no significo un factor adverso en ninguna estación. La estaciones cubiertas por madera son más ajustables cuando las áreas de trabajo cuentan con acceso para vehículos mientras que las estaciones cubiertas por plástico son más útiles en áreas remotas.

Keywords: American Marten, Fisher, *Martes americana*, *Martes pennanti*, Northern Raccoon, *Procyon lotor*, survey methods, track plates

Introduction

The need for land management agencies to monitor forest carnivore populations has increased in recent years (Ruggiero *et al.* 1994). Consequently, numerous techniques have been developed or refined to facilitate carnivore monitoring (e.g., Gese 2001, York *et al.* 2001, Belant 2003a, 2003b). Track stations are one method used frequently to detect presence and habitat use of many carnivore species (Barrett 1983, Loukmas & Halbrook 2001, Fecske *et al.* 2002). Track stations can be classified as open or covered (Zielinski & Kucera 1995), with the type of station used dependent on the species being surveyed and other factors, including weather conditions.

Although several types of covered track stations have been used to survey carnivores (King & Edgar 1977, Zielinski & Kucera 1995, Gompper *et al.* 2006), comparisons between types of track stations have been limited (e.g., Foresman & Pearson 1998). Several factors could influence carnivore detection at covered track stations including materials used to construct track stations, size of entrance opening, and tracking medium or substrate. Zielinski & Kucera (1995) attempted to standardise use of track station devices in forest carnivore surveys. My objective was to compare wooden and plastic covered track stations, the two covered track stations emphasized in Zielinski & Kucera (1995), for the detection of American Marten *Martes americana*, Fisher *M. pennanti* and Northern Raccoon *Procyon lotor*. Performance comparisons were based on species detection rates, latency to first detection (LTD), effort for field placement and cost.

Study Area

The study was conducted in the central Upper Peninsula of Michigan, USA (46°20'–40'N, 85°50'–86°10'W), on land administered by the Hiawatha National Forest (HNF) and the Pictured Rocks National Lakeshore (PRNL). The study area consisted of uneven-aged forests. In areas with well-drained soils, tree species were predominantly Sugar Maple *Acer sacharrum* and American Beech *Fagus grandifolia*. Areas with moderate- to poorly-drained soils contained several coniferous tree species including spruce *Picea* spp., Balsam Fir *Abies balsamea* and White Cedar *Thuja occidentalis*. From concurrent carnivore monitoring and radio-telemetry studies, I determined that American Marten, Fisher, and Northern Raccoon were present throughout the HNF study area, whereas only American Marten and Northern Raccoon were present at PRNL (J. L. Belant, unpublished data).

Methods

Wooden and plastic covered track stations used in this study were constructed as described by Zielinski & Kucera (1995) with two exceptions. I used screws in place of rubber straps to hold wooden track stations together and used photocopy toner (Belant 2003b) in place of soot as a tracking medium. Wooden covered track stations consisted of a box with inside dimensions of about 25 × 25 × 81 cm. The boxes were made using four pieces of 13-mm thick, medium-grade plywood. Both ends of the boxes were open. An aluminum plate (20 × 75 cm) containing the tracking medium (photocopy toner) was then placed on the inside bottom of the box. Plastic covered track stations consisted of a 1.5-mm thick sheet of plastic (40 × 80 cm) that was bent into a half cylinder with the edges placed inside a raised lip on each of the outer edges of a galvanized steel base (28 × 80 × 0.1 cm with a 1.0 cm raised lip along the two 80 cm sides) and were kept in place by a combination of the force acting to straighten the plastic and the use of adhesive tape. Both ends of the plastic track stations were open. As with wooden covered track stations, a similar sized aluminium plate containing the tracking medium was placed on the steel base

inside each plastic track station. Both types of tracking stations were designed to be disassembled for transporting by foot into remote field sites (Zielinski & Kucera 1995).

Three wooden and three plastic track stations were used (six stations total) in each of eight sample units during the 2002 trial and each of seven sample units during 2003 trials. Each sample unit comprised 4 mi² (10.4 km²) as recommended by Zielinski & Kucera (1995) and was located at least 1 mile (1.6 km) from other sample units. Track stations were placed systematically within each sample unit at 0.3-mi (0.5-km) intervals within 50 m of gravel roads with low vehicle use. For the first station placed in each sample unit, I randomly assigned the track station type (wooden or plastic) and side of the road (left or right) from which the forest was entered to place it. The next track station was of the other type and placed in the forest on the opposite side of the road of the preceding track station. This process was continued until the six track stations were placed.

Track stations were placed on the HNF on 1 October 2002 (Fall) and checked every two days for 28 days. During 2003, track stations were placed on 13 May (Spring) and 3 October (Fall) and similarly checked at 2-day intervals for 28 days. Track stations were baited with chicken wings and scented with commercial trapping lures. Track stations were set at the bases of large trees or along large woody debris, with the rear opening covered by sticks to preclude access by the species being investigated. Stations were rescented at 6–8 day intervals or after heavy rain and rebaited as necessary. Carnivore tracks were identified to species and recorded; contact paper was removed from track plates and stored in acetate envelopes. I distinguished American Marten and Fisher tracks using field guides (Murie 1954, Halfpenny 1986, Rezendes 1999) and measurement criteria developed by the Michigan Department of Natural Resources (MDNR; R. Earle, MDNR, USA, unpublished data). Northern Raccoon tracks were readily distinguishable from American Marten and Fisher tracks.

To assess efficacy, I determined and compared the number of each type of track station that was visited by each species and the cumulative total of new stations visited during each trial. I also recorded latency to detection (LTD; the number of days until first detection) for each target species found at each track station and calculated means (±SE). I used *t*-tests to compare mean LTD between track station types for each species during each trial (SAS 1990). I also used multiple range permutation procedures (MRPP) and permutation tests for matched pairs (PTMP; BLOSSOM software; Foresman & Pearson 1998) to compare rates of LTD for wood and plastic track stations by sample unit for each season and detection rates between seasons at PRNL. Statistical significance was established at $P < 0.05$.

Results

In HNF during fall, American Marten, Fisher, and Northern Raccoon were detected in six, four, and five sample units, respectively (Table 1). Adequate data to perform MRPP analyses were obtained only for American Marten; the number of sample units this species was detected in was similar (PTMP = 0.198, $P = 0.54$) for wooden and plastic track stations. The number of sample units Fishers and Northern Raccoons were detected in appeared similar for wooden and plastic track stations.

At PRNL, the number of sample units where American Martens were detected was similar for wooden and plastic track stations during spring (PTMP = 0.905, $P = 0.81$) and fall (PTMP = 1.00, $P = 0.85$; Table 1). Although sample sizes were too small for analyses, the number of sample units Northern Raccoons were detected at appeared similar for wooden and plastic track stations during both seasons.

Mean LTD was similar ($P \geq 0.37$) between track stations for each species during all trials at HNF and PRNL and ranged from about 14 to about 18 days (Table 2). Cumulative percent of stations with tracks detected for each species was comparable for both track station types during the trial at HNF (Fig. 1). During spring, the overall cumulative number of plastic track stations where American Martens and Northern Raccoons were detected was 10–15% less than detections at wooden track stations (Fig. 2). During fall, overall cumulative detections of both species were similar for wooden and plastic track stations.

As both types of track stations used in this study were covered, rain did not appear to adversely affect their efficacy. Of 672 total detection opportunities for all track stations at HNF, American Martens were recorded 18 times (3%), Fishers were recorded six times (1%) and Northern Raccoons were recorded 12 times (2%). The total number of detections for each species was identical for wooden and plastic track stations (18 detections each).

Of 588 total detection opportunities at PRNL during spring, American Martens were detected 22 times (4%), 13 times at wood track stations and nine times at plastic track stations. Northern Raccoons were detected 12 times overall (2%); 10 detections were at wood track stations and two detections were at plastic track stations. The total number of detections for both species was over three times greater during fall than spring at PRNL. Of 588 total detection opportunities during fall, American Martens were de-

Table 1. Success of wooden and plastic covered track plate stations used to detect medium-sized forest carnivores on the Hiawatha National Forest (HNF) and Pictured Rocks National Lakeshore (PRNL), central Upper Peninsula of Michigan, USA, 2002–2003. Numbers indicate sample units (n = 8 for HNF; n = 7 for PRNL) in which the species was detected. Percentages are in parentheses.

			Detection rate for:		
Location	**Season**	**Species**	**Wooden**	**Plastic**	**Combined**
HNF	Fall	American Marten	5 (68)	4 (50)	6 (75)
		Fisher	2 (25)	3 (38)	4 (50)
		Northern Raccoon	4 (50)	3 (38)	5 (63)
PRNL	Spring	American Marten	6 (86)	3 (43)	6 (86)
		Northern Raccoon	3 (43)	2 (29)	3 (43)
	Fall	American Marten	4 (57)	5 (71)	5 (71)
		Northern Raccoon	3 (43)	4 (57)	5 (71)

Table 2. Mean latency to detection at wooden or plastic covered track stations for 3 forest carnivore species on the Hiawatha National Forest (HNF) and Pictured Rocks National Lakeshore (PRNL), central Upper Peninsula of Michigan, USA, 2002–2003.

			Mean latency to detection for:							
			Combined		Wooden		Plastic		Test statistics	
Location	**Season**	**Species**	Mean	SE	Mean	SE	Mean	SE	t	*P*
HNF	Fall	American Marten	15.5	2.2	14.0	3.3	16.9	3.1	0.64	0.54
		Fisher	13.7	0.8	13.3	1.3	14.0	1.2	0.38	0.72
		Northern Raccoon	17.8	2.8	20.5	3.9	15.0	4.2	0.96	0.37
PRNL	Spring	American Marten	11.1	1.6	9.7	2.5	12.3	2.1	0.79	0.44
		Northern Raccoon	11.1	2.6	8.0	4.0	12.4	3.3	0.74	0.49
	Fall	American Marten	12.1	1.7	10.2	1.9	14.0	2.7	1.14	0.27
		Northern Raccoon	13.3	2.7	10.0	3.2	16.7	4.1	1.29	0.23

tected 63 times (11%), 22 times at wood track stations and 41 times at plastic track stations. Overall, Northern Raccoons were detected 41 times (7%), 14 times at wood track stations and 27 times at plastic track stations.

Wooden track stations were easily placed and stabilised because the screws which held the four panels together provided rigidity. Plastic track stations required more effort to set up because of attaching the plastic cover to the base plate with adhesive tape. Also, the plastic cover was less rigid which required additional time placing logs and branches against the cover to ensure stabilisation. Excluding track plates, wooden track stations weighed about 4.3 kg; plastic track stations weighed about 2.5 kg. Materials to construct wooden and plastic track stations cost about USD 7.0 and USD 8.3, respectively, per station.

Discussion

Based on the number of sample units in which species were detected, the two covered track stations performed similarly for American Martens, Fishers and Northern Raccoons. Thus, either type of track station should be equally effective to assess carnivore presence or activity. Although materials used to construct track stations could influence relative use by carnivores, in suitable habitat, variables such as track station placement or size of track station opening would be expected to have a greater effect on forest carnivore detection (Zielinski & Kucera 1995).

In all cases, mean LTD was greater than the number of days (12) recommended for track station surveys for detection of American Martens and Fishers (Zielinski & Kucera 1995). Such

Figure 1

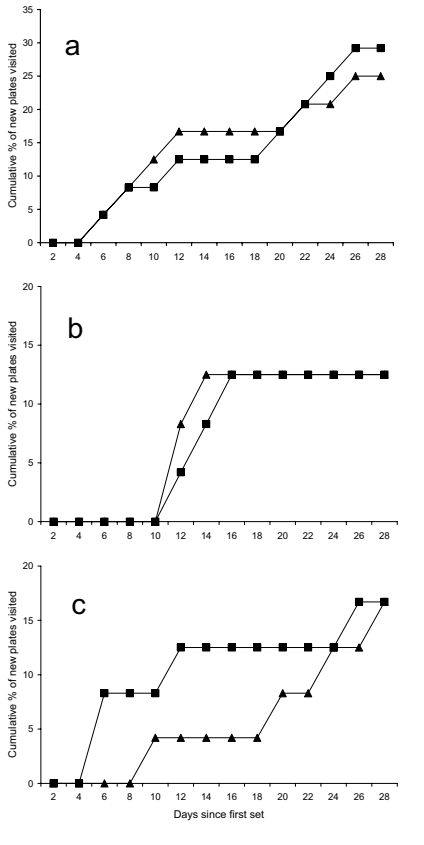
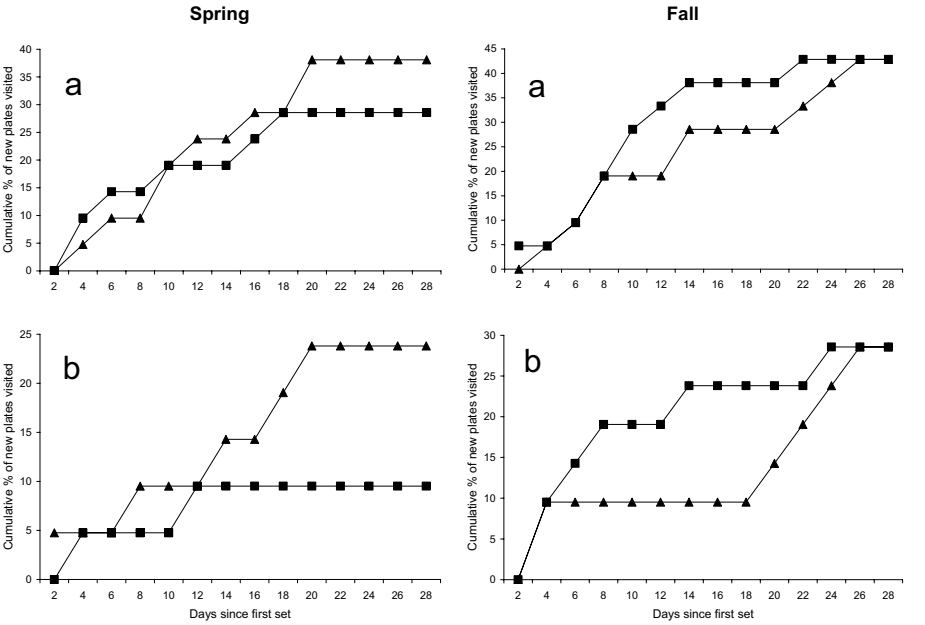


Fig. 1. Wooden (triangles) versus plastic (squares) covered track-plate visitation by (a) American Marten, (b) Fisher, and (c) Northern Raccoon, Hiawatha National Forest, central Upper Peninsula of Michigan, October 2002.

Fig. 2. Wooden (triangles) versus plastic (squares) covered track-plate visitation by (a) American Marten and (b) Northern Raccoon, Pictured Rocks National Lakeshore, central Upper Peninsula of Michigan, May–June (spring) and October (fall) 2003.

Figure 2



faster detection rates were recorded on the same study area in HNF during 2001 (J. L. Belant, unpublished data). Factors including availability of alternative food (Bull *et al.* 1992), carnivore density, and season may affect LTD. Because of the experimental design employed, stations in this study were placed systematically in contrast with placement of stations to maximize detection during occupancy studies. Longer track station deployment times than recommended by Zielinski & Kucera (1995) should be considered when systematic placement of stations is necessary to meet study objectives or when carnivore abundance is anticipated to be low. An alternative approach to increase probability of detection would be to conduct multiple surveys in the same study area (Zielinski & Kucera 1995).

The cause of variation observed between spring and fall trials at PRNL in the total number of American Marten and Northern Raccoon detections observed at wooden and plastic track stations is unknown. Similarly, the reason for fewer total number of wood track stations used by these species during spring at PRNL is unknown. It is likely, however, that both occurrences were artifacts of track station placement relative to individual animal distributions and movements. In this study it would have been possible for an individual animal to be detected 14 times at one track station in a single trial. This form of pseudoreplication can confound interpretation of results and is why the sample unit (block) design was employed in this study.

Detection rates were considerably greater during fall than spring for American Martens and Northern Raccoons. Increased detection rates in fall were probably related in part to increased movements of juveniles during dispersal or home range establishment (Sanderson 1987, Strickland & Douglas 1987). In addition, females with dependent young can have restricted home ranges during spring (e.g., Sanderson 1987), which could reduce detection rates. When logistically feasible, annual timing of field surveys to detect carnivore presence should include periods of greatest animal activity or abundance.

Plastic track stations cost 19% more than wooden track stations. Less expensive sources, particularly for the plastic sheeting, may be available. I recommend use of wooden covered track stations in areas readily accessible by vehicles because of their similar efficacy at detecting American Martens, Fishers, and Northern Raccoons; lower cost; and reduced time and effort required to stabilise them during placement. Plastic track stations are recommended in remote areas because of reduced weight. Covered track stations used in this study are likely suitable for other mustelid and procyonid species; entrance size and length of the track stations could be modified to accommodate the species being investigated. Also, it is likely that other materials used to construct track stations (e.g., plastic culvert or corrugated plastic; Loukmas & Halbrook 2001, Gompper *et al.* 2006) would allow detection of species in this study. Additional comparisons of carnivore detection rates with alternative materials and designs to assess their relative efficacy and also to improve track station performance are warranted.

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