

## A New Record of an American Marten (*Martes americana*) Population in Southern Vermont

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### Abstract.

American Marten *Martes americana* were once widely distributed in Vermont (USA) prior to European settlement, but overtrapping and habitat loss resulted in their extirpation from the state by the early 1900s. Marten were given state level protection in 1972 and despite a three-year reintroduction effort (1989-1991) to restore them, they currently remain endangered in Vermont. Marten sightings, tracks, and recovered carcasses from several parts of Vermont in the last 15 years suggest Marten are once again present in the region but it is unclear how widely distributed they are and whether a breeding population exists. Between 2015 and 2017, we conducted camera surveys in 45 sampling units (5km<sup>2</sup>) located primarily within the Green Mountain National Forest of southern Vermont to verify the presence of an American Marten population. Marten were detected in 17 of our 45 sampled units, with several accounts of multiple individuals simultaneously occurring at the same camera station. Data from our camera surveys support the presence of a breeding population of Marten in southern Vermont restricted to a narrow portion of the Green Mountain National Forest. Marten in southern Vermont represent the southernmost population in the eastern United States and conserving them presents a number of challenges due to their potentially low abundance and geographical isolation.

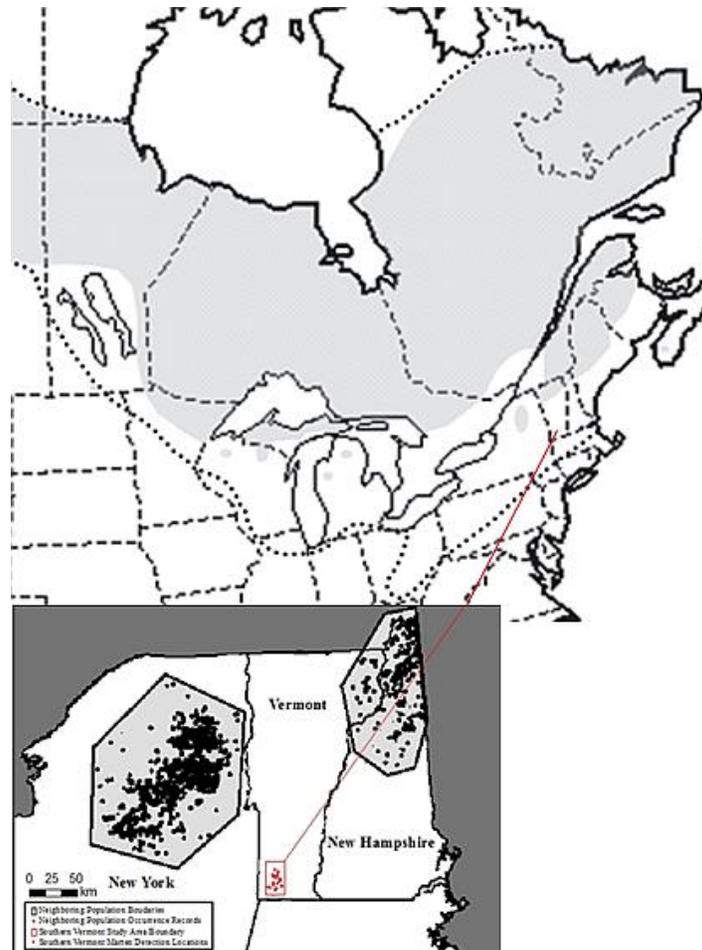
**Keywords:** camera-trapping, conservation, Marten, United States.

## Introduction

American Marten *Martes americana* is a small carnivore native to North America with a broad range that extends from the tree line in Alaska and Canada south through the Sierras and the Rocky Mountains (Figure 1). The range of Marten also extends into the north-eastern United States where, historically, they were widely distributed and reportedly common as far south as western Massachusetts prior to European settlement (Godin 1977). Like other native furbearers (Fisher; *Pekania pennanti*, Mink; *Neovison vison*), their numbers and distribution declined significantly in the Northeast as a result of overtrapping and habitat loss (Silver 1957, Brander and Books 1973) and by the early 1900's, they were extirpated from most areas of the Northeast except for the Adirondacks of New York and northern portions of Maine (Krohn 2012).

Marten were state-listed as endangered in 1972 and their active recovery began with a three-year reintroduction program (October 1989 - December 1991) initiated by the Vermont Fish and Wildlife Department (VFWD) and the United States Forest Service (Moruzzi *et al.* 2003). During this time, Marten from Maine (n=104) and New York (n=11) were reintroduced at two sites with suitable habitat in southern Vermont (DiStefano *et al.* 1990; Royar 1992). Despite these reintroduction efforts, track count surveys in 1990 suggested the presence of no more than four Martens (Royar 1992), and photos taken

during winter 1994 to 1995 confirmed the presence of no more than two (Brooks 1996). A final camera survey, conducted between 1997 and 1998 resulted in no Marten detections and consequently, Vermont Fish and Wildlife deemed the reintroduction effort in southern Vermont unsuccessful (Moruzzi *et al.* 2003). One plausible explanation for the failure of the reintroduction was competition and predation by fishers, another native carnivore of the Mustelidae family that has steadily recovered in last fifty years following a period of overexploitation that peaked in the early 1900's (Brander & Books 1973).



**Figure 1.** Historical map of the distribution of American Marten in eastern North America modified from Romanski & Belant (2008). Gray shading in top map represents current distribution and dotted line represents distribution prior to European settlement. Bottom map shows neighbouring Marten (*Martes americana*) populations in the North-eastern United States (modified from Jensen 2012) including the current study area (boundary outlined in red) and individual detection locations of Marten from 2015-2016 camera surveys (red dots) in southern Vermont.

Beginning in 1997, sightings and tracks provided evidence that Marten were present in north-eastern Vermont and may represent an expanding population from northern New Hampshire (Kelly 2005). Between 2010 and 2014, an accumulation of evidence including incidental captures during the fisher trapping season, tracks, and two verified photos from

triggered cameras (Chris Bernier, Vermont Fish and Wildlife, personal communication) indicated Marten were also present in southern Vermont. The sporadic reports do not indicate how widely distributed Marten are in southern Vermont and whether a viable self-sustaining population exists. The Marten is currently a state-listed endangered species (10 V.S.A. Chap. 123 2012) in Vermont and as such, requires a thorough understanding of its current distribution, habitat requirements, and limiting factors to effectively manage it. The objectives of our study were to; 1) Provide verifiable evidence of a Marten population in southern Vermont from standardized camera surveys and 2) Provide a preliminary estimate of their geographic distribution across our study area.

## Materials and methods

### *Survey area*

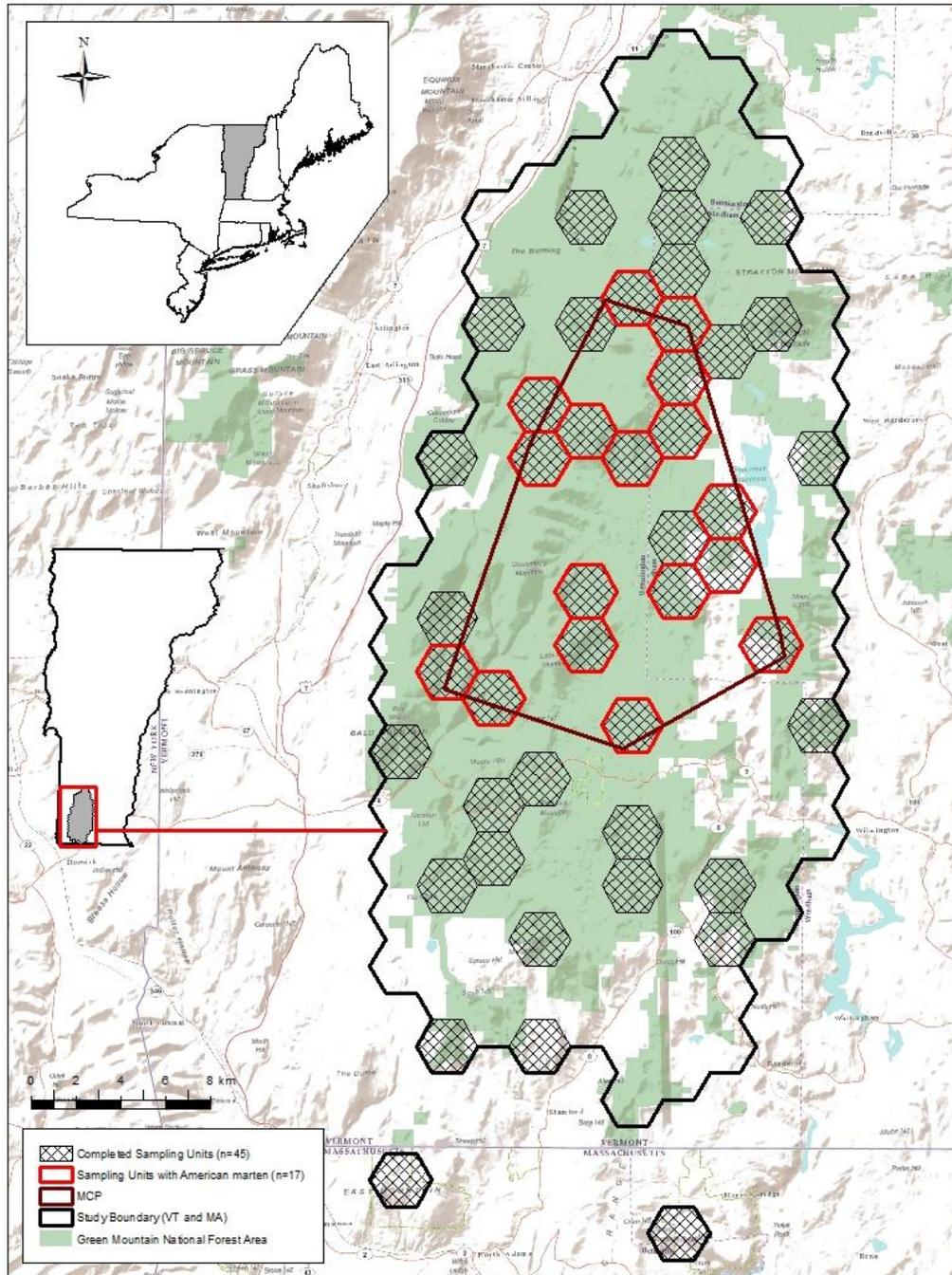
Our study area was primarily located within the southern extent of the Green Mountain National Forest (GMNF) in southern Vermont (Figure 2) and included three federally designated wilderness areas (Lye Brook Wilderness Area, George D. Aiken Wilderness Area, and Glastenbury Wilderness Area). We also sampled two units further south in state forests located in north-western Massachusetts. The area we sampled in the GMNF is mountainous with a maximum elevation of 1,220 m and is composed primarily of mixed northern hardwood-conifer stands comprised of American beech (*Fagus grandifolia*), yellow birch (*Betula alleghaniensis*), red maple (*Acer rubrum*), and sugar maple (*Acer saccharum*). Coniferous stands are predominantly spruce (*Picea* spp.) and occur near wetland areas.

### *Methods*

We completed camera surveys between January 2015 and April 2017 in 45 units (5km<sup>2</sup>) that were scaled to represent an area equivalent to the average home range size of male American Marten (Jensen 2012). During this time, we conducted surveys in 45 sampling units, logging 4,075 total operating trap days, and 97,800 total trap hours. Sample units within our study area were selected based on a stratified random sampling. We created strata using the relative probabilities of a Marten being present within a 5km<sup>2</sup> unit from a recently developed an Environmental Niche Model (MaxEnt) model of Marten occurrence in the Adirondacks of New York (Jensen 2012). Based on the model, units in our study area were grouped into four strata ranging from high relative probabilities of Marten presence ( $\geq 0.39$ ) to low probabilities ( $< 0.15$ ) of Marten presence.

Within each of the 45 sample units, we used an array of 6 randomly placed triggered cameras (Moultrie 990is, Moultrie P150s, and Bushnell Trophy Cam Aggressors) to survey for American Marten. Cameras were mounted on trees 1.5 to 2 m above ground surface and aimed slightly downward toward the base of a bait tree to maximize the field of view. On

the bait tree, we wired one can of sardines approximately 1 m above the ground (Figure 3) and emptied another can at its base. Bait trees were also scented with a skunk essence-petroleum jelly mixture (<15 ml) and a curiosity scent containing peppermint-anise oil extracts (<1.5 ml).



**Figure 2.** Map of completed survey units (n = 45) in southern Vermont and north-western Massachusetts study area indicating units with American Marten detections (Red). Most units were located within regions of the GMNF (Highlighted in light green). Outline (Brown) represents estimate of the Marten distribution in our study area.



**Figure 3.** American Marten image captured while visiting camera-station bait in southern Vermont.

Surveys lasted 15 days and were broken up into three five-day periods, during which camera stations were re-scented, re-baited, and data cards exchanged following each survey period. Cameras were set to operate for 24 hours per day and recorded date, time, and temperature of all detections. Images were reviewed by a minimum of two individuals; noting the date, time, and frequency of detections. In cases where species identification was uncertain, three people reviewed the photographic evidence and a positive identification was made only if a consensus could be reached.

## Results

Between 2015 and 2017, we detected Marten in 17 of the 45 units (Figure 2). Using ArcGIS data management tools, we calculated a minimum convex polygon to estimate the approximate size of the distribution of this population. The size of distribution covers an area of 184.83 km<sup>2</sup> based on 48 Marten detection records at individual camera-trap stations within the study area (Figure 2). Marten were found as far north as the southern portion of Lye Brook Wilderness and as far south as Route 9 near Searsburg, Vermont (Figure 2). Detections occurred in all four strata and nearly all occurred during the winter months. Multiple individuals were seen in the same photos (Figure 4) and photos were recorded at different camera of marten that had very different body sizes being consistent with adult and juvenile age classes.



**Figure 4.** Photographic evidence of multiple American Martens from camera-trap surveys conducted during the winter of 2016 in southern Vermont.

## Discussion

Our data from standardized camera surveys provides the first, verifiable records of a contemporary American Marten population in southern Vermont. This Marten population represents the southernmost extent of their known range in the eastern United States and is one of only two breeding populations in Vermont. Marten were historically found throughout New England as far south as Massachusetts (Figure 1) but were virtually eliminated from the Northeast by the early 1900's due to overtrapping and habitat loss. Marten were listed as endangered in the state of Vermont in 1972 and have only been reported in the state within the last 15 years. The earliest reports from north-eastern Vermont suggest that Marten may be moving into the area from neighbouring Canada or New Hampshire. Marten were considered absent from southern Vermont as recently as 2010 until snow tracks and incidental captures suggested otherwise. The reintroduction of Marten to southern Vermont between 1989 and 1991 (Moruzzi *et al.* 2003) was considered unsuccessful but the presence of Marten near the reintroductions suggests that it was either successful or that the area has recently been recolonized via long distance dispersal. A genetic analysis of marten samples ( $n = 27$ ) supported several possible explanations for their presence in southern Vermont including long distance dispersal from northern Vermont and northern New Hampshire (O'Shea 2014). A more recent examination of mtDNA and microsatellite data from ongoing research suggests that marten in southern Vermont did not likely originate from dispersal events involving other populations following the reintroduction (Aylward *et al.* 2016 unpublished data) and leaves open the possibility for alternative explanations.

## Conservation Implications

The Marten population in southern Vermont is of considerable conservation concern. The limited evidence and the recent timeframe of their presence in southern Vermont indicates they are not likely abundant. Marten also appear to occupy only a narrow distribution in the Green Mountain National Forest and may be regionally isolated from the two closest Marten populations in New Hampshire (150 km) and New York (97 km; Figure 1). Connectivity with other populations of Marten in the region may be possible

based on their maximum recorded dispersal distance however, Johnson et al. (2009) found that 80% of dispersing juvenile Martens established a home range within 20 km from where they were born. If the southern Vermont population of marten is small and isolated, it is more susceptible to demographic stochasticity and the genetic effects of inbreeding and low genetic diversity associated with drift.

Fishers are considered a potential limiting factor of Marten and they were detected in 44 out of our 45 sample units. Previous studies have provided data that Fishers may be important intraguild predators of Marten (Raine 1981, Hodgman *et al.* 1997). The presence of an abundant Fisher population near the area of the Marten reintroduction could explain why it presumably failed. Marten typically inhabit higher elevations and areas with deeper snow compared to Fishers and are better equipped to travel in deep snow conditions due to their lower body mass to total foot area ratio (10.1 to 12.2 g/cm<sup>2</sup>) compared to Fishers (21.1 to 32.0g/cm<sup>2</sup>). Thus, deep snow conditions provide a competitive advantage for Marten (Krohn 2012). Changes in annual snowfall due to global climate change could potentially alter competitive dynamics between Marten and Fisher at the southern extent of their range and ultimately jeopardize the persistence of the southern Vermont Marten population.

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