

Ecology and Management of *Martes* on Private Timberlands in North Coastal California

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Abstract

Green Diamond Resource Company has conducted periodic studies of fishers on its California timberlands since 1994. A graduate study in 1994 and 1995 used track plates to investigate the distribution and habitat associations of fishers. Fishers were detected at 65 percent of the survey segments during both years combined but marten were not detected. A repeated track plate survey conducted a decade after the initial effort revealed the presence of marten west of a known population on public lands. An abbreviated track plate survey effort in 2006 again confirmed the presence of marten in the same area of the ownership and a potential expansion of the occupied area. During 2010 and 2011, we used remote cameras to survey 75 stations in a 2 km² hexagonal grid in the northern portion of the ownership. We detected fisher at 45 camera stations, marten at eight stations and both species at six stations. Marten are persisting in areas where we initially detected them in 2004, but additional studies are necessary to investigate habitat use, demographics, dispersal and interactions with competitors like the fisher.

Key words: camera, fisher, managed forest, marten, non-invasive survey, track plate

Introduction

The marten (*Martes americana*) and fisher (*Martes pennanti*) are coexistent mesocarnivores inhabiting the coastal forests of northern California. Within north coastal California, the Humboldt subspecies of marten (*M. a. humboldtensis*) historically occurred in the coast redwood zone from the Oregon border south to northernmost Sonoma County. However, since 1995, surveys conducted in this region suggest that martens no longer occupy most of their historical range (Slauson 2003, Zielinski et al. 2001). Currently, martens are known from only one small population in southern Del Norte and northern Humboldt Counties, which comprise less than 5 percent of its historical range in this part of the state (Slauson 2003). Historical records suggest that martens in northwestern California were closely tied to late-successional coast redwood (*Sequoia sempervirens*) forests (Slauson and Zielinski 2003); however, the one remnant population in this region occurs in an area dominated by Douglas-fir (*Pseudotsuga menziesii*) and tanoak (*Lithocarpus densiflorus*) forest associations (Slauson et al. 2007), with coast redwood associations limited to the western edge of the currently occupied range (Slauson et al. 2007). This population uses two structurally distinct forest types with a common link of

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dense shrub cover; one occurring on serpentine soils and one on more productive non-serpentine soils (Slauson 2003, Slauson and Zielinski 2007, Slauson et al. 2007).

In California, fishers historically ranged from Marin County to the Oregon border, east to Mount Shasta and Lassen Peak and south through the Sierra Nevada to northern Kern County (Grinnell et al. 1937). Fishers currently exist in two disjunct populations in California: one on the west slope of the southern Sierra Nevada and the other in the Klamath Mountains and Coast Ranges of northwestern California (Zielinski et al. 1995). There has long been a concern over habitat loss and alteration due to rapid harvest of mature and old-growth Douglas-fir forests (Rosenberg and Raphael 1986).

Both species have been petitioned for listing under state or federal endangered species acts. The United States Fish and Wildlife Service determined that the west coast population of fisher warranted protection under the Endangered Species Act, but were precluded from being added to the list of threatened or endangered species due to higher priority actions (USFWS 2004). The fisher was officially added to the candidate species list at the time of this ruling. The California Department of Fish and Game recently completed a comprehensive status review of fisher in response to a listing petition (CDFG 2010), but the species was denied protection under the state endangered species act. The Humboldt marten was recently petitioned for federal listing as a threatened or endangered species (Center for Biological Diversity and Environmental Protection Information Center 2010).

Green Diamond Resource Company (GDRCo) has conducted periodic studies focused on fishers inhabiting its California timberlands since 1994. These track plate surveys were suitable for detecting martens, and surveys conducted a decade after the initial effort revealed the presence of marten several km west of the known population on public lands. An impromptu survey effort in 2006 to investigate a potential regional decline in fisher numbers again confirmed the presence of marten in the same area and a potential expansion of the occupied area. The detection of a marten in Prairie Creek Redwoods State Park in 2009 (Slauson and Holden 2009) and about 11 km west of the detections on GDRCo ownership prompted additional surveys on select areas of GDRCo lands in 2010 and 2011. This paper summarizes results of non-invasive surveys for *Martes* conducted on GDRCo's managed forests since 1994.

Study area

We conducted surveys in Humboldt and Del Norte Counties, California on approximately 150,000 ha of timberlands owned primarily by GDRCo. Coast redwood forest dominated the coastal areas and lower elevations. Douglas-fir replaced redwood as elevation and distance from the coast increased. Hardwoods existed as pure stands or common forest components. Red alder (*Alnus rubra*) and maple (*Acer macrophyllum*) dominated in coastal mesic sites, while tanoak, madrone (*Arbutus menziesii*) and giant chinquapin (*Chrysopsis chrysophylla*) occurred at higher, more xeric sites. The entire study area was within 30 km of the Pacific Ocean, and elevation on the study area ranged from 5 to 1400 m. The maritime climate, which produces fog or low clouds throughout the year, has definite wet and dry seasons (NOAA 2001) with mean summer and winter temperatures of 8 and 15 °C respectively (Zinke 1988). Annual precipitation occurs mostly as rain from

November through April and varied from 95 cm near the coast to 150 cm in the coastal mountains (NOAA 2001). Substantial and persistent snow occurred at elevations above 1000 m. Most of the study area had been subjected to timber harvest over the past century and consisted of second and third-growth forests, ranging in age from recently harvested to 120 years.

Methods

We conducted surveys for mesocarnivores using enclosed track plates (Fowler and Golightly 1994, Ray and Zielinski 2008) in 1994, 1995, 2004, and 2006 and remote cameras from 2010 to 2011. We placed a maximum of six track plates (stations) in suitable habitat at approximately 1 km intervals within 5 km linear segments (Fowler and Golightly 1994). We baited each track plate with a piece of chicken. We re-baited and replaced sooted plates every other day for 22 consecutive days. We surveyed during January to May, but a subset of segments was surveyed during June to August to assess seasonal variation. We calculated detection ratios based on segments by dividing the number of segments with >one detection by the number of segments sampled. These detection ratios were used to assess trends in detection ratios (i.e., index of population size or density) over time and by region.

Prior to 2010, no surveys were conducted with the specific objective of determining the distribution or habitat associations of marten on GDRCo's ownership. However, our field techniques were equally suitable for martens. In 2010, we deployed remote cameras at stations centered on a 2 km² hexagonal grid randomly located on the ownership (Zielinski et al. 2007). We randomly selected units to sample, but also focused on areas where marten were detected during prior track plate surveys. We deployed cameras for a minimum of 3 weeks at each station. We baited stations with raw chicken and a commercial trapping lure (Caven's Gusto Lure, Minnesota Trapline Products, Pennock MN) as an attractant. We baited and checked stations weekly with the general exception that some stations were baited and checked every other week due to complications with access due to weather or other demands on field personnel. During the pilot work in 2010, we tested several models of purchased and loaned cameras to assess reliability, ease of use, function and other important factors. In 2011, we began placing two RECONYX (RECONYX, Inc., Holmen, WI) cameras (models HC500 and PC800) at each sample unit. Cameras were located approximately 3 to 5 m and at right angles from the bait tree.

Results

During all surveys in 1994, 1995, 2004 and 2006 we operated a total of 975 individual track plate stations. We obtained 101 and 135 fisher detections in 1994 and 1995 respectively on 26 of the 40 (65 percent) survey segments during both years combined. We obtained a total of 78 fisher detections at 20 of the 40 segments in 2004. In 2006, we obtained 115 fisher detections at 12 of 18 segments surveyed. Mean detection ratios during the four sample periods from 1994 to 2006 varied from 0.40 to 0.67 at the segment level. The mean latency to detection (LTD) for all surveys was 11.6 days. The distributional pattern of detections across the study area indicated that almost all survey segments in the more interior Douglas-fir and mixed

redwood-Douglas-fir regions had detections. We detected fewer fishers in the more coastal redwood areas, southern regions near Humboldt Bay and the Eel River drainage and the northern region near the Oregon-California border.

We did not detect marten during the 1994 or 1995 track plate surveys. The repeat track plate survey conducted in 2004 yielded a total of six marten detections at four track plates on two segments in the Klamath region of the ownership. To confirm that the tracks recorded on the sooted track plates were indeed marten, we put a camera trap at select locations and obtained photographic evidence of marten. With the repeat of the track plate survey in 2006, we obtained a total of 13 marten detections at nine track plates on three segments. We also confirmed marten presence in 2006 with a camera trap.

We sampled 75 2 km² units with cameras between September 2010 and June 2011. We obtained photographic evidence of fisher at 45 stations (60 percent) and marten at eight stations (10.6 percent). Seven out of eight stations had multiple visits by marten. Fishers were detected at 75 percent of the stations with marten. The mean LTD for marten was 11 days (minimum = 5, maximum = 16 days).

Discussion

Our surveys indicate that fishers were relatively abundant and well distributed throughout the majority of the ownership during the periods of study, suggesting current forest management strategies are compatible with fishers habitat needs. However, Matthews and others (2011) found that indices alone were not adequate for detecting significant changes in a fisher population. Another study over a similar but larger geographic region including Redwood State and National Park and Humboldt Redwood State Park also indicated that fishers were generally less frequently detected in areas closer to the coast (Beyer and Golightly 1996). In addition, this broader survey also showed a pattern with few fishers detected in the northernmost (Smith River watershed) and southernmost (Eel River watershed) portions of the study area. A survey of Redwood National and State Parks provided corroboration relative to fisher habitat use in the redwood region (Slauson et al. 2003). An analysis of track plate surveys throughout old growth and second growth portions of the park indicated that fishers were found more than expected in second growth and less than expected in old growth. However, this study also found that fishers were associated with structurally complex portions of the second growth stands.

Our current knowledge of the marten on the study area is very limited. The lack of detections of martens during most surveys does not prove that they were absent, but the preponderance of negative data certainly indicated that martens were either very rare or absent over most of the study area. With the overall dearth of marten detections, it is obvious that we lacked the data to assess any trends in the marten population, and we are not able to draw any valid conclusions about habitat use. Presumably, the martens detected on GDRCo's ownership in 2004 and 2006 were dispersers or peripheral residents from the core population to the east on public lands. It may be strictly coincidental, but the potential expansion of martens onto our study area occurred at the same time that the regional population of fishers was temporarily declining. Our surveys in 2004 indicated a potential decline in fisher abundance as evidenced by fewer detections relative to the other survey years. Matthews et al. (2011) documented a decline in relative abundance of fishers from 1998 to 2005 on

the neighboring Hoopa Valley Indian Reservation. Although we detected martens at track plates where fishers had been previously detected, no martens and fishers were detected at the same track plate during the same survey period in 2004. Fisher and marten were detected at only one track plate during the same survey period in 2006. While our survey results do not allow for a definitive assessment of the trend in the coastal marten population, it appeared as if martens were dispersing further from their core population during the mid-2000s relative to the 1990s. In addition, a marten was detected approximately 10 km further to the west in Prairie Creek Redwoods State Park in 2009. Regardless of any potential localized expansion of martens within GDRCo's ownership, it remains clear that the marten population was small and isolated to only a small portion of the ownership.

Our recent camera survey data suggests that fishers are relatively abundant within the Klamath region of the study and that they also overlapped the marten detections more than we observed during the prior track plate surveys. The negative interaction between fishers and martens has been noted in numerous locations throughout their range and the inverse relationship in abundance between the two species may be the result of this interspecific interaction. Although our sample size of marten detections was small (eight), we observed fishers at 75 percent of the cameras where marten were detected. We observed one bobcat (*Lynx rufus*) at a station where we also detected marten and fisher. However, our surveys were not designed to attract bobcats and likely do not accurately represent the abundance of bobcats present within the managed landscape. Forest management activities that encourage growth of other mesocarnivore populations may also be considered a threat to marten populations, as some of these species (e.g., fisher and bobcat) may opportunistically kill martens when encountered (Hamlin et al. 2010). Loss, modification, and fragmentation of habitat are considered significant ongoing threats to the remaining population of martens in northwestern California (Hamlin et al. 2010). Past timber harvest activities have eliminated much of the late-seral forests in coastal northern California, and due to the specialized habitat requirements of martens, such as large diameter live trees, snags, and logs, it would likely require decades of little or no timber harvest in large areas to develop habitat with the necessary structural characteristics to support martens (Hamlin et al. 2010).

Slauson et al. (2003) indicated that the marten should be considered a 'highly imperiled taxon' within the redwood region and that Redwood National and State Parks (RNSP) contains both the largest remnant patches and the largest total amount of old growth redwood forests. They concluded that the long-term persistence of martens within the coastal forests of northwestern California will likely require both the maintenance of areas currently occupied by martens and the expansion of their distribution. They further noted that expansion of the marten's distribution would require the combined effects of the restoration of suitable habitat and functional landscape connectivity to enable recolonization of suitable, but currently unoccupied habitat. However, they went on to note the critical conservation dilemma that the restoration of forest habitats with the structural characteristics necessary to be suitable for martens may take decades while the small isolated extant population of coastal martens was at serious risk of losing genetic variation or elimination due to stochastic demographic or environmental events such as wildfire. This led Slauson et al. (2003) to conclude that while restoration efforts within the coastal parks may eventually facilitate recolonization by martens, other conservation measures may be necessary to re-establish martens due to significant barriers created by large areas of

primarily early-seral forest on private lands, the Klamath River and U.S. Highway 101.

Another proactive conservation option that could yield more immediate benefits to the marten population is human assisted dispersal. This approach would be similar to a reintroduction with the exception that limited evidence suggests that marten are currently capable of dispersing to the coastal parks. The marten observed in Prairie Creek Redwoods State Park in 2009 is presumably evidence of a naturally dispersing animal. However, natural dispersal of male and female martens is impeded by considerable ecological and anthropogenic barriers between the existing population and available habitat in the coastal parks. These barriers and the abundant mesocarnivore population on managed lands could constrain natural establishment of a population of martens in the coastal parks. If the martens we detected on private managed forests are reproducing, it may be possible to identify dispersers from this area and deliberately move them westward to suitable habitat on the coastal parks. This strategy is not without complexities that need to be thoroughly explored prior to implementation. For example, this project would likely involve multiple partners from federal, state, tribal and private organizations, a commitment to funding for implementation and monitoring, and some initial basic research such as investigations of dispersal of marten. It would also be prudent to evaluate species reintroduction guidelines in the context of this specific effort (IUCN 1998). Ideally, this collaborative action would increase survival of juveniles relative to that of natural dispersers, it would establish a viable population of martens within coast redwood habitat in the parks, and it could reduce the vulnerability of the population to stochastic events such as disease and wildfire.

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