

Documentation of mountain lions in Marin County, California, 2010–2013

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Prior to 2010, mountain lions (*Puma concolor*) have rarely been documented in Marin County, California. Although there are reports of sightings of mountain lions or observations of mountain lion sign, most have not been verified by photographs or physical samples. A search of museums throughout the United States (Long and Sweitzer 2001) revealed that the only specimen from Marin County appears to be a mountain lion collected in 1931 (MVZ:Mamm:47199). Gross and Fitzhugh (1985) compiled a list of 148 reports of mountain lion observations in Marin County from 1961 to 1984 based on agency records or personal communications with local residents. The majority of those accounts were visual recollections that could not be verified, and no physical or photographic documentation accompanied any of the reports. Since 1972, four depredation permits have been issued for mountain lions in Marin County, with no confirmed kills under those permits (CDFW 2014).

Of several wildlife surveys conducted in Marin County from 1990 to 2003 (Riley 1999, Fellers and Pratt 2002, Howell and Semenov-Irving 2005, E. E. Boydston, unpublished data), verifiable mountain lion detections were obtained only in Point Reyes National Seashore in far western Marin County. These detections were 11 images collected by motion-activated cameras during 1998–2001 (Fellers and Pratt 2002) and a video clip of a mountain lion in 2003 (Fellers 2003). Additional images of mountain lions in Point Reyes National Seashore were obtained from a single motion-triggered camera that was not part of a larger survey during 2009–2010 (G. M. Fellers, USGS, unpublished data).

Beginning in 2010, we conducted a pilot study of mountain lions in Marin County using motion-triggered cameras. Our objectives were to obtain additional documentations, confirm the presence of mountain lions outside of Point Reyes National Seashore, and

determine if mountain lions had a regular presence in the county. We deployed a total of 14 digital cameras: three Cuddeback Capture (Cuddeback Digital, De Pere, WI) incandescent flash cameras taking still pictures and 11 Bushnell Trophy Cam IR (Alliant Techsystems Inc., Anoka, MN) cameras set in video mode. We set unbaited cameras within four focal areas on private and public lands, with successive starting dates for the four areas as access permission was obtained from land owners or management agencies for monitoring: (1) Nicasio—01 October 2010; (2) Olema—21 January 2011; (3) the Alpine Lake region of Mount Tamalpais—26 September 2011; and (4) Bolinas—12 September 2012 (Figure 1; geographic center: 38° 00' N, 122° 41' W).

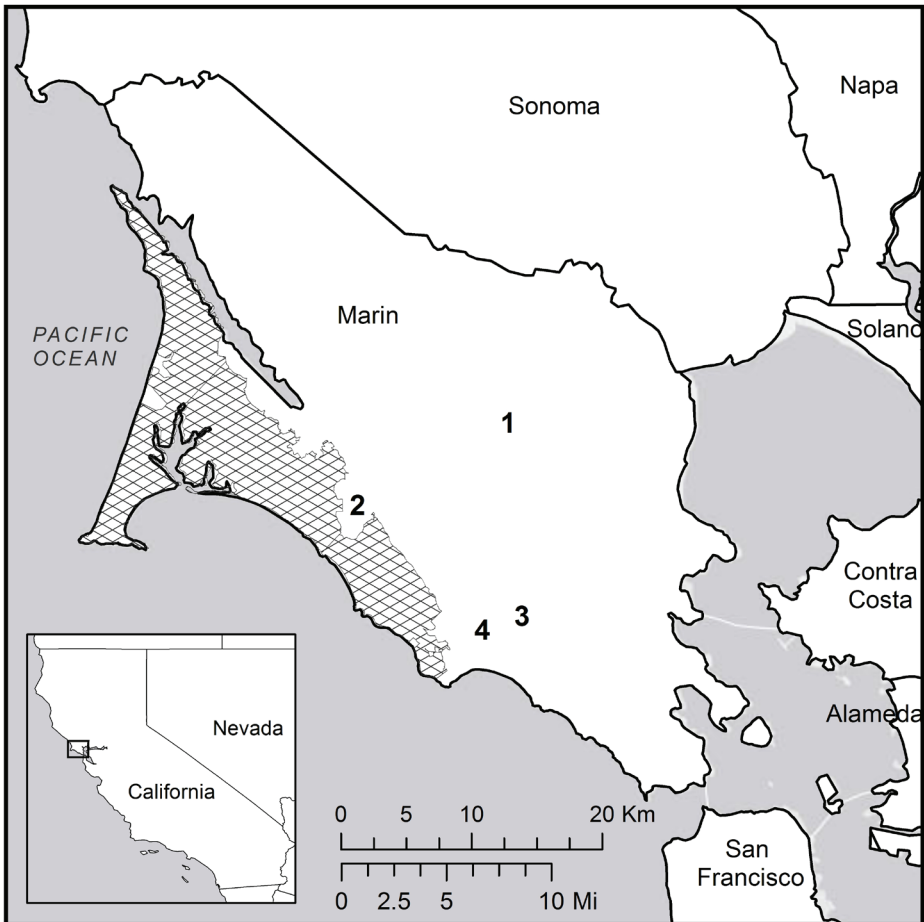


FIGURE 1.—From October 2010 to April 2013, motion-triggered cameras were placed at four locations in Marin County, California, which has an area of approximately 1,368 km² (528 mi²). Numbers indicate the focal areas described in this paper: (1) Nicasio; (2) Olema; (3) Alpine Lake; (4) Bolinas. Other labels are nearby counties, and the cross-hatched area delineates Point Reyes National Seashore.

Within each focal area, one to four cameras were placed along unpaved fire roads or private access roads that were infrequently used by people. Cameras were placed at locations where a road narrowed due to topographical features such as a steep embankment or drop-off on one or both sides, or at an intersection with other unpaved roads or wildlife trails, with distances from 0.3 to 2 km between cameras. After a mountain lion was first detected on a trail camera in the Nicasio focal area, we set up paired cameras 3 m apart on the same side of the road or at 90° angles to obtain simultaneous or nearly simultaneous images showing different views of an animal walking by them.

We considered the focal area as the sampling unit, and grouped pictures and videos from the same focal area, at the same time of day, into detection events. We measured monitoring time as the number of calendar days per focal area, rather than estimate effort based on total numbers of cameras. To determine if one or more mountain lions were detected, we examined physical characteristics of the lion in each image (Kelly et al. 2008), and compared different views from the same detection event to build a photo-ID record. For this process, we first used images taken by paired cameras within a focal area. We then compared images across all detection events. This note reports on results of continuous camera monitoring within the four focal areas through April 2013.

In total, we obtained 122 digital images (still pictures and video clips) with mountain lions in them; no single picture or video clip showed more than one mountain lion at a time. There were 55 different detection events, with from one to six images per event, and at least 14 hours separating events. Multiple images of the same detection event always occurred within 20 minutes of each other and most were within 5 minutes. The first detection of a mountain lion in Nicasio was on 15 November 2010, 45 calendar days after placement of the first camera and prior to setting cameras in other focal areas. During 942 calendar days of monitoring in Nicasio, we obtained 24 mountain lion detection events with a median of 21 days between detections. The first mountain lion detection in Olema was on 04 March 2011 after 42 calendar days of monitoring in that area. In 830 calendar days of monitoring in Olema, there were a total of 16 detection events with a median of 30 days between events. A mountain lion was first detected in the Alpine Lake region on 21 December 2011, 86 days since initiating monitoring. After 582 days in Alpine Lake, we obtained 14 mountain lion detection events separated by a median of 22 days. In 230 days of monitoring in Bolinas, we had 1 detection event on 06 October 2012, 24 days after initiating monitoring.

The most conspicuous physical characteristic in the mountain lion images was an ocular defect that manifested as corneal cloudiness and a lack of tapetal reflection or “eyeshine” in the right eye (Figure 2A, Figure 3). This ocular defect may have been scarring of the cornea due to trauma or disease (K. Freeman, Ophthalmology for Animals, personal communication; B. D. Jansen, Arizona Game and Fish Department, personal communication; K. Krause, Serrano Animal and Bird Hospital, personal communication; S. Weldy, Serrano Animal and Bird Hospital, personal communication), and was visible in 61 images and 40 detection events. Additional physical characteristics consistently observed in detection events showing this right-eye defect included the pattern of ear notches, white flecks on the back, white patch on back of the ear, a swelling at the base of the tail in the perianal region bilateral, and sagging abdomen. Based on matching two or more of these physical characteristics, we were able to identify this same individual in a total of 46 detection events and 112 images. We refer to this animal as PC01. Other more general characteristics such as physical build and a smooth tail shape were also consistent across images of PC01. In more than half of these detection events, the penis sheath was visible, confirming PC01

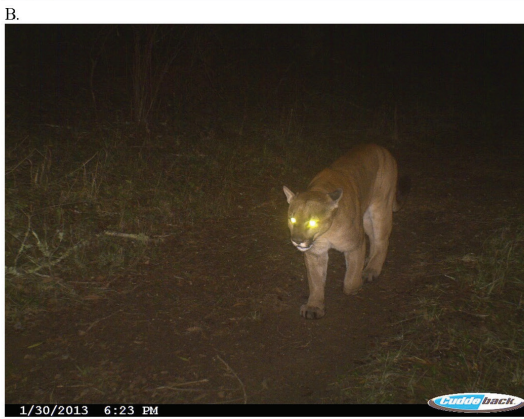


FIGURE 2.—Images from the same camera near Nicasio, Marin County, California showing differing eye shine patterns. (A) A mountain lion with an ocular defect and eyeshine registering in only the left eye was detected multiple times, including 26 March 2013 and 22 May 2011 (inset image). This mountain lion also had notches in its left ear and white shoulder flecks. (B) A mountain lion with eyeshine registering in both eyes was also detected on 30 January 2013.



FIGURE 3.—Photographic images of a mountain lion with asymmetrical eyeshine taken with a Cuddeback Capture camera near Nicasio, Marin County, California. Video clips and pictures are posted at: <http://wildfelids.smugmug.com/>

was a male (Montana Fish, Wildlife and Parks 2009). The 46 detections in which we could identify PC01 spanned January 2011 through April 2013. During this period, PC01 was detected in three focal areas: Nicasio, Olema, and Alpine Lake.

There were five detection events in which the mountain lion photographed did not have the identifying features of PC01, but exhibited characteristics not seen in images of PC01. Two of these events captured a mountain lion with eyeshine in both eyes. One of these events occurred on 30 January 2013 in Nicasio (Figure 2B), in which an additional image confirmed the animal in this detection event was male. The other detection occurred on 06 October 2012 in Bolinas, and was the only mountain lion detection in that focal area. The remaining detection events occurred on 12 June 2012 (two events 14 hours apart) and 29 June 2012 in the Alpine Lake area. The eyeshine pattern could not be determined in images from these three events, but all images showed an animal that appeared much leaner than PC01. Furthermore, a distinct kink in the tail at the midpoint along the length of the tail was visible in two of the events, and one of the images confirmed that the animal was a male. While there was not enough evidence to confirm these five detection events represented one or more individuals, we conclude they represented at least one mountain lion in addition to PC01.

The suitability of habitat for mountain lions in Marin County (Torres et al. 1996), the wide-ranging habits of this species (Beier et al. 2010, Dickson and Beier 2002, Pierce and Bleich 2003), and the wide distribution of mountain lions in California, including documentations in nearby counties (Ernest et al. 2003, CDFW 2014), suggested that mountain lions would occur in Marin County. Our detections of mountain lions on cameras outside of Point Reyes National Seashore add multiple verifiable confirmations to the records of their presence in this county. Further, we repeatedly documented one male mountain lion over a period of 27 months, who was consistently and uniquely identified by an ocular defect in his right eye and other physical characteristics. We also confirmed the presence of at least one other male mountain lion during the study period.

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