THE CALIFORNIA COOPERATIVE WOLVERINE SURVEY: A PROGRESS REPORT

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Abstract: Wolverines (*Gulo gulo*) historically occurred in mountainous areas of California from the north coast to the Cascades, and south to the southern Sierra Nevada. Populations were severely reduced in the late 19th and early 20th centuries by commercial trapping. Current distribution is based mostly on sporadic, unverified reports of sightings and tracks. We used remote photographic bait stations in areas of historic range and recent reports in an attempt to document the current existence of wolverines in California. Wolverines were not detected through the spring of 1992.

Wolverines (*Gulo gulo*), the largest terrestrial mustelid, occur throughout the northern latitudes of both Eurasia and North America (Wilson 1982, Hash 1987). The wolverine's historic southern limit in North America was approximately the 38th parallel, with extensions farther south along the Rocky Mountains and the Sierra Nevada and Cascade mountain ranges. Wolverine range has contracted over the past 150 years, particularly in the more southerly areas, beginning with the period of European expansion, the fur trade, and the extirpation of the bison (*Bos bison*)(Hash 1987).

Today, wolverine populations remain in northern Canada and Alaska and parts of northern Europe, although nowhere are they common. In the conterminous United States, the largest population of wolverines is in northwestern Montana (Hornocker and Hash 1981). Reports of wolverines exist from Colorado, Nevada, Oregon, Utah, Washington, and Wyoming (Hash 1987). During the winter of 1992-93, wolverines were captured for radio telemetry in central Idaho (J. Copeland, Idaho Dep. Fish and Game, pers. commun.).

In California, the historic range of the wolverine included much of the north coast and the Sierra Nevada (Grinnell et al. 1937, Schempf and White 1977). Schempf and White (1977:25) described the modern range to include a broad arc from Del Norte and Trinity counties eastward through Siskiyou and Shasta counties, and then southward through the Sierra Nevada to Tulare County. Subsequent reports have enlarged this range to include the White Mountains in eastern Mono County (Kovach 1981). Aside from these broad distributional data, based on early fur-trapping records and sporadic reports of unverified sightings, little is known about wolverine occurrence or abundance, and nothing is known about wolverine ecology, in California.

In North America, the four ecological investigations of wolverines include work in the arctic tundra of northwestern Alaska (Magoun 1985), in forested, montane areas of southcentral Alaska and southwestern Yukon Territory (Gardner 1985, Banci 1987), and in northwestern Montana (Hornocker and Hash 1981). Wolverines in these studies occurred in low densities (one wolverine per 50-200 km^2) in a variety of habitats, were largely solitary, had large home ranges (100-700 km^2), and traveled extensively, up to 20 km/day, even in the most rugged areas. Hash (1987:579) described them as "scavenging predators", and Hatler (1989) summarized the wide variety of food items, including both plant and animal material, found in the diet of wolverines.

The wolverine is classified as threatened by the State of California (Anon. 1991a) and is a Category 2 candidate for federal listing as threatened or endangered under the federal Endangered Species Act (Anon. 1991b). The objective of the present study was to determine the distribution of wolverines in California through the use of photographic bait stations. The present report documents results through May 1992.

METHODS

Our first field season was in the summer of 1991, and we used 110-size cameras (Jones and Raphael 1993) set at stations baited with carrion placed in areas of historic wolverine range and recent reports. Subsequently, we restricted field efforts to winter, when black bears (*Ursus americana*) were not active. Further, wolverines are reportedly more attracted to bait in winter (Hornocker and Hash 1981). We also changed to the Trailmaster camera system (Goodson and Associates, 10614 Widmer, Lenexa, Kansas, 66215), a commercially available product that couples an infra-red trigger to a weatherproof, 35mm, fully automatic camera (Kucera and Barrett 1993). A film exposure occurred when the infra-red beam was broken by an animal that was attracted to the bait. Camera stations were established from December 1991 through April 1992. The last station removed was in May 1992. Additional stations are in place during the 1992-93 season, but data from these are not reported here.

Personnel who monitored the stations received training in the operation of the camera and a set of guidelines for establishing and attending the stations. Stations were to be visited at least once every two weeks; however, the frequency of station visits varied with ease of access, weather and snow conditions, and personnel availability. Access to the stations was by foot, truck, snowmobile, skis, snow cat, or helicopter. For bait, we used parts of the carcass of road-killed mule deer (*Odocoileus hemionus*), or fish supplied by state fish hatcheries, and in one case the carcass of a white-tailed hare (*Lepus townsendii*). Baits were placed in trees, approximately 2m off the ground or snow in an attempt to keep them out of the reach of coyotes (*Canis latrans*). To increase the odor of the baits, on several sets we added fish emulsion sold as fertilizer at garden-supply shops. The Trailmaster system was positioned such that the infra-red beam passed approximately 3-8 cm below the bait and 5-10 cm lateral to the trunk of the tree. In an attempt to determine if wolverines scavenged mule deer killed by mountain lions (*Felis concolor*), Trailmaster cameras also were placed over recently lion-killed deer, left overnight, and examined the next morning; these cameras were in association with a study of mountain lions conducted by the California Department of Fish and Game (CDFG) near Bishop, Inyo County.

RESULTS

A total of 57 Trailmaster camera stations were established in the winter of 1991-92 (Table 1). Wolverines were not detected. At least twenty species were detected at the stations, including marten (*Martes americana*), fisher (*M. pennanti*), mountain lion, bobcat (*Felis rufus*), black bear, spotted skunk (*Spilogale putorius*), gray fox (*Urocyon cinereoargenteus*), coyote, ringtail (*Bassariscus astutus*), raccoon (*Procyon lotor*), *Peromyscus* sp., Douglas' squirrel (*Tamiasciurus douglasii*), flying squirrel (*Glaucomys sabrinus*), chipmunks (*Tamias* sp.), California ground squirrel (*Spermophilus beecheyi*), hairy woodpecker (*Picoides villosus*), Clark's nutcracker (*Nucifraga nucifraga*), raven (*Corvus corax*), and turkey vulture (*Cathartes aura*). At the 10 lion-killed deer stations, only mountain lions were detected, except for one black-billed magpie (*Pica pica*).

Martens were the most widespread of the species detected, occurring at 18 of the 57 (32%) stations (Table 1). They were attracted by baits that included deer, fish, and white-tailed hares. Martens were detected from site PG-6, near Mt. Lola, Nevada County, at an elevation of 2530 m, to site IN-4, west of the town of Independence, at 2316 m. The highest elevation at which martens were photographed was 3078 m at IN-1, near Saddlebag Lake, Mono County. The lowest elevation at which martens were detected was 2073 m at WA-2 in the Ward Creek drainage, Placer County. Martens were not detected over a large area of the west slope of the central Sierra Nevada (sites PG-1, PG-2, PG-3, PG-6), although they were on adjacent areas of the east slope (e.g., sites WA-2, WA-3, WA-4), and martens are known to occur farther west of our west-slope stations (Fowler and Golightly 1991).

A fisher was detected at one site (KL-1a), in northern California on the north slope of the Trinity Alps on the Klamath National Forest.

Once black bears became active in the spring, many of the stations attracted them. A bear often would remove the entire bait package, and occasionally knock the camera sideways or hit the infra-red transmitter or receiver. One camera was damaged in this way. In several instances, the cable leading from the infra-red receiver to the camera was chewed through, probably by a squirrel.

DISCUSSION

Although wolverines were not photographed, we developed techniques appropriate to conduct a survey for wolverines. For such a wide-ranging and low density species as a wolverine, it was necessary to expand the scope of coverage by including various agencies and volunteers. We demonstrated the value of the remote photographic technique to document the presence of rare carnivores, such as the fisher, as well as more common ones, such as the marten and ringtail. We are hopeful that the current negative results were due to the low density of wolverines and insufficient survey effort and not because of an inappropriate technique or that wolverines are extinct in California. Despite a budget cut and a very severe winter, efforts to document wolverines in California continue in the winter of 1992-93.

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Table 1. Locations of photographic bait stations and species detected at them, December 1991-May 1992. Land ownership abbreviations are: NF = National Forest (U.S. Forest Service), LTBMU = Lake Tahoe Basin Management Unit (U.S. Forest Service), TNC = The Nature Conservancy. Locations are shown as Universal Transverse Mercator (UTM) coordinates, NAD-27 datum.

Site	Land Ownership	UTM Zone	UTM Northing	UTM Easting	Elev (m)	Date	Species
IN-1	Inyo NF	11	4205000	301000	3078	19 Dec 91	Marten
IN-2a	Inyo NF	11	4170000	322000	2438	21 Dec 91	Marten
IN-2b	Inyo NF	11	4170000	318000	2804	8 Feb 92	Marten
IN-3a	Inyo NF	11	4143000	404000	2438	12 Dec 91	Gray fox
						2 Feb 92	Peromyscus sp.
						2 Feb 92	Striped skunk
IN-3b	Inyo NF	11	4135000	395000	2621	24 Mar 92	Grey fox
IN-4	Inyo NF	11	4070500	383000	2316	18 Dec 91	Marten
IN-5	Inyo NF	11	4124500	360500	2316	25 Mar 92	Marten
						26 Mar 92	Ringtail
						5 Apr 92	Raccoon
ST-1	Stanislaus NF	11	4243400	256200	2590	11 Feb 92	Marten
						26 Feb 92	Raven
ST-2	Stanislaus NF	11	4241200	251200	2316	10 Mar 92	Marten
						29 Mar 92	Coyote
						28 Apr 92	Black bear
ST-3	Stanislaus NF	11	4241000	254200	2377	16 Mar 92	Marten
ST-4	Stanislaus NF	11	4243500	244000	1981	6 Mar 92	Douglas' squirrel
						24 Mar 92	Peromyscus sp.
ST-5	Stanislaus NF	11	4245000	246200	2011	25 Apr 92	Peromyscus sp.
ST-6	Stanislaus NF	11	4244500	248200	2225	8 May 92	Black bear
ST-10	Stanislaus NF	11	4246500	269500	2896	27 Apr 92	Bobcat
						2 May 92	Clark's nutcracker
						6 May 92	Black bear
ST-11	Stanislaus NF	11	4246200	257200	1829	14 Apr 92	Douglas' squirrel
ST-12	Stanislaus NF	11	4248200	268500	2926	26 Apr 92	Clark's nutcracker
						5 May 92	Black bear
						11 May 92	Marten
EL-1	El Dorado NF	10	4302000	756000	2377	11 Mar 92	Marten
LA-2	LTBMU	10	4305800	754500	2286	25 Feb 92	Marten
						2 Mar 92	Raccoon
						22 Mar 92	Douglas' squirrel
LA-3	LTBMU	10	4296000	760500	2341	13 Mar 92	Flying squirrel
						14 Mar 92	Marten
LA-4	LTBMU	10	4306300	751000	2134	7 Mar 92	Marten
WA-2	LTBMU	10	4335800	740700	2073	17 Jan 92	Marten
WA-3	LTBMU	10	4334500	739200	2164	10 Mar 92	Marten
WA-4	LTBMU	10	4335000	738500	2438	20 Mar 92	Marten
WA-5	LTBMU	10	4333900	739200	2195	5 Apr 92	Marten
TA-2	Tahoe NF	10	4373500	731000	2134	31 Dec 91	Douglas' squirrel
						20 Jan 92	Hairy woodpecker
TA-4	Tahoe NF	10	4366700	731900	2408	21 Dec 91	Marten
						9 Jan 92	Douglas' squirrel
TA-4a	Tahoe NF	10	4366800	732800	2316	29 Jan 92	Marten
PG-1	Tahoe NF	10	4332500	735000	1859	10 Mar 92	Douglas' squirrel
						2 Apr 92	Black bear
PG-2	Tahoe NF	10	4334000	728800	1890	23 Mar 93	Flying squirrel
						26 Mar 92	Douglas' squirrel
PG-4	Tahoe NF	10	4343000	716400	1006	18 Mar 92	Black bear
PG-6	Tahoe NF	10	4365100	727100	2530	20 Mar 92	Marten
PG-7	Tahoe NF	10	4349000	712800	1950	24 Mar 92	Black bear

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