

Does the Cougar Inhabit Sleeping Bear Dunes National Lakeshore?

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ABSTRACT: Increasing numbers of cougars (*Puma concolor*) have been documented in Great Plains and Midwestern states in recent years. This includes numerous reports of cougars in Michigan; however, evidence of a natural population has not been obtained. We conducted track surveys and operated camera stations from November 2004 through April 2005 in Sleeping Bear Dunes National Lakeshore (SBDNL), Michigan. We obtained no images of cougars during 863 camera nights and did not observe cougar tracks or associated sign (e.g., scats, hair, kill sites) during 493 km of track surveys. Presence of 10 carnivore species, including bobcat (*Lynx rufus*), coyote (*Canis latrans*), and domestic dog (*Canis familiaris*) was documented. We also investigated four cougar sightings and one report of cougar tracks within and adjacent to SBDNL. We were unable to locate any cougar sign at the sighting locations but did observe sign of coyote and bobcat. A domestic dog made the reported cougar tracks. We found no evidence supporting the presence of cougars at SBDNL.

Index terms: camera survey, cougar, Michigan, *Puma concolor*, Sleeping Bear Dunes National Lakeshore, track survey

INTRODUCTION

The historic range of the cougar (*Puma concolor*) extended across portions of Canada, throughout the lower 48 states, and as far south as Chile and Argentina (Lindzey 1987). The current established range of the cougar in the United States extends predominantly from the west coast to the eastern edge of the Rocky Mountains, south through portions of Texas, and east to western South Dakota (Lindzey 1987, Johnson 2000). The reduction in the cougar's historic geographic range has been attributed to hunting, predator control, and land use changes (Currier 1983). With the removal of bounties in western North America by 1970, cougars have increased numerically and expanded their range in many western states (Dixon 1982). However, the only documented breeding population in eastern North America occurs in Florida (Maehr 1997).

The status of cougar in eastern North America has been debated for decades (Cardoza and Langlois 2002). Numerous sightings of cougars are reported throughout eastern North America each year. Many articles in scientific and popular literature have been written attempting to contextualize limited available information (Wright 1965, Lawrence 1989, Stoczek 1995, Cardoza and Langlois 2002, Bolgiano et al. 2003). In recent years, however, sightings or other physical evidence of cougars have been obtained in a number of Great Plains and Midwestern states (e.g., Benedict et al. 2000, Heist et al. 2001, Clark et al. 2002, Nielsen et al. 2005). Many confirmed sightings are of males that may be dispersing

from the eastern fringe of their occupied range (e.g., Thompson and Jenks 2005).

Taxonomists have recognized 30-32 subspecies of cougar (Currier 1983, Culver et al. 2000), with 13 occurring north of Mexico (Dixon 1982). However, recent genetic analyses suggest that cougars throughout the United States and Canada are of a single subspecies, *P. c. cougar* (Culver et al. 2000). Although the eastern cougar subspecies (*P. c. cougar*) that historically occupied Michigan is considered extinct by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service 2005), controversy exists regarding the presence of cougars in Michigan (Butz 2005). Despite claims of a small, isolated cougar population in the Upper Peninsula of Michigan (Evers 1992, McDougall 2004), no supporting evidence was provided. It has also been suggested that groups released western cougars into areas of the eastern United States in the early 1990s, resulting in cougars in the Lower Peninsula of Michigan and elsewhere (McDougall 2004). Population estimates of 50-80 cougars in the Upper Peninsula and 30-50 in the Lower Peninsula of Michigan have been reported in state newspapers but not substantiated. Little physical evidence is available to support claims of a wild population of this size. Hair collected from a vehicle that reportedly struck a cougar during November 2004 in Menominee County (Upper Peninsula), Michigan, was determined to be from a cougar based on DNA analysis of four hairs in the sample (T. Cooley, Michigan Department of Natural Resources [MDNR], pers. comm.). Continent of origin (North or South America),

used to establish whether the cougar was likely captive (see Culver et al. 2000), was not determined. Ten scats reportedly collected from eight locations, four each in the Upper and Lower peninsulas of Michigan, had DNA profiles consistent with cougar (Swanson and Rusz 2006). Continent of origin was determined to be North American for one scat; useable DNA sequences for other scats were not obtained.

Sleeping Bear Dunes National Lakeshore (SBDNL) is located in the northwest Lower Peninsula of Michigan in Leelanau and Benzie counties. Although SBDNL lacked physical evidence confirming cougar presence, numerous sightings of cougars and their sign have been reported within and adjacent to SBDNL in recent years. These reports included a person followed by a cougar in September 2003. Because of these sightings and considering human injuries and deaths from cougars (Beier 1991), SBDNL took a cautionary approach, which emphasized public safety. Following the September 2003 incident, personnel at SBDNL created and placed signs at all mainland trailheads alerting visitors that observations of cougars had been reported and how to respond if a cougar was encountered. In response to controversy about their warning signs, SBDNL required additional information on cougar presence to make more informed management decisions. This included our work to determine if cougars were present in SBDNL.

STUDY AREA

We conducted the study from November 2004 through April 2005 in the 161-km² mainland portion of SBDNL (44° 77' N, 86° 05' W). Dominant overstory vegetation is comprised of coastal forests, including red oak (*Quercus rubra*) and jack pine (*Pinus banksiana*), and mixed northern hardwood forests, including sugar maple (*Acer saccharum*) and American beech (*Fagus grandifolia*) (Hazlett 1991). Other overstory habitats include oak (*Quercus* spp.) and oak-aspen (*Populus* spp.) forests, birch (*Betula* spp.)-aspen forests, pine (*Pinus* spp.) plantations, abandoned fields, wetlands, and open dunes. Primary prey of mountain lions in Michigan

would undoubtedly be white-tailed deer (*Odocoileus virginianus*; Lindzey 1987). Estimated white-tailed deer densities in the study area during October 2004 were about 7-10/km² (L. Visser, MDNR, pers. comm.). Yarding behavior of deer was not observed during the study; snow depth was typically ≤ 20 cm. Average high and low temperatures were about 27 and 16 °C during July and -2 and -9 °C during January, respectively.

There were 83 km of designated trails and 158 km of roads distributed throughout the mainland portion of SBDNL. During 2004, about 1.1 million recreational visits were reported for SBDNL; 62% occurred during July and August (www2.nature.nps.gov/stats/). Monthly visitation was lower during November-April, ranging from about 4000-23,000. Average human population density in Leelanau and Benzie counties during 2000 was 21.4/km² (www.census.gov).

METHODS

We used three methods to assess cougar presence: remote camera systems, track surveys, and investigations of reported observations of cougars or their sign. Three types of camera systems with flash units (seven total units) were used: (1) TrailMaster® TM-1500 (Goodson Associates, Inc., Lenexa, Kans., USA) active infrared units with 35-mm cameras ($n = 4$); (2) Camtrakker® (CamTrak South Inc., Watkinsville, Ga., USA) passive infrared unit with 35-mm camera ($n = 1$); and (3) Camtrakker passive infrared units containing digital cameras with 512 mb removable storage disks ($n = 2$). Camera systems were designed to take an image when an object intercepted the infrared beam (active) or entered the detection area (passive). Digital and 35-mm cameras were programmed to be able to take an additional image 20 seconds and 2 minutes after the previous image was taken, respectively. We used Kodak MAX 800 ASA color print film (Eastman Kodak Company, Rochester, N.Y., USA) for 35-mm cameras.

We positioned the seven camera systems throughout SBDNL in areas that were 150-

1500 m from the nearest road. Locations were selected based on reported observations of cougars, evidence of substantial white-tailed deer activity, and habitat corridors that would serve as travel routes. We periodically moved cameras to new locations to ensure effort was distributed throughout SBDNL based on the above criteria. However, greater effort was expended in the southern portion of SBDNL because about two-thirds of cougar sightings have been reported there. At each location, we typically wired a portion of a deer carcass to the base of a tree, and scented the area with commercial cougar urine, skunk essence, and catnip oil. Although success attracting cougars to baited sites has been variable, these attractants have been used previously and cougars have been attracted to baited sites (C. Elizalde-Arellano, Escuela Nacional de Ciencias Biológicas, IPN, pers. comm.). Carcasses of deer killed by automobiles were collected along roadsides and frozen until needed for bait. At each location, we attached a camera to a tree and directed it toward the bait, which was located 5-10 m away. For TrailMaster camera systems, the infrared sending units were attached to the same tree as the deer carcass, about 40-55 cm above the ground. Vegetation was removed from the path between the sending and receiving units of TrailMaster systems to reduce the likelihood of branches intercepting the infrared beam and activating the camera. We tested each system during initial setup and during each camera inspection by moving on hands and knees between the camera and deer carcass. Sites were baited and lured once each week. Film and disks were usually replaced weekly, and batteries were replaced as necessary to keep equipment operating without interruption.

We conducted snow track surveys once each month from January-March 2005. A training session describing track characteristics and other sign (e.g., caches) of cougars and other resident mammalian species, in addition to methods for measuring tracks following Halfpenny (1986), was conducted for all study technicians. During each survey, we walked designated trails on foot except those containing large areas of unvegetated dune and beach habitat. We traversed unplowed roads primarily

using snowmobiles at speeds <16 kph and occasionally by foot. Because deer typically move into the beach dune/pine forest interface during spring, we also conducted a track survey on foot along this ecotone during April. We recorded all discernable tracks encountered by species based on field guides (e.g., Halfpenny 1986, Rezendes 1999) and observer experience. If cougar tracks or tracks suspected to be cougar were encountered, the tracks were to be photographed then forward- and backward-tracked to locate additional sign (e.g., scat, hair) that could be identified using DNA (Culver et al. 2000) or until it could be determined that the suspected tracks were not made by cougar.

Previous reports of cougars and their sign received by natural resource personnel at SBDNL have been maintained in a database. During our track and camera surveys, we also investigated sightings and sign that were reported to us by the general public within 24 hrs of the observation. Locations where observations occurred and the surrounding areas were thoroughly searched, typically by two observers. We compared 2004 cougar sightings with the monthly number of visitors during 2004 to see if a relationship existed between the number of visitors present and the number of cougar sightings. We selected 2004 data because concerted efforts were made to ensure that as many cougar sightings as possible were included in the database.

RESULTS

We established cameras at 30 locations for an overall density of 1 camera/5.4km². Cameras were operational for 863 total nights, a mean of 29 ± 13 (SD) nights/location. We obtained 226 images of animals but none of cougar. Of these, 224 could be identified to species (99%). Carnivores were documented on 79 occasions, including bobcat (*Lynx rufus*; 16), coyote (*Canis latrans*; 18), red fox (*Vulpes vulpes*; 2), domestic dog (*Canis familiaris*; 23), house cat (*Felis catus*; 2), and raccoon (*Procyon lotor*; 18). Remaining images were of deer, several bird species, and red squirrel (*Tamiasciurus hudsonicus*).

We conducted 493 km of track surveys during the course of the study. During January-March, we searched 457 km for evidence of cougars primarily on the trail system and unplowed roads. Effort was distributed evenly among months with a mean of 0.95 km/km² each month. About 60% of these surveys were conducted on foot. In addition, we conducted 36 km of track surveys on foot along the interface of the beach/dune and forest habitats during April. Overall, we detected >460 identifiable carnivore track sets including 22 of bobcat, 300 of coyote, and 40 of red fox. We detected the same species during track surveys as during the camera survey. In addition, we observed tracks of striped skunk (*Mephitis mephitis*), river otter (*Lontra canadensis*), mink (*Mustela vison*), and weasel (*Mustela* sp.). Numerous deer tracks were observed throughout the lakeshore during all months of the study.

We investigated four cougar reports and one report of cougar tracks during February and April 2005. In each instance, we determined the specific location of the observation based on a detailed description by the observer or by the observer taking us to the actual location. Locations were searched within 24 hours of reporting; inclement weather (e.g., rain, snow) did not occur between the observations and our investigation. No evidence of cougars was found at any of the five locations. Of the reported cougar observations, we found bobcat tracks at one location, coyote tracks at one location, and bobcat and coyote tracks at two locations. The reported cougar tracks, shown to us by the individual that made the report, were made by a domestic dog.

Thirty-six cougar reports were documented since 1997; 32 reportedly were actual sightings while four were observations of cougar sign. Sixteen reports were obtained in 2004 and five during January-April 2005. SBDNL personnel or official SBDNL volunteers made ten of the sightings. Overall, there was a general direct relationship between the number of cougar sightings and the number of visitors at SBDNL during 2004 (Figure 1).

DISCUSSION

The U.S. Fish and Wildlife Service currently lists the eastern cougar subspecies (*P. c. cougar*) as endangered and presumed extinct in the wild (U.S. Fish and Wildlife Service 2005). We found no evidence to suggest the presence of cougars at SBDNL. The three techniques we employed (track surveys, remote cameras, investigations of sightings) have been used previously to document cougar presence (Van Dyke et al. 1986, Roof and Maehr 1988, Pike et al. 1999, Novack 2003), although Van Dyke and Brocke (1987) suggested that sightings should not be used to determine distribution and abundance of cougars. Track surveys to document cougar presence are considered feasible (Van Sickle and Lindzey 1992) and should also include measurements such as gait and stride, as well as behavior (Cardoza and Langlois 2002). Brocke (1996) estimated that conducting searches along 19.8 km of road under good conditions was necessary to detect one resident female. In an area of Florida with sporadic cougar use, evidence of cougars was detected on average every 17 hours using vehicle surveys (Roof and Maehr 1988). Previous comparative studies employing remote camera systems are limited. In a 300-km² area in Guatemala with a resident cougar population, Novack (2003) obtained 32 photographs of cougars in 814 camera nights at 32 locations; however, cougar density in this area was unknown. Our efforts were considerably greater than the efforts of these previous studies, suggesting that if any cougars were resident, we would have detected them.

We observed a general association between the number of observations of cougars and number of visitors, similar to cougar sightings in South Dakota (South Dakota Department of Game, Fish and Parks 2005). It was not surprising that the reported observations of cougars and their sign that we investigated were concluded to be misidentifications. Downing (1996) estimated that ≥90% of reports he received from the eastern United States were misidentifications. Possible causes for misidentifications were summarized by Cardoza and Langlois (2002) and included contextual recall, conscious inferential

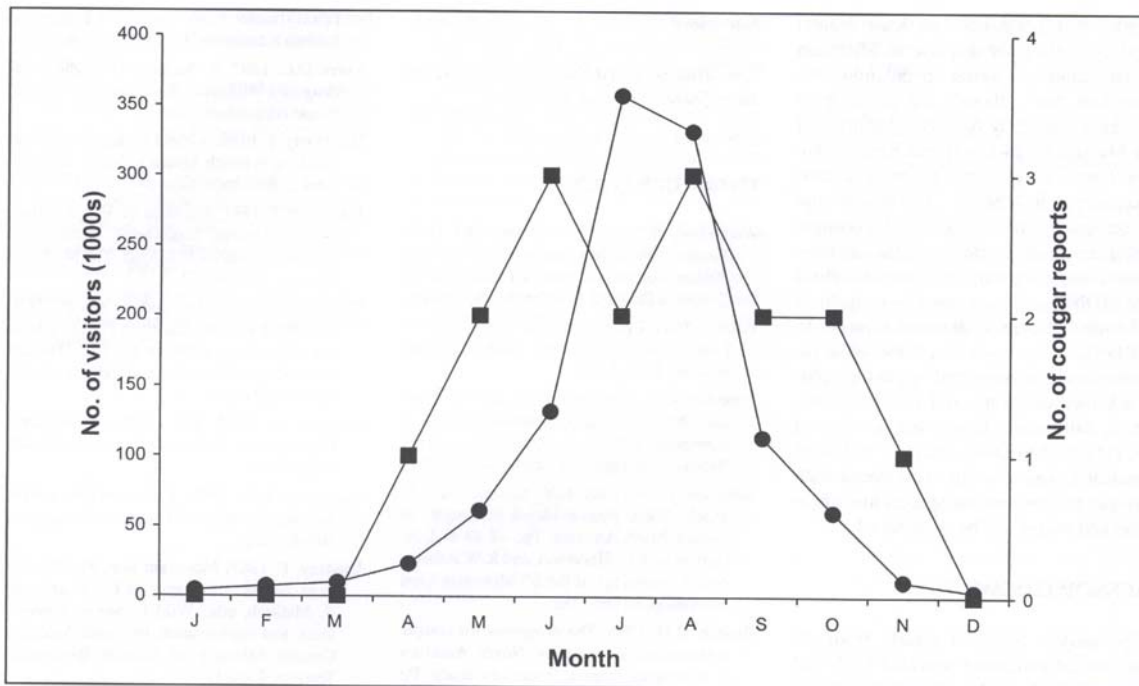


Figure 1. Number of visitors (circles) and number of reported observations of cougars or cougar sign (squares) during 2004, Sleeping Bear Dunes National Lakeshore, Michigan, USA.

processes, and unconscious bias.

It has been suggested that cougar observations could represent dispersing individuals from western populations. Although cougars rarely disperse distances >200 km (Anderson et al. 1992, Maehr et al. 2002), considerably greater distances have been reported (Logan and Sweanor 2000). The longest reported dispersal was of a radio-collared subadult male cougar traveling from the Black Hills of South Dakota and Wyoming to northern Oklahoma where it was apparently killed by a collision with a train (Thompson and Jenks 2005). The straight-line distance from the last telemetry signal to the mortality site of this cougar was 1067 km (Thompson and Jenks 2005). The distance between the Black Hills and the Upper Peninsula of Michigan is about 1200 km. This event provides evidence that juvenile male cougars from western populations can disperse into the Midwest, which may explain the increased number of confirmed cougars in

the Midwest (Nielsen et al. 2005).

If a breeding population of up to 80 individuals occurred in Michigan (the geographic extent of some population estimates included the mainland portion of SBDNL), as has been suggested in popular media and books (e.g., Evers 1992, Butz 2005), one would expect physical evidence of cougars to be more common. For example, South Dakota has an estimated population of 165 cougars of which 6-9 individuals were killed by vehicles in 2004 (South Dakota Department of Game, Fish and Parks 2005). Humans in South Dakota killed an additional 12 cougars during 2004 because of accidental snaring, depredation on domestic animals, and other events (South Dakota Department of Game, Fish and Parks 2005). Of an estimated population of 70-100 individuals in Florida (D. Land, Florida Fish and Wildlife Conservation Commission, pers. comm.), seven cougars died from collisions with vehicles between July 2003 and June 2004 (Land

et al., unpubl. data). In Florida, collisions with vehicles are the third largest source of mortality for cougars and represented 19% of total mortalities for radio-collared cougars between 1981 and June 2004 (Land et al., unpubl. data). Thus, recent human-caused annual mortality in South Dakota and Florida cougar populations is $\geq 7\%$. If Michigan had the number of resident cougars purported in popular media (up to 80 individuals), we would expect more than the single cougar-vehicle collision to have occurred.

Cougar populations have increased in many parts of western United States and Canada, possibly due to removal of bounties and more stringent harvest regulations (Logan and Sweanor 2000). The increased abundance of cougars in western North America has contributed in part to the increase in documented cougars eastward into the Great Plains and some Midwest states (Nielsen et al 2005). Based on recent movement data (Thompson and

Jenks 2005), cougars (at least males) could theoretically disperse to Michigan from established western populations. We conclude that although the presence of cougars apparently has been documented in Michigan (Swanson and Rusz 2006), we found no evidence to support their occurrence in SBDNL. We recommend maintaining a database of reported cougar sightings, perhaps similar to the internet-based cougar sighting database maintained by MDNR, and continued investigations of such sightings within and adjacent to SBDNL. When possible, these observations should be supported by photographs, track measurements, and tissue samples (e.g., hair, scat). Tissue samples should be subjected to DNA analyses, including nuclear DNA, at a lab experienced with cougar genetics, so that species identification and origin can be determined.

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