A SURVEY OF RECENT ACCOUNTS OF THE MOUNTAIN LION (PUMA CONCOLOR) IN ARKANSAS

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ABSTRACT - We collected physical evidence (scats and tracks) that suggested the presence of 1 or more mountain lions (Puma concolor) in Arkansas from 1998-1999, and conducted a survey of mountain lion occurrences in Arkansas from 1996-2000. Mountain lions were reported statewide, with most in the Ozark and Ouachita Mountains. In addition to the surveys, we collected 7 pieces of tangible evidence (e.g., scats, tracks, and video) from 1996-2000. A survey of the U.S. Department of Agriculture, state veterinarians, and an Arkansas Game and Fish Commission (AGFC) internal survey of their wildlife officers documented at least 101 captive P. concolor in the state. The origins of reported free-ranging animals could not be determined.

INTRODUCTION

The mountain lion's (Puma concolor) original range is the largest of any native terrestrial mammal in the Western Hemisphere, extending from the southern Yukon Territory of Canada to southern Chile (Dixon 1982, Lindzey 1987), and covering most of North America (Currier 1983). With the exception of southern Texas and south Florida, it has been widely thought that mountain lions were largely extirpated from the central and eastern portions of the United States (Lindzey 1987).

In recent years there has been an accumulation of physical evidence and numerous sightings of mountain lions in areas where they were thought to be extirpated. For example, in 2001 a lactating female with 2 cubs was killed near Duluth, Minnesota and a small population has since been acknowledged in the northern portion of the state (Zuidema 2002). Sightings by natural resource professionals and the public have also occurred in the Upper Peninsula and northern Lower Michigan; more recently a set of tracks and a photograph of an animal confirmed their existence (Zuidema 2002). Likewise, a few mountain lions may inhabit portions of northern Wisconsin (Zuidema 2002). In 2001, an apparently wild individual was killed by a car in Shelby County, Iowa and tracks have been confirmed from other counties (Iowa Department of Natural Resources press release 2001, Clear Lake, IA). In 2000, a wild mountain lion was killed after being struck by a train in Randolph County, Illinois

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(Illinois Department of Natural Resources press release, 2000, Springfield, IL). In 1999, an interagency Mountain Lion Response Team was formed in Missouri after 4 hunters killed and photographed a mountain lion, a second was videotaped, and rabbit hunter’s dogs treed another (Missouri Conservationist 1999). Bischof and Morrison (2000) reported a mountain lion killed by a hunter and discussed 8 additional observations in Nebraska. Bolgiano et al. (2000) pointed out that physical evidence of mountain lions in eastern North America has been accumulating. This phenomenon may also be occurring in Arkansas.

The white-tailed deer (Odocoileus virginiana) in Arkansas had dwindled to about 300 animals by the early 1930s. At this time, it was widely believed that the mountain lion (Puma concolor) was extirpated from the state (Young and Goldman 1946). Deer numbers have increased in Arkansas since the late 1940s (Cartwright 1999). In 1949, a mountain lion was killed by a hunter in western Arkansas (Sealander 1951). In the 1950s and 1960s, sightings and discovery of sign increased and in 1969 a hunter killed a mountain lion in southeastern Arkansas (Lewis 1969, 1970, Noble 1971, Sealander 1956). Sealander and Gipson (1973) summarized 63 mountain lion records from 1945 to 1972 and suggested that a small and possibly increasing mountain lion population existed in the state.

In 1975, a hunter killed a mountain lion in western Arkansas and in 1978 a track, a sighting, and steroid analysis of a scat confirmed the presence of a second mountain lion in the area (Harvey and Barkley 1979). Reports of mountain lions by citizens, hunters, and biologists increased to over 30 reports per year in the mid-1980s (Arkansas Game and Fish Commission records). A field study from 1988-91 failed to discover mountain lions or their sign in Arkansas and concluded that there were “no wild reproducing populations of mountain lions in Arkansas” (McBride et al. 1993). As a result, the Arkansas Game and Fish Commission (AGFC) discontinued a database of reported free-ranging mountain lions.

More recently, tracks and scat from 5 localities in Pulaski, Perry, Garland, and Hot Spring counties were determined to be those of mountain lion (Witsell et al. 1999). This renewed an interest in the possible presence of free-ranging mountain lions in Arkansas. As a result, with cooperation from the AGFC, we (1) re-established a mountain lion clearinghouse; (2) determined the relation among reports, physiographic region, and deer harvest; and (3) examined the geographic relation between captive mountain lions and mountain lion sightings.

METHODS

We used mail surveys, information from hunting groups, AGFC records, U.S. Department of Agriculture (USDA) records, and unsolic-
ited reports from Arkansas citizens to evaluate the current status of mountain lions in Arkansas. Due to controversy regarding presence of reproducing mountain lions in Arkansas (McBride et al. 1993), we classified our reports in 1 of 4 reliability classes according to standards set by the Florida Panther Conference (Pritchard 1976) and used by the AGFC in the 1980s. Class I evidence includes a photograph of an animal, scat, track, or a cast of a track. Class II evidence are sightings made by an observer of known reliability (i.e., a biologist). Class III observations are made by an unqualified observer, but are accompanied by convincing descriptions or details and Class IV sightings are highly questionable. We restricted data to 1996-2000 to reflect recent patterns and minimize error in respondent recollection. We omitted reports referring to black animals. Reported sightings were followed-up by field searches when incidents had occurred within 3 days and since last rainfall.

Surveys

A survey of 850 natural resource professionals was conducted from fall 1999 to summer 2000 following the format of Berg et al. (1983) and Pike et al. (1999). Recipients included 124 AGFC biologists, 139 county agricultural and extension agents, 63 Arkansas State Park employees, 75 Arkansas Forestry Commission personnel, 419 members of the Arkansas Trappers Association, and 30 employees of the Arkansas Natural Heritage Commission, Nature Conservancy, Ozark Natural Science Center, as well as timber company biologists. All sampled individuals had relevant job descriptions and were distributed throughout the state. We requested information concerning mountain lions reportedly seen directly, those reported by other reliable individuals known to the respondent, sign observed by the respondent, and sign observed by other reliable individuals. The reliability of individual evaluations, even by biologists familiar with the characteristics of *Puma* sign, can often be problematic and these reports were interpreted with caution (Belden 1978, McBride et al. 1993). We also requested the date, location, and description of the event. A map of Arkansas was included for marking locations of sightings. A reminder mailing was sent in July 2000 to recipients who had not responded.

Prior to the 1999 deer-hunting season, posters requesting information on mountain lion sightings and sign were mailed to 1200 hunting clubs that leased land from timber companies. It followed the format of Hardin (1996) and included information concerning identification of mountain lions, tracks, and scat. All unsolicited and poster-generated reports were followed with attempts to verify the information with a telephone interview. These reports were not used if the respondent was
not the observer, the description of the event was too vague, or the respondent could not be contacted by telephone.

A second survey was mailed to 251 Arkansas veterinarians to estimate numbers and locations of captive mountain lions in the state. A letter was also sent to the USDA State Veterinarian requesting locations of breeders, exhibitors, and brokers of captive mountain lions. Any individual may possess mountain lions if obtained from a person with a USDA Wild Animal Dealer permit and only breeders, exhibitors, and brokers are permitted and inspected.

Data analyses

We used ARC/INFO (Environmental Systems Research Institute, Redlands, CA) to plot reported locations of sightings or sign relative to county boundaries, highways, lakes, and rivers. We included location data from Sealander and Gipson (1973) for comparison with this study. Sighting and sign location concentrations were calculated using the Spatial Analysis extension for ARC/INFO (ESRI, Version 2) as the number of locations per 60 km².

We conducted statistical analyses using the Statistical Analysis System (SAS Institute, Inc. 1990). We used logistic regression to determine the association between the number of reported mountain lion sightings and statewide deer harvests (1996-1999). We used Chi-square analysis to test for changes in the number of sightings and sign across seasons.

RESULTS

A total of 349 (41.1%) sighting/sign questionnaire surveys were returned. These included 98 sightings and 38 observations of sign throughout the state for 1996-2000. Forty-seven percent of the reports described observations by the respondent. Posters and unsolicited reports produced 13 usable records for the same time period.

Reliability ratings for all reports included: 7 (5%) in Class I, 23 (15%) in Class II, 107 (72%) in Class III, and 12 (8%) in Class IV. Class I evidence included a video (Montgomery County), 2 sets of tracks (Pulaski and White counties), and 4 scats (Hot Spring, Pulaski (2), and Garland counties). Five (3%) of the Class IV reports were of black animals.

Reports of sightings and sign were distributed throughout the state (Fig. 1). Most reports were from the Interior Highlands, including 23% from the Ozark Mountains and 40% from the Ouachita Mountains. The Gulf Coastal Plain accounted for 23% of sightings and sign, while the Mississippi Delta had the fewest reports (14%). Two concentrations were in the Ouachita Mountains of western Arkansas (primarily Yell, northern Pike, and southern Montgomery counties), and in the west central part of the state (including western Pulaski, northern Saline, and southern Perry counties). Other reports centered in northwestern Arkan-
sas within the Ozark Mountains, including Crawford, Washington, and Benton counties.

More observations were reported during the fall ($\chi^2_{0.05,3} = 10.3465, P = 0.0175$; winter 27; spring 22; summer 24; fall 44). Reports were associated with the 1996 to 2000 deer harvests ($R^2 = 0.9614, P = 0.0195$).

USDA reports indicated 12 breeders, exhibitors, or brokers in the state. However, the exact number of mountain lions could not be discerned due to frequent changes in the number of animals held by each entity. State veterinarians reported an additional 30 locations housing at least 1 mountain lion.

**DISCUSSION**

The return rate of our survey (41.1%) was similar to mountain lion surveys in Oklahoma (46%; Pike et al. 1999) and Wyoming (42.7%; Berg et al. 1983) and was comparable to that of a recent Arkansas mammal status survey (42.3%; Majors et al. 1996).

![Figure 1. Relative concentrations of reported sightings and sign (1996-2000), locations of Class I evidence, and locations of known captive mountain lions in Arkansas. Darker shade indicates greater concentration (number of locations per 60 km²) of reported sightings and sign. Physiographic Regions: Oz = Ozark Mountains; Ou = Ouachita Mountains; WGCP = West Gulf Coastal Plain; MD = Mississippi Delta.](image-url)
The Ouachita and Ozark Mountains consist of rugged and isolated habitat with sparse human populations and were expected to produce the most reports. These areas also have the highest black bear (*Ursus americanus*) densities in the state (Smith 1990). Along with the Gulf Coastal Plain, these 3 areas have experienced increases in white-tailed deer (Cartwright 1999). Furthermore, Jordan (1994) included these areas among the top 10 for reestablishment of the Florida panther (*P. c. coryi*). The Mississippi Delta, with the exception of Crowley’s Ridge and the White River National Wildlife Refuge, has little topographical relief, intensive agricultural development, and little forest cover, an apparent prerequisite for the species in the southeastern U.S. (Maehr et al. 2001).

Sealander and Gipson (1973) summarized what they considered to be all reliable mountain lion reports in Arkansas from 1945 through 1972. They concluded that the mountain lion was “holding its own” and possibly increasing in numbers due to an increasing deer population. They indicated that mountain lion populations were centered near the Saline and Ouachita River bottomlands in southeastern Arkansas, the White River National Wildlife Refuge near the confluence of the White and Arkansas rivers, the western Ozark Mountains north of the Arkansas River, and the Ouachita mountains in west central Arkansas south of the Arkansas River. Our data (Fig. 1) also implicate the Ozark and Ouachita mountains, but include more of the state as well. We recorded approximately the same levels as Sealander and Gipson (1973) in the southeastern bottomlands. We also show more reports in the southwestern part of the state where Sealander and Gipson (1973) had only scattered reports. There were no reports from the White River National Wildlife Refuge (a high use area for consumptive and nonconsumptive recreation). Although not specifically listed by Sealander and Gipson (1973), both studies show concentrations in the northeastern part of the Ozark Mountains.

Our classification approach (Pritchard 1976) included 30 reports from natural resource professionals. These Class I reports are the best evidence of mountain lions in the state. Of the Class I evidence, 3 scats and 1 set of tracks were previously verified (Witsell et al. 1999). While these data indicate the presence of individuals, they do not necessarily indicate an actual population of mountain lions.

Pike et al. (1999) and Berg et al. (1983) found a significant correlation between mountain lion sightings and deer harvests in Oklahoma and Wyoming; we found a similar correlation in Arkansas. Arkansas is experiencing a rapid increase in the white-tailed deer population, estimated at approximately 1 million, and harvest records show a corresponding increase (Cartwright 1999). White-tailed deer represent the
major prey for mountain lions (Anderson 1983). Jordan (1993) found that the 3 previously mentioned potential reintroduction sites in Arkansas received an equal or greater prey density ranking compared to the northern Florida and southern Georgia feasibility reintroduction site as well as the panther-occupied site in southern Florida. Thus, Arkansas deer are likely capable of supporting a viable mountain lion population.

A tendency for hunters and wildlife professionals to be more active during fall may explain the increase in reported mountain lions at this time. There could be other explanations for a greater number of fall sightings such as reduced vegetation that would allow animals to be seen more easily.

A large captive mountain lion population apparently exists in Arkansas. Captive animals occasionally escape or are released. In 1987, the AGFC reported a dead, declawed, mountain lion in Franklin County (Mosby 1988). However, the frequency and extent of other such events are unknown.

A survey of AGFC wildlife officers indicated a minimum of 101 captive animals in the state (Sasse 2001). The officers indicated the presence of captive mountain lions in Benton, Yell, Ashley, Union, and Calhoun counties, all of which are located in areas where mountain lion sightings are most frequent (Fig. 1). They also reported the release and unsuccessful recapture of a mountain lion in Yell County in 1997. Furthermore, one of us (GAH) knew of several mountain lions released in the area of Montgomery and Pike counties in 1988, another area of many reports. Although there is little evidence for this, others have suggested that released and even declawed mountain lions can persist in areas of suitable habitat and prey (Belden and Hagedorn 1993, R.T. McBride, pers. comm.).

**Conclusion**

With increasing numbers of mountain lion sightings and accumulation of hard evidence, it appears that free-ranging mountain lions have occasionally appeared in Arkansas. However, the number of animals, their origination, taxonomic status, and breeding status are unknown.

We have documented a minimum of 4 mountain lions in Arkansas over a span of 5 years based on Class I evidence. In all likelihood, they are the result of releases or escapes or animals dispersing from neighboring states. East Texas (Robertson and Altman 2000), Missouri (Hardin 1996, Missouri Conservationist 1999), and Oklahoma (Pike et al. 1999) have mountain lion populations, free-ranging animals, or persistent reports of sightings. However, given the large number of captive lions, the lack of regulation, and known releases and escapes, free-ranging animals in Arkansas may all be from captivity.
A renewed interest in Arkansas mountain lions has occurred with increased sighting reports and accumulation of hard evidence. The AGFC has classified them as a non-game mammal (B.D. Sasse, pers. comm.). Based in part, on the results of this study, regulations regarding captive animals and a protocol for recording and evaluating reported sightings throughout the state have been revised.

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