

Knowledge of and Attitudes Toward Mountain Lions: A Public Survey of Residents Adjacent to Saguaro National Park, Arizona

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If humans and mountain lions (Puma concolor) are to coexist, managers need to understand how both use an area and understand the local public's view toward large predators. In spring 2000, the authors conducted a telephone survey of 9 local wildlife managers and a mail survey to assess 493 suburban residents' knowledge of and attitudes toward mountain lions near Tucson, Arizona. All agencies wanted more information that could lead to improved management of mountain lions. The overall response to the public survey was 52% (493 / [1,000-52]). Respondents' knowledge of mountain lion biology was low ($M = 2.5 \pm 0.07$ [SE] out of 7.0). Respondents supported management measures that protect mountain lions in all landscapes and opposed measures that removed protections. There is local support of mountain lion conservation, and it is recommended that educational opportunities be created for the local public so residents are informed about mountain lion research and management.

Keywords mountain lions, public attitudes, Puma concolor, survey

Introduction

Human–mountain lion (*Puma concolor*) encounters have increased throughout western North America since 1970 (Beier, 1991). Habitat fragmentation is a possible cause for increased occurrences of mountain lion encounters with humans and domestic animals in California (Mansfield & Weaver, 1989; Beier, 1991, Torres, Mansfield, Foley, Lupo, & Brinkhaus, 1996). Urban encroachment has also been correlated with rising numbers of encounters in Colorado (Halfpenny, Sanders, & McGrath, 1991). Urbanization in Tucson, Arizona is proceeding rapidly; the human population in metropolitan and surrounding areas has grown by approximately 200,000 (11%) in the last 10 years (Tucson Planning Department 2000, <http://www.ci.tucson.az.us/planning>). Human developments border, and in some areas surround, local wildland areas.

If coexistence between humans and mountain lions is to be maintained, wildlife agencies and managers may need to educate human residents about mountain lion biology and

H. Messing provided guidance and support in the creation and implementation of this project. N. Kline provided assistance in the development of the survey instrument. S. Smith, R. Steidl, and P. Jones assisted with statistical analyses. W. Grunberg and A. Honaman assisted with GIS mapping and provided use of lab facilities. This study was funded by the United States Bureau of Reclamation and the United States National Park Service.

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behavior and respond to the management preferences of the human population. Wildlife managers are mandated to manage and take public opinion into account when creating or revising mountain lion management policy (Tarrant, Bright, & Cordell, 1997). Managers must have information about local attitudes and knowledge to effectively incorporate public opinion. The importance of public opinion in wildlife management has been established (Decker, Brown, & Seimer, 2001). Large predators, with few exceptions (Grinder & Krausman, 2001) have received limited attention in the Tucson Basin. Because mountain lions reside in the area, the present authors were interested in how the public viewed their presence and how agencies managed them. They performed a survey of wildlife managers in southeastern Arizona and residents who live in an area adjacent to Saguaro National Park, where mountain lions occurred. Managers were asked about their protocol for dealing with mountain lions and if there is a need to manage specifically for mountain lions. The public survey was designed to assess local residents' (adjacent to Saguaro National Park, Arizona) knowledge of and attitudes toward mountain lions.

Study Area

The public survey was conducted within the 1.25-km suburban area surrounding the Tucson Mountain District of Saguaro National Park (SNP), west of Tucson, Arizona (Figure 1). The surrounding area is populated by approximately 4,000 residents. The Tucson Mountains rise from 664 m to 1,429 m and are west of Tucson. They include the Arizona upland subdivision of Sonoran Desert scrub and semi desert grasslands (Brown & Lowe, 1980).

Methods

Resource Manager Interviews

Each federal land-managing agency in southeastern Arizona, and state and county agencies in the Tucson area (i.e., U.S. National Park Service [Saguaro National Park], U.S.

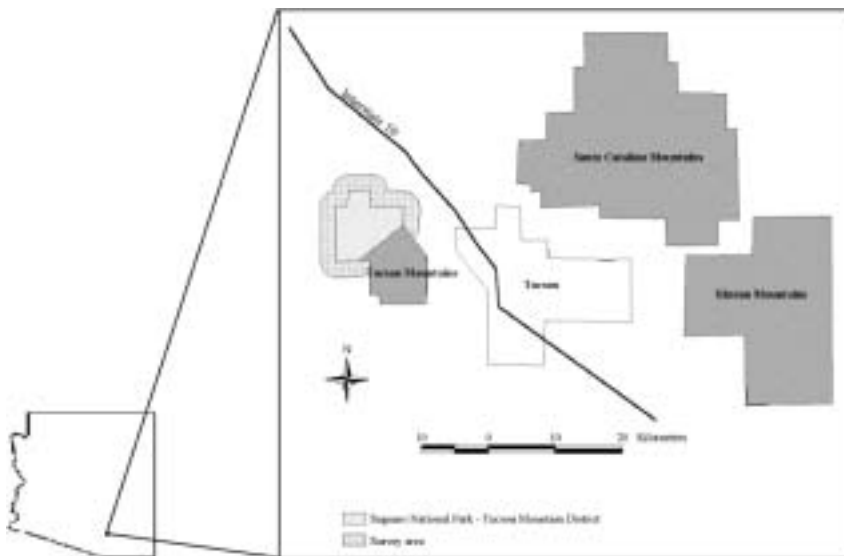


Figure 1. Survey area.

Bureau of Reclamation, U.S. Department of Agriculture Forest Service [Coronado District], U.S. Bureau of Land Management, U.S. Fish and Wildlife Service [Buenos Aires National Wildlife Refuge and Cabeza Prieta National Wildlife Refuge], Arizona Game and Fish Department, Oracle State Park, and Pima County Parks and Recreation) were contacted. The managers were selected to be interviewed based on the fact that, if mountain lion management in the area were to be modified, that manager would play a direct role in modifying management policy or would be the head natural resource manager within the agency. Open-ended interviews were then conducted with nine professional resource managers in the Tucson area by telephone to determine their information needs for management of mountain lions and their habitat.

Public Survey

The mail survey (Casey, 2002) was sent to residents who live within 1.25 km of the Tucson Mountain District of Saguaro National Park, near Tucson, Arizona. This area was selected because it was adjacent to mountain lion habitat and because a survey in this area would provide Saguaro National Park with information about the knowledge and attitudes of people living near the park boundary. A list of these residents was obtained from the Pima County Tax Assessor's Office and selected a simple random sample of 1,000 people (approx. 25% of the area's population) to receive mail surveys.

A self-administered, mail-back multiple-choice questionnaire was designed to assess the attitudes and knowledge levels of suburban residents about mountain lions (Casey, 2002). The survey included five questions about mountain lion sighting information, seven questions testing knowledge of mountain lion biology, eight questions dealing with respondents' attitudes toward mountain lion management, two questions about personal safety, two questions about wildlife research, two questions about respondents' desire for educational opportunities about mountain lions, and six demographic questions. The survey was pre-tested by administering it to 10 Tucson residents who volunteered to check the survey for clarity. Changes were then made that improved the quality of the survey.

Mailing procedures followed Dillman (1978). An introductory letter was first sent explaining the purpose of the study, followed a week later by a cover letter reemphasizing the purpose of the study and assuring anonymity, the survey instrument, and a stamped, pre-addressed return envelope. Two weeks later, a thank you and reminder postcard was sent. Non-response bias was checked for by calling a 10% sample of non-respondents ($n = 51$ people) and asking them five questions from the survey. Non-respondents and those that completed the questionnaire provided similar responses.

Residents' knowledge levels were summarized using a scoring system (score = total number of questions answered correctly; possible range 0–7) and used *t*-tests to assess knowledge differences between males and females, between people who had visited the park (visitors) and those who had not (non-visitors), and between people who had seen mountain lions and those who had not. One-way analysis of variance (ANOVA) was used to determine knowledge differences among residents of various age categories, education levels, and categories indicating length of time at the current residence. Multifactor ANOVA was used to assess the effects of all demographic variables on knowledge score simultaneously. Pearson's chi-square test was used to evaluate attitudinal differences between males and females, between visitors and non-visitors, and between people who had seen mountain lions and those who had not.

Results

Resource Manager Interviews

Saguaro National Park posted information pertaining to mountain lions; however, this information was limited to warnings posted when human–mountain lion interactions occurred. Two organizations had no management plans or policies dealing with mountain lions (i.e., Pima County Parks and Recreation and U.S. Bureau of Reclamation). Four organizations did not permit hunting of mountain lions in their area of jurisdiction (i.e., Oracle State Park, Saguaro National Park, and Cabeza Prieta and Buenos Aires National Wildlife Refuges), and three organizations (i.e., Arizona Game and Fish Department, the Coronado District of the U.S. Forest Service, and U.S. Bureau of Land Management) allowed hunting subject to Arizona hunting regulations (Arizona Game and Fish Department, 2001).

When asked if there is a need to manage specifically for mountain lions, respondents from Cabeza Prieta and Buenos Aires National Wildlife Refuges, United States Forest Service, Pima Country Parks and Recreation, and Oracle State Park responded there was no need. Representatives from United States Bureau of Reclamation and United States Bureau of Land Management indicated that mountain lions would not be a part of their jurisdiction unless management became a cooperative effort with other agencies. The Arizona Game and Fish Department expressed a need to manage mountain lions, particularly with local declines in prey abundance and to minimize human–mountain lion interactions. Saguaro National Park also cited declining prey numbers on park lands and expressed concern that mountain lions may be lost from the local fauna.

The most frequent (3 of 9 organizations) requests for information that would be needed to effectively manage mountain lions were mountain lion population estimates and densities, habitat requirements, and sighting and human–mountain lion encounter information. Other information needs (each requested only once) included minimum viable population estimates, territory sizes, limiting factors for mountain lion populations, how to manage the suburban–wildland interface, how artificial water sources affect predator densities and distribution, which human disturbance factors should be managed, and expert opinions on local management options.

Public Survey

Of the 1,000 surveys mailed, 493 responses (49%) were received. Fifty-two surveys (5%) were returned as undeliverable, for an overall response rate of 52% (493/[1,000-52]). Fifty-three percent of the respondents were male, 44% were female, and 3% did not report their gender. The majority of respondents (76%) were >41 years old and had lived in the area for >6 yrs (65%). Eighty-two percent had some college education, a bachelor's degree, or a graduate degree. Ninety-five percent of respondents had visited the Tucson Mountain District of Saguaro National Park, and 80% regularly participated in some type of outdoor activity (e.g., hiking, birdwatching). Thirty-three percent ($n = 162$) of respondents reported seeing free-roaming mountain lions in landscapes around Tucson. Thirty-six percent of respondents ($n = 172$) had neighbors that reported seeing free-roaming mountain lions in Tucson or the surrounding wildland areas.

The mean knowledge score was 2.5 ± 0.07 ($n = 493$, range 0–7) out of the possible 7. Males scored 0.6 ± 0.13 points higher than females ($t_{477} = 4.54$, $p < 0.001$, from a two-sided, two-sample t -test). People who visited the Tucson Mountain District of Saguaro National Park scored an average of 0.7 ± 0.30 points ($p_{484} = 0.02$) higher than non-visitors,

and people who saw wild mountain lions scored approximately 0.8 ± 0.14 points ($p_{487} < 0.001$) higher than those who had not. No statistical difference was detected in knowledge score by age ($F_{3, 474} = 2.14, p = 0.09$), education ($F_{3, 472} = 1.16, p = 0.33$), or length of residence ($F_{3, 480} = 1.81, p = 0.14$). When demographic variables were analyzed simultaneously, similar results were obtained (gender: $p < 0.001$, visitor status: $p = 0.03$, and wild sighting or not: $p < 0.001$).

Only 8% of residents surveyed ($n = 37$) believed mountain lions are common in Pima County, but 48.7% ($n = 233$) knew that mountain lions inhabit areas within 2.5 km of their homes (Table 1). When asked how to respond to an aggressive approach by a mountain lion, 60.2% indicated that a person should shout and try to look as large as possible. Thirty-seven percent of respondents indicated that there have been one human deaths in Arizona due to mountain lion attack. There has never been a human death caused by mountain lions recorded in Arizona.

The majority of respondents (74.6%) correctly identified the picture of a mountain lion track. The remaining 25% selected either a wolverine (*Gulo gulo*) (13%) or a coyote (*Canis latrans*) track (12%). Sixty-five percent ($n = 311$) of respondents did not know that only female mountain lions raise the kittens. Twenty-one percent of respondents ($n = 102$) correctly identified deer (*Odocoileus* spp.) or deer and javelina (*Pecari tajacu*) as the primary food items of mountain lions in the Tucson area (Table 1).

The majority of respondents (78.8%) favor mountain lion protection on public and private land, but 69% believe that mountain lions should be shot or trapped when they have caused problems that affect humans (Table 2). A majority of respondents (54.4%) oppose policies that would protect mountain lions only within national parks and other reserves. Twenty-five percent of respondents selected the response that mountain lions should be controlled (i.e., shot or trapped) anywhere they are found in association with human developments. However, 92% selected the response that a bounty on mountain lions should not be reinstated. Most respondents (71%) stated that it is appropriate to kill mountain lions for public safety, but 12% feel that it is never appropriate to kill a mountain lion. A minority of residents supported killing mountain lions to protect livestock (27%), for sport hunting (12%), and for protection of wild prey species (7%).

Length of residence did not affect any of the respondent attitudes investigated in this survey ($p > 0.05$) (Table 2). Men disagreed with mountain lion protection in all areas more frequently than women. Women disagreed more frequently than men with the idea of mountain lions being controlled (trapped or shot) in all areas associated with human development. Women also more frequently opposed the statement that mountain lions should not be protected under any circumstance.

Respondents that were 18–40 years old were most likely to disagree that mountain lions should be protected only within national parks. Respondents >55 years of age were most likely to agree that lions should be controlled anywhere they are found in association with human developments. Visitors and people who had seen wild mountain lions were more likely to disagree with such a predator control imperative than non-visitors or people who had not seen wild lions, respectively.

As education level increased, respondents had a decreasing frequency of agreeing with the following ideas: (1) mountain lions should be fully protected only within national parks, (2) mountain lions should be controlled anywhere they are found in association with human developments, (3) mountain lions should only be controlled when they have caused problems affecting humans, and (4) a bounty on mountain lions should be reinstated.

Respondents (83%) supported efforts to maintain mountain lion populations in Saguaro National Park. They also supported such efforts in other mountain ranges surrounding

Table 1
Suburban Residents' Knowledge about Mountain Lions, Assessed by Responses to Questions Pertaining to Mountain Lion Biology and Historic Interactions with Humans in Tucson, Arizona, 2000

Knowledge questions	% response (n = 474-478)		Association with variables (NS or p-value)					
	Correct	Incorrect	Gender	Age	Education	Length of residence	Visitor or non-visitor	Wild sighting
Aware that mountain lions living within 2.5 km of [respondent's] residence	48.7	51.3	NS	NS	NS	NS	NS	<0.001
Know status of mountain lions in Pima County, Arizona	7.6	92.4	0.023	NS	NS	NS	NS ^a	NS
Know recommended response to aggressive approach by a mountain lion	60.2	39.8	<0.001	NS ^a	NS ^a	NS ^a	NS ^a	0.001 ^a
Know no. human deaths in Arizona due to lion attacks	22.1	77.9	NS	0.021	NS	<0.001	NS	NS
Aware that only female mountain lion rears young	34.4	65.6	NS	NS	NS	NS	NS	NS
Able to identify picture of track	74.6	25.4	NS	NS	NS	NS	NS	NS
Know main prey item(s)	21.4	78.6	0.006	NS	NS	NS	NS	<0.001

^a20% of cells contain <5 individuals; Chi-square results uncertain.

Table 2
Public Support for Management of Mountain Lions in Tucson, Arizona (2000), as Described by Responses to Belief Statements

	% responses				Association with variables (NS or <i>p</i> -value)						
	Strongly agree	Mildly agree	Undecided	Somewhat disagree	Strongly disagree	Gender	Age	Education	Length of residence	Visitor or non-visitor	Wild sighting
Mountain lions should....											
.....be protected in all areas.	59.7	19.1	7.1	5.7	8.4	0.001	NS ^a	NS	NS	NS ^b	NS
.....be protected only in National parks.	22.3	15.5	7.8	18.9	35.5	NS	0.009	0.007	NS	NS	NS
.....be shot or trapped near human development.	9.9	14.7	7.8	18.7	48.9	0.012	NS	0.042	NS	0.010	0.010
.....be shot or trapped only if they caused a problem.	33.6	35.5	8.6	10.6	11.7	NS	0.041	0.029	NS	NS	NS
.....not be protected under any circumstance.	2.9	2.7	2.7	10.7	80.9	0.013	NS ^b	NS ^b	NS ^b	NS ^b	NS
.....be managed under a reinstated bounty.	3.1	1.2	4.2	6.9	84.6	NS	NS ^b	0.043 ^b	NS ^b	NS ^b	NS

^a NS = not significant; i.e., *p*-values > 0.05; ^b20% of cells contain < 5 individuals; Chi-Square results uncertain

Tucson (86%). Respondents (90%) indicated that these efforts were important. Local residents (85%) indicated that mountain lions play an important role in the ecological balance of wildlands. When asked to explain the role, the most common responses were that mountain lions control other species' populations (37%), play a part in the balance of nature (22%), play the role of a predator (13%), and prey on the sick and weak of other species (12%).

Survey respondents also indicated that urban expansion is detrimental to mountain lion populations in the Tucson area (79%). Over half of the respondents (52%) stated that urbanization is detrimental because it reduces mountain lion habitat. Some respondents indicated expansion causes reduction of habitat for prey species and increased human–mountain lion interactions, which could lead to control efforts (18%). Most residents stated that the following actions would be beneficial to mountain lions: zoning restrictions to reduce housing densities in areas of mountain lion use (71%); acquisition of land for habitat and movement corridors (63%); and a ban on mountain lion hunting (59%).

The majority of respondents were not concerned about being attacked by mountain lions. Fewer than 7% of respondents ($n = 33$) indicated being somewhat to very worried about being attacked in their neighborhoods, and approximately 16% ($n = 81$) indicated fear of attacks while recreating in natural areas.

Residents (68%) favored the use of hands-on wildlife research techniques (e.g., trapping and radio collaring). Twenty-two percent had no opinion and only 10% opposed hands-on techniques. Seventy-four percent of residents also supported the possibility of future research on mountain lions in the local area. Ten percent of the respondents disagreed with this possibility. The majority (76%) of surveyed residents desire more educational opportunities dealing with mountain lions. Ninety-two percent of respondents indicated Saguaro National Park Visitor Center should provide information about mountain lions and their management.

Discussion

The local managers surveyed did not perceive a need to manage specifically for mountain lions. However, they had a broad array of information needs that should be met before improved management of mountain lions could be considered. These information needs included basic biological and ecological information about mountain lions. With the increasing human population of Tucson and local declines of prey populations (Arizona Game and Fish Department, 2001), species-specific management of mountain lions in the near future may be inevitable. Combined with the public's support to maintain mountain lion populations in the national parks and mountain ranges adjacent to Tucson, specific management for mountain lions may be a priority.

Local residents did not understand mountain lion biology, but expressed support for maintenance of mountain lion populations in the Tucson area. This is consistent with other public surveys (Lohr, Ballard, & Bath, 1996; Brooks, Warren, Nelms, & Tarrant, 1999). The present results also supported the assessment that the local public believes mountain lions should not be shot or trapped simply because they are found in association with human development (Manfredo, Zinn, Sikorowski, & Jones, 1998). However, the majority of respondents to the survey preferred that mountain lions be removed if they caused problems affecting humans, including killing pets and livestock or injuring humans. Although women more frequently opposed the statement that mountain lions should not be protected under any circumstance, managers will likely continue to remove problem lions, especially with the recent increase of attacks on humans in the western United States.

This study revealed a high level of support by the respondents for maintaining mountain lion populations and improving their management in the Tucson area. Although positive public attitudes toward large predators have been documented (Pate, Manfredo, Bright, & Tischbein, 1996), more negative attitudes were expected due to a recent attack in Arizona and human deaths due to mountain lion attacks in Colorado and California (Mountain lion attacks on people in the United States and Canada; http://www.tchester.org/sgm/lists/lion_attacks.html). Overall, respondents indicated a desire to maintain local populations of mountain lions and to manage them in a way that requires few control measures other than removal of mountain lions that cause damage to humans or domestic animals.

The authors recommend educational opportunities for the public be provided at the visitor centers in the Rincon Mountain and Tucson Mountain districts of Saguaro National Park. These visitor centers receive >200,000 visitors/year and provide excellent opportunities for education because people visiting the park to hike will be traveling through mountain lion habitat. Pamphlets and displays should be created to inform visitors about mountain lion biology and personal safety information. There were no differences in knowledge scores about mountain lions due to age or education level, so it is suggested that these educational opportunities be focused toward the general public instead of toward specific segments of the population. Urban sprawl will increase the amount of contact that humans have with wildlife, and increased interactions can put wildlife and humans at risk. However, increasing public knowledge about wildlife and associated safety measures should help to prevent harmful interactions. Increased knowledge about mountain lions may also increase visitors' enjoyment of and appreciation for the park if they are taught to look for and identify mountain lion signs, such as tracks, scats, scrapes, and kills.

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