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## Proceedings of the Vertebrate Pest Conference

### **Title**

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### **Permalink**

<https://escholarship.org/uc/item/8st1s2tw>

### **Journal**

Proceedings of the Vertebrate Pest Conference, 18(18)

### **ISSN**

0507-6773

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### **Publication Date**

1998

### **DOI**

10.5070/V418110035

# TRENDS IN MOUNTAIN LION DEPREDATION AND PUBLIC SAFETY INCIDENTS IN CALIFORNIA

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**ABSTRACT:** Mountain lions (*Puma concolor*) are widely distributed and have apparently expanded their range and increased in abundance in California since the early 1970s. Conflicts between mountain lions and humans have increased during this period. Trends in verified mountain lion damage to livestock and pets are reported for the 26-year period 1972 to 1997. Confirmed mountain lion attacks on humans are summarized for the period 1890 to 1997. This information was analyzed by county, and related to mountain lion habitat suitability, livestock distribution, and human population trends. Health and physical characteristics of a sample of 417 mountain lions were also analyzed for the period 1990 to 1996. Public policy related to mountain lions is discussed with emphasis on trends in conflicts with humans and management implications.

**KEY WORDS:** mountain lion, depredation

Proc. 18th Vertebr. Pest Conf. (R.O. Baker & A.C. Crabb, Eds.) Published at Univ. of Calif., Davis. 1998.

## INTRODUCTION

The mountain lion (*Puma concolor*) is widely distributed in California over approximately 62% of the state (253,828 sq. km). Of this area, it is estimated that 170,486 sq. km is moderately to highly suitable habitat (Torres et al. 1996). There have been numerous changes in state law intended to guide management of this controversial species. Despite these measures, conflicts between humans and mountain lions have increased in number and sensitivity.

This paper reviews recent trends, and updates information on mountain lion depredation and threats to public safety in California, provided by Mansfield and Torres (1994). The objectives in this review were to: 1) provide verified data for mountain lion damage to property and threats to public safety; and 2) discuss factors associated with these trends and implications for management of conflicts involving mountain lions. The authors hope sharing this information will provide insight and encourage an increased understanding of complex relationships between factors influencing mountain lion-human interactions in California.

## POLICY AND PUBLIC OPINION

Management of mountain lions in California has a long and diverse history. The initial state law designated the species a bountied predator, and it was in effect from 1907 to 1963. During that 57-year period, records indicate that 12,461 mountain lions were killed (Mansfield and Weaver 1989). From 1963 to 1969, lions were managed as nongame and take was not regulated or systematically recorded. In 1969, the Legislature designated mountain lions as game mammals and required hunting licenses and tags for taking them. During the period 1970 to February 1972, records indicate 4,953 tags were issued and 118 mountain lions were killed. In 1972, the Legislature enacted a moratorium on hunting, required a depredation permit for taking lions causing damage, and directed the California Department of Fish and Game to

determine the status of mountain lions and to make recommendations for their management.

In response, the Department initiated field studies in the early 1970s, including radiotelemetry which provided the first empirical estimates of home range size and local densities to complement refined estimates of statewide distribution (Sitton and Weaver 1977). It also implemented a depredation permit procedure which has been relatively consistently applied from 1972 until the present. The relatively few changes involved minor variation in the length of time for which a permit was valid, distance from the damage site a lion could be pursued and taken, and prohibiting the use of a foot snare for taking a lion after June 1990.

The mountain lion was again classified a game mammal in 1986 when the last extension of the hunting moratorium laws expired. This abrupt change in status resulted in the Department of Fish and Game recommending, and the Fish and Game Commission immediately adopting, a regulation continuing depredation permits. The Department also recommended deferring a decision on hunting lions until the available information related to the statewide and regional mountain lion populations could be analyzed and alternatives evaluated. In 1987, the Commission requested, and the Department provided, a biologically conservative proposal for the regulated take by licensed hunters of up to 190 lions distributed over four zones, excluding southern California. This hunting proposal was challenged in court during 1987 and 1988, with an appeal pending in 1990 when a ballot initiative (Proposition 117) was approved by 52% of the voters. This change in law designated the mountain lion a "specially protected mammal," prohibited hunting, and further restricted the take of lions causing damage to property. Proposition 117 also increased the penalties for illegally taking lions, authorized the Department to take lions which were a perceived threat to public safety, and directed the expenditure of \$30 million of existing public funds annually for 30 years to

specific activities, including acquiring habitat for mountain lions and other wildlife.

Recreational hunting of mountain lions has been prohibited for 25 years in California, and circumstantial evidence indicates lions have become more numerous and expanded their range over that period (Torres et al. 1996). Concurrent with that trend, the human population in the state has increased from approximately 19 million in 1970 to over 32 million in 1998. The influence of this expanding human population, on both the landscape and the nature of conflicts with mountain lions, has been great. Public opinion regarding lions ranges from speculating that the increasing statewide population poses a serious threat to human lives, populations of prey and property, including livestock and pets, to believing that increases in the human population and activity in lion habitat are solely responsible for conflicts. Both of these extreme views involve the potential errors of generalizing statewide and assuming that changes in human and lion demographics operate independently. The available information reflecting mountain lion and human activity provides a basis for evaluating some relationships in factors which may contribute to conflicts between lions and humans in California.

## DATA AND TRENDS

### Depredation

The policy, regulations, and data collection procedures for mountain lion depredation have been fairly consistent since 1972. They include issuing a permit on request of the property owner in each case where the Department verifies a mountain lion was responsible. There are strict guidelines which are intended to restrict take to the offending lion. Information is recorded on the date, county, sex of lion taken, type of property damaged, and other factors involved in each case. The carcass of any lion taken must be provided to the Department. During the period 1972 to 1997, depredation incidents by lions ranged from 4 in 1972 to 323 in 1995. The number of mountain lions taken ranged from 1 in 1972 to 121 in 1994 (Figure 1).

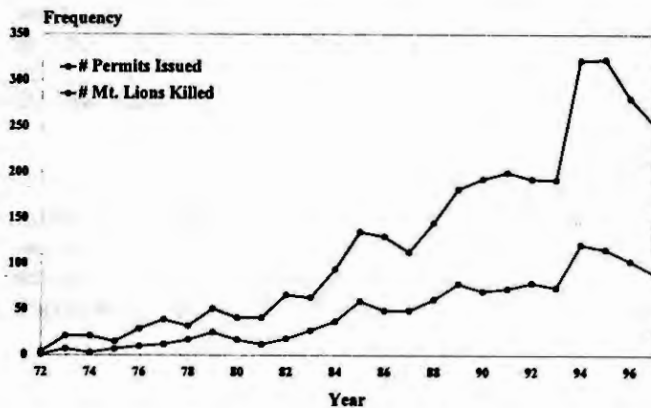


Figure 1. Summary of confirmed mountain lion depredation incidents in California, 1972 to 1977.

A detailed multi-variate analysis of these data through 1995 by Torres et al. (1996) determined that there were several significant direct relationships, including those between domestic sheep depredation and the amount of suitable lion habitat by county and pet depredation and average annual new house development by county. It appears that increasing domestic sheep depredation may reflect increases in the distribution and abundance of mountain lions. Counties with increasing trends in pet depredation are the same areas where public safety problems have increased which may reflect increases in human activity in lion habitat.

Domestic sheep have accounted for over half of the total in terms of type of property damaged annually over the last 25 years (Figure 2). When the data were analyzed separately for the periods 1972 to 1984 and 1985 to 1995, there was a significant increase in the number of permits issued for damage to pets and a significant decrease in the number of permits issued for damage to cattle (Torres et al. 1996). The highest concentrations of depredation permits were issued in the north coastal (Humboldt and Mendocino counties), northwestern (Lake, Shasta, Siskiyou, and Trinity counties), and central Sierra Nevada (Amador, Calaveras, El Dorado, Kern, Mono, Tulare, and Tuolumne counties) regions of the state.

It appears that pet depredations are associated with high human populations. The highest concentrations of pet depredation was in the south coastal (Los Angeles, Orange, and San Diego counties) and northern and southern Sierra Nevada (Alpine, Butte, Inyo, Lassen, Madera, and Tulare counties) regions. Mountain lion attacks on pets appeared to be inversely related to total depredation by county.

The sex ratio of lions associated with total livestock depredation had a male bias which varied from 60% for cattle to 75% for horses. Lions involved in pet depredation had a female bias with only 45% male, and this difference was significant. Within the limitations of age estimates obtained during necropsies, about two-thirds of the lions associated with livestock and pet depredations were adults (>2 years old) and one-third were subadults.

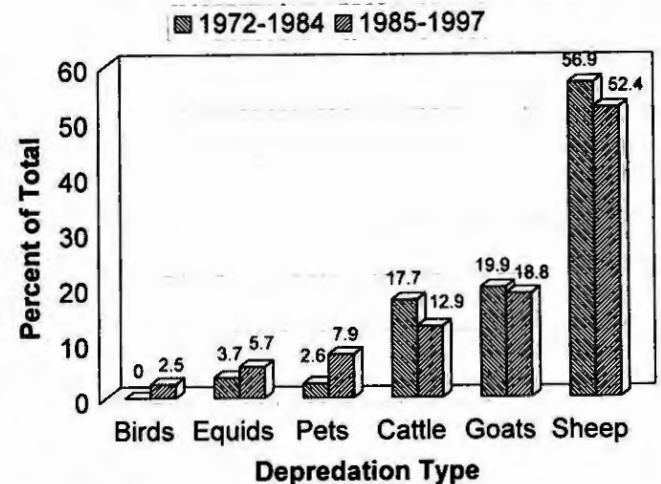


Figure 2. Type of mountain lion depredation (% of total) by time period (1972 to 1984, 1985 to 1995) in California.

### Public Safety

There have been 10 verified cases of mountain lions attacking humans in California from 1890 to the present, eight of them from 1986 to 1995. They involved 12 victims and five fatalities. The sex ratio of lions associated with public safety problems had a slight female bias at 46% male and was similar to that for pet depredation. Dates, locations, and additional information on these incidents are summarized in Table 1. Because of the low number of public safety incidents, potential statistical analysis is limited. However, Torres et al. (1996) speculated that the deaths of two adult women from mountain lion attacks in 1994 resulted in an increase in public attention to, and concern for, mountain attacks on livestock, pets, and humans. They concluded that the increase in requests for depredation permits in 1994 and 1995 was likely due to those events, and that pet depredation may be related to potential public safety problem areas.

### Mountain Lion Physical Condition

The health and condition of a sample of 417 mountain lions necropsied during 1990 to 1996 were generally assessed. Lions were classified as being in either "fair to excellent" or "poor" condition based on weight, amount of body fat, coat condition, and general appearance. The condition of mountain lions killed on depredation permits was compared to the condition of lions dying from other causes during the same period. Those causes included take for public safety, roadkills, disease, and various injuries.

During the period 1990 to 1996, 97% of the lions killed on depredation permits were classified as being in fair to excellent condition, and 100% were in that condition during four of those years. In contrast, 75% of the mountain lions dying from other causes were in fair to excellent condition. Only eight of the sample of 309 lions taken on depredation permits during this period were in poor condition. Of these lions in poor condition, four were old (>7 years), three were young (<1 year old), and one had damaged teeth. The poor condition of these lions appeared to be due to starvation as a result of their inability to catch prey rather than disease.

### DISCUSSION

There is strong circumstantial evidence that mountain lions have increased in numbers and expanded their range in California during the last 25 years. Concurrently, there is speculation by a segment of the public that prohibiting hunting during that period is responsible for the increase. The human population in California has increased by over 40% during that period, and there is speculation by a segment of the public that expanding urban development into mountain lion habitat is responsible for the increase in lion-human conflicts. Although these factors appear to contribute to the trends

in conflicts between lions and humans, they do not explain the trends statewide. These generalizations fail to consider the regional variation in important factors including habitat quality, prey availability and human impacts on the landscape.

Despite these contrasting views and opinions, most of the public recognizes mountain lions as a valuable part of California's wildlife diversity. There appears to be a common desire to focus potential management on practical and biologically sound solutions that ensure long-term viability of mountain lion populations while promoting public safety and minimizing property damage. However, the state's mountain lion management policy has been primarily influenced by polarized advocates insisting that activities be narrowly focused.

The California Department of Fish and Game has developed management goals for mountain lions which include: 1) maintaining viable mountain lion populations; 2) minimizing conflicts related to public safety, property damage, and other wildlife; 3) protecting important habitats; 4) recognizing their ecological role and value; 5) monitoring populations and conducting research; and 6) improving public awareness. These goals set the stage for solutions based on a sound biological principles and public support. Meeting these goals will require funding for long-term population monitoring and research which has not been available.

### CONCLUSIONS

Mountain lion activity reflected as verified damage to livestock and pets tends to support the conclusion that lions have increased in number and expanded their range in California during the last 25 years. Depredation on domestic sheep is directly related to the amount of suitable lion habitat at the local and regional levels. Pet depredation by mountain lions is increasing as a proportion of total depredation, and it may be a useful indicator of lion activity in proximity to humans. Since lion attacks on humans occur so infrequently, statistical analyses with other covariates are not practical.

Managing mountain lions in California will continue to be a challenge. Polarized public opinion and political pressure by narrowly focused advocates have limited the options for adaptive management and applied research which may help reduce conflicts between mountain lions and humans. There is a need to manage lions in conjunction with, not in isolation from, concerns for public safety, protecting property, and other wildlife interactions.

### ACKNOWLEDGMENTS

The authors are grateful for the assistance and advice provided by Mr. Steve Torres for both general review and statistical analysis of mountain lion and human activity data; and Ms. Amy Brinkhaus for summarizing data and preparing figures.

Table 1. Verified mountain lion attacks on humans in California, 1890 to 1995.

Date	Location	County	Type	Victim		Mountain Lion	
				Age	Sex	Age	Sex
June 1890	Quartz Valley	Siskiyou	Fatal	7	M		F
July 1909	Morgan Hill	Santa Clara	Fatal <sup>b</sup>	10	M		
			Fatal <sup>b</sup>	22	F		
March 1986	Caspers County Park	Orange	Nonfatal	5	F	2	M
October 1986	Caspers County Park	Orange	Nonfatal	6	M		
March 1992	Gaviota State Beach	Santa Barbara	Nonfatal	9	M	A	M
September 1993	Cuyamaca Rancho State Park	San Diego	Nonfatal	10	F	1-2	F
April 1994	Auburn State Rec. Area	El Dorado	Fatal	40	F	2-3	F
August 1994	Dos Rios (remote)	Mendocino	Nonfatal <sup>c</sup>	50s	M	2	F
			Nonfatal <sup>c</sup>	50s	F		
December 1994	Cuyamaca Rancho State Park	San Diego	Fatal	56	F	A	M
March 1995	Angeles National Forest	Los Angeles	Nonfatal	28	M	A	F

<sup>a</sup>Ages recorded in years. Adult mountain lion ( $\geq 3$  years) are noted as A.

<sup>b</sup>Fatalities diagnosed due to rabies.

<sup>c</sup>Mountain lion confirmed to have rabies.

<sup>d</sup>Adapted from Torres et al. 1996.

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