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December 15, 2015

Sonke Mastrup, Executive Director

California Fish and Game Commission

P.O. Box 944209

Sacramento, California 94244-2090

Dear Commissioners:

My name is Tom Randolph and I am the retired Exec. Secretary of the State Range Committee of the Board of Forestry. I have worked with the Commission before on Forestry and Wildlife issues and was the manager of the California Forest Improvement Program.

The purpose of this letter is to encourage the Fish and Wildlife Commission to direct the Department of Fish and Wildlife to change their management strategy from single species management to a more holistic approach to that of all species management based on carrying capacity of all the species together.

The reason for this is twofold:

For example when considering the Deer Management Plan for California you need to balance the prey animals that are effecting the deer population. This affects a lot of other species such as the wolf that may get established in California the Mtn. lion, bears and coyotes. Before that happens the number of predators effecting the deer, domestic animals and people need to be managed. From studies by Fish and Wildlife, UC Cooperative Extension, and the Pacific Southwest Range and Experiment Station- the predator to prey ratio in California is way out of balance and has been that way for some time.

The second reason is that you have a lot of stakeholders affected such as landowners, cattlemen, woolgrower's timber companies, wild life groups, Native Americans, environmentalists, the general public, Federal agencies and the University system. These groups need to be represented on technical advisory committees within each deer tag zone. Their purpose is to provide input into

managed hunts and TAKE OF ANY SPECIES outside its natural carrying capacity. The Commission Member that facilitated the formation of the Klamath River technical advisory committee and brought all stakeholders together to develop a management plan for the River was really farsighted and did a great service for all the people in the State. The values of all these groups are then considered and more SCIENCE is put into decision making as appose to competing interests constancy battling. This doesn't improve and maximize the potential of the resource for all.

Also, when considering all species management the Department of Fish and Wildlife should be TOTALLY GENERAL FUNDED and not dependent on shrinking license revenue and special fund moneys. It's the public's resource and everyone has a responsibility to fund it and because IT IS MANDATED BY LAW.

Enclosed is an issue paper I wrote for the Range Committee of the Board of Forestry and the California Cattlemen and papers from the Pacific Southwest Range experiment Station on Mtn. Lions and predators. Its and older study but the deer population has continued in a downward spiral. The Cattlemen in Shasta County have written a resolution to find a legislative remedy to the predator to prey ratio because it is so far from what's happening on the ground.

Thank you for your time and your service to our State.

Sincerely,

Thomas D. Randolph

Thomas D. Randolph Contact: [redacted]

Phone: [redacted]

E-Mail: [redacted]

CC : To Commission Members

7/23/14 Draft

For Range Management

Advisory Committee

By Tom Randolph

ISSUE PAPER: Propose legislation for the balanced management of predators on wild lands, rangelands and the rural urban interface in California.

PROBLEM: Populations of the California Black Bear, Mtn. lion, coyotes and other predators have sky rocked because of environmental factors, sociological factors, and political factors. These populations have put the people of the State at risk, domestic animals at risk, and have significantly led to the decline and lack of migratory deer in the State. Ranchers have lost millions of dollars of livestock, families have lost beloved pets, and the State loses millions of dollars of tax revenue and jobs generated from the timber and livestock industry. Also, millions of dollars are lost because California hunters go out of State for a quality hunting experience. The regulations are complicated and not management oriented to balance the predator and prey ratio. The management strategies promote large and unbalanced predator populations and single species management due to budget restriction and special interest political pressure. Rangeland is beginning to transition from grass types to brush types with the loss of historic population of grazing animals not present and increasing the fire problem exponentially. It was once thought that the deer numbers were down because of aggressive fire protection strategies, and the transition from grass to brush and unpalatable brush species was the result. With the number, the size, and intensity of wildfires today there is a substantial increase in palatable browse species yet the population of browsers has not increased proportionately. Lack of water is another aspect of predator management. Climate change and drought have caused animals to focus on smaller concentrations of water making them more

subject to predation. Unregulated Marijuana gardens are often protected by poacher's taking browser species and increasing the prey numbers.

SOLUTION: Pass Legislation to allow for the take (Managed Hunts) of any wildlife species that is impeding the balance and carrying capacity of their natural habitat in the State. This includes Bears, Mtn. Lions, Coyotes, porcupines etc.. This number should be managed by local biologists and a Regional committee that has experience in utilizing management strategies in specific counties. Committee should represent a broad range of expertise and be able to peer review issues and represent landowner input.

PRO: This measure will provide more safety to the general public, less dollar loss to producers and a healthier more diverse environment.

The wildlife populations on wild land, rural urban interface, and Federal Land would be managed by local people under the State Fish and Wildlife Commission (Regional Committees- DFW, Land owners, general public, Coop Ext., US Fish and wildlife) familiar with the local populations. Migratory animals should be managed with cooperative agreements with affected agencies (Counties, State other agencies etc)

The intensity of wildfires and the cost of suppression could be lessened substantially.

More tax revenue could be generated by the state, counties and business through more traditional hunts for the balanced management of all species similar to other Western States.

Watersheds would be better protected with more grazing animals lessening the impact of wild fire intensity and size.

Better diversity of wildlife species leading to a healthier environment

NEGATIVE: By not doing anything grazing animal numbers will continue to reduce over time increasing wildfire intensity.

Water capacity will be lessened in reservoirs with fire flood sequence increasing.

Millions of dollars will be spent on larger wildfires

The safety of the general public will be put in peril as more bears and Mt. lions are allowed to increase their populations and their food supply will be found domestically.

By not doing anything there will be less wild life diversity

By not doing anything millions of dollars of tax revenue will be lost to the State and the recreational dollars will be lost to business because more hunters and sports enthusiasts will go out of State for a quality experience. (Nevada, Utah, Colorado, Wyoming, Montana Idaho, Washington, and Oregon brag about the revenue they receive from Calif... Nevada has special events for California hunters that go out of State to entice more revenue to their State)

By not doing anything Ranchers will lose more livestock and domestic animals and continue to cost the producers millions of dollars.

NOTE: Currently the management of species that are a nuisance can be destroyed by the landowner, however this is neither legal nor practical and does not address the root of the problem.

United States
Department of
Agriculture

Forest Service

**Pacific Southwest
Forest and Range
Experiment Station**

P.O. Box 245
Berkeley
California 94701

Research Note
PSW-392
August 1987

Mountain Lions: Preliminary Findings on Home-Range Use and Density in the Central Sierra Nevada

Donald L. Neal **George N. Steger** **Ronald C. Bertram**

Neal, Donald L.; Steger, George N.; Bertram, Ronald C. *Mountain lions: preliminary findings on home-range use and density, central Sierra Nevada.* Res. Note PSW-392. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture; 1987. 6 p.

Between August 1983 and December 1985, 19 mountain lions were captured, radio equipped, and monitored daily within a portion of the North Kings deer herd range on the west slope of the central Sierra Nevada in California. The density of adult mountain lions was estimated to be one per 33.3 km^2; that of adults and kittens together was estimated to be one per 20.9 km^2. Home-ranges averaged 265 km^2 for adult females and 350 km^2 for adult males. Home range overlap was high among females, among males, and between males and females. Some mountain lions migrated elevationally with the deer, but others remained at low elevations throughout the year. The preliminary results of this study suggest that mountain lions could be limiting the North Kings deer herd.

Retrieval Terms: mountain lion, *Felis concolor*, predators, home range, population density, Sierra Nevada

Most deer populations of the Sierra Nevada of California have been declining for the past three decades. Research and habitat treatment aimed at reversing this trend have been concentrated on the North Kings population of migratory California mule deer (*Odocoileus hemionus californicus*) in eastern Fresno County. The population was estimated at 17,000 animals in 1950[1] and by 1972 had declined almost 80 percent to an estimated 3500 animals.[2] Intensive efforts to improve the habitat have failed to reverse or even stop the decline.[3] The population in January 1986 was estimated at 2,000 animals.[4]

In the early 1970's composition counts indicated that low fawn survival was the principal cause of the continued decline in the North Kings population. Predation by mountain lions (*Felis concolor californica*), black bears (*Ursus americanus*), and coyotes (*Canis latrans*) has recently been identified as the principal cause of fawn mortality.[5] Of the 90 fawns radio-equipped in the population since 1978, 43 (48 pct) have been killed by predators. Of the fawns killed by identified predators, 47 percent were taken by mountain lions. Between August 1983 and November 1985, we radio-equipped 23 does and monitored them for 22.5 deer-years. Of these 23 does, 5 were killed by mountain lions—an average of 22 percent per deer year.[4] Although predation is probably not responsible for the decline of the deer population, it is probable that predation—especially by mountain lions—is preventing its recovery. This level of predation seems to indicate a high mountain lion density, or at least a high mountain lion: deer ratio.

Recent track surveys[6,7] indicate that mountain lion densities equal to that of the North Kings area are widespread in California. This contrasts with earlier findings suggesting that mountain lions were in low numbers in California. In 1922, Bruce[8] estimated a total of 600 mountain lions in the State. In 1976, the California Department of Fish and Game estimated the State's population at 2400 animals,[9] based on an estimated average density of about three lions per 259 km^2 (100 mi^2) and 181,300 km^2 (70,000 mi^2) of mountain lion habitat in California. Koford[10] estimated that there were only 1,000 mountain lions in California in 1977, based on an estimate of one lion per 518 km^2 (200 mi^2) over 38,850 km^2 (15,000 mi^2) of mountain lion habitat in the state. In 1985 the California Department of Fish and Game reported 4,800 animals in the State, with an annual increase of about 8 percent.[11]

With this wide disparity in density estimates, we lacked sufficient information to understand the relationship between mountain lions and the North Kings deer population. Therefore, we undertook a study of mountain lions and their movements in the range of the North Kings deer population in 1983.

This note reports a study to (a) determine the daily and seasonal movements of mountain lions, in the central Sierra Nevada, with emphasis on

the temporal correlation with seasonal range use by deer; (b) determine seasonal and annual home range sizes; and (c) estimate mountain lion density. The effort was not intended to be a major study of mountain lion ecology—only an aid to understanding the role of the North Kings deer population to recover from its decline. Preliminary findings suggest that mountain lions could easily be limiting the North Kings deer herd.

STUDY AREA AND METHODS

The range of the North Kings deer population is located in eastern Fresno County, California, primarily within the Sierra National Forest. It includes approximately 2070 km² (800 mi²), ranging in elevation from 200 to 3300 m (650 to 10,800 ft). The winter range varies in elevation from 200 to 1000 m (650 to 3300 ft) and vegetation varies from foothill woodland, through chaparral, to the lower ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) forest.[1,2] The summer range starts at about 1,600 m (5250 ft) and extends to over 3,000 m (9840 ft). The habitat types range from ponderosa pine forest, through white fir (*Abies concolor* Lindl.), mixed-conifer and up to lodgepole pine (*Pinus murrayana* Grev. & Balf.) forest.

We captured the mountain lions by locating fresh tracks, trailing and treeing with dogs, and tranquilizing with dart-delivered drugs. Radio transmitters were attached to the animals with collars. Each animal was weighed and described. During the 1985 capture phase of the study all mountain lion sign was recorded and mapped. Sightings, differences in track size, tracks associated with scratches, and the presence of kitten tracks with adult tracks were used by experienced personnel to determine sex and age of lions from sign. Evidence of each individual was then compared to known locations of radio-equipped and other known mountain lions in the area to separate specific animals.

We attempted to radio-locate each transmitter-equipped animal each day. When a signal was received, the animal's location was determined by triangulation, drawn on maps in the field to allow the observer to detect errors or unusual movements at once. If a location was in question, additional radio directions were taken to verify the animal's location. Occasionally the observer walked to a location close to the animal to verify the accuracy of the radio location or determine whether the animal was alive and well.

Because of rough terrain and the line-of-sight nature of the VHF frequency radio signals, we could not locate all mountain lions each day. To mitigate this problem, we used aircraft to locate the animals as often as twice per week. This procedure helped reduce bias introduced by underestimating a lion's use of inaccessible terrain.

Radio locations were marked on field maps, recorded on field sheets, and entered into a computer data base by using the Universal Transverse Mercator System. The elevation at each location was also recorded. Locations were graphically plotted on the maps.

Monthly, seasonal, annual, and total home ranges were determined from these radio locations. Total home range includes all the area used during the entire period that the animal was radio equipped. Home range boundaries were determined by connecting sequential radio locations with a straight line, which represents the shortest distance the animal could have traveled between locations. After all locations were connected, the outermost lines were used to delineate the home range boundary. This process provides a biologically reasonable representation of home range boundaries when 50 or more radio locations are available on one animal.

RESULTS

During this study, our activities were restricted by road access, weather, and possible conflicts with other activities to approximately 557 km² (215 mi²). Mountain lion capture was done during three periods. By the end of 1985, a total of 19 mountain lions—17 adults and 2 kittens—had been captured and radio-equipped; 3 in August of 1983, 3 in February and March of 1984, and 13 during March through August of 1985 (*table 1*). Five of the radio-equipped mountain lions have died—two and possibly three were illegally shot, one died of unknown causes, and one died as a result of

Table 1—*Basic data for mountain lions radio-equipped during the study, central Sierra Nevada, California.*

Animal identification	Date of capture	Sex	Age at capture (yrs)[1]	Body weight (kg)	Observations	Home range (km)[1]	Proportion[2]	Notes
83-620	8-14-83	Female	3	42.5	58	31	—	Died 10-1-83
83-640	8-15-83	Male	4	63.5[1]	428	787	45.4	
83-200	8-17-83	Female	3-4	50.0	613	204	96.8	Died 11-4-85
84-220	2-25-84	Male	4-5	55.0	189	334	—	Died 9-23-84
84-600	2-27-84	Female	3-4	39.0	362	320	65.0	Died 2-4-86
84-226	3-03-84	Female	7+	40.0	365	252	20.0	
85-230	3-23-85	Female	2-3	35.5	119	200	98.5	
85-240	3-26-85	Female	5	44.0	126	444	67.5	
85-420	3-28-85	Female	2-3	35.5	133	185	83.8	
85-456	4-11-85	Male	5	56.5	112	223	97.7	
85-620	4-11-85	Male	4	49.0	98	179	79.7	
85-550	4-19-85	Male	3	52.5	74	270	29.7	
85-510	5-08-85	Female	0.7	18.0	131	—	—	Kitten
85-390	5-10-85	Female	3	35.5	91	142	34.7	
85-225	5-15-85	Female	1-2	30.8	56	402	71.0	
85-165	5-16-85	Male	6	56.0	27	429	54.3	
85-195	6-02-85	Male	7-8	54.5	80	230	81.5	Died 12-10-85.
85-740	8-21-85	Female	0.9	—	54	—	—	Kitten
85-560	8-23-85	Female	1.5	31.0	54	236	41.5	

[1]Estimated.
[2]Proportion of the animals total home range that was within the study area.

having been caught in an illegal trap. Poor physical condition probably contributed to the death of the latter two lions.

In addition to the 19 lions captured and radio-equipped, 16 additional adults, identified as being different from the radio-equipped individuals, were determined to be using the 557 km² area. Eight of these were females with litters. The number of kittens in each litter was not determined. Animals still dependent on and accompanying their mother were classified as kittens. All independent individuals, usually 18 months of age or older, were classified as adults.

Radio Locations

To date, we have obtained 3,166 radio locations, averaging 167 per animal (range: 27 to 613). The wide range in number of recorded locations was due primarily to the amount of time the animals had been radio equipped (*table 1*). By the end of 1985, for example, mountain lion 83-640 had been carrying a radio for 28.5 months and 85-560 had been radio equipped for only 4 months.

Mountain Lion Density

Of the 17 adult mountain lions radio-tagged within the 557-km² study area, 15 were alive and being monitored at the same time. Using this as an absolute minimum number of mountain lions in the study area gives an estimate of crude density of one adult lion per 37.1 km² (7.0/100 mi²). Including the two radio-equipped kittens brings the total crude density to one lion per 32.8 km² (7.9/100 mi²).

However, during the 1985 capture phase 16 additional adults and 8 litters of kittens were discovered and identified as being different from the radio-equipped individuals. Of these, 13 of the adults—nine females and four males—and six of the litters were found within the 557-km² study area. This brings the minimum number of adult mountain lions using the area to 28—18 females and 10 males—or one adult lion per 19.9 km² (13.0/100 mi²).

The number of kittens in each litter was not determined. Anderson[13] reviewed 17 studies and reported an average post-natal litter size of 2.67. However, based on track observations, we believe the litters in our study area were slightly smaller. Counting the two radio-equipped kittens and using an average litter size of 2.25 gives a total of 15.5 kittens, or one kitten per 35.9 km² (7.2/100 mi²).

The number of mountain lions using the study area is not the same as lion density. The home ranges of all radio-equipped mountain lions extended outside the study area, and those of the nonradio-equipped lions can be expected to do the same. We also believe other mountain lions, as yet undetected, use the area.

To protect against overestimating lion density in the study area we counted only that proportion of each radio-equipped lion's home range that was within the study area. For example, if only 50 percent of a lion's home range was within the 557-km² study area, then it was counted as 0.50 lion. The average portion of home ranges of the 15 adults within the study area was 60.1 percent for the females and 59.1 percent for the males (*table 1*).

Using these values reduces the total number of radio-equipped adult lions using the area to 9.0. Assuming that the same proportion of the unradioed adult lions' home ranges are within the study area gives their total at 7.7. This gives a minimum density for the study area of one adult per 33.3 km² (7.8/100 mi²). Applying the proportional value for their mother's home range to the two radio-equipped kittens and the mean proportion for females to the unradioed kittens gives 10.0 kittens, or one kitten per 55.7 km² (4.7/100 mi²). This is a total density of one mountain lion per 20.9 km² (12.4/100 mi²) or one per 8.0 mi². This is the density of mountain lions known to be using the area and therefore represents only a conservative estimate.

Home-Range Size

Total, annual, seasonal, and monthly home-range boundaries and sizes were determined for 16 mountain lions; this includes all of the adult lions that carried transmitters for 4 months or longer. Excluded were adult female 83-620, which was killed 6 weeks after being captured, and the two kittens—85-510 and 85-740. Total home ranges of the nine females averaged 265 km² (102 mi²) and ranged from 142 to 444 km² (55 to 171 mi²). Home ranges of the seven males averaged 350 km² (135 mi²) and ranged from 180 to 787 km² (70 to 304 mi²).

Home-Range Overlap

The nine radio-equipped females had home ranges totalling 2385 km² (921 mi²), of which 1433 km² (553 mi²) were within the boundaries of the 557 km² study area (*fig. 1*). This is 2.6 times the area available, eliminating the possibility of these animals maintaining exclusive home ranges. The crowding appears even greater when females without radios are considered. Clearly, home ranges of female mountain lions overlap considerably in our study area.

To illustrate the extent of that overlap we use lion 83-200, a 49-kg (108 lb) female captured at 3 to 4 years of age. She has been radio-equipped for more than 28 months and has been radio located 613 times. She shared 100 percent of her home range with two to four other radio-equipped adult females and an unknown number without radios (*fig. 2*). The home range of female 85-420 overlapped 41 percent of 83-200's home range and she overlapped 45 percent of 84-420's home range. However, when home-range boundaries were drawn on a monthly basis, the picture changed. Each female's home range overlapped the other by only 13 percent. The short-term areas of use shifted frequently and prevented much of the potential contact between female mountain lions.

Home ranges of the male mountain lions also showed considerable overlap (*fig. 3*). Like the females, they appeared to temporarily avoid portions of their home ranges when they were occupied by another male. However, occasionally two males were found within a few hundred meters of each other for 2 to 3 days within that overlap zone.

Figure 1—Home ranges of nine radio-equipped female mountain lions. The solid, wide line indicates the boundary of the 557-km² study area.

During an 8-month period in 1985, females 83-200 and 85-420 were radio located at approximately the same time on 98 days. The distances between them ranged from 1.2 to 25.7 km (0.7-16 mi) and averaged 11.1 km (0.7 mi). During the same period, male 85-195 and female 83-200 were found separated by distances of 0.0 to 30.8 km (0.0-19.1 mi) and averaged 5.7 km (3.5 mi). Apparently 83-200 was sometimes more tolerant of the presence of a male than of another female mountain lion.

We often found several mountain lions concentrated in a small area. For example, on two occasions, eight radio-equipped mountain lions were located within an area of less than 50 km² (19.3 mi²) and once we found six within an area of 18 km² (6.9 mi²). We suspect that several other lions were in these areas at the time. On other occasions we found three males within a 7.5-km² (2.9-mi²) area. Certain areas appear to be favored for these concentrations.

Elevational Movements

While elevational movements were variable throughout the year, especially for males, two distinct patterns were identified. One group shifted elevation seasonally, matching the migration patterns of the deer, and another group remained at lower elevations all year. The two kittens and female 83-620 provided data for only a short time and were excluded from this preliminary analysis.

Twelve lions—seven females and five males—focused their summer activity between elevations of 1600 and 2000 m (5249 and 6562 ft), which includes the lower summer range of the North Kings deer herd.[2] During the winter, these lions spent most of their time between 1000 and 1400 m (3280 and 4593 ft), the upper winter range for deer (*fig. 4*). Short-term movements between elevational zones occurred throughout the year at unpredictable times. However, the general migration between seasonal ranges occurred during the periods that the deer migrated.[14]

Two female and two male lions were found to be nonmigratory. These animals had yearlong home ranges concentrated at elevations between 700 and 1000 m (2297 and 3280 ft), lower than even the winter ranges for the migratory lions (*fig. 4*). Because these animals spent the summers below the concentration of deer, they must have used other prey during that period. Resident deer are scarce in these areas during the summer. The nonmigratory lions were frequently found in the foothills on cattle ranches or in developed rural areas. Reports of pet and livestock losses have increased considerably in the past few years.[4]

Examination of mountain lion scats from throughout the North Kings range showed a variety of diet items including 26 percent small mammals, 6 percent cattle, 1 percent dog, and 60 percent deer on a percent occurrence basis.[15]

The mountain lions that stayed at low elevations year around were also distinguished from the migrating lions by having smaller home ranges and narrower annual elevation ranges. The home ranges of the low-elevation lions averaged 211 km² (81 mi²) and the home ranges of the migrating lions averaged 333 km² (123 mi²), or 58 percent larger ($t=2.34$; $P<0.05$). The elevational ranges averaged 1295 m (4246 ft) for the nonmigratory lions and 2105 m (6906 ft), or 63 percent greater, for the migratory lions ($t=10.16$; $P<0.001$)

DISCUSSION AND CONCLUSIONS

Preliminary analysis of the data clearly shows that the North Kings range has a high density of mountain lions; there is extensive home range overlap between individual lions of both sexes; and some mountain lions have a migratory and some have a nonmigratory seasonal pattern of range use.

In 1925, Bruce[16] found that there was about one mountain lion per 93 km² (36

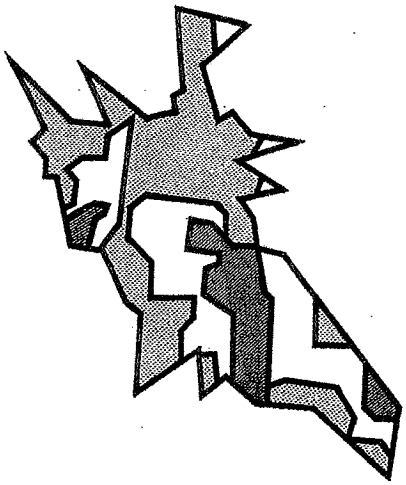

Figure 2—Total home range of female lion 83-200, showing areas shared with home ranges of various numbers of other female mountain lions.

mi²) and that each lion used a home range of about 259 km² (100 mi²). In 1975, Koford[17] estimated that there were four "established" adult mountain lions using the 2072 km² of the North Kings range (1 per 518 km²). This was probably a gross underestimate, as was his statewide estimate. Our current estimate of one adult per 33.2 km² may apply to another 570 km² of the North Kings range. We further estimate that the remaining 945 km² has about 25 percent of that density or one adult per 132.8 km². This extrapolates to about 41 adult mountain lions using the total (summer, winter, and migratory) range of the North Kings deer population, or an average of one adult per 51 km² (5.1/100 mi²). The total of all mountain lions (adults and kittens) using the North Kings deer herd range is estimated to be one per 31.4 km² (8/100 mi²).

The evidence of high mountain lion density is supported by the increase in lion sightings reported by both biologists and the public in and adjacent to the North Kings deer herd range. Mountain lions are being seen in agricultural, suburban, and urban areas in most parts of California. Livestock depredation has increased steadily since the beginning of the moratorium in 1971[4] (*fig. 5*).

If Bruce's[16] lion density estimate was correct, and if it held true during the years of increasing deer numbers, up through the 1950's, the ratio of deer to mountain lions may have been as high as 750:1. Using current estimates of deer numbers and our estimates of lion numbers gives a ratio of only 49:1. With deer making up an estimated 60 percent of the lion diet and being the only large prey other than cattle in the area, it appears that mountain lions could easily be limiting the deer population.

All radio-equipped mountain lions in the study area made unpredictable moves, yet demonstrated what Etkin[18] referred to as a "sense of locality." Other than the two kittens, no individual's behavior was different enough to identify it as a transient. We also found nearly complete overlap between home ranges. It appears that no individual lion has any exclusive area, and we found areas used by as many as five female and four male radio-equipped mountain lions. We found behavior described by Hornocker[19] as "mutual avoidance." Mountain lions moved in what appeared to be an effort to avoid a shared portion of their home ranges when another lion entered. This avoidance behavior combined with the high lion density to create a constantly shifting pattern of use.

The nonmigratory seasonal-use pattern of some mountain lions may or may not be the result of the high lion density. However, we think there is a possibility that this is the result of the low primary prey population, the high competition

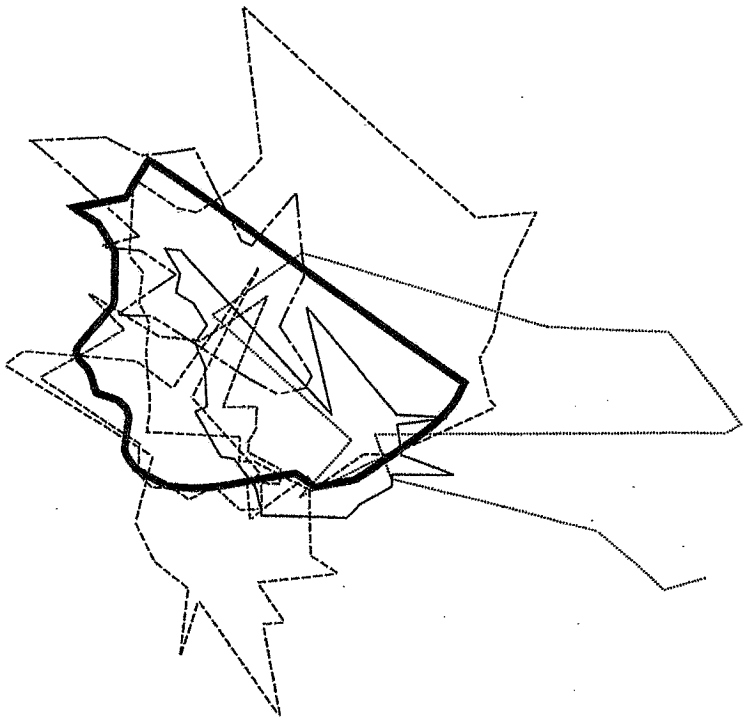

Figure 3—Home ranges of six radio-equipped male mountain lions. The solid, wide line indicates the boundary of the 557-km² study area.

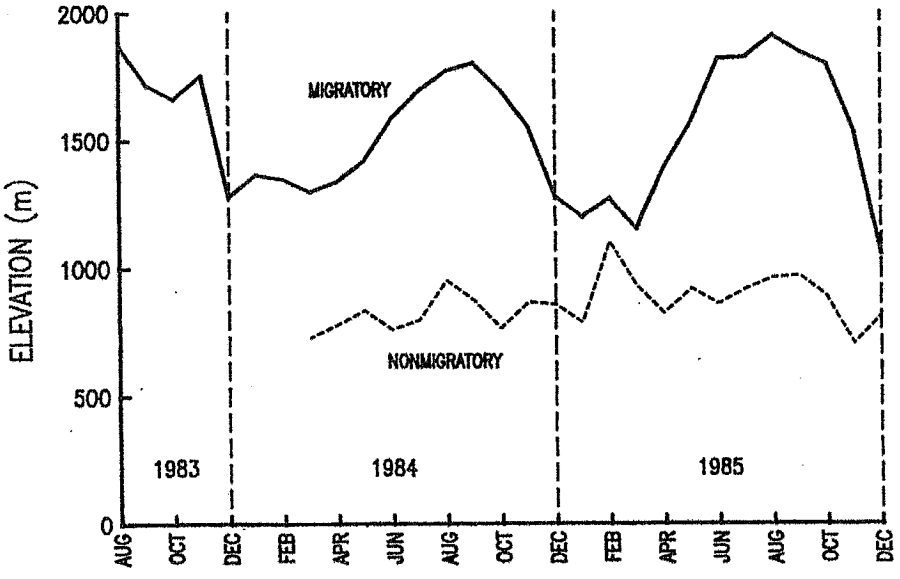

Figure 4—Monthly mean elevations of migratory and nonmigratory mountain lions monitored in the range of the North Kings deer population.

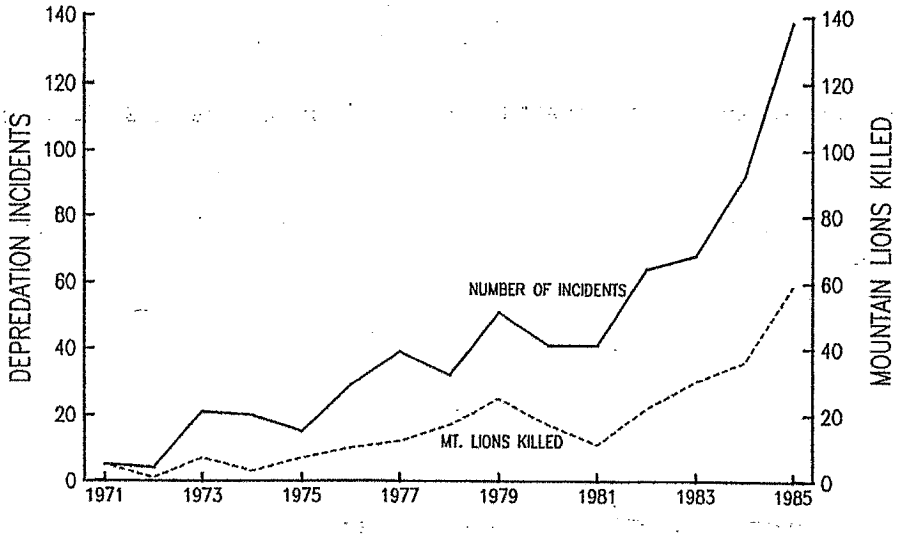

Figure 5—Number of depredation incidents by mountain lions and mountain lions killed under depredation permits since the passage of legislation prohibiting sport hunting in 1971.

for it, and the availability of alternate prey at the lower elevations.

We believe the low deer:mountain lion ratio on the range of the North Kings deer herd is an unusual situation. It is the result of a declining deer population and high mountain lion density, probably a response to 14 years of protection. This condition has serious implications for those responsible for the management of deer and livestock.

ACKNOWLEDGMENTS:

We thank Douglas Bowman, Ronald Rempel, Charles Evans, Buddy Fazio, John Oldham, Paul Neal, Susan Steger, Lorin Goering, Gary and Anthony Eberlein, and Michael Chapel for collection of field data. We appreciate the skill and dedication of David Fjelline, Raymond Nelson, and Blue Milsap, hunter-trappers who captured the mountain lions. A special thank you is given to the many hard-working student volunteers from the University of California at Davis, whose efforts made this study possible. We also thank the Fresno County Recreation and Wildlife Commission and Board of Supervisors for financial support of this research.

END NOTES AND REFERENCES

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The Authors:

DONALD L. NEAL, is a range scientist assigned to the Station's wildlife monitoring research unit, headquartered in Fresno, Calif. He earned a degree in animal science at California State University, Fresno (B.S., 1957) and a degree in plant science at the University of Nevada (M.S., 1962). He joined the Station's staff in 1956. **GEORGE N. STEGER**, a range technician with the unit, earned a degree in range management at California State University, Chico (B.S., 1973). He joined the Station's staff in 1978. **RONALD C. BERTRAM**, a wildlife biologist, is assigned to the California Department of Fish and Game's Region 4 headquarters, in Fresno. He earned a degree in wildlife management at Humboldt State University, Arcata, California (B.S., 1976). He has been employed by the Department since 1976.

THE EFFECT OF PREDATION ON DEER IN THE CENTRAL SIERRA NEVADA

DONALD L. NEAL, Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Dept. of Agriculture, Fresno, California 93710

ABSTRACT: Two studies, one to determine the direct causes of fawn losses in the North Kings deer herd, and the other to examine mountain lion behavior as it relates to deer, are described. Predation was the largest cause of fawn loss, resulting in the death of 50.6% of all fawns during the first 12 months of life. Mountain lions were the principle predator, and were responsible for 49% of the fawn kills. Coyotes, bears, and bobcats took 27%, 22%, and 3% respectively. Mountain lion density was estimated at 1 per 8 square miles (12.4/100 mi ^{2}). Home-ranges averaged 102 square miles for adult females and 135 square miles for adult males. Home-range overlap was extensive. Most mountain lions migrated seasonally with the deer but some remained at low elevation throughout the year on foothill ranches and in the vicinity of rural communities.

Predator Management in North Coastal California: proceedings of a workshop held in Ukiah and Hopland, Calif., March 10-11, 1990 (G. A. Giusti, R. M. Timm, and R. H. Schmidt, eds.). University of California, Hopland Field Station Publication 101.

Most deer herds in California have been declining since the mid-1950s. The North Kings deer herd in eastern Fresno County declined from an estimated 17,000 animals in 1950 (Longhurst et al. 1952) to 1,800 in 1989 (M. Boland, personal communication). A long-term, interagency research and application program was conducted during the 1970s to discover the cause of the decline, develop remedial measures, and apply those measures to reverse the decline (Bertram 1984). Early in the program deer herd composition counts indicated that low fawn survival was limiting the herd. Habitat factors were assumed to be the major factor contributing to the loss, but the direct cause could not be determined because dead fawns were not being found in the field.

One of the studies conducted as part of the North Kings Program was to determine the influence of cattle on habitat use by fawns. New-born fawns were captured, equipped with radio transmitters, and radio-located each day to determine their habitat use patterns, with and without cattle present. Radio-monitoring of these fawns also provided an opportunity to locate fawns soon after they died and determine the direct cause of death.

The causes of fawn loss as determined from this radio-equipped population is the first study reported in this paper. The second study came about when early results indicated that predation, especially by mountain lions, was an important cause of fawn loss. As a result, mountain lion behavior and density within the range of the North Kings deer herd was studied by radiotelemetry.

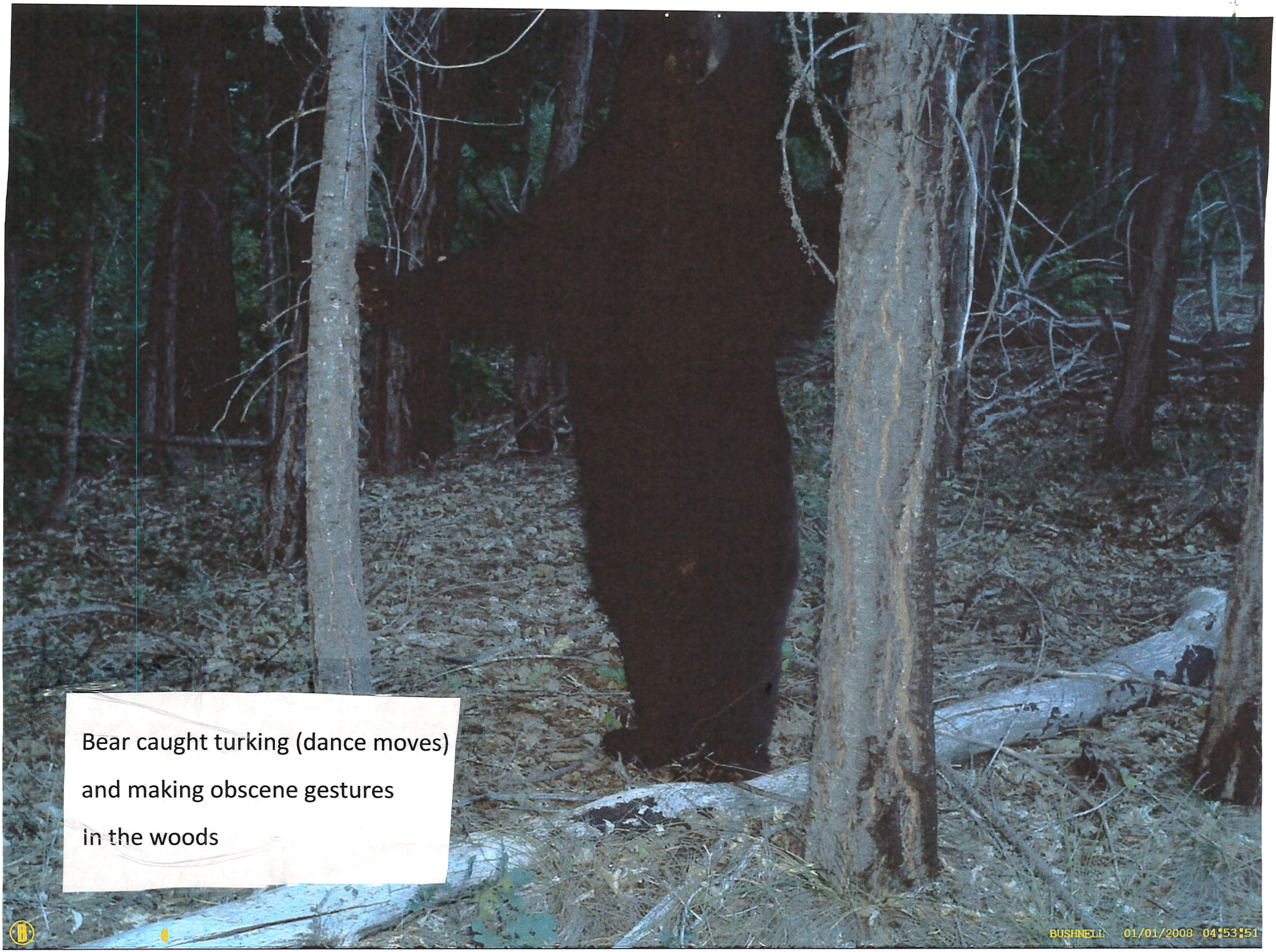
STUDY AREA

The studies were conducted within the range of the North Kings deer herd, an 800 square mile area in eastern Fresno County, mostly within the Sierra National Forest. Elevation ranges from 800 to over 13,000 feet (Bertram 1984). Deer winter ranges are generally below 4,000 feet and include the upper oak woodland and lower yellow pine forest types (Barbour and Major 1977). Summer ranges are above 5,500 feet in elevation and include the upper yellow pine, white fir-mixed conifer, and red fir forest types. Recreation, logging, forest regeneration, hydroelectric development, and livestock grazing all have impacts on the range of the North Kings deer herd.

METHODS

Fawn Mortality

Newborn fawns were located, mostly by spotlighting from vehicles on logging roads (Steger and Neal 1981). Once located, the fawns were captured, examined, weighed, and equipped with radio transmitters attached with neck collars. The fawns were located daily by radio triangulation and locations were marked on maps and aerial photographs. The radio transmitters included a module which changed the transmitted pulse rate when a fawn died. When a transmitter signaled that a fawn was dead a search for the fawn was started immediately.


Bear caught turking (dance moves)
and making obscene gestures
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