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IMPACT OF MOUNTAIN LION (FELIS CONCOLOR AZTECA MERRIAMI) ON MULE DEER AND CATTLE IN NORTHWESTERN ARIZONA.

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Abstract: During four years of study, 16 adult mountain lions were captured on a 406 km^2 study area. Eleven kittens are known to have been produced on the area. Of the above, 7 adults and 4 kittens are known to be dead. An average population of 7 resident adult lions is postulated for the area. The species composition of 58 kills made by lions was 64 percent mule deer, 32 percent cattle, and 4 percent other species. Sixty-two percent of the examined lion scats contained deer, 34 percent cattle, with 4 percent representing other species. Selection of calves over other prey was noted. Estimate of total kill per year ranged from 77-193 deer and 21-97 cattle per year, depending upon the method used to estimate killing frequency.

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Others who have contributed to the study include Anthony Crilley and Bill Murphy of Arizona; Jack Foxworth and Charles Adleta of Texas; Wells Heath of Paducah, Kentucky; and Jack Fletcher, D. V. M., of Prescott, Arizona.

INTRODUCTION

Hornocker (1970) studied mountain lions (*Felis concolor missoulensis* Goodman) in an Idaho wilderness situation where the principal prey species were mule deer (*Odocoileus hemionus* Rafinesque) and elk (*Cervus canadensis* Linneaus). While his study, and the following work in the same area by other investigators (Seidensticker et al. 1973), added much to our knowledge of the impact of lions on big game and of lion social behavior, they did not explore the special problem encountered when livestock are also available as prey. Information is badly needed concerning the impact of lions on domestic stock under defined lion and prey densities.

Russo and Carr (1969) reported on the status of the lion in Arizona and discussed difficulties encountered in attempts to gather sound management information on the species. Although the lion has been classified as big game in Arizona since 1971, little has actually changed regarding its practical legal status. In general, the net result of added restrictions on taking of lions has been increased difficulty in estimating the numbers of lions taken. Lion control has apparently gone underground in the hands of ranchers in many areas.

While we feel that better policies are probably needed governing both management and control of the lion in Arizona, little solid information is available to furnish guidelines in developing such policies. This paper reports on a four year effort to census lions and evaluate their impact on an area where both mule deer and cattle (*Bos taurus*) range into prime lion habitat.

The Study Area

The study was conducted on and around the Spider and Cross-U Ranches in northwestern Arizona (Fig. 1). These ranches, including their private holdings and allotments on the Prescott National Forest, have been closed to all lion hunting since the fall of 1971. This closure encompasses approximately 406 km^2 and constitutes the intensive study area. Movements of lions were not limited to

the closed area. As a result total area involved in the study to date amounts to approximately 552 km^2.

Elevational range of the study area is approximately 950 to 2,200 meters. Vegetative communities within its bounds range from Arizona Upland Desert scrub (lower Sonoran life zone) to Montane coniferous forest (transition zone). Terminology used here is after Brown and Lowe (1974). A high percentage of the study area is covered by dense interior chaparral and pinyon-juniper woodland (upper Sonoran zone). These latter two types constitute the bulk of the lion habitat.

Average annual rainfall is approximately 50 cm., with most falling during midwinter (Dec.-Mar.) or during localized summer thunderstorms (July-Sept.). Winter precipitation occasionally falls in the form of snow, but seldom remains on the ground for more than a week. Even in midwinter, extended periods of warm, dry weather are common. Temperatures range from about -12° (C) to over 38° (C).

Prominent plant species in the chaparral type include turbinella oak (*Quercus turbinella*), manzanita (*Arctostaphylos* spp.), mountain mahogany (*Cercocarpus* spp.), and various forms of ceanothus (*Ceanothus* spp.). The chaparral, pinyon-juniper, and mixed conifer vegetational communities all intergrade on the

study area, making strict delineation of types difficult. Major tree species include pinyon pine (Pinus edulis and Pinus monophylla), Utah juniper (Juniperus osteosperma), alligator-barked juniper (Juniperus Deppeana), ponderosa pine (Pinus ponderosa), and Gambel oak (Quercus Gambelii). Arizona sycamore (Platanus Wrightii) and Fremont cottonwood (Populus Fremontii) are common in riparian communities.

Mule deer are the most common wild ruminant on the area. Pronghorn (Antilocapra americana) occur in limited numbers, and javelina (Dicotyles tajacu) are occasionally seen. Smaller mammals which might be potential lion prey include jackrabbits (Lepus californicus), cottontails (Sylvilagus auduboni) and rock squirrels (Ammospermophulus variegatus). Porcupines (Erithizon dorsatum) are known to occur in the area, but have been rare in recent years. A few Merriam's turkey (Meleagris gallopavo merriami) occur on the area and probably constitute the only potential bird prey species for lions.

Cattle grazing is the primary economic land use on the area. Allotment sizes and grazing intensities are established by the U. S. Forest Service. All but approximately 38 km^2 of the area are made up of lands administered by the Forest Service. The remainder is deeded land.

MATERIALS AND METHODS

Methodology in marking lions followed closely that developed by Hornocker (1970) and Seidensticker et al. (1973), with modifications enforced by local conditions. Lions were trailed with dogs, treed, and darted with a CAP-CHUR gun. Sernylan (phencyclidine hydrochloride) was used for immobilization in dosages approximating those developed by Hornocker.

Dryland lion hunters traditionally use relatively large numbers of dogs (6-8), allowing them to range free while hunting. This is essential to maintain momentum on the trail under hot, dry conditions. It increases, however, the risk of catching kittens on the ground. At times it interferes with collection of large numbers of scats as the dogs will consume any fresh droppings they find.

Lions are marked with numbered rope collars and, in most cases, with radio-collars. Ear tags were used during the first year, but after lions were found to be sloughing them their use was discontinued. Screw worms (*Cochliomyia hominivorax*) are periodically a problem in the southwest, and techniques which tend to produce continuing open wounds are best avoided. Screw worms were considered a possible cause in the death of one mature female.

Radio transmitters were supplied by Telonics of Mesa, Arizona, and operated at 147.5 megahertz. All radio locations of lions were made from fixed-wing aircraft. Efforts were made to locate lions daily over extended (15- to 30-day) periods to facilitate location of kills. When lions were located in the same place for two or more consecutive days, a kill was suspected, and when possible a search was made. Dogs were generally used. Efforts were made to wait until the lion had departed before initiating a search. This had the advantage of minimizing disturbance at the kill site. It functioned, however, to make pre-kill condition of prey hard to assess, since kills were often consumed and scattered before inspection. Femurs were collected from 19 adult deer and 1 fawn. These have been inspected visually, but no laboratory analysis of fat content has yet been made. Of these, only one 8-10 year old adult showed signs of nutritional stress. One other kill inspected showed evidence of an old leg injury.

Deer Census

Censusing of deer in Arizona chaparral is always difficult. Rough terrain combined with dense brush render direct ground surveys useless. Pellet group counts (Smith et al. 1969a; Neff 1968) have probably been most successful, but are feasible only

on large study areas where long term studies are anticipated. At its inception, the present study was anticipated to last only 4 to 5 years, hence use of manpower to establish permanent pellet plots was considered unwise.

Deer numbers were roughly estimated during 3 of the 4 years using helicopter surveys. Approximately 10 hours of flight time were expended over a 2-day period each year. In 1972, a strip-census was used with 26 east-to-west strips of varying lengths being traversed at approximately 0.80 km intervals. Strip width was estimated at about 180 meters. During 1973 and 1974, a block sampling method was used. In 1973, 19 square-mile (2.6 km^2) blocks were surveyed (Bartman 1974). The sample size was increased to 27 blocks in 1974. Efforts were made to make complete counts on these blocks. Boundaries of the blocks were estimated from the helicopter using aerial photos and topographic features. Statistical analysis of these data has not been attempted.

During the past year (1974-1975), priorities in funding were given to flights of fixed-wing aircraft for locating lions and, particularly, to aid in locating kills. The helicopter surveys were discontinued. Deer numbers in central Arizona have changed slowly in recent years. Censuses every 2 to 3 years, combined

with annual ground classification counts, probably yield adequate estimates of deer density. Annual changes, when they occur, are generally too small to be detected with any certainty by available techniques.

Lion scats were collected incidental to other activities and were analyzed with the aid of a low-power stereo microscope.

RESULTS

Lion Numbers

Sixteen mature lions (Table 1) were captured on the study area. Insofar as can be determined, these were all resident (as defined by Hornocker 1970) lions. To date, no lions that appear to be transient have been captured, although three litters of kittens approximately 1 year of age are known to be on the area at the present time. Tracks of two small lions traveling together were also seen during the past winter. Whether these remained on the area is not known.

The summary shown in Table 2 represents a minimum estimate of lions using the area. Recapture data and/or tracks confirmed the presence of these animals. I am certain that at least one unmarked mature male and three unmarked females are residing in the area. The two possible transients mentioned above may still be present. Based on radio-tracking data, the

latest lion captured (No. 23) probably has kittens. This yields an overall estimate of at least 3 adult males, 10 adult females, 8 advanced, but dependent kittens, and 3 new kittens, for a total of 24 lions. Seven adults and 4 kittens are known to have died during the 4 year period (Table 1).

The Deer Population

Central Arizona deer herds generally peaked during the mid to late 1950's, declined rapidly in the early 1960's, and stabilized at a relatively low density over the past 10 years. The deer herd on the study area apparently followed this pattern closely.

Helicopter surveys yielded a midwinter estimate of 1.8 to 3.6 deer per km^2 (Table 3) during the first 3 years of the study. The difference in estimated densities is considered a result of the varying sampling designs used rather than an actual change in deer numbers. Some error undoubtedly existed in estimating the strip width covered during the 1972 surveys, perhaps yielding an estimate that is slightly higher than reality. The block surveys used in 1973 and 1974, however, assume complete counts on 1-square-mile (2.65 km^2) blocks. Complete counts were not realized, however, and population estimates using this method are undoubtedly low. Actual densities probably fall somewhere between the estimates obtained (approximately 2.5 deer/km^2).

This would yield an average January population estimate of about 1,000 deer.

Mule deer on the area are year round residents. Climatic changes normally cause deer to use a different aspect rather than to make long movements. Even these changes in distribution are probably dictated more by availability of annual food plants than by severity of climate.

At present population levels, nutritional stress is not thought to be a problem for deer herds in the Arizona chaparral (McCulloch and Urness 1973). By shifting diets through the year, adequate protein intake is maintained. Animals in poor condition are rare at any time of year. In this habitat deer are seldom browse-dependent for long periods. There is no acceptable means of evaluating condition and trend of the moisture-dependent forbs and half-shrubs which constitute much of the chaparral deer diet. At a low deer density, range condition is generally a function of seasonal moisture, and may change from fair to excellent in a few weeks as moisture patterns change.

Conception rates in central Arizona deer herds have been estimated at 1.5 fawns/mature doe ($2\frac{1}{2}$ years or older) (McMichael 1969). Fawn survival, however, is consistently low, with greatest losses apparently occurring within the first

month after birth (Smith et al. 1969b).

Cattle Population

The combined U. S. Forest Service permits for the Spider and Cross-U ranches total 900 animal units. Grazing patterns are being converted to a rest-rotation employing 16 to 48 km^2 pastures. Cattle are rotated between pastures during the year. No effort has been made to determine if this rotation system influences the number of cattle killed by lions.

Herd size and composition varied from time to time during the study as calves were born or bought, older classes of animals were added or removed, or calves were sold. This made it difficult to estimate the actual number of animals on the range at any given time. Year round breeding and the resulting extended calving period further complicate estimates of herd size or composition for any period. New calves appear on the ground in limited numbers every month of the year, with the peak in March.

Stocking figures from ranch records are shown in Table 4. In addition to the animals shown, approximately 70 range bulls are run on the combined ranches each year. These, however, are not normally vulnerable to lion predation.

Calving success (to sale time) varied considerably over the 4 years, but averaged approximately 70 calves per 100 cows.

This is a low average for ranches of this type in the habitats represented. Initial conception rates for cattle on the area are unknown, but are generally considered to average 85-90 percent (J. Savoini, D. V. M., Prescott; Dr. Floyd Franks, Univ. of Idaho, Moscow, pers. comm.). Mean breeding cow numbers over the 4 years was estimated at 434 per year. This would yield a potential calf crop of 391 calves, using a 90 percent conception rate and no *in utero* losses. An estimated 304 calves survived to sale time, giving an average postnatal loss of 87 calves per year. This considers only calves born on the ranches. Actual numbers of vulnerable animals present is confounded to some extent by the addition of weaner calves or yearlings from outside sources during some years.

Lion Kills

Sixty-two lion kills were verified by project personnel on and in the immediate vicinity of the study area. These include 37 mule deer, 23 cattle, 1 pronghorn, and 1 cottontail (Table 5). The cottontail was killed, but not eaten, by a large marked male.

Seasonal differences in relative proportions of prey seemed to occur (Table 5), although conclusions drawn here must be tentative due to the limited numbers of kills classified in each prey class. Mule deer bucks were taken in highest numbers in

the November-February period. This period covers both the post-hunt period, when wounded bucks would be most available, and the rut, when healthy bucks are most vulnerable to predation. Mule deer fawns were taken most frequently during the July-October period, which includes the season when fawns are born and the critical weeks immediately following.

The extended winter calving period for cattle is reflected by high kills during the entire period from November to June. The reduced number of calves killed by lions from July-October probably results from the increased number of deer present, as well as the reduction in numbers of very small calves in the herd. Actual numbers of kills shown in different seasons should not be compared. They vary with the effectiveness of the search for kills from period to period rather than killing activity of lions.

Selection of Prey

Overall, a selection of calves over other local prey is apparent. The kill of larger classes of cattle was obviously light. The ratio of calves to deer on the study area probably never exceeded the ratio at the time calves are sold, which is approximately 1 calf:3 deer. The year round average is probably nearer to 1:5 or even smaller. The ratio of calves to deer in the kill, however, approaches 1:2. I suspect this is due more to the

relative vulnerability of calves than to any real effort at selection by lions.

Within the deer kill, some selection for bucks seems apparent. Bucks made up about 12 percent of the deer herd, and 29 percent of the kill. Fawns were apparently taken approximately in proportion to their occurrence in the herd. Fawns (deer less than 10 months old) comprised 29 percent of the kills and 31 percent of the deer population (determined from mid-January surveys). By this time of year natural mortality has reduced the fawn cohort to near its low point. If strong selection for fawns were occurring, the proportion of fawns in the kill should be higher than the proportion found during the surveys. Potential error in estimating the proportion of fawn losses should be recognized. Extremely young fawns are probably completely consumed, leaving no evidence. Furthermore, we find the fewest number of kills during the July-October period when fawns are at their peak.

The relative proportions of prey species varied with means of discovery (Table 6). Of the combined kills discovered by trailing and radio-location, 64 percent were deer and 32 percent cattle, pronghorn and rabbits accounting for the rest. Kills initially reported by neighboring ranchers were not used in calculating these percentages. I suspect that ranchers probably

made more effort to report cattle kills than deer kills. Kills found while trailing lions contained a higher proportion of cattle than did kills found by radio-location. The radio-location kills, however, were heavily weighted with data on five female lions tracked during the past two years and thus may not be representative of the killing behavior of the total lion population. Data on kills made by known males are limited (Table 7), but indicate that they may take a higher proportion of cattle than do females.

A high proportion of lions on the area appear to be taking cattle. To date, 36 kills have been attributed to 12 known lions. Six of the 12 killed cattle at least once; 10 were known to have killed deer. Four were credited with both deer and cattle kills. One lion killed deer, cattle, and pronghorn.

A ratio of deer:cattle nearly similar to that in the lion kills was also found in lion scats examined for evidence of prey (Table 8). Since scats were not collected from the vicinity of known kills, scat analysis should give an estimate of prey proportions independent of the kill data.

Number of Animals Taken

Hornocker (1970) has discussed the difficulties involved in determining frequency of killing by individual lions. He has

indicated that adult lions each killed between 860 and 1300 kg of large prey animals per year. This was the equivalent of 5 to 7 elk, or 14-20 deer per year. He noted that the number of elk was unrealistic due to spoilage and other losses, but also felt that smaller prey species helped to fill in between larger kills, particularly in the summer.

Indicated differences in post-kill behavior between lions on this area and those on the Idaho study area lead us to suggest that the frequency of large prey is probably higher here. Hornocker reported that each kill was buried and closely guarded against scavengers. We have not observed such consistency in behavior in this study. Many of the sites where kills were made do not provide suitable materials for covering them. While some effort at covering a kill is often made, many are left fully exposed. Neither does tendency to guard kills, as noted by the Idaho workers, seem to be as prevalent here. Lions have been found to bed 1 to 2 km from fresh kills during midday and return to them at night. As a result, many kills are at least partly used by scavengers.

At these elevations in Arizona, preservation of meat by freezing seldom occurs. While night temperatures drop to sub-freezing levels during midwinter months, thawing typically

occurs by midday. As a result, meat decomposition proceeds at a rapid rate throughout the year. Length of time individual kills are used and the percentage of meat eaten is consequently reduced. Time spent by lions at individual kills (as determined by radio-tracking) was not markedly different between winter and summer. During the warm months (April-Sept.) time at kills varied from 2 to 5 days, averaging 3.2 (N=14). During the cooler months (Oct.-March) it varied from 1 to 4 days, averaging 3.0 (N=10).

Amount of meat provided by each kill is apparently less here than in Idaho. Hornocker (1970) used estimates of average live weights from mule deer from Montana of 64 kg. Similar data are not available for Arizona. Dressed weights for 147 buck mule deer from Arizona chaparral averaged 52.6 kg. For 171 does, the mean dressed weight was 35.9 kg. Converting these to live weights using the graph devised by Severinghaus (1949) for whitetails yields an average live weight estimate of 63.6 kg for bucks and 47.7 kg for does. Buck to doe ratios on the study area for the 4 years has been approximately 1:5, thus the weight of adult mule deer at the time of the fall hunt would be approximately 50.8 kg, or some 80 percent of the weight of mule deer farther north. While the average weight of all cattle on the area would

probably be in excess of 227 kg, animals over 136 kg were rarely taken by lions and a very high proportion of kills were 91 kg or less.

There is little evidence that lions feed on rabbits or rodents to any extent at any time of year on this area.

Everything considered, it appears that more large animals must be taken here to satisfy the lion's basic meat requirements than was necessary in Idaho. Using Hornocker's (1970) estimate of 860-1300 kg of prey per lion, we can calculate that each lion would require 17-25 deer or 10-14 calves per year. These figures must be considered minimal under our study conditions.

Data obtained on one lion (Fig. 2), a female with an unknown number of kittens, leads us to suggest that some lions may kill more animals than they can possibly consume. In four of eight instances this lion made multiple kills within a short period of time. In some cases kills in close proximity were apparently made on the same day and cached within 9 to 90 meters of each other. These instances involved: (1) 1 mule deer doe and 2 fawns, (2) 1 mule deer doe and 1 fawn, (3) 1 mule deer buck and 1 calf, and (4) 1 mule deer doe and 1 fawn. Three of the four instances occurred during periods of relatively warm weather when meat decomposition was rapid. These kills were made over a period of one year, hence are unlikely to have been due

to young kittens having restricted the hunting area of the female. The extent to which other lions may exhibit similar behavior is not known.

Other evidence suggesting that killing frequency may be higher here than in the Idaho study area comes from radio locations of lions. Seidensticker (1973) in Idaho reported that lions generally traveled about between kills, rarely spending more than one day in the same location. On our area lions exhibit a pattern behavior characterized by short (2-4 day) periods when the lion is essentially sedentary, followed by periods marked by extensive travel. Due to lack of snow and the difficulty involved in reaching the kill sites, we were not able to establish that a kill was made at each location where consecutive daily fixes suggested such might be the case. Documenting kills at these sites was also complicated by the fact that lions (particularly mature males) frequently retreated to rimrock areas or heavy bush, away from the immediate vicinity of the kill, once they had fed. Fig. 2 illustrates this movement pattern for one female and shows known kills as well as instances where possible kills were made. Similar tabulations have been completed for all lions where adequate data are available. Estimated days between possible kills using this method are shown in Table 9.

Undoubtedly, using radio fixes in this fashion to determine time and location of kills tends to overestimate killing frequency since lions on occasion interupt their travels for reasons other than having made a kill. Seidensticker (1973), however, found that lions in Idaho spent from 1-19 days at kills. He did not report how often a lion moved on after spending only one day at a kill. A lion would probably have no incentive to tarry near a kill site when the animal taken was a small fawn that might be completely consumed at one feeding. Also, as mentioned before, at least one lion consistently made more than one kill at an individual site. Both types of behavior would tend to compensate for the overestimate of killing frequency that would result from assuming each instance of arrested movement indicated a kill.

At this time (June 1975) seven adult female lions are known to occupy the study area. The movements of four of these are almost entirely within the boundaries of the area. While the other three range outside as well, they spent 25 to 50 percent of their time on the area. Three of these females have large kittens. Two mature males are also known to use the area and to spend approximately 50 percent of their time within study area boundaries. I do not believe that all of the original population of resident lions has been marked and suspect that due to mortality

of adult lions over a 4 year period some immigration may have taken place. I am reasonably certain of at least one unmarked male and two or three unmarked females on the study area.

A daily population of seven resident adults, thus, appears to be a reasonable average of current lion use-rate for the area. Three are females with kittens, killing at a rate of once every 6.8 days; the remainder are kittenless females or mature males killing at a rate of once every 10.4 days. At these rates the seven lions would be responsible for 302 kills per year, 193 of which (64 percent) would be deer, 97 (32 percent) cattle. These may be considered the maximum potential kill.

A minimum estimate of kills can be calculated using Hornocker's (1970) data on annual kill poundage. At an average of 50.8 kg per deer and 90.7 per calf, the lions on this area would account for 77-110 deer and 21-32 calves per year.

Impact on Deer

The impact of lion depredations on the area's mule deer population is perhaps best assessed by analyzing it in relation to other estimated losses within the herd. With an apparently stable deer population and assuming a minimum production of 100 fawns per 100 does, approximately 500 deer per year are being removed from the herd by various factors annually. Of this toll, lions

are taking an estimated 77-193 deer. Legal take by hunters is approximately 75 bucks annually, based on weekend roadblocks during hunts. Wounding loss and illegal kill is unknown. A high proportion of the remaining losses must be attributed to other predators and early postnatal mortality. Lions thus appear to be a major cause of deer mortality, contribution to the current relatively low deer population. Lion depredations alone, however, under current circumstances, would not prevent the deer herd from increasing if other losses were significantly reduced.

Impact on Cattle

Assessment of cattle losses cannot be placed in the same framework as deer losses, since, under a commercial operation, any losses are undesirable. Annually, between 21 and 97 head of cattle (mostly calves) were estimated taken by lions. While the upper limit of this range represents perhaps too large a portion of total cattle losses, it nonetheless suggests that a significant proportion of calves lost on the ranch each year are taken by lions.

Two approaches might alleviate the problem. The preponderance of small calves in lion-killed cattle suggest that converting from a cow-calf operation to one that utilized weaner steers only might reduce the number of cattle taken by lions.

Holding calves out of lion country until they reach 140 kg or more might accomplish the same end. Few ranches, however, have facilities conducive to either type of operation and the economics of such ranch management practices may rule against them. It's possible, too, that in the absence of calves, lions would switch to larger classes of livestock. Studies of the effectiveness of the above cattle management options in reducing lion losses might yield valuable information.

It would also be interesting to reassess livestock losses on our study area at a time when deer numbers were higher. Deer census data and general observation of the range indicate that the deer population on the study area is relatively low. Forage conditions suggest that the area could support a much higher deer population. We can hypothesize that the number of cattle taken may be inversely proportional to the size of the deer herd. Given a fairly stable lion population, lions may conceivably have a less depressing effect on a large deer herd than on the present reduced herd, even if the lions increase the proportion of venison in their diet. We are not, however, able to increase the number of deer at will in the southwest. Whether we will experience increased deer densities in the near future which might allow the above evaluations to be made remains to be seen.

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Table 1. Fate of lions captured and marked on the Cross U - Spider study areas, 1971-75.

Lion #	Date of initial capture	Sex	Age	Present Status and Remarks
2	11/23/71	♀	Young mature	Currently being monitored. Known to have 2-3 unmarked kittens approximately 12 mo. old.
3	11/27/71	♂	Mature prime	Killed by hunters 4/15/73 about 4 mi. south of capture site out of study area.
4	12/15/71	♂	Old mature	Killed 3/18/73 by hunter south of study area.
5	12/16/71	♂	Mature prime	Rumored killed by hunter winter of 1973-74. Unable to confirm, but not recaptured since 3/26/73.
6	2/9/72	♀	Mature	Still on study area periodically (captured last 2/27/75).
7	3/28/72	♀	Mature	Died of unknown causes approximately 5/23/73. Apparently unrelated to study.
9	1/12/73	♀	Mature	With litter of three small kittens when captured. ♀ rejected kittens after handling; they perished. ♀ ultimately died 2/1/73 from loss of canines and subsequent inability to kill.
10, 11, 12	(Kittens of above ♀)			
13	4/22/73	♂	Mature prime	Last captured 2/22/74. Believed to still be on study area.
14	11/15/73	♂	Mature prime	Removed collar after one week. Believed to still be on study area.
15	11/16/73	♀	Mature	At least one kitten killed at capture. Currently being monitored with litter of three kittens now 10 mo. old.
16	1/24/74	♀	Mature	At least one kitten about 4-5 mo. old with her at time of capture. Monitored until 11/21/74. Ultimate fate of kitten(s) unknown.
17	4/11/74	♀	Mature	Pregnant when captured. Unknown number of kittens apparently born within two weeks of capture. At least two still with her 4/4/75. Currently being monitored. Kittens now 14 mo.
18	11/9/74	♀	Mature	Unmarked ♀ killed illegally on study area by deer hunter.
19	12/11/74	♀	Young mature	Currently being monitored.
21	2/12/74	♂	Prime mature	Fatality involved with fall from tree at time of capture.
23	4/6/74	♀	Young mature	Still being monitored.

Table 2. Summary of known lion population on the Cross U - Spider study area, 1971-75.

	♂	♀	Juv.
Total known lions	6	10	12
Known mortality	4	3	4
Estimate remaining population	2	7	8*

* One should be independent by now.

Table 3. Results of January mule deer surveys on the Cross-U Spider study area, 1972-74.

Year	Survey Method	Approx. area Surveyed, km^2	No. Deer	Deer/ km^2	Est. area population ♂	♀	F	Total
1972	Helicopter - strip census	67	253	3.6	146	920	395	1461
1973	Helicopter - 1 $mi.^2$ blocks	49	93	1.8	107	429	194	730
1974	Helicopter - 1 $mi.^2$ blocks	69	126	1.8	80	422	228	730

Table 4. Estimates of vulnerable cattle numbers on the Cross-U - Spider study area, 1971-1974

Year	Cows	Calves	Yearlings	Total
1971*	225	195	45	465
1972	311	356**	314	981
1973	461	266	419	1146
1974	585	365***	508	1458

* Spider Ranch only. Cruss-U figures not available for this period.

** Includes 115 bought during year. Calf crop on ranches totaled approximately 241

*** Calving record for Spider not available at this time. Total calculated using average calving rates from previous years.

Table 5. Lion kills located on or in vicinity of Cross-U - Spider study area by season of kill, 1971-75.

Period	Mule Deer				Cattle			
	♂	♀	F	Uncl.	Calf (400 lb.)	Yearling (400-600 lb.)	Adult (+600 lb.)	Other
Nov/Feb	7	6	1	3	8	1	1	0
Mar/Jne	2	4	3	2	11	1	0	0
Jul/Oct	0	3	5	1	1	0	0	2
	9	13	9	6	20	2	1	2
	Total deer - 37				Total cattle - 23			

Table 6. Lion kills by means of location on or adjacent to study area, 1971-75.

	Mule Deer	Cattle	Other
Means of Location			
Trailed to kill or discovered by project personnel	17	12	0
Reported by neighboring ranches	1	5	0
Radio locations	19	6	2
	37	23	2

Table 7. Kills by sex of lion on Cross-U - Spider study area, 1971-74.

	Mule Deer	Cattle	Other
Known ♀	20	6	1
Known ♂	4	4	1
Unknown	13	13	0
	37	23	2

Table 8. Contents of lion scats collected on the study area by percent occurrence.

	Number	Percent
Deer	27	54
Cattle	13	26
Deer and cattle	4	8
Peccary	1	2
Pronghorn	1	2
Rabbit	1	2
Porcupine	3	6
	50	100

Table 9. Average number of days between kills for six adult female lions.

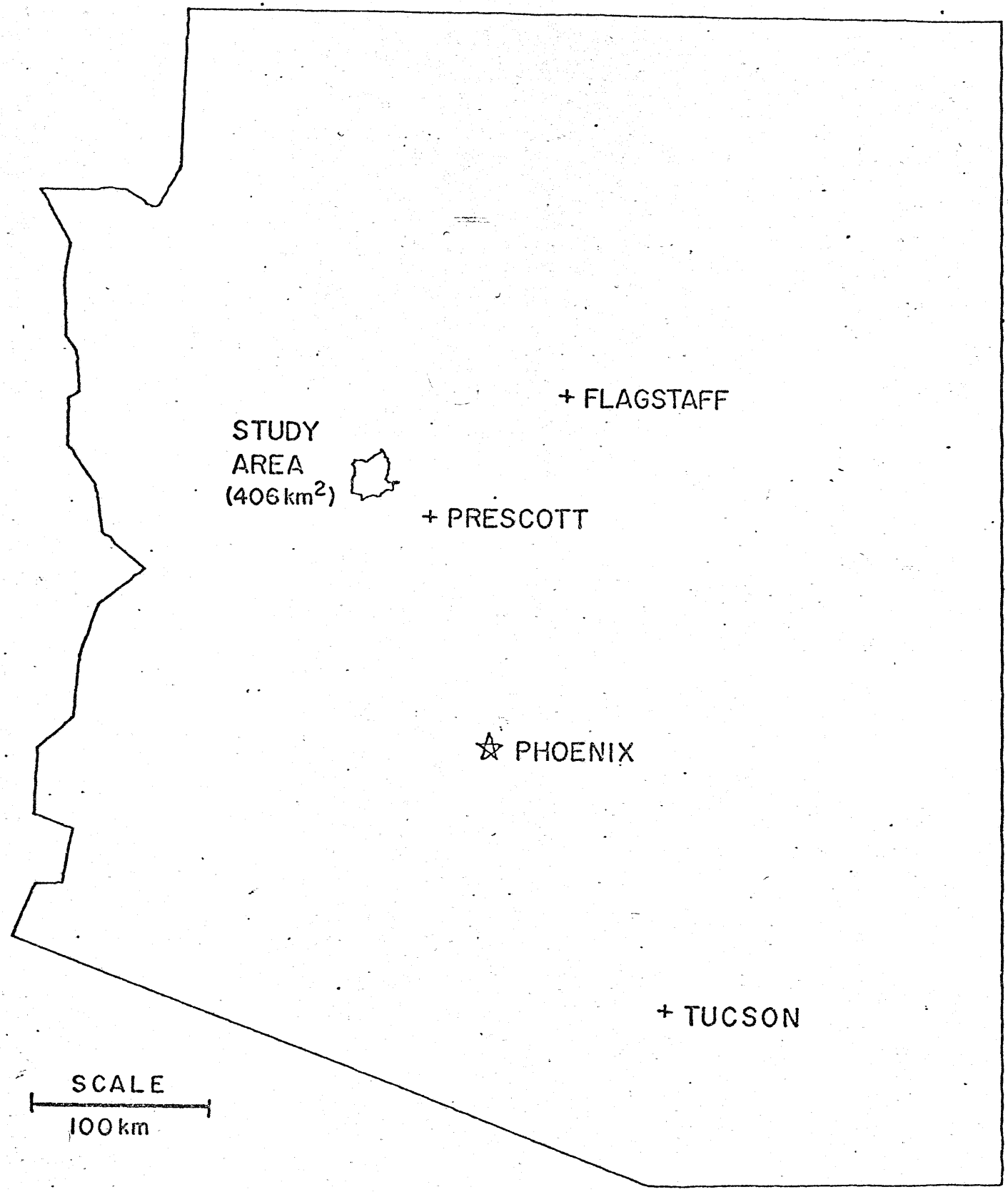
Lion No.	Without Young	With Young
2	11.1	6.1
15	9.7	6.0
16	--	8.5*
17	--	6.7
19	9.6	--
23	11.0	--
Totals	10.4	6.8

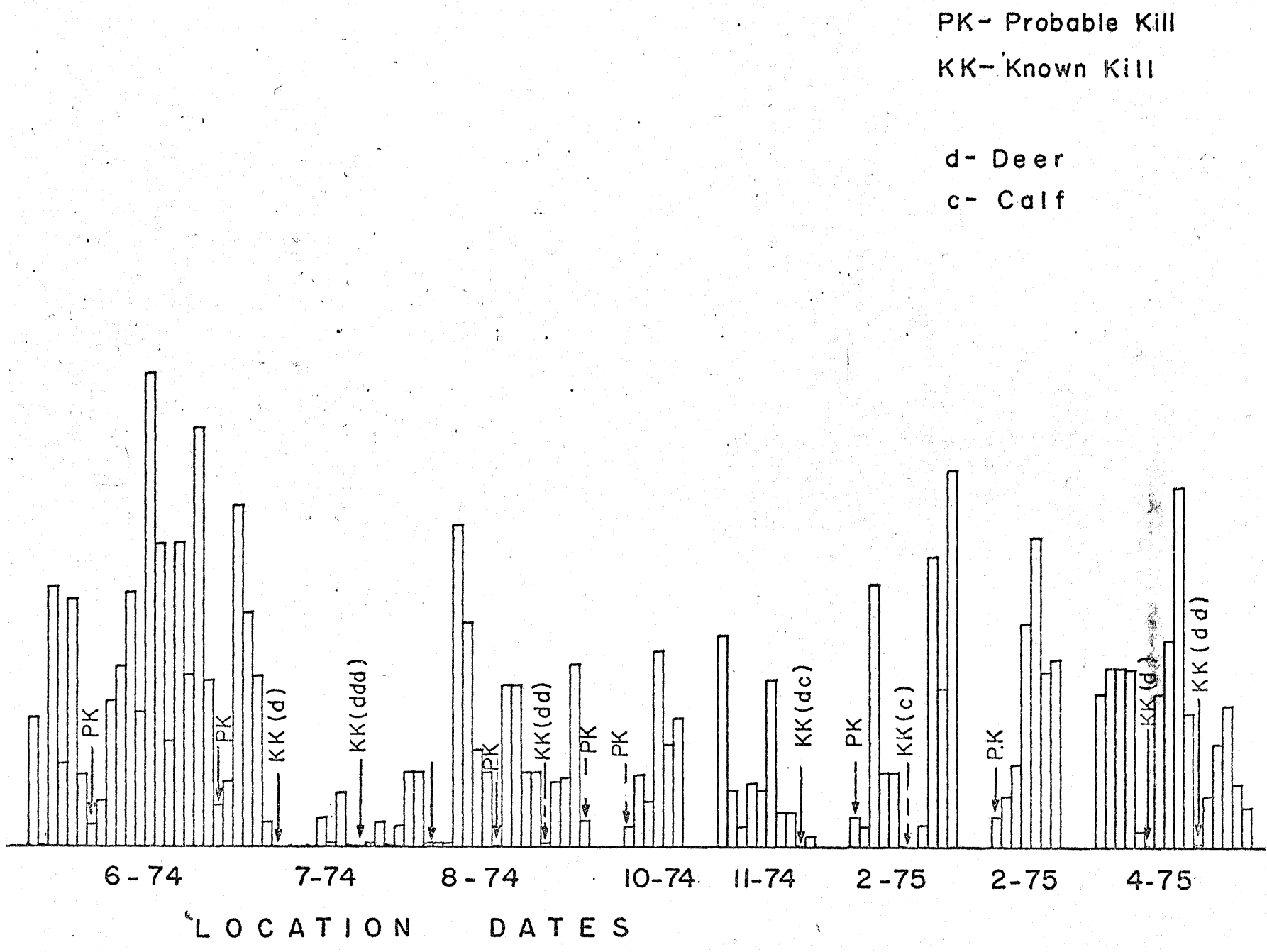
*One kitten only

LIST OF FIGURES

Fig. 1 Outline map, State of Arizona, showing study area location.

Fig. 2 Movement patterns of female lion number 2 on Cross-U - Spider Ranches. April 1974 to April 1975.


+ FLAGSTAFF
STUDY
AREA
(406 km²)
+ PRESCOTT
PHOENIX
+ TUCSON
SCALE
100 km


PK- Probable Kill
KK- Known Kill
d- Deer
c- Calf
PK
PK
KK (d)
KK (ddd)
PK
KK (dd)
PK
PK
KK (dc)
PK
KK (c)
P.K
KK (d)
KK (dd)
6-74
7-74
8-74
10-74
11-74
2-75
2-75
4-75
LOCATION DATES