After 15 years of protected status, Governor George Deukmejian (R) vetoed the extension of the California mountain lion hunting moratorium in 1985. The California Fish and Game Commission decided to allow lion hunters to pursue, tree, and shoot lions by a 3-2 vote in April. The mountain lion population was estimated to have increased to 5100 animals according to California Fish and Game since hunting was banned. Controversy between hunters and non-hunters continues and a coalition of groups, including the Sierra Club has filed suit against the California Fish and Game Department to gain an injunction against the hunt.


Two men observed puma tracks in an area of dense hardwood thicket along the Cypress Bayou bottoms between Springridge and Keatchie, Louisiana in Caddo Parish. In addition, two deputies of Caddo Parish saw a puma on the Old Mansfield Road about 2 miles north of the Desoto Parish line, directly behind the KV Bar near Keithville in Caddo Parish on November 30, 1965. The puma was shot as it stood near the road in the glare of the headlights. This puma weighed 114 pounds twelve hours after death. Standard body measurements in millimeters were: total length, 2070; tail, 775; hindfoot, 275; ear, 94; height at shoulders, 660. The length and width across the toe pads of the left hind foot were 88 and 62; across those of the left front foot, 80 and 68. The length of the testis was 28. All of the recent records of the puma were in or near the three bordering parishes of Natchitoches, DeSoto, and Caddo in northwest Louisiana.


A new geographic race of puma, Felis concolor youngi, is described from Bruni Ranch, near Bruni, southeastern Webb County, Texas.


Because a fossil species of felid from the lower Pleistocene of China, Felis youngipei, already possessed the name youngi, the puma of southern Texas designated Felis concolor youngi was changed to Felis concolor stanleyana.


The Adirondacks appear to have been the final stronghold of the cougar in the east. Several were reported to have been killed in New York about 1877. The last record for the state was in 1894, when Game Protector R.B. Nichols saw a cougar 7 miles above Indian Lake Corners on the Cedar River. In Pennsylvania, bounties were paid for "panther" in 1866, and two were killed in Clearfield County in 1891. In New Jersey the last cougars were destroyed between 1830 and 1840. At one time they were not uncommon in southern Massachusetts and in Connecticut; but they disappeared in this region some time before 1800. Linslev. 1842. stated that he saw a
specimen in Mix's Museum that was supposedly killed in northern Connecticut. A few remained in northern Vermont and New Hampshire until about 1888; two were reported in 1907 as having been seen 50 miles from Norcross, Maine, and one, according to accounts, was shot in that state about September 1, 1906. The last cougar reported killed in Vermont was shot by Alexander Crowell near Barnard, November 24, 1881. This was a large animal weighing 182 pounds and measuring 7 feet in length. The specimen now is in the state collection at Montpelier. It is reported that two men, while hunting in 1891 near Andover, Maine, saw and shot at a cougar.


SUMMARY

During the past three year period a total of twenty definite cases of predation were recorded. These are broken down as follows: lions, 8 kills; coyotes, 7 kills; bobcats, 2 kills; golden eagle, 1 kill; and stray dogs, 2 kills. It is believed that the lion is a far more serious predator than the relative figures indicate. Only about 20 percent of the coyote and bobcat stomachs examined showed game animal remains, and a part of this may have been carrion. Three lion stomachs examined all contained fresh deer meat and hair. It is recognized that predators are responsible for a considerable loss of game animals on the Gila Forest; however, there is no evidence to indicate that predators reduce game populations below the carrying capacity of the range. It is recommended that moderate predator control be continued over most of the forest to keep predator populations at their present low level.


The author recalls his experiences with mountain lions in western Montana when he was a 10 year-old boy. The American Indians called the mountain lion the "Cat of God," because of its regal bearing. They also named it "Father of Game" and "Greatest Hunter," in deference to its skill as a predator. There were only 31 confirmed cases of mountain lion depredation in California in 1978.


SYNOPSIS

In recent years, human-mountain lion interactions have been increasing in many Western states, including in Colorado. It can be difficult to maintain an appropriate perspective of mountain lion habitat when interactions between humans and mountain lions are on the rise. This questionnaire was designed to provide this perspective. Perspective is a subjective evaluation of relative significance or point of view. Twenty-six states and provinces provided information. Six states did not have mountain lion populations. Thirteen states reported mountain lion populations ranging in size from 635 to 5,100+ animals. Twelve states allow hunting and their harvests average 150 mountain lions/state/year. Population sizes of the remaining states are small or undetermined. Populations are believed to be stable in six states and increasing in eight; the status of mountain lions in other states is unknown. However, 10 states reported increasing levels of interaction with people. In the past 5 years, people were injured by mountain lions in Arizona, California, Texas.
Alberta, Colorado, and Washington. In Washington, injuries were to two researchers of mountain lions. Four fatalities occurred in Colorado, Montana, and British Columbia. In California and Colorado, mountain lions take an average of 53 pets/year. Other states reported several incidents/year. Forty mountain lions/year were killed by private parties to prevent injury to people or animals. Wildlife agencies killed another 130 for the same purpose. Eight states relocated about 50 cats. Ten states do not relocate mountain lions. Problems occur when mountain lion and deer hunting are either allowed or prohibited. Density of people in areas with conflicts ranges from very low to quite high. Only British Columbia reported decreasing encounters that, however, are from levels higher than totals in many states. Data on sex and age of mountain lions in incidents with either pets or humans were available from California, Montana, Nevada, British Columbia, and Colorado. In the under age 3 class, 29 males and 44 females were involved. In the over age 3 class, 59 males and 37 females were involved. The data indicate that encounters between humans and mountain lions are increasing. Populations of mountain lions are at least stable or increasing in most states, although some states do not have a firm assessment of numbers. The number of injuries have been low, but four were fatal. Hunting and animal damage control are used to prevent conflicts. In addition, some states are working with the media and homeowners to disseminate information to reduce or prevent mountain lion-human interactions.


SYNOPSIS (summarized)

Data bases were developed by McGrath, Halfpenny, and Sanders in Visicalc and DBase III. These data bases included general information for mapping and listing sightings. Two additional database structures are now also used. The first, in DBase IV, can be used for several objectives and meets the need for recording more than sighting information. A set of response guidelines for handling calls using the categories of sighting, encounter, incident, and attack was initiated. Temporal, spatial, geographic, and behavioral comparisons of the data were other goals. DBase IV allows analysis and reporting from multiple data files by common field linking. To ensure adequate data collection and simplified data entry, form screen entry (with direct data file access) was chosen. DBase IV does not require knowledge of programming because it is menu-prompted. The data entry format mimics the data collection form. Data can be entered on the form or directly onto the screen. The screen allows multiple choice selections for several fields. The data collection form was produced with Formtool software. The second data analysis structure was established by Halfpenny and Sanders to analyze behavioral data. The structure is a Lotus Symphony Spreadsheet with the same field names as the DBase IV structure. Symphony includes word processing and database capability and can communicate with DBase data files through its ASCII files or other translators. These structures are available from the Colorado Division of Wildlife on DBase III or IV, Lotus 123 versions 1, 2, and 3, and Symphony.


Fifteen mountain lions (Felis concolor) were captured, marked, and released in the Colorado River and Eagle River drainages from 1986 through 1990. The male to female ratio was 88:100 and the male:female:kitten ratio was 66:100:83. A young
radio collared male moved >50 kilometers from an area west of Delta, CO into GMU 25. The lion remained in this area until it died. Two male lions from this study emigrated >50 kilometers and were harvested by sport hunters.


It is recommended that serious consideration be given by the sportsmen, Commission, and others to removing the cougar, or mountain lion, from the predator list and placing this animal on the game animal list. In the near future the value of this animal as well as other predators, will assume major importance to the hunting public. The smaller predators can sustain relatively heavy harassment and harvest, but the lion cannot. At present two states afford the lion complete protection--Florida and South Dakota. An open season, beginning with deer season and continuing through March 31, with no bag limit is a realistic beginning. It is not expected that this season will result in many lions being taken, but it does show we recognize the value of the species and allow for future management. If damage to livestock should arise in these areas there are both private and federal lion hunters to take care of any depredation complaint. It is estimated that there are no more than 6,500 cougars left in the United States and possibly as few as 4,000. The elimination of this species from this or any state is not something to be proud of. He should be afforded nominal protection.


The type of season was either sex statewide with no closed season. There were no limits, quotas or tags required. The only requirement was a current hunting license. As a game animal, it is unlawful to hunt the cougar with any revolver or self-loading pistol; or by the use of or with the aid of any flashlight, spotlight, automobile headlight, lamp, or other artificial light of any kind; or at any time other than between sunrise or sunset; or in any manner other than with shotgun, rifle, or bow and arrow, held in hand, but excluding the crossbow and bolt. Any cougar causing livestock losses should be reported to the Commission so that appropriate action may be taken. The Commission may authorize the taking of depredating cougars by any manner or means or at any time.


The mountain lion was classified as a predatory animal with no protection at all until classified as a game animal in 1965. Lion population levels were apparently very low until the 1930's, when domestic sheep kills increased with enough frequency to require a lion control program. The annual kill of lions by the Bureau of Sport Fisheries and Wildlife during the 33 year period, 1916-1949 ranged from 0-10. A full-time lion hunter was employed in 1949. In 1950, the kill increased to 54 and has ranged from 50-181 annually until 1969. Following classification as a game animal in 1965, a license was required for hunters and guides, and a permit was required to capture and hold a lion in captivity. In 1968, a tag was required in addition to the hunting license, with no limit placed on the number of tags an individual could purchase. In 1970, the hunting season was reduced and tags were limited to one per
license holder. All lions harvested had to be checked with Department Officers for tag validation and sealing of the hide. A tooth, a stomach sample, and the reproductive tract of the females were taken. For the five years prior to fiscal year 1965, an average of 93 lions were killed annually. During the five years since 1965, the average annual kill had been 55.


A total of 314 mountain lion hunting licenses, including 71 nonresident, were issued for the 1973-74 season and 72 lions were taken. Thirteen lions were also taken for other reasons. The license issue was 46% below, and the hunting harvest was 25% above, those of the previous year. A decreased hunting license issue resulted mostly from the change from a no-fee to a five dollar fee. Lions were taken from 26 hunting districts throughout the state. Males accounted for 71% of all 1973-74 mortalities. Age class groupings indicate 36% sub-adults (age class II or less) and 36% young adults (age classes III and IV). Successful hunters provide information about their lion on a special trophy application form soon after their hunt, and also at the end of the season on a special inquiry. Tissue samples from 63% of the lions were positive for Trichinella larvae. Various recommendations are presented.


During the 1974-1975 mountain lion season, 352 licensees including 93 nonresidents, trophied 91 lions from 31 hunting districts throughout the state. The license issue was 12% above and the hunting harvest was 26% above, those of the previous year. Female mortalities of 46% compares to 29% in 1973-74. Age class groupings indicate 41% subadults (age class II or less) and 38% young adults (age class III and IV). Information from licensees was also obtained from questionnaires.


During the 1975-76 mountain lion season, 406 licensees including 118 nonresidents, trophied 76 lions from 27 hunting districts throughout the State. The license issue was 15 percent above, and the hunting harvest 16 percent down, from the previous year. Female mortalities of 40 percent compares to 46 percent in 1974-75. Age class grouping indicates 42 percent subadult and 16 percent young adults. Several lion hunters also harvested bobcat and lynx. A program resulted in 20 marked mountain lions released in the population. Various recommendations are presented.


During the 1976-77 mountain lion season, 587 licensees (including 70 nonresidents) trophied 70 lions from 31 hunting districts throughout the State. A total of 14 lion mortalities also occurred by nonhunting causes. The license issue was 45 percent above, and the hunting harvest 8 percent down, from the previous year. The proportion of 48 percent females among known mortalities compares to 40 percent in 1975-76. Age class grouping indicates 43 percent sub-adults and 35 percent young adults and 22 percent adults. Several lion hunters also harvested bobcat and lynx. A
tagging program resulted in 11 marked lions released in various populations. Recommendations are presented.


During the 1977-78 mountain lion season, 676 licensees (including 102 nonresident) trophyed 88 lions from 36 hunting districts throughout the State. The license issue was 15 percent above, and the hunting harvest 26 percent above the previous year. The mortality of 40 percent females was down from 48 percent of the year before. Age designation of the lion harvest was 34 percent subadult, 41 percent young adult, and 25 percent adult. Several lion hunters also harvested bobcat and lynx. The tagging studies provided 13 marked lions in the western populations. Management considerations are presented.


During the 1978-79 mountain lion season, 765 license holders (including 123 nonresidents) trapped 75 lions from 39 hunting districts throughout the State. The license issue was 13 percent above, and the hunting harvest 15 percent below, the previous year. The mortality of 51 percent females was up from 40 percent of the year before. Age designation of the lion harvest was 36 percent subadult, 44 percent young adult, and 20 percent adult. Several lion hunters also harvested bobcat and lynx. The tagging studies resulted in 11 marked lions. Two wild known-age skulls were obtained from the tagging program. Management considerations are presented.


During the 1979-80 mountain lion season, 725 license holders (including 111 nonresidents) harvested 82 lions from 37 hunting districts throughout the State. The license issue was 5 percent below, and the hunting harvest 9 percent above, the previous year. The mortality of 41 percent females compares to 51 percent of the year before. Age designation of the lion harvest was 34 percent subadult, 47 percent young adult, and 19 percent adult. The tagging studies resulted in 9 marked lions. Two known-age skulls were obtained from the tagging program. Management considerations are presented.


During the 1½-month 1980-81 mountain lion harvest season, 848 license holders (including 61 nonresidents) harvested 64 lions from 37 hunting districts throughout the State. The license issue was 17 percent above, and the hunting harvest 22 percent
below, the previous year. A 45 percent decline in nonresident lion hunters was due to a three-fold fee increase. A decreased lion harvest is attributed to delayed and below average snow cover during the season. The mortality of 43 percent females compares to 41 and 51 percent for respective prior seasons. Age designation, by skull suture closure, in the lion harvest was 37 percent subadult, 31 percent young adult, and 32 percent adult. Three marked lions were harvested during 1980-81, with one having a probable known age of 4½ years. Management considerations are presented.


A total of 113 mountain lions were taken from 49 hunting districts during the 1981-82 season. The 963 licenses were a 14 percent increase over 1980-81. Harvest data indicate: 39 percent of females; age of both sexes were 40 percent subadult, 36 percent young adult, and 24 percent adult. Six marked lions were reported with only one being a probable known age of 6½ years. Management considerations are presented.


A total of 140 mountain lions were taken by hunters from 49 hunting districts during the 1983-84 season. The 1,153 licenses issued to 1,021 residents and 132 nonresidents were a small increase over the previous season. Harvest data are summarized since the first season in 1971-72. Management considerations are presented.


Sarcocysts of Sarcocystis sp. were found in the striated muscles from 11 of 14 wild Florida panthers (Felis concolor coryi) and four of four cougars (two wild F. concolor stanleyana and two captive F. concolor of undetermined subspecies). The common occurrence of sarcocysts in muscles of top carnivores such as panthers and cougars is unexplained. This stage of the life cycle is normally confined to the muscles of the prey species. Because large felids are rarely preyed upon, it is unlikely that a species of Sarcocystis has evolved using large cats as intermediate hosts. Therefore, the presence of these sarcocysts might be an indication of immune compromise in these felids, enabling the atypical development of the sarcocysts.


In 1993, Smallwood and Fitzhugh introduced a rigorous method to make individual animal identification by tracks more objective than previously possible. Working with nine mountain lions, they were able to correctly group 100% and 92% of the tracks from the left and right rear feet, respectively. While they worked with lions that were geographically separated, the identity of the mountain lions was unknown. In order to refine the "ground truth" the Smallwood-Fitzhugh method, 324 photographs of radio-collared mountain lion tracks were collected during the winter and spring of 1994 in Round Valley, Bishop, California. Tracks were photographed...
during different times of the day in different soil substrates, including snow. Linear, area, and angle measurements were taken directly from the photographs and subsequently analyzed statistically using Fisher's linear discriminant analysis for more than two groups. Track dimensions were measured both manually and by various computer programs, including ArcInfo geographical information systems. Preliminary results suggest that, based on the three types of measurements, approximately 80% of the track sets correspond with the appropriate radio-collared mountain lion.


No author had previously made any special effort to determine the systematic status of the mountain lions in California. A new race, Felis oregonensis californica May, revived name, is described. After study of 30 skulls, the authors found, as did Merriam (1901) that "the limits of variation for adults of each sex fall within surprisingly narrow bounds." Skull measurements of Felis oregonensis californica are provided.


A list of 148 reports of mountain lion observations from Marin County is presented. The reliability of the observations was unknown.


A section of the San Joaquin River drainage approximately ten miles long on the north side of the city of Fresno was checked for mountain lion sign. On September 24-26, 1985, dirt roads and other areas of trackable soil and dew covered golf course fairways were surveyed for tracks and other signs of mountain lions. The survey was conducted by an experienced tracker riding a motorcycle. No mountain lion sign was found, but local residents reported six sightings of mountain lions, four of them following the highway death of a mountain lion in the same vicinity.


Deer hunters which were night spotting the country for bucks that they intended on hunting the next day spotted a panther along a brushy fencerow in 1940 or 1941. They wrote in to dispute an article entitled "Panthers are Popular" which appeared in the January issue.


Fifteen subspecies of the cougar are differentiated. Vancouver Island appeared to be the center of abundance in the Pacific Northwest and the author felt it likely that, on an area basis, there were more cougars on Vancouver Island than anywhere else on the continent. Since 1916 (in the past 45 years) there have been eight incidents involving cougar attacks on man in British Columbia. Only one of these resulted in fatality, that of a child at Kyuquot on the west coast of Vancouver Island. Three other attacks were fairly serious but not fatal. The majority of these cougars were
young animals. Suggested possible reasons for cougars attacking man were that cougars may mistake man for deer, and that the cougar may have initially been after a pet dog when the boy or man became involved. No bounty is offered for cougar in British Columbia. Cougars too close to settlements or molesting stock are killed by government hunters. One government hunter disagrees with the generality that the cougar is largely nocturnal on Vancouver Island. He had often "read sign" that indicated the cat prowls by day.


Twenty-one mountain lions (*Puma concolor*) were captured on Big Bend Ranch State Park, 22 January 1993 through 28 March 1996, using leghold snares and trained hounds. Captured mountain lions were examined, aged, and a series of morphological measurements were recorded. Sixteen mountain lions were fitted with radio transmitters operating on specific frequencies. Radio-collared mountain lions were monitored from the ground and fixed-wing aircraft. A total of 711 locations was recorded for 10 male and 5 female mountain lions. Home ranges were delineated for 6 male and 5 female mountain lions. Average annual ranges (100% minimum convex polygon) for adult male mountain lions (348.6 square km) were larger ($P < 0.05$) than for adult female mountain lions (205.9 square km). Average percent overlap (100% minimum convex polygon) of annual female-female, male-male, and female-male mountain lion ranges were 26.1, 22.9, and 28.9, respectively. Annual shifts were apparent ($P < 0.05$) for female mountain lions and for the cumulative male mountain lion ranges. Mountain lion density (No./100 square km) ranged from 0.26-0.59. Mountain lion mortalities were attributed to predator control practices on private land ($n = 15$), hunting ($n = 1$), and other causes ($n = 3$) on the study area. The mountain lion population level on BBRSP was limited by high mortality rates of female and male mountain lions.


**SYNOPSIS**

Signs can be used for detecting the presence and interpreting the behavior of mountain lions. However, careful investigation by persons knowledgeable in tracking is needed to assure reliable results. Criteria for evaluation of tracks include general shape of prints (flat arc of toes with rounded, leading edge), no registration by claws, toes (number asymmetry, and size), interdigital pad (bi-lobing, front slope, posterior alignment), front versus hind foot differences, overstep, and tail drags. Criteria for evaluation of scat include large diameter, segments nearly as long as wide, and lack of pointed ends. Non-segmented scat results from moist protein diets. When made carefully, measurements of print and gait patterns provide useful information about sex, age, and individual identity. However, scientists should identify good measurements for each subspecies because of size differences. Additional clues for identifying the presence of mountain lions include scent marks, scat heaps, scratch trees, deer drags, feeding sites, buried carcasses, and feeding patterns on fresh kills. Fresh kills should be necropsied to determine spacing of canine teeth in bites and presence of damaged, blood engorged tissue indicative of wounds from predation on a living animal. Behavioral clues in trails include elusive behavior in available cover and movement by shortest path directly between tree
During the 1980's, reports of interactions between humans and mountain lions increased along the east slope of the Front Range, especially in Boulder County, Colorado. However, the lack of data made evaluating the frequency and effect of interactions difficult. To assess the potential of future problems, an intensive solicitation of reports was started with radio, television, and newspaper advertisements in 1985. Information was requested on observers, physical and temporal settings, and mountain lions and their behavior. We received 398 reports to date. Interactions between humans and mountain lions were short (1.7 min), at close distances (44.5 m), at low elevations (1,829 m), and in or near city limits. The number of reports was slightly higher during winter when deer populations peaked around Boulder. The nature of reports has changed. After 1988, interactions during daylight hours and closer to population centers increased, which suggested mountain lions are habituating. Increased interactions in summer are notable because cubs learn from their mothers that being around humans is all right. Market and unrestricted deer hunting reduced deer herds in Boulder County to zero in 1906. Since that time, populations of people, pets, deer, and mountain lions have grown to the highest levels ever and are continuing to increase, making interactions with mountain lions an increasing reality. Although risk of an attack to individuals is low (1 in 2,200,000 person-days in mountains), 2 attacks (1 fatal) and 38 recent interactions where mountain lions were dominant suggest that another attack will occur soon.


SYNOPSIS

While seeking to establish their own range, young mountain lions may encounter humans around urban settings. Mountain lions, killed during encounters with humans, were necropsied to identify age, sex, and reproductive status. Additional track data were used to construct an age and sex profile of mountain lions involved in encounters. Our small sample suggests neither age nor sex bias in encounters.


General description and measurements are provided. The fifteen recognized subspecies, type localities, and marginal records are detailed. A map delineates where the subspecies are found in the western hemisphere.


An authentic record of a mountain lion attacking, killing, and partially devouring a 14 year-old boy near Brewster, Okanogan County, Washington on December 17, 1924 is
The body was dragged a hundred feet or more to the base of a cliff where it was partially concealed beside a fallen tree. The lion had completely stripped the skin and flesh from the face and neck, no vestige of hair remaining, and had also eaten the hands and lower arms to the elbows and the flesh from the entire left leg from shoe top to hip joint. Upon finding the boy, identified as James Fehlhaber, his coat was placed over his face and help was sought back at the house. When they returned an hour later, the coat was missing. The coat was found the next morning in the lion's lair torn to shreds approximately 200 feet away, indicating that the lion had returned to its kill during their absence. About 5 weeks later, on January 20, 1925, a young lion was killed by a rancher in a coyote trap, about 4 miles from where the boy was attacked. Upon examination of the stomach, a considerable wad of human hair, bones, and other remains were found. The stomach of the lion and major portions of its contents were sent to the Smithsonian Institute for examination. A mass of hair, two small pieces of blue denim, and one piece of course white goods with seam which may have been a portion of a pocket were found. A discharged revolver cartridge was also found in the mass of hair. It was determined that the stomach contents contained remains of the Fehlhaber boy, and it is probably the first authentic record of a human being killed by a puma.


Stanley Young and Edward Goldman's book, The Puma, Mysterious American Cat, is quoted concerning records of the puma in Oklahoma during the past century. A lion track was discovered in 1953 by game department biologist George Merrifield and a plaster cast was made. A mountain lion skull found in a Cimarron County cave in 1938 was donated to Dr. Bryan Glass, A&M College mammalogist, and represents the only Oklahoma lion skull known to science.


The author describes the cougar research performed by Percy and Penny Dewar which was to determine the size and mobility of the cougar population in a 2,600 km² area of Vancouver Island. Enough sightings had been recorded to say that the cougar exists in all provinces except perhaps Prince Edward Island and Newfoundland/Labrador. There had been three deaths caused by cougars in British Columbia. About 20 other cases had been recorded since 1916 in which the cougar had caused actual bodily harm. The natural history and habits of the cougar in British Columbia are described.


A skeleton of a puma was discovered in Higginbothams Cave No. Four, 1.3 miles west of Frankford, Greenbriar County, West Virginia, in August 1959. The skeleton lay on a surface of a mudbank, 30 feet above a subterranean stream. The bones were sent to the National Museum and were considered to be the Recent Felis concolor couguar Kerr, and the bones and teeth matched closely those of a skeleton of F. c. couguar from Capon Springs, West Virginia (USNM 848).


The author joined Harley Shaw, research biologist with the Arizona Game and Fish
Department, for a week of tracking lions in the Huachuca Mountains of southern Arizona. General information on the cougar is provided from many other researchers. Recommendations are given for people who live in lion country and for those individuals that may encounter a lion in the wild.


The cougar was bountied in Oregon from 1912 to 1961, with 7,307 cougars bountied. During the final bounty year, 13 were bountied and all were taken in western Oregon. Until 1968, an open season with no limit was established. In 1968, the Oregon Legislature elevated the cougar to game animal status and for the first two years no cougar could be taken unless by a landowner protecting his livestock. The cougar became a trophy species in 1970 and 9 cougar were harvested during the first season. Most of the cougar population in Oregon was located in the southwestern and northeastern portions with Douglas fir-trailing blackberry habitat type predominating. It was the author's opinion that old-growth with low-density understory and good visibility played an important part in the food chain of the cougar and timber was more important than topographic cover. A total of 41 days of tracking found 15 cougar with an average of 2.7 days of searching per cougar track observed. A method for estimating numbers of pumas by means of summer track counts was provided.


Five men apparently spotted a mountain lion on July 23, 1975 along the Cataloochee River Valley in the North Carolina portion of the Great Smoky Mountains National Park. The eastern mountain lion had been considered extinct outside of Florida for nearly 100 years.


Five cougars (Felis concolor) were captured and an adrenal response test was administered by injecting synthetic adrenocorticotropic hormone and monitoring plasma cortisol levels at 15-min intervals for 120 min. Three were selected for treatment and chased 5 or 6 more times to simulate the stress they might experience during a pursuit-only season; the other two served as controls and were chased only once more, at recapture. The adrenal response test was administered again at recapture. The cougars in the treatment group had a lowered plasma cortisol profile after the simulated pursuit season, indicating an altered physiological response of the adrenals to the stress of repeated chases.


This plan will be utilized for assessing and managing the many and varied impacts of people on mountain lions and their habitats. The management effort is to ensure long-term annual returns from the mountain lion resource to the citizens and visitors of Idaho, maintain current mountain lion populations, and attempt to stabilize harvest and provide increased protection to the female segment of the population. Between 1915 and 1941, 251 mountain lions were killed in Idaho by hunters employed by the State, livestock associations, and the Federal Government. with the take by private
individuals unknown. An annual average of 80 lions were turned in for bounty during 1945-1958. Average annual sport harvest (unregulated) was estimated at 142 lions from 1959 through 1971. An estimated 300 lions were taken during the 1971-72 season. Due to declining numbers, the mountain lion was classified as a big game species on July 1, 1972, and the lion harvest was regulated for the first time. An average of 80 lions were taken annually from 1973-76; 131 from 1978-81; and 270 for 1986-89. Hound hunting accounted for an average of 72% of the lion harvest for the 1985-89 seasons. This plan places emphasis on reducing accelerated harvest rates, stabilizing harvest levels, and reducing female harvest. Data indicated that 756 hunters spent nearly $400,000 hunting lions in Idaho in 1983. Lion tag sales have almost doubled since 1983 and with associated cost increases, the 1988 lion season probably contributed approximately one million dollars to the Idaho economy. The goal was to maintain the age ratios of the harvest within 5% of 35% for the K-3 year age class, 44% for the 4-7 year age class, and 21% for the 8 year and older age class, but was not attained during the 1986-1990 planning period. The five year (1991-1995) goals, statewide management policies, management strategies, and top priority programs are outlined. Hunting opportunity, unit groupings, Big Game Management Units, and Mountain Lion Data Analysis Units are described.


Predation by cougars (Felis concolor) in the Junction Wildlife Management Area of central British Columbia was examined from December 1986 to July 1988. Radio collared cougars were monitored daily and predation rates were determined from kill site examination. Predation rates on bighorn sheep (Ovis canadensis californiana) and mule deer (Odocoileus hemionus hemionus) were determined for females with kittens and ranged from 0.7-2.1 ungulates/week. The rate of predation was dependent on a number of factors including the number and age of kittens, season, and extent of competition from scavengers. Coyote interactions with cougars at kill sites were found to be particularly important. In a 200 km$^2$ portion of the study area, 130 coyotes were removed over the 2 year period. The predation rate of a female (3 kittens) within the coyote removal area averaged 1.3 kill per week while that of a female (2-similarly aged kittens) in the non-removal area averaged 2.2 kill per week. Moreover, observations of cougars abandoning kills following harassment by coyotes, has led to an examination of the importance of scavengers, particularly coyotes, in regulating cougar predation rates.


Base-line ecological characteristics are needed to establish a state-wide management plan for mountain lions (Puma concolor) in Texas. I studied spatial patterns, habitat use, food habits, and demographic characteristics of a mountain lion population on privately owned lands in southern Texas. During a 3-year period (Mar 1994-Mar 1997), 19 mountain lions were captured and radiocollared. Average annual ranges (100% minimum convex polygon, square kilometers) for adult female mountain lions (131.76) were smaller ($P < 0.01$) than for adult males (503.48). Male-male and male-female mountain lion annual range overlap was extensive and annual shifts were apparent ($P < 0.05$). Adult (4 F, 5 M) mountain lions did not use ($P < 0.0001$) habitats in proportion to availability. In general, riparian habitats were preferred ($P < 0.1$) and chaparral habitats were avoided ($P < 0.1$) or used proportionately by female and male mountain lions. Subadult male ($n = 4$) and female ($n = 6$) mountain lions
dispersed at <13 months and dispersal distances (km) ranged from 11.0-95.6 and 6.3-23.1, respectively. Mountain lions consumed a variety of prey and preferred white-tailed deer (*Odocoileus virginianus*) (*P* < 0.1), avoided feral hog (*Sus scrofa*) (*P* < 0.1), and showed no selection for collared peccary (*Tayassu tajacu*) (*P* > 0.1).

Mountain lion litters (*n* = 13) were uniformly distributed by season (*P* > 0.05) and minimum litter size (mean plus or minus standard deviation) was 1.77 plus or minus 0.83. Mountain lion density ranged from 0.59-0.74 (No/100 square kilometers).

Mountain lions (radiocollared + nonradiocollared) died from hunting (*n* = 23), predator control practices (*n* = 3), and other causes (*n* = 3) on the study area. Annual survival for male and female mountain lions was 0.81 and 0.59, respectively. High mortality and low productivity of female mountain lions may limit population levels in southern Texas.


Although mountain lions (*Puma concolor*) have been reported in all 10 ecological regions of Texas, research has been limited to the Trans-Pecos Region of west Texas. The Trans-Pecos Region has produced >75% of the statewide mountain lion mortalities in the last 10 years. Researchers have focused on mountain lion food habits, spatial patterns, population dynamics, parasites, and behavior. Currently, there are two research projects in Texas regarding mountain lion ecology (one in the Trans-Pecos Region and the other in the Rio Grande Plains of south Texas). In this manuscript, we provide a review of mountain lion ecology in Texas, discuss ongoing research of mountain lions in south Texas, and identify research priorities for mountain lions in Texas.


Normal haematological values and fibrinogen levels were obtained from a number of healthy adult Felidae in the collection of the Zoological Society of London. The group comprised 29 pumas (*Felis concolor*), 32 lions (*Panthera leo*), 27 tigers (*P. tigris*), 19 leopards (*P. pardus*), 18 jaguars (*P. onca*) and 22 cheetahs (*Acinonyx jubatus*). The values provided a basis for identifying abnormalities in the blood of sick individuals of these species and for undertaking interspecies comparisons.


A historical summary and provincial-state comparison of the cougar bounty system and management status is presented. A bounty existed on the cougar from 1910-1957 and over 20,000 animals were harvested during that period. From 1930 to 1955, approximately 13,257 cougar (530/year) were harvested in British Columbia. On the average, 10% of the actual depredation involves cougar while 6% of the total number of complaints involves cougar. There were 15 verified cases of cougars attacking humans in British Columbia up to 1976. To date there had been an additional 2 deaths and 9 attacks on humans. The cougar achieved big game status in 1966. Thereafter, seasons became more restrictive, tags and compulsory inspection were introduced and females with kittens were protected. The average harvest declined
from 530/year to 190/year during the period of compulsory inspection (1976-1988). During this period, 56.3% of the total kill were males and 43.5% represented females. With a 6-10% harvest rate, the current proportion of females in the harvest was of some concern. It appeared that due to several mild winters in previous years and subsequent increase in prey population that the cougar population was stable or increasing and harvest based calculations indicate that there may be a minimum provincial population of 2,280-3,800 cougars.


Populations of some endangered species have become so small that they have lost genetic variation and appear to have become fixed for deleterious genetic variants. To avoid extinction from this genetic deterioration, individuals from related subspecies or populations may have to be introduced for genetic restoration i.e., elimination of deleterious variants and recovery to a normal level of genetic variation. I construct a general population genetics framework from which to evaluate the potential for genetic restoration, and I discuss its specific application to the Florida panther. The translocation of Texas cougars into the free-ranging Florida panther population has been recommended to genetically restore the Florida panther, a subspecies of Felis concolor that appears to have both a low level of genetic variation and low fitness. Specific recommendations recently given by a scientific panel are to introduce enough animals so that there is approximately 20% gene flow in the first generation of translocation and approximately 2-4% in the generations thereafter. I evaluated these recommendations in a theoretical population genetics framework and found that they should result in the removal of most detrimental genetic variation and an increase in the standing genetic variation without a high probability of loss of any adaptive Florida panther alleles. Unless the population of the free-ranging Florida panthers is very small, the planned translocation should result in genetic restoration of the Florida panther.


Movements of 22 cougars (Felis concolor) were monitored by radio-telemetry between January 1979 and July 1981 in southern Utah. The population, composed of resident, transient, and juvenile cougars, remained relatively constant in size for 3 years. Densities (0.4-0.5 cougars/100 km²) were considerably lower than has been reported elsewhere. Average annual home area size of resident females (685 km²) and a single resident male (826 km²) were substantially larger than other home area sizes reported. Home areas of resident females overlapped and resident male home areas may have overlapped as well. Despite the degree of overlap observed, with the exception of family groups, close spatial associations were rare. Dispersal of cubs appeared to be independent of adult resident density. Density of resident cougars appears to be regulated by a social pattern based on land tenure but limited by abundance of mule deer, their principal prey on this study area. The relative vulnerability to hunting of different cougar cohorts is discussed.


Twenty-two cougars (Felis concolor) were monitored by radiotelemetry between January 1979 and July 1981 in southern Utah. The population comprised of resident.
Transient, and juvenile cougars, remained relatively constant during the study. Densities (0.3-0.5 cougars/100 km$^2$) were considerably lower and home-area size of four resident females (685 km$^2$, SE=257, range= 396-1454) and a single resident male (826 km$^2$) were larger than reported for other areas. Home areas of resident females overlapped, but with the exception of family groups, close spatial associations were rare. Dispersal of male cubs appeared independent of resident adult density. Density of resident cougars was apparently regulated by a social pattern based on land tenure, but limited by the abundance of mule deer (Odocoileus hemionus), their principal prey.


Ten family groups of cougars (Felis concolor) were monitored by tracking and radio-telemetry between January 1979 and July 1982 in southern Utah. The study area was closed to cougar hunting after April 1979. Density of cougars in the area was low (0.5 cougars per 100 km$^2$). Litters ranged from 1-4 cubs, and averaged 2.4 at 3 months of age. Survival of cubs observed between 3 and 10 months of age (N=10) was 72% and from 10 months of age to dispersal at 16-19 months was 92% (N=13). Survival of cubs (N=18) to dispersal in 8 family groups monitored was 67%. Identified causes of death included accidents, poaching, and possible cannibalism. Two of 3 cubs orphaned at 6 months died before the normal age of dispersal. Analysis of movement patterns of family groups suggested that mortality of cubs would be even higher in hunted populations, particularly when hunting seasons coincide with birth peaks.


Pumas were widely distributed in the Pleistocene of both North and South America. It is suggested that this species is derived autochthonously in North America from some earlier cats assigned to the genus Pseudailurus.


Background information concerning the Endangered Species Act of 1973 and the Fish and Wildlife Service's responsibilities under the Act is discussed. The recovery plan and team concept, the responsibilities of recovery teams and guidelines for preparation of recovery plans are explained in detail. The relationship of this concept to the Florida panther (Felis concolor coryi) and the status of recovery efforts for this species are presented.


The type locality classification system of the puma is examined.

Liver and kidney vitamin A reserves of forty-one Felidae in a zoological garden have been recorded. It is suggested that when a meat diet is fed, with the calcium/phosphorus ratio corrected to 1:1, 200 i.u. of Vitamin A per kg provides for adequate liver storage. Liver vitamin A reserves were low in enteric disease. Storage of large quantities of vitamin A in the kidneys is not characteristic of all Felidae and only in the jungle cat and caracal lynx were appreciable quantities of fat being excreted, save in the tiger. The urine of two puma was tested and found to be negative for Vitamin A. A table is provided which lists the cause of death, liver and kidney weights and i.u. of vitamin A, ratio of body weight to liver weight, and fat found in proximal convoluted tubules for 41 specimens of Felidae, including 5 pumas.


During one year's time, from October, 1934, and extending into September, 1935, an investigator was placed in the field to make a special study of the mountain lion in New Mexico and Arizona. It is stated that a mountain lion will, on certain very rare occasions, attack human beings, usually under stress of acute starvation or extreme old age. Indeed, in practically all cases of persons being killed by bears or lions of any kind, they were very seldom consumed. In fact, the author was unable to find a single case of attacks on humans in which the flesh was actually eaten. Lion country is usually characterized as rocky, with the steepest and most rugged of ravines and canyons. A lion seldom goes through a country; he will go around it by way of the ledges and rock rims. Very bushy, steep hillsides, with rock cliffs above and below, form the ideal country. They do not seem to favor very high country and are seldom found in high timberline or tundra country, but seem to prefer the lower ridges and slopes where the cover is thicker and the game more plentiful. Generally a lion is unwary about a trap, but will seldom come to a scent bait. The lion does most of his prowling at night and appears to be diurnal only during stormy weather or out of necessity. A deep dusk rather than total darkness suited them best. The cougar can and does swim rivers, but it is doubtful that he does so from any desire to sport in the water. The lion scrape or scratch is one of the most striking features of lion hunting in all its phases. It is made by the male lion for the most part and usually indicates the track of a male lion. Its absence on a track correspondingly indicates a female. This scraping habit of the lion produces a small mound of pine needles and rubble several inches in height, seldom higher. The dirt and needles are scraped up from one side with the paws to form the pile on which the urine is deposited. The act is in every sense a scent station which is put along the rims and ridges of his runs. The scrapes are usually in selected places under overhanging bushes or trees. The purpose of the scratch is probably a sex challenge, very similar to that of the dog. This is illustrated by the fact that a male lion, when actually courting a female, will scrape very frequently. From the tracks it is certain that a lion does not miss any opportunity to smell old scrapes, whether they are his own or those of a strange lion. Close observation of tracks makes it fairly certain that the male cougar scrapes with his hind feet. The lion seldom, if ever, buries his dung; although the dung is frequently found on top of these scrapes. About one scrape in five is topped with dung. There is some evidence that lions are monogamous. The evidence seems conclusive that the same lions often mate together year after year and return to the same hunting grounds. The female, when in heat, starts to hunt a male and circles the country by means of the rims and ridges, leaving her scent of a female in heat, perhaps on the very scrapes of the male. A wandering male, upon scenting the female scent signs, starts to trail her up and court her. If there are two males on the
scene, there will likely be a fight. On completion of the mating action which may last all day, the couple go quietly about their prowling and hunting. The male and female remain together for perhaps two months, certainly not longer, and then separate again for a year or more. It is most likely that a female has a litter about every year and a half, as the dates of birth are so irregular. Thus, every third year she might give birth to kittens in the spring. It is evident that there are no set times for mating or birth, although the greatest number of records favor the spring. A female lion was killed on April 16 and was carrying 4 embryos some two months along. The young number 2-4, rarely 5, with 3 given as the average and sex ratios about evenly divided. They have a full set of teeth in about a month and are weaned in the wild at around two to three months of age. The female makes a kill in the neighborhood and then goes back and leads the kittens to the kill where they stay until it is consumed. In all but two of the fifty-odd kills examined during this survey, there were tooth-marks on the back and neck of the kill, which would have caused death. The neck of the victim is often fractured upon striking the ground. The attack is always from the top or from the side and not from beneath. The lion springs high and catches wherever he can with the vertebrae as his goal. The hind legs, with their ripping claws, undoubtedly play a large part. After the kill is made, the lion usually drags the carcass to a new spot downhill, as much as two or three hundred yards. The first meal is usually made from the belly, and the skin seems to be relished as one of the best parts. Usually the carcass is covered with leaves, sticks, and pine needles which may be scraped up over it. Deer kills may be buried, eaten upon, and reburied as many as 10 times. Such burying is the sure and only proof of a lion kill. This survey found 84% of the kills were bucks. All dung specimens examined contained hair. Large fragments of bone, hooves, quills, feet, and claws, as well as grasses were not uncommonly found. Mule deer comprised 54% of the stomach and dung specimens examined. Whitetail deer comprised 28%; porcupine comprised 5.8%; cottontail comprised close to 4%; jackrabbit comprised 2%; domestic cow comprised 2%; unidentified or of little significance comprised 4.7%. Neither horse nor any type of bird or feathers were found.


A study of the mountain lion was initiated and had been three years in progress. The examination of 3000 scats indicated the following prey items by percentages: Rocky Mountain mule deer, 54%; white-tailed deer, 28%; porcupine, 5.8%; cotton-tail rabbit, 4%; black-tailed jack-rabbit, 2%; domestic cattle, .5%. The remaining 5.7% varied and included badger, striped skunk, gray fox, coyote, beaver, and prairie dogs. In addition, minor percentages of grasses (various species) and seeds (opuntia and juniper) were found. It was of interest to note the entire absence of any feather or bird kill of any kind. Every collecting station was in a sector heavily ranged by cattle, horses, sheep, and goats and the opportunity was not lacking for an equal number of kills from the domestic categories. Most sources state that a lion kills a deer a week, but from the records of the daily wanderings of over 200 lions, this was judged to be too high and a deer a month would come closer to the mark.


Mathematical models similar to a model developed by Kenneth R. Dixon and George W. Cornwell are created and applied to studies involving one-predator-one-prey systems. The theoretical origins of these models are first presented as developed by
K.E.F. Watt. An analysis of the prey equation in the model is made by John Durgala to adapt it to represent the white-tailed deer of the Central Adirondacks. Using Dixon and Cornwell’s model as a basis, David Smith has developed a similar model to reflect the mule deer-puma interactions in the Idaho Primitive Area as observed by Maurice Hornocker et al. Then, he has adapted this model to predict white-tailed deer-puma interactions in a Central Adirondacks setting with the addition of the prey terms developed by Durgala. Finally, after an extensive analysis of wolf characteristics, Carl Springer has used a wolf-moose model originally proposed by Dixon and Cornwell and adapted it to a Central Adirondacks setting with the aid of some of the values determined by Durgala. Appropriate recommendations and conclusions are made concerning the use of these models.


The mycoplasmas isolated from captive wild felines showed a strong relationship to but were not identical with Mycoplasma felis. Exceptions were M. arginini and strain PU, isolated from pumas, which were distinct.


The author tells of a major automobile manufacturer which called one of its models the Cougar. Television commercials were broadcast all over with the voice of the announcer saying “There's a cougar bounty this spring... Get your cougar bounty now...”. The first Jesuit priests on the continent were offered one bull per cougar skin. Over the years, federal bounties were supplemented by local awards ranging from 50 to 500 dollars, but more commonly 15 to 25 dollars. Jimmy Owen, a passionate cougar killer, was reported to have killed 600 on the Kaibab plateau. In 50 years, California paid about a quarter of a million dollars for more than 10,000 cougar scalps. The first specimens to be seen by Europeans were probably the "leones" on the coast of Honduras and Nicaragua which were pointed out to and recorded by Christopher Columbus. At least two victims of cougar attacks were known to have died shortly afterwards from rabies.


This is a summary of Florida panther (Felis concolor coryi) research and management activities since 1976. Although some results are very preliminary, it appears that a viable but isolated population of panthers exists from Lake Okeechobee south in the Big Cypress/Everglades physiographic region. Some scattered documentation of animals exists outside this area but the significance of these animals is unclear. The threats that face the population include shrinking habitat, reduced prey base, disease and parasites, and possible reduced genetic diversity. Efforts are underway to subvert what appears to be a long term extinction process by identifying and mitigating threats wherever possible and by reintroducing panthers into formerly occupied range.

The response of mule deer numbers to predator control on Black Gap Wildlife Management Area (BGWMA) was examined for 1982-1989. Twenty-five mountain lions and 62 coyotes were taken from BGWMA during the study period with most of the lions removed during the first 2 years. Coyotes were removed at a nearly uniform yearly rate over the study period. The trends of predator populations could not be determined with confidence, however, comparisons to rabbit trends implied that coyote numbers were substantially reduced on BGWMA while predators appeared to cycle with rabbits in Big Bend National Park (BIBE). Javelina numbers on BGWMA could not be estimated, but the distributions of indexed density did not show any trend during the study. Estimating mule deer numbers proved complex for the study period and a new perspective on interpretation of transect surveys is proposed which accounts for inconsistent animal density over the area, inconsistent group size, the lack of independence in animal behavior, and the critical density created by the transect design itself. Mule deer on BGWMA are thought to have increased from 1982 until 1986-87 and then declined through 1989. The causes of this change could have been some combination of predator control, vegetative change, and factors from outside of the study area, but the contribution from these potential influences could not be distinguished. Predator control on BGWMA proved expensive during the study period and, though an impact on the mule deer population was expected, the direct effect could not be measured definitively. Recommendations which include the ecological implications of the study are provided.


Three specimens of puma, two skulls from Mer Rouge, Moorehouse Parish and a skin and skull from Vidalia, Concordia Parish, identified the Louisiana puma as different from any that had yet been described. The Louisiana puma is much more closely related to the puma of Florida than to the northern form or to F. oregonensis azteca. It seemed certain that the distribution between Florida and Louisiana was at one time continuous. However, because they varied so much in color, it seemed best to regard it as a separate subspecies. The type species of Felis arundivaga sp. nov. is described including color, skull and teeth, and measurements. The rich rusty red back of the Florida puma and the pale, uniformly colored back and tail of the Texas puma readily distinguishes them apart from the Louisiana puma.


A mountain sheep (Ovis canadensis), and two mule deer (Odocoileus hemionus) were killed, and hoarded by a cougar (Felis concolor). The prey were hoarded within 19 m of a game trail, and 22 m of an open hillside. The carcasses lay within 5 m of each other, and were all less than one month old. The sheep was 9.5 years old, and the deer were 2.5 and 3.5 years old.


The author had searched the literature with little success for instances of voluntary swimming by the larger cats. He provides two records of voluntary swimming; one of the jaguar and one for the puma. The puma was encountered in mid-stream on the Alto Orinoco in the neighborhood of Parguaza Hills. The river was at least one mile wide at this point and the puma became confused and tried to board the launch when intercepted. It seemed unlikely that the puma could have been cornered and driven into the river.

A black panther scare is over in Lawrence County, Pennsylvania. After several reports and media coverage, it was discovered to be a large house cat.


Only six studies had been conducted on the puma in California. These studies focused equal attention to radio-telemetry and track transecting. This study radio-collared and monitored the movements of six resident pumas (4 males, 2 females) between 1978 and 1981. The density of adult pumas was estimated to be 1.9 to 2.3 per 100 km$^2$. The home ranges of female and male pumas was estimated to average 67 and 157 km$^2$, respectively, and female home ranges did not overlap while some male home ranges overlapped extensively. A stable and abundant year-round prey base contributed to the relatively high density and small home range data. The smaller home range of the female was used more intensively than the male, presumably due to reduced hunting radius of a female with cubs.


**SUMMARY**

The collection and analysis of ecological data for pumas is still in its infancy. Development of reliable aging techniques and measures of recruitment are essential for the building of realistic stock recruitment models. Standardization of sampling schemes for radio-collared pumas and the analysis of these data are imperative for the comparison of behavior between studies. It is particularly important to increase the number of pumas radio-tagged and the number of relocations per individual per study. We must not overlook the value of models nor misuse them. They can be a valuable tool if we recognize and understand their limitations. Stock recruitment models and predator-prey models should receive priority attention.


The population densities and sex-specific home ranges of mountain lions, *Felis (Puma) concolor*, were studied in the Mount Hamilton area of the Diablo Range in California. Six adult resident lions were captured, radio-collared, and located 543 times between November 1978 and June 1982. Population estimates for the core study area varied from 1.2-1.5 adults to 1.9-2.3 adult lions per 100 km$^2$. The mean home range size was 157.5 km$^2$ for males and 66.5 km$^2$ for females. Females had smaller home ranges than males but utilized them more intensively. The home ranges of females overlapped extensively with those of males. Male home ranges varied from having no overlap to extensive overlap with adjacent males. Territoriality in
mountain lions may be facultative depending on the environmental regime.


A study of the ecology of an unexploited population of puma (*Puma concolor*) was conducted in the Mt. Hamilton area of the Diablo Range, California from March 1984 through June 1989. The study area comprised 550 km$^2$ of public and private lands about 20 km east of San Jose, California. Elevations vary from 300-1100 m with the majority of the land mass above 600 m. The study area is a mosaic of chaparral, oak woodland, north slope woodland, oak-bigberry manzanita woodland, annual grassland, and oak savanna communities. Twenty-four pumas (9 males, 15 females) were radio-tagged with a capture effort of 173 days for a success rate of 13.9% or 1 puma for every 7.2 days of hunting. One 3-5-year-old male died during the capture process for a capture mortality of 3.7%. Two methods were used to estimate population density: proportional and aerial. The proportional method sums the proportion of the home ranges of resident pumas that were in the core of the study area (335 km$^2$). The size of the core area will greatly affect the density estimate and hence this method had a large subjective component. Aerial flights provided an instantaneous picture of the spatial relationship for all radio-tagged pumas. Hence, the aerial method used a minimum convex polygon to enclose the locations of resident pumas from each flight. These weekly density estimates were then averaged for each year between 1985-89. The aerial method provided a more reliable estimate that was more than twice as large (3-5 adult pumas/100 km$^2$ vs. 0.9-2.0 pumas/100 km$^2$) as the more traditional, proportional method. The more objective aerial method is recommended for cases in which the number of resident pumas exceeds 5 and the capture effort has been concentrated in 1 area. The mean age at time of capture for pumas >24-months of age was 69 months for males (n=4) and 67 months for females (n=11). Three males and 7 females survived to greater than or equal to 7-years of age during the study. One female was a minimum of 13 years old. The sex ratio for all adult cats (n=17, 6 males:11 females) sexed during the study did not differ from parity. This small sample is nearly 2:1, but it may not be representative of the population. Eleven radio-tagged and 2 untagged (5 males: 8 females) pumas died of natural causes between March 1987 and April 1989. The mean age at death for these pumas was 79 and 60 months for males and females, respectively. The mean age at death, excluding pumas <24-months of age, was 79 and 90 months for males and females, respectively. The average age of this unexploited population was much higher than reported for pumas in moderately to heavily hunted areas. Thirty pumas less than or equal to 18-months of age in 19 separate litters indicated a mean litter size of 1.6 cubs/litter. This was a conservative estimate since in many cases siblings may have gone undetected. The maximum litter size was 3, but no cubs under 3 months of age were observed. Only 1 litter out of 7 was known to have >1 cub survive to the yearling class. The mean litter size for this study was lower than reported for harvested populations. Pumas (n=14) in this area were aseasonal breeders with small peaks in late winter and early fall. Birth intervals for 2 adult females varied between 20-24 and 30-34 months. Subadult males were about 21-months of age at dispersal and moved 29-58 km from their natal range. The unexploited population of pumas in the Diablo Range consists of a relatively stable population of old individuals with a low turnover of residents. The relatively low productivity, low juvenile survival and older dispersers is typical of an unharvested population. Six methods were used to examine the pumas' home range: 1) minimum convex polygon (MCP); 2) bootstrapping of the MCP (BMCP); 3) modified minimum area polygon (MMAP); 4) harmonic mean (HM); 5) fast fourier transform (FFT); and 6) 95% bivariate normal ellipse (BVN). The average size of the annual home range varied from 61 km$^2$ (MMAP) to 117 km$^2$ (BVN), and 135 km$^2$
(MMAP) to 285 km² (BVN) for adult females and males, respectively. The MMAP and 95% FFT produced the lowest, and the BVN consistently produced the highest home range estimates. All of these methods but the BVN appeared to have some utility for examining the home ranges of large carnivores. The MCP, BMCP, and the MMAP were robust to deviation from the assumption of independence of locations. However, only the BMCP adjusted estimates for sample size. The HM and the FFT allowed for an assessment of the internal anatomy of the home range. The 50% FFT was relatively stable and may be a useful home range index for comparisons among puma studies. There were no seasonal shifts in home range use and pumas exhibited only small differences in their annual home ranges. Female home ranges had a weaker harmonic mean center than males indicating that they used their smaller home ranges more intensively. There was no home range overlap between adjacent males with concurrent locations. The home ranges of 4 females varied from 13-95% exclusive. However, the 2 females with the greatest amount of overlap shared <10% of their core area (50% HM). The diel activity pattern of pumas was monitored for 1,345.4 hours (males = 265.9 hrs, females = 1,078.5 hrs) using a strip chart recorder that measured variations in the radio signal. Pumas exhibited weak activity peaks at 0500-1000 hours and 1600-2100 hours with no difference between males and females ($X^2 = 35.6, P = 0.046$). This pattern was similar to that of a black-tailed deer (Odocoileus hemionus columbianus) in the area. Forty-five kills and 131 scats were collected 1983-89. Eighty-one scats were analyzed by a previous researcher (1983-85) and 50 scats were analyzed for this study (1986-89). Deer made up 82% (37 deer: 13 bucks, 17 does, 7 fawns) of the kills and 74% of the scats. Wild pig (Sus scrofa) were found in only 5% of the 1983-85 scat sample but occurred in 20% of the 1986-89 sample. Pigs, however, were up only 2% of the kill record. There was a higher frequency of pigs in the scats during the wet season (38%) than in the dry season (11%). A linear preference index indicated pumas preferred bucks and avoided does. The high incidence of pigs in the scats was consistent with the results of an earlier study (1978-80). Pig populations were known to fluctuate in the area and it is possible that the density of pigs influenced their use by pumas. Livestock was found in <7% of scats in all 3 studies (1978-80, 1983-85, 1986-89), and only 20 depredation incidences were reported 1971-89. A deer:puma ratio of 210-350:1 was calculated for this area. This relatively high ratio and the preference of pumas for a more reproductively expendable segment of the deer population (i.e. bucks) suggests that pumas did not exhibit a strong limiting force on the deer herd in the Diablo Range during the study.


SYNOPSIS

A study of the ecology of an unexploited population of mountain lions (Felis concolor) was conducted in the Mt. Hamilton area of the Diablo Range, California, from March 1984 through June 1989. The study area comprised 550 km² of public and private lands about 20 km east of San Jose, a major metropolitan area in the state. Elevations varied from 300 m to 1,100 m and most of the land mass was above 600 m. The study area was a mosaic of chaparral, oak woodland, north slope woodland, oak-bigberry manzanita woodland, annual grassland, and oak savanna communities. Twenty-four mountain lions (9 males, 15 females) were radio-marked with a capture effort of 173 days for a success rate of 13.9% or 1 mountain lion for every 7.2 days of hunting. One 3-5 year old male died during the capture process for a capture mortality of 4.2%. Two methods were used to estimate population density. The proportional method was used to sum the proportion of home ranges of resident
mountain lions in the core of the study area (335 km$^2$). The size of the core area greatly affected the density estimate and, hence, this method had a large subjective component. Aerial flights provided an instantaneous picture of the spatial relation of all radio-marked mountain lions. Hence, the aerial method used a minimum convex polygon to enclose the locations of resident mountain lions from each flight. Weekly density estimates were averaged for each year between 1985 and 1989. The aerial method provided a more reliable estimate that was over twice as large (3-5 adult mountain lions/100 km$^2$ vs. 0.9-2.0 mountain lions/100 km$^2$) as the more traditional, proportional method. The more objective aerial method is recommended when the number of resident mountain lions exceeds five and the capture effort is concentrated in one area. The mean age at time of capture for > 24 months old mountain lions was 69 months for males (n=4) and 67 months for females (n=11). Three males and 7 females survived to greater or equal to 7 years of age during the study. One female was at least 13 years old. The sex ratio of all adult cats (n=17; 6 males:11 females) examined during the study did not differ from parity. The sex ratio was nearly 2:1 in this small sample but may not be representative of the population. Eleven radio-marked and 2 untagged (5 males:8 females) mountain lions died of natural causes between March 1987 and April 1989. The mean age at death for these individuals was 79 months for males and 60 months for females. The mean age at death, excluding mountain lions <24 months old, was 79 months for males and 90 months for females. The average age of this unexploited population was much higher than that of mountain lions in moderately to heavily hunted areas. Thirty greater than or equal to 18-month-old mountain lions in 19 separate litters rendered a mean litter size of 1.6 cubs/litter. This was a conservative estimate because in many cases siblings may have gone undetected. The maximum litter size was 3, but no cubs less than 3 months old were observed. Only one of seven litters was known to have more than one cub survive to the yearling class. The mean litter size was lower in this study than in harvested populations. Mountain lions (n=14) in this area were aseasonal breeders with small peaks in late winter and early fall. Birth intervals for 2 adult females varied between 20-24 and 30-34 months. Subadult males were about 21 months old at dispersal and moved 29-58 km from their natal range. The unexploited population of mountain lions in the Diablo Range consisted of a stable population of old individuals with a low turnover of residents. The low productivity, low juvenile survival, and older dispersers is typical of an unharvested population. The Mt. Hamilton Range supports 75-150 adult mountain lions. Currently the Diablo Range from southern Mt. Hamilton is undeveloped. However, subdivisions in Santa Clara County are beginning to push into the foothills of this range. State and county parks comprise 10% of the Mt. Hamilton area. These public lands are fragmented and too small to support a viable mountain lion population by themselves. Therefore, large contiguous parcels of private and public lands must be maintained with land uses compatible with conserving deer and mountain lion habitat. Cattle ranching should be encouraged to continue in the area because of the low level of livestock losses. The continued existence of mountain lions in the Diablo Range and in the state hinges on maintenance of large areas (1,250-16,700 km$^2$) of wildland interconnected by suitable dispersal corridors.


The tracks of two Florida panthers and panther scat were the only clues that were turned up during more than a month of searching the most likely panther areas of southern and central Florida. A seven member "panther recovery team" was appointed in 1976 by the federal government to improve the chances of survival of the Florida panther. Team estimates of panther numbers range from 10 or 15 to 100 or 200. Florida began paying bounties on the panther in 1832 and unrestricted hunting was allowed until 1950 and limited hunting until 1958. There is a possibility
that captive breeding and release may be an integral part of the recovery effort, with
the Everglades National Park receiving high priority for transplanted cats. Differing
opinions of the team members are presented.

Hornocker, M.G., J.J. Craighead, and F.W. Pfeiffer. 1965. Immobilizing Pumas with
Succinycholine Chloride and Pentobarbital Sodium. J. Wildl. Manage. 29:880-883.

Succinycholine chloride was administered intramuscularly to 13 mountain lions
captured with the use of dogs in western Montana. The average for 19 different
dosages was 1 mg/17.4 pounds body weight. The average dosage for 12 adult lions in
the wild (including 4 juveniles and 3 dosages for 2 lions brought in from the field and
held in captivity) was 1 mg/13.1 pounds body weight. Two lions anesthetized with
pentobarbital sodium, after initial immobilization with succinycholine chloride,
received an average dosage of 10.9 mg/pound body weight. Succinycholine chloride
is highly effective for immobilizing lions but should not be administered to treed
animals that may be subjected to injurious or fatal falls.

Hornocker, M.G. 1967. An Analysis of Mountain Lion Predation Upon Mule Deer

This study was designed (1) to investigate the dynamics of a mountain lion
population, and (2) to assess the impact of a population of lions on populations of
big-game animals. The research was carried on in the Idaho Primitive area;
tensive work was limited to the winter and early spring seasons. Lion population
numbers were stable during the three-year study period, and available evidence
indicates the present population level existed for some time prior to the start of the
study. Intraspecific relationships, manifested through territoriality, acted to limit lion
numbers and maintain population stability. Dispersal and mortality, particularly of
young individuals, appeared to be important limiting mechanisms. The population
was centered around a nucleus of mature individuals well-established on territories,
but segments of the population were dynamic, exhibiting an inflow and outflow of
individuals from season to season. These transients were composed predominantly of
young animals. Strife appeared to be kept to a minimum by a "mutual avoidance"
behavioral mechanism. Specific hunting territories were shared but appeared never to
be used by more than one lion or family of lions at a time. Individuals, regardless of
sex, appeared to respect the of another in a specific area. The "mutual avoidance"
hypothesis is advanced as an important factor in the maintenance of lion populations.
This mechanism provides for the distribution of lions in both space and time without
costly fighting. It also appears to insure greater success in securing large prey
animals. Population size of prey species--mule deer, elk, and bighorn sheep-- was
established by making ground and aerial counts each year. Bighorn sheep numbers
remained constant during the three-year period, but populations of deer and elk, the
principal prey species, increased. The range was considered overstocked by deer and
elk. Forty-four elk and 39 deer were recorded as definitely killed by lions during the
three-year period. Only two kills of bighorn sheep were found: lion predation on this
species appeared insignificant. Seventy-five percent of the elk killed by lions were
1½ years old or less and 9½ years or older; 57 percent of the deer kills were in these
age classes. More "young" than "old" animals were killed. Lions were non-selective
in their killing, except for "negative selectivity" in the case of a mature bull elk.
Factors acting separately or collectively to increase prey vulnerability included prey
density, behavior, age, health, inter- and perhaps intraspecific strife, and the lion's
predatory characteristics. It was concluded that elk and deer populations were
limited by the winter food supply and that predation by lions was inconsequential in
determining ultimate numbers of elk and deer. Lion predation, however, is a
powerful force active to damen and protract severe prey oscillations and to
distribute ungulates on restricted, critical range. From the theoretical standpoint, it also appears to be a strong evolutionary force, acting to remove less fit individuals from the population. The effects and influence of such predation are considered of great significance in the maintenance of ecologic stability in wilderness environments.


This paper covers the first 4 years of a continuing study and reports on the preliminary findings concerning territoriality and its function in a mountain lion population in the Idaho Primitive Area in central Idaho. Forty-three different lions were captured and marked during four winter and early spring seasons. Thirty-one individuals were recaptured 89 times, making a total of 132 captures during the study. Nine resident adults, captured a total of 59 times, provided the bulk of data on home range and territoriality. Minimum size of the male's winter home range was constant from year to year, but it varied for females, depending upon their reproductive status. The smallest winter home range for a female during a single season was approximately 5 square miles and the largest was approximately 20 square miles. Males utilized larger areas and resident males occupied distinct winter territories without overlap while resident females shared some common areas. Male territories overlapped those of females. Lions exhibited a high degree of tolerant but unsocial behavior. No evidence of territorial defense was noted. Transient lions of both sexes moved freely through occupied territories. A mutual avoidance behavioral mechanism acted to distribute lions in both time and space. Visual and olfactory marks serve to facilitate avoidance between lions.


The author and Wilbur Wiles had spent the previous five years in the Idaho Primitive Area tranquilizing, examining, weighing, marking, and releasing 46 different mountain lions, many again and again, to learn about their lives, movements, and habits. This article details the findings of this ongoing study.


Authentic records of mountain lions exist from 47 of the 48 contiguous states and the District of Columbia. The author had for the previous six years studied cougars in an area encompassing 200 square miles in the Big Creek drainage basin at the center of the 1-1/4 million acre Idaho Primitive Area in central Idaho. Most of the research was conducted during the winter and spring, from November to May, when deep snows drive game animals as well as cougars to the lower elevations along major stream courses. Over the six year period, 51 different lions were captured, marked and released. Forty-four of them were released in the Big Creek study area. In all, 173 captures were made, the same animals captured several times during the course of the study. The lion population was stable, with 10 or less adults as full-time winter residents of the study area. These resident lions had firmly established territories. Females shared some areas, but males maintained rigid territories. Females had a minimum home range of 5 to 25 square miles and males 15 to 30 square miles. Strong territoriality was the primary factor which regulated mountain lion numbers. Mutual avoidance seemed to have evolved as a non-damaging means of spacing solitary lions. Although not common, cannibalism was documented and was considered a "internal" population control mechanism which operated when other
checks were not effective. During the six-year period, five females produced 10 litters for a total of 25 kittens. Examination of 198 lion feces showed that deer and elk comprised 70% of the cougars winter diet. Of the elk killed, 75% were young (1.5 years or less) or old (8.5-9.5 years or more); 62% of the deer were young or very old. More adult males and fawns and calves were killed in proportion to their numbers in the total population. Availability of winter food, not mountain lion predation, was the key factor limiting elk and deer populations. Factors other than food supply controlled lion numbers. Territoriality limited the size of the lion population within the study area. Lions do lower the rate of increase of their prey before disease or starvation can take their toll. Lions also distribute prey species on restricted range which reduces overuse of the vegetation.


The mountain lion population was stable during the five years that it was studied. Intraspecific relationships, manifested through territoriality, acted to limit numbers of lions and maintain population stability. Dispersal and mortality of young individuals appeared to be important limiting mechanisms. The population was centered around a nucleus of mature individuals well established on territories. Young transient lions entered and left the study area without apparent conflict. Numbers of bighorn sheep remained constant but populations of deer and elk, the principle prey species, increased and the range was considered overpopulated and over-browsed. Fifty-three elk and 46 deer were killed by lions during the four-year period, and only 2 bighorn sheep kills were found. Seventy-five percent of the elk killed by lions were less than 1.5 years old or more than 9.5 years old. Sixty-two percent of the deer killed were in those age classes. More "young" than "old" animals were killed. Fifty percent of all the elk and deer killed were considered in poor condition. Lions appear to select young elk, select against mature bulls, and killed mule deer indiscriminately. Elk and deer populations were limited by the winter food supply, and predation by lions was inconsequential in determining ultimate numbers of elk and deer.


The objectives of this investigation were: 1) to instrument selected lions with radio transmitters within an established population to assess daily, weekly, and seasonal movements on both summer and winter ranges; 2) to collect information on territoriality in an attempt to gain further insight into specific mountain lion population dynamics; and 3) to obtain information on both winter and summer food habits and interpret the importance in the dynamics of both the lion and its prey populations. The work was not complete and no attempt was made to interpret the data presented.

Hornocker, M.G. 1971. Suggestions for the Management of Mountain Lions as Trophy Species in the Intermountain Region. Annual Proc. Western Assoc. of State Game and Fish Commissioners. 51:399-402.

OBSERVATIONS AND CONCLUSIONS:

(1) The mountain lion population has remained stable. This is accomplished by a fairly rigid social organization. The population is made up of resident adults, juveniles still with their mother, and transient (or non resident) adults.
(2) The density of lions is about one resident adult per 12-14 square miles in winter; this decreases greatly in summer when lions disperse from winter range.

(3) In general, the resident population is made up of approximately 50% adult females, 20% adult males, and 30% young-of-the-year.

(4) Resident females normally produce young at two-year intervals. Average litter size is 2.5.

(5) Resident females are essential to the maintenance of a population. Resident males are expendable if adjacent populations produce young which may become transient (or potential residents) on the area. These transient males may act as breeders for resident females.

(6) In the wilderness environment where the work was conducted, lions had little effect on ultimate numbers of mule deer and elk. Other factors acting separately or collectively acted to hold down ungulate populations. Winter food was believed the most critical, with weather an indirect factor.

(7) The evidence indicated that lion predation is actually beneficial to deer and elk populations. This is increasingly important in setting management objectives in any wilderness and semi-wilderness environment where these species interact.


This paper was presented as part of a long term ecological study of the puma and reports on dosages of phencyclidine hydrochloride administered to pumas captured during the study. All immobilizations occurred during the winter months utilizing trained dogs to capture the pumas. An average of 4.8 man-days of hunting and tracking were required for each capture. Fifty-one pumas were caught and marked over a six year period; thirty-two were recaptured 118 times, making a total of 169 captures during the study. Pumas were given intramuscular injections of Sernylan (phencyclidine hydrochloride) in aqueous solution, 100 mg per ml concentration.

RESULTS

A total of 89 dosages were administered and included 27 given to adult males, 27 to adult females, 16 to juvenile males, and 19 to juvenile females. Dosages for adult males and females averaged 1 mg of drug per 907 g (2 lb) body weight with a range of 1 mg per 372 g - 2 kg (0.8-4.3 lb) in males and 453 g - 2.3 kg (1-5 lb) in females. Dosages for juveniles were heavier and averaged 1 mg per 538 and 509 g (1.3 and 1.2 lb) for males and females, respectively, with a range of 1 mg per 198-991 g (0.7 - 2.3 lb) in males and 198-679 g (0.7 - 1.8 lb) in females. The extremes in the ranges for both adults and juveniles were few- only one dosage in 27 adult males was heavier than 1 mg per 453 g (1 lb) and only one was lighter than 1 mg per 1.5 kg (3.5 lb). In juveniles, only 2 of 16 males and 2 of 19 females received a dosage heavier than 1 mg per 453 g (1 lb). The average time elapsed from the injection until pumas could be approached and managed was 10.6 minutes.


The author's ten year landmark study of the cougar in the Idaho Primitive Area is
presented. He and his associates have captured, examined, marked and released cougars over 300 times. Major findings included: 1) The lion population consisted of resident adults, juveniles still with their mothers and transient adults. (2) The lion population remained stable throughout the study due to a fairly rigid system of territorialism. Lions divided up the area and confined themselves mostly to their particular area, (3) In the wilderness area where the study was conducted, lions had little effect on deer and elk populations.


Two female and one male previously orphaned 6-7 month-old mountain lions were radio-collared and released back into a wild population to determine the feasibility. These kittens were captured prior to two months of age and weighed approximately 15 pounds. After 2½ months of secluded feeding they were released approximately 50 miles west of their capture site. The females weighed 44 and 48 pounds, and the male weighed 58 pounds at the time of release. The male had to be killed 28 days after its release because of a possible threat to personnel due to the animal returning to the field station where it was reared. This male had lost 14 pounds when killed and appeared to be starving. Radio contact was lost with one female a week after release and its carcass was found 35 miles northwest from the release point and the cause of death was undetermined. The other female had established a 14 square mile home range which centered 14 miles northeast of the release site and was still being monitored. It was believed that kittens younger than 6-7 months cannot survive on their own.


Intrinsic regulatory mechanisms were documented in populations of three species of Felidae. In mountain lions (Felis concolor) and bobcats (Lynx rufus) a land tenure system which we have termed territorialism operating throughout the year acted to limit population density. In leopards (Panthera pardus) social behavior limited breeding density in a given area. These behavior systems, all in unexploited populations of long standing, operated with little strife. The authors submit that a highly evolved, peaceful social system has evolved for these species of cats. Such a system operates throughout the year and each individual's lifetime, not just seasonally.


A 5-year study of mountain lion ecology in the Northern Yellowstone Ecosystem was initiated during winter 1987-88. Objectives include documenting population parameters, spatial relationships, predator-prey relationships, and the impacts of sport harvest. Predator control activities in and adjacent to Yellowstone National Park (YNP) from 1904 to 1925 reduced or eliminated lions from the study area. Lions existed at very low numbers from 1925 to 1980. Based on capture and telemetr

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information collected during 1987-88, a population with resident individuals is well established both within and adjacent to northern YNP. Fourteen lions were captured within YNP; 12 were instrumented with radio collars. Social organization and spatial relationships appear similar to populations studied in Idaho, Montana, and Wyoming. The principal prey of lions within YNP during the winter was elk. Mule deer and small mammals were more important outside YNP where the availability of these items was greater than within. At least 5 adult female lions, 3 adult males, 5 kittens, and 1 orphaned male were present outside YNP. Mortalities to marked and unmarked lions included deaths to 1 orphan and 1 young adult by starvation, 3 adults to sport harvest (2 partially resident to YNP), and 2 kittens to unknown causes.


The objectives of this project were to: 1) document the social organization, structure, productivity, and mortality parameters of the population; 2) evaluate home range size, and daily and seasonal movements; 3) relate food habits, home ranges, and movements of mountain lions to topography and prey animal abundance and distribution; and 4) evaluate the impacts of sport harvest on the population trend, structure, and mortality of mountain lions in Paradise Valley. Preliminary data was not sufficient to draw any conclusions.


The objectives of this project were to: 1) document the social organization, structure, productivity, and mortality parameters of the population; 2) evaluate home range size, and daily and seasonal movements; 3) relate food habits, home ranges, and movements of mountain lions to topography and prey animal abundance and distribution; and 4) evaluate the impacts of sport harvest on the population trend, structure, and mortality of mountain lions in Paradise Valley. Preliminary data was not sufficient to draw any conclusions. Three living panthers were of immediate concern. Land management practices and public use regulations that increase deer or hog populations and other non-contaminated prey could shift panthers away from contaminated prey species. Recommendations including management actions, testing actions, and source identification and elimination actions are presented.


CONCLUSIONS AND RECOMMENDATIONS

During the past 71 months of research, 124 mountain lions have been captured, marked, and released. We handled those lions 212 times. We have fitted radio-collars on 60 lions (36 females, 24 males), and have located them 6,000 times. We have compiled data for 310 prey animals found on the study area and classified them as lion prey and probable lion prey (270), and prey that died of other causes (40). Research during the next 4 years will focus on documenting the changes in lion population dynamics and social behavior that result from the experimental removal, and documenting changes in the survival of desert mule deer and desert bighorns that
may result in changes in the mountain lion population.


Mountain lions will never overgrow the countryside. They are very territorial and limit their numbers. The size of their territory is determined by the food supply. Lions kill deer and elk routinely, but most of their prey are very young or very old and are not of breeding age. Food supply, hunting, and weather determine deer and elk numbers. Every state with lions except Texas regulates the killing of lions. Consequently, lions have made an amazing comeback. A ten-year study led by Ken Logan and Linda Sweanor was initiated in the San Andres Mountains, an 80-mile-long range in the Chihuahuan Desert. The first five years (1985-90) were spent studying basic lion ecology. After determining the population dynamics were stable, 13 of the 20 resident lions in one-third of the study area were relocated to another part of the state, with the other sections left undisturbed. They wanted to document the rebuilding of the remaining lion population and wanted to know how the transplanted lions would react to their new location. In addition, it was important to document how the removal of such a major predator from the ecosystem would affect the cougar's main prey, the resident mule deer. Since 1985, a total of 148 lions had been marked and thousands of radiotelemetry observations have been made. The study area supported only 30 adult resident lions and 15 to 30 dependent kittens at any one time. Aggression was a major difference between the lions of New Mexico and those of Idaho. In Idaho, both males and females lived peaceably, seldom fighting. In the San Andres, fighting—often to the death—is common. San Andres males also kill females and kittens. Another difference was that in New Mexico, kittens are born year-round and are usually independent by 14 months as opposed to Idaho where most kittens are born in spring and stay with their mothers for 18 to 20 months. After relocation of 11 adults and 2 subadults, one young male was found back home 4 months later in the San Andres Mountains which was a distance of 300 air miles. Four of these have settled in, two were killed by resident males, and two died from injuries sustained from hunting deer or elk. The remaining lions are wandering and continue to be monitored. Lion research in Yellowstone National Park, led by Kerry Murphy, provided an estimate that the northern Yellowstone region holds 18 resident adults. These cougars behave much like Idaho cats except that, as in New Mexico, kittens leave the mother earlier and much fighting occurs. California biologist Paul Beier examined records of unprovoked attacks in the United States and Canada between 1890 and 1990. Of the 53 documented attacks, nine were fatal. Thirty of the 53 attacks on humans occurred in British Columbia and twenty took place on Vancouver Island.


CONCLUSIONS AND RECOMMENDATIONS

During the past 80 months of research, 154 mountain lions were captured and marked. We handled those lions 262 times. We fitted radio-collars on 79 lions (48 females, 31 males), and we have located them 78,000 times. We compiled data for 334 prey animals found on the study area and classified them as lion prey and probable lion prey (290), and prey that died of other causes (44).

Probably less than 300 lions are killed in Arizona each year, most by professional guides. The lion is the greatest predator in the west with each adult killing more than 3000 deer in their lifetime. Arizona is represented by at least three geographical races of lions: the Kaibab, the Brown or Yuma, and the Aztec, or Mexican. The Aztec (Felis concolor azteca) is the most common race in Arizona and ranges from the south rim of the Grand Canyon south to Guadalajara, Mexico. There are 30 subspecies of mountain lions in the New World and half of these are found in North America.


Detailed ejaculate traits for 28 species of nondomestic felids are presented. In general, they produced ejaculates with sperm concentrations (per ml of ejaculate) of <300 x 10^6/ml with a wide range in sperm motility ratings with the majority of ejaculates containing relatively high proportions of morphologically abnormal spermatozoa. The mean total abnormalities/ejaculate ranged from 16.3 to 84.3%.


The Florida panther (Felis concolor coryi) is a severely threatened relict population of puma (also known as cougar or mountain lion) whose historic range included the Southeastern United States. Severe habitat destruction and human development have reduced the subspecies to < 50 animals living in the Big Cypress Swamp-Everglades National park ecosystems in southern Florida. The problem is exacerbated by recent findings demonstrating low genetic diversity within this subspecies, and without intervention, the Florida panther population has been predicted to be extinct within 25-40 years. The objectives of this study were to: 1) characterize reproductive traits in the male Florida panther; and 2) compare these data to other less threatened wild puma populations in North and South America and from captive pumas from unknown genetic origin. Testicular volume, semen traits and pituitary/gonadal hormones were measured in 5 puma populations: Florida (F. c. coryi, n=16); Chile (F. c. patagonica, n=2; F. c. puma, n=1); Colorado (F. c. hippolestes, n=7); Texas (F. c. stanleyana, n=9); and North American zoos (F. c. spp., n=16). Seven of 16 (43.8%) Florida panther males were unilaterally cryptorchid compared to 1/35 (2.9%) in other puma populations. Overall, Florida panthers had lower (P<0.05) testicular volume, poorer (P<0.05) sperm progressive motility and more (P<0.05) morphologically-abnormal sperm (mean, 93.5%) than other populations. Florida panthers also demonstrated the highest (P<0.05) incidence of sperm with defects in the acrosome (>40%) and mitochondrial sheath (partial or complete aplasia; 75%). Transmission electron microscopy revealed discontinuities in the acrosome, extraneous acrosomal material under the plasma membrane and remnants of the golgi complex under the acrosome. No differences (P>0.05) were measured in mean circulating FSH, LH or testosterone between Florida panthers and other puma populations.
populations. Seminal traits and concentrations of FSH and LH were similar (P>0.05) between cryptorchid and non-cryptorchid Florida panthers, but cryptorchid males produced less (P<0.05) serum testosterone than non-cryptorchids. These results demonstrate that there are major physiological differences among populations of Felis concolor. Compared to other less-endangered puma subspecies, the Florida panther is distinguished by poorer sperm progressive motility and an extraordinary incidence of unilateral cryptorchidism and sperm acrosomal/mitochondrial defects.

Next