Ackerman, B.B., T.P. Hemker, F.G. Lindzey, and A.J. Button. 1981. Cougar Numbers in the Henry Mountains, Utah. Encyclia 58:57-62.

In 1978, Utah had the largest harvest of any state with a reported harvest of 236 cougars which was 22% of the national total. The Henry Mountains, an isolated, desert mountain range located in south-central Utah, was closed to hunting in April, 1975 in anticipation of the cougar study. Five kinds of cougar sign were searched for: tracks, scratches, female scat mounds, kills, and incidental scats. One of the most easily found sign was scratches (scrapes) in the substrate made by the forefeet of the male. Females often bury their scats in mounds of needles and soil and were usually found under trees and were often associated with kills of large prey. Cougar scats were usually identifiable because of their large size, presence of considerable hair and bone fragments, and greenish-grey color. Initially only three sets of tracks were found during 10 man-days in July and September, 1978. Between November 1 and December 20, 1978, seventy man-days of effort was expended looking for cougar sign. Ten sets of cougar tracks, two female scat mounds, and two rabbit kills were found. It was concluded that 2-3 adult cougars inhabited the Henry Mountains during the census period. The study was moved to the Boulder-Escalante Mountains in January 1979, where cougars used home areas of 300 to 900 km^2, which was larger than reported in most other regions, possibly due to differences in terrain or prey density. The growth of these cougar populations is probably slow due to the reliance of individual immigration over large expanses of unsuitable habitat.

Ackerman, B.B. 1982. Cougar Predation and Ecological Energetics in Southern Utah. M.S. Thesis, Utah State Univ., Logan. 103pp.

Diet of cougars (Felis concolor) was studied from December 1978 to August 1981, on a 4500 km^2 study area near Escalante, Utah. Prey eaten was determined from analysis of 112 animals consumed as prey, and from 239 cougar scats. Mule deer (Odocoileus hemionus) were the major prey item, comprising 81% of biomass consumed. Lagamorphs, large rodents and smaller predators were also important components. Cattle comprised less than 1% of the diet, although commonly grazed on the cougar's summer range. Adult male and juvenile (less than 1 year) mule deer were killed more often than expected, in fall ($P < 0.10$) and in winter ($P < 0.001$). Older deer were also taken more than expected ($P < 0.005$). Cougars were a major cause of mortality of mule deer (41% of all adult female deaths, 35% of the male), but only 6% of mortality of juveniles. Selection of prey seemed to be a function of prey vulnerability, rather than one of active choice by the predator. Motion-sensitive radio-transmitters were placed on 15 cougars, from 3 months to 7-9 years of age. Three parameters of the radio signal were used to determine activity levels during 6483 1-minute sampling periods: number of changes in pulse rate, predominant pulse mode, and signal integrity, based on 308 minutes of "known" activity. Cougars showed distinct crepuscular (sunrise, sunset ± 2 hours) activity peaks ($P < 0.001$). Proportion of time active was less at night than during crepuscular periods ($P < 0.001$), but greater than during daylight ($P < 0.001$). The 1 adult male was more active than females with older cubs, both of which were more active than female with smaller cubs and small cubs. Estimates of energetic costs of basal metabolism, and of activity, growth, and reproduction were used in a predictive model of energy cost of free-existence. Information on dietary composition, live weight and energy content of prey animals, and assimilation efficiencies were used to provide estimates of the frequency at which deer were killed (deer/day) and consumed (kg/day). Single adults were estimated to kill 1 deer per 8-16 days. Females with 3 large cubs would kill 1 deer as often as every 2-3 days. A known population of 8 adult cougars was predicted to consume 417 deer per year.

Ackerman, B.B., F.G. Lindzey and T.P. Hemker. 1984. Cougar Food Habits in Southern Utah. J. Wildl. Manage. 48(1):147-155.

Diets of cougars (Felis concolor) were studied from December 1978 to August 1981, on a 4,500 km^2 study area near Escalante, Utah. Prey eaten by cougars was estimated from analysis of 112 animals consumed as prey and from 239 cougar scats. Composition of diet was corrected based on feeding trials using captive cougars. Mule deer (Odocoileus hemionus) were found to be the major prey item, 81% of biomass consumed. Lagomorphs, large rodents and smaller predators were also important components of the diet. Cattle comprised less than 1% of the diet, although they were abundant on the cougars' summer range. Age structure of deer killed by cougars indicated that older (>7 years) deer were killed more often than expected ($P< 0.005$).

Ackerman, B.B., F.G. Lindzey, and T.P. Hemker. 1986. Predictive Energetics Model for Cougars. In Cats of the World: Biology, Conservation, and Management, S.D. Miller and D. Everett (eds.). National Wildlife Federation, Wash. D.C.

A predictive model was developed to estimate required energy intake and number of prey animals consumed by free-ranging cougars (Felis concolor). Activity data for input into the model were provided by monitoring 15 radio-transmittered cougars between April, 1979 and September, 1980. Activity samples were placed in 1 of 3 activity classes, using a discriminant function based on simultaneous visual and radio signal observations. Costs of growth and reproduction were added to the cost of activity to predict age- and sex-specific energy needs. Predicted biomass of prey required was higher than published estimates derived from captive cougars. The predicted frequency of kills of large prey, however, agreed with frequencies reported by others from field observations. The predicted interval between kills of mule deer (Odocoileus hemionus) was: 8-11 days for a resident male, 14-17 days for a resident female, and 3.3 days for a female with 3, 13-month-old cubs. Total energy requirements of a cougar population are largely dependent on its sex and age composition. Changes in composition may alter the effect of the cougar population on its prey.

Adams, R.B., L.A. Harveson, P.B. Robertson, M.E. Tewes and J.D. Hillje. 2003. Reproduction and Dispersal of Mountain Lions in Southern Texas. Page 52 *in* L. A. Harveson, P. M. Harveson, and R.W. Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

In Texas, mountain lions (Puma concolor) are considered non-game animals and may be harvested throughout the year. Due to this status it is important for researchers to understand reproduction and dispersal characteristics of mountain lions if viable populations are desired. Data were collected regarding kitten/subadult mountain lion dispersal and reproduction in southern Texas from 1993-2000. Researchers observed/monitored 9 female kittens and 7 male kittens. Four subadult male and 5 subadult female mountain lions were collared and monitored, and dispersed at <13 months; male dispersal distances ranged from 9.40-53.8 km and female dispersal distances ranged from 6.30-23.1 km, and typically followed primary (rivers) or secondary (creeks) waterways to new habitats. The average home range size was 203.7km^2 and 315.7km^2 for females and males, respectively. Of the 16 litters produced over the study period, 6.25% occurred during the spring, 31.25% occurred during the summer, 25.00% occurred during the fall, and 37.50% occurred during the winter. Fourteen dispersals by 9 subadults occurred during the study with 43% of the dispersals occurring in the fall, 29% occurring during the winter, 21% during the spring, and 7% in the summer months. Knowledge of this information could be useful for determining future management needs.

Adams, R.B., J.C. Pitman, and L.A. Harveson. 2006. Texas Tortoise (*Gopherus berlandier*) Consumed by a Mountain Lion (*Puma concolor*) in Southern Texas. The Southwestern Naturalist 51(4):581-582.

Abstract

Mountain lions (*Puma concolor*), throughout their distribution, eat a variety of prey, but primarily consume large prey (e.g., cervids). While monitoring radio-collared mountain lions, we saw a mountain lion kitten consuming a Texas tortoise (*Gopherus berlandieri*). Small prey might increase survival of young mountain lions developing predation skills required for solitary survival as adults.

Akenson, J., M. Henjum and T. Craddock. 1997. Diurnal Bedding Habitat of Mountain Lions in Northeast Oregon. Page 84 *in* W.D. Padley, ed., Proc. Fifth Mountain Lion Workshop: 27 February- 1 March 1996; San Diego, California.

Abstract

We initiated an evaluation of diurnal habitat use by mountain lions (*Puma concolor*) in Northeast Oregon. From 1992 to 1994 we completed 61 habitat plots at diurnal bed sites. We compared 32 winter and 29 summer habitat plots with 30 random plots. We described the structural composition of microhabitat features within a 50 meter radius surrounding the lion beds. Five lions were fitted with activity sensing transmitters to determine when a lion was at rest. We used a specially trained hound to document actual bed sites. In winter and summer, lions used forested rimrock for bedding in greater proportion than indicated available by random plots ($P<0.05$). There were significantly more downed logs present in summer plots than random plots ($P<0.05$). All habitat plots had either forested rock structure, downed logs, or both. Results suggest that lions need both vertical and horizontal cover components to feel secure enough to bed.

Akenson, J.J., M.C. Nowak, M.G. Henjum and G.W. Witmer. 2003. Characteristics of Mountain Lion Bed, Cache and Kill Sites in Northeastern Oregon. Pages 111-118 *in* S.A. Becker, D.D. Bjornlie, F.G. Lindzey, and D.S. Moody, eds. Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming.

Abstract

We described mountain lion (*Puma concolor*) habitat characteristics during two studies in the same area of northeastern Oregon during the 1990s. In the first study (1992-1994) we evaluated micro-habitat features associated with 61 diurnal bed sites that were not associated with kills. We used similar techniques in the second study (1996-1998) to evaluate habitat features at 79 cache sites near lion-killed prey. A dog was used to find 93% of the diurnal bed sites. Radio telemetry triangulation was used in the second study. Characteristics of diurnal bed sites and cache sites were compared with random habitat plots. Rock structure and downed logs were identified as important habitat components at diurnal bed sites. Canopy cover at cache sites was significantly higher than at random sites. Cache sites also were associated with rock structure, but not to the same degree as diurnal bed sites. In both studies mountain lions used sites in close proximity to habitat edges more frequently than expected based on random plots. Understanding the similarities and differences of habitat use at diurnal bed, cache and kill sites sheds light on the ecological adaptation of mountain lions to the multiple environmental influences and disturbances of managed forests.

Akenson, H.A., J.J. Akenson, H.B. Quigley and M.G. Hornocker. 2003. Four Decades of Cougar-Ungulate Relationships in the Central Idaho Wilderness. Page 127 *in* S.A. Becker, D.D. Bjornlie, F.G. Lindzey, and D.S. Moody, eds. Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming.

Abstract

Research conducted on cougars (*Puma concolor*) in the Big Creek drainage in each of the last four decades has enhanced the understanding of the dynamic nature of cougar – ungulate relationships. In 1964, Maurice Hornocker initiated his benchmark research on this cougar population and assessed the role of cougar predation in regulating ungulate populations. Each study that followed has had different objectives, yet, combined these projects provide a rare continuum of ecological information on the dynamics of cougar – prey relationships. This cougar population has been influenced by significant environmental changes over the last 40 years. The ungulate prey base has fluctuated, but generally elk numbers have increased and deer have decreased. Total ungulate biomass was similar in the 1960's and 1980's, but was 12% lower in the study just completed. The dynamics of carnivore competition, both inter-specific and intra-specific, has changed since introduced wolves recolonized the drainage in the 1990s. A large-scale forest fire 2 years ago drastically altered winter and summer ranges and affected predator – prey relationships. We compared cougar population size, structure, reproduction, and mortality factors; prey selection during 3 time periods; and evaluated pre and post-fire data in the recent study. The estimated resident cougar population was 9 adults during the first 2 studies in the 1960's and early 1970's. The resident population grew to an estimated 13 adults in the mid-1980's, but dropped to 10 individuals by 2000, and down to 6 resident cougars by 2002. The population increase during the 1980's was in the adult female segment and it corresponded with an increasing elk population. The current low population is a result of a decreasing elk population, ungulate displacement from fire, increased hunter harvest of cougars, increased intraspecific strife, and competition with wolves for the same prey base. Cougars selected for elk rather than mule deer during the first study, but killed elk in proportion to their relative abundance during the study in the 1980's and recent study (2000). Historical perspectives from pioneer diaries indicate similar cougar population numbers. In 1888 a bounty hunter removed 12 cougars from the drainage, then ten years later a different cougar hunter noted trapping and poisoning 12 individuals on Big Creek. Archeological evidence, old newspaper articles and diaries, and early agency field notes are all integrated into this discussion of long-term predator - prey relationships. The lengthy record of information on predator and prey populations in the Big Creek drainage arguably makes this cougar population the best understood in North America.

Akenson, J., H. Akenson and H. Quigley. 2005. Effects of Wolf Reintroduction on a Cougar Population in the Central Idaho Wilderness. Pages 177-187 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

Wolves *(Canis lupus)* were reintroduced in the central Idaho wilderness in 1995 and 1996 and rapidly established packs in

areas previously occupied by cougars *(Puma concolor*). We spent four winters studying the relationship between sympatric wolves and cougars in the Idaho wilderness, beginning work the first year the two carnivores coexisted. We examined the potential for competition during winter between resident cougars and a newly established wolf pack for food, space, and habitats through radio telemetry tracking and examination of 192 carcasses. We found that wolf and cougar diets were almost identical. Winter home ranges of wolves and cougars overlapped, although the wolf pack home range size was 2-20 times the size of individual cougar home ranges. We observed wolf utilization of cougar-killed prey and evidence of wolf avoidance by cougars. Although no interspecific killing was documented between wolves and cougars, the effects of competition, a declining prey population, and heavy hunter harvest of cougars were expressed by low recruitment, decreased adults, and disrupted social structure in the cougar population. A large-scale wildfire provided a unique opportunity to compare wolf and cougar responses to catastrophic environmental change. Wolves, with large home ranges, were more adaptable to change than were cougars. For cougars, the combination of decreased prey numbers, low reproductive rate, high hunter harvest, and large-scale habitat alteration from fire appeared to amplify the effects of competition from the recently established wolf pack and increased intraspecific strife. The cougar population experienced a period of instability during this study, as cougars adapted to coexistence with another large carnivore in a dynamically changing environment.

Alberta Forestry, Lands and Wildlife. 1992. Management Plan for Cougars in Alberta. Wildl. Manage. Planning Series Number 5, Edmonton, Alberta. 91pp.

EXECUTIVE SUMMARY

Although widely distributed in southern and western Alberta during early exploration and settlement, cougar numbers were reduced by the turn of this century. Such scarcity may have been related to the observed decline in large mammal populations, which in turn was related to the unregulated hunting and severe winter weather of that period. Cougar numbers increased during the first half of the 1900s following the recovery of prey populations. Bounty payments between 1937 and 1964 suggest that, in the mountains and foothills north of the Bow River, significant cougar populations occurred, which probably reflected greater ungulate numbers than at the present time. The cougar occupies a similar distribution in Alberta in the 1900s as in historic times. The population in Alberta is estimated at 685 cougars of which about 640 occur on provincial lands (excludes national parks). This estimate is largely based on the results from a single intensive, capture/recapture study in the Sheep River area of southwest Alberta and, therefore, must be considered crude. Density estimates for Wildlife Management Units range from 4.0 cougar/100 km^2 to <0.1/100 km^2. Numbers of recreational hunting licenses sold in Alberta varied from 54 to 173 during 1973-74 to 1989-90 with the peak in 1979. The annual cougar harvest ranged from 21 to 47 animals with a mean of 32. Most (>80 percent) of the harvest was taken in southern Alberta (south of the Bow River). Hunters prefer and select for large male cougars; however, 45% of the harvest during 1973-1988 were females. The provincial cougar population has not been overhunted, but harvests in individual WMUs may have been excessive in certain years. Complaints involving cougars are uncommon in Alberta. Although a mean of 54 occurrences were reported annually to the Fish and Wildlife Division during 1982-1988, only about 4 claims were approved annually for compensation. Management policies, goals, objectives and strategies were listed as follows: (1) The cougar population, at 640 on provincial lands, will be maintained in Alberta, (2) Cougar populations will be managed on Regional Cougar Management Areas. Maximum allowable annual man-caused mortality in any specific CMA will be 15 percent, (3) Recreational hunting management strategies for cougar will protect regional populations through harvest quotas on a CMU basis, an approximate 48-hour registration requirement, and a maximum annual harvest of 10 percent. The hunting season, open throughout the foothills and mountain region, will be for three months in the winter, (4) Collection of biological data from dead cougars will continue. Mandatory submission of skulls from hunters will replace the existing voluntary program. All cougar mortalities regardless of cause will be registered, (5) The moratorium on pursuit seasons, i.e., special seasons outside of hunting seasons in which houndsmen train dogs or provide viewing opportunities, will be maintained. Should nonconsumptive demand increase, this strategy will be reviewed, (6) The Division will initiate discussions with the appropriate land management agencies and grazing patrons regarding management strategies to minimize cougar-cattle conflicts on public land. In cases of confirmed cougar damage on private land, the Division will attempt to remove the offending cougar, almost always by translocation to another area, (7) Additional studies of cougar populations will be encouraged. One component of study should focus on the effects of predation on prey populations, (8) The Division will provide an extension service to educate residents about cougar in Alberta.

Alexander, S.M., T.B. Logan and P.C. Paquet. 2006. Spatio-Temporal Co-Occurrence of Cougars (*Felis concolor*), Wolves (*Canis lupus*) and Their Prey During Winter: A Comparison of Two Analytical Methods. Journal of Biogeography 33(11):2001-2012.

Results Cougars showed a trend in distribution from higher elevation and less rugged terrain in December, to lower elevation and more rugged terrain in March. This trend differed from that for wolves, which showed a more stable affinity for low elevation and less rugged valley bottoms across all months. The logistic regression models indicated variable positive and negative associations of cougars with wolves by month, and changes in prey associations over time. Notably, there was a shift in co-occurrence for both predators from elk to deer in March. We found high predictive accuracy for all probability surfaces, except for the month of January. Our image comparison showed that spatial co-occurrence amongst all species increased over winter, except that wolves and cougars were negatively correlated in February. Combining the results of each approach we found that cougars and wolves converged spatially over winter at the landscape scale (i.e. the valley), while showing more discrete use of that space over time and by habitat attributes (e.g. forest cover, topographic complexity, and prey track density).

Main conclusions In the Rocky Mountains, the spatial distributions of cougars and wolves converged into the valley floor as winter progressed. Cougars were distinct from wolves and prey in the intensity of this shift. We determined that a comparison of predictive surfaces alone fails to explain species co-occurrence. The surfaces must be coupled with investigation of respective species–environment models to account for temporal changes in associations. We suggest that the two approaches represent different ecological scales: image comparison may be best for landscape- (valley) level analysis, while logistic regression is best for site-level analysis. Ultimately, both approaches were critical to our analysis. Finally, the variability observed over time suggested that annual and seasonal models may obscure important ecological patterns and processes, especially for cougars.

Allen, R. 1950. Notes on the Florida Panther (Felis concolor coryi, Bangs). J. Mammal. 31:279-280.

Evidence presented indicated that the Florida panther does have the ability to scream. An account of a large male panther killing a deer in captivity is presented. The Florida panther appears to be "rangier" in build than western panthers and seems to differ slightly in facial expression.

Allen, R. and W.T. Neill. 1954. The Raccoon Preyed Upon by Panther and Rattlesnake. Everglades Natural History 2:46.

A female Florida panther was shot and killed in April 1946 after she leaped upon one of the dogs used to tree her. She measured five feet, nine inches from nose to tip of tail, and weighed ninety-four pounds. Her stomach contained the remains of a raccoon, which had been bolted in large chunks. Local hunters claimed that in summer panthers frequently preyed upon raccoons.

Alvarez, K. 1986. Some Perspectives on Strategy and Survival Prospects for the Florida Panther. Pgs. 1-6 In: Survival of the Florida Panther; A Discussion of Issues and Accomplishments. W.V. Branan (ed.), Florida Defenders of the Environment. 67pp.

A remnant population of the Florida panther (Felis concolor coryi) survives at the southern extremity of the Florida peninsula. Approximately 12-13 panthers inhabit protected contiguous public lands where man competes with the panther for white-tailed deer and feral hogs. The remainder are private lands that could be lost to intensive agriculture in the near future. If current trends continue, without specific remedial management measures on public lands, extinction of the Florida panther will result. Management measures to provide a prey base adequate to support a viable panther population must therefore be implemented on public lands and research must be initiated to determine what level of human harvest is compatible with the panther's needs. Appropriate state and federal agencies must agree on a common plan of action that gives an uncompromising priority to the survival requirements of a viable panther population. Agency resistance has prevented the implementation of several feasible recommendations.

Alvarez, K. 1986. Importance and Problems of Maintaining Private Lands as Panther Habitat. Pgs. 52-53 In: Survival of the Florida Panther; A Discussion of Issues and Accomplishments. W.V. Branan (ed.), Florida Defenders of the Environment. 67pp.

Half or more of the existing Florida panther population inhabits privately-owned lands. Some of the lands are relatively large tracts. Others, such as South Golden Gate, consists of thousands of small lots. Many of the larger tracts are being converted to intensive agriculture. It is theoretically possible to save much of this land as panther habitat-- if certain unprecedented efforts are made. A plan must be formulated to identify upland tracts to be purchased. Regulatory agencies must coordinate with management agencies to preserve in toto, wetlands that would connect upland habitat blocks. Legislation is needed to establish special funding and staffing to expedite complex small-parcel acquisition projects.

Anderson, A.E. 1980. Mountain Lion Population Dynamics. Colorado Division of Wildl., Progress Rep., Proj. No. W-126-R-3, Wk. Pl. 8, Job 1, 14pp.

A review of the published and unpublished literature on the mountain lion was continued with about 900-1,000 references now read, catalogued and cross-referenced under 31 subject headings. Analyses of quantitative data on the biology of the mountain lion was the major activity. A list of the resultant 17 completed tables and 8 tables and 3 figures in progress is presented along with a working outline for the critical synthesis of literature now underway.

Anderson, A.E. 1982. Mountain Lion Population Dynamics. Col. Div. Wildl. Progress Rep., Proj. No. W-144-R-l, Wk. Pl. 6, Job 1. Pgs. 143-159.

The puma literature synthesis was completed and submitted for review. Three female puma were captured and radiocollared in 32 days of hunting; one of these was killed five days later. Only 30 of 50 attempts to locate 3 radiocollared puma with aerial telemetry were successful but 15 of the 20 failures were owing to one puma whose linear movements approximated 48 km and 2 of 3 locations were about 2 and 19 km north of the study areas, respectively.

Anderson, A.E. 1983. Mountain Lion Population Dynamics. Progress Rep. Col. Div. WildI. Proj. No. 45-01-503-l5050, Wk. Pl. 6, Job 1. 2lpp.

A review of literature on puma was published. Seven puma were captured and radio-collared. Nine pumas were tracked with aerial telemetry at approximate weekly intervals for periods ranging from 2.5 to 12 months. Of 178 telemetric locations subjectively rated "good" in accuracy, 51 (29%) occurred more than once within individual square kilometers and one female with cub(s) contributed 31 of those replicated locations. Location sites of individual puma relative to seasonal changes in mean elevation and distance between successive location sites are described statistically.

Anderson, A.E. 1984. Mountain Lion Population Dynamics. Col. Div. WildI. Res. Rep., Proj. No. 45-01-503-15050, Wk. Pl. 6, Job 1. Pgs. 221-268.

Five puma were captured and radiocollared in 111 days of hunting effort November 19, 1983 to May 17, 1984. Two of the 5 puma died a violent death; one was cannibalized and the other died from unknown causes but a predacide was suspected. As of June 29, 1984, 8 of 16 puma captured and radiocollared since the study began were being radio-tracked on an approximate weekly basis. Twelve puma were tracked with aerial telemetry during this fiscal year and telemetric locations subjectively rated as "good" totaled 347. Since the study began, 431 "good" telemetric locations have been obtained from 7 puma yearlong which ranged from 39 to 99 "good" locations for individual puma. The elevation of puma locations averaged highest May through October as did distances between successive locations. Three adult female puma appeared to occupy adjacent, discrete home ranges yearlong while the home ranges of two other females were superimposed. The yearlong home range of a mature male extended over a 37 x 16 km rectangle and encompassed the home ranges of 4 radiocollared females.

Anderson, A.E., C.R. Anderson, and D.M. Kattner. 1984. Mountain Lion Population Dynamics. Pgs. 147-148 In: J. Roberson and F. Lindzey (eds.) Proc. of the Second Mountain Lion Workshop. Utah Div. Wildl. Res. and Utah Coop. Wildl. Research Unit, Zion National Park. 271pp.

The study objective was to assess the effects of sport hunting on a puma population which occupied a range of about 700 square miles. The first phase of the study concentrated on capturing and radio-collaring all resident pumas on the study area. As of February, 1985, twenty-two puma had been radio-collared of which 8 have died, the location of two is unknown, and one has only been located twice over the last year. The remaining eleven continue to be located with aerial telemetry.

Anderson, A.E. 1988. Mountain Lion Population Dynamics. Job Progress Report, Proj. No. W-153-R-2, Wk. Pl. 6A, Job 1. Col. Div. Wildl. Pgs. 193-225.

Five puma (Felis concolor) were captured for the first time, and 5 radio-collared puma died. Seven mature radio-collared males were recaptured for blood, tissue, and semen sampling, and a mature female was recaptured and re-collared. Since 1981, 57 puma have been handled, and 29 have died. The major causes of death were sport hunting outside the study area (7) and capture (9). The mean ± SD number of days from capture to death for 11 male and 9 female puma were 307.0 ± 221.2 and 458.2 ± 358.6, respectively. Young (<24 months) puma comprised 61.4% of the total sample. Sex ratios for individual and combined age classes did not differ ($P < 0.05$) from equality for samples of either living or dead puma.

Anderson, A.E., and R.J. Tully. 1988. Status of the Mountain Lion in Colorado. Pgs. 19-23 In: R.H. Smith (ed.) Proc. of the Third Mountain Lion Workshop. Arizona Chapter, The Wildlife Society and Arizona Game and Fish Department, Prescott, Arizona. 88pp.

There were no reliable estimates of the total number of mountain lions currently within Colorado, although the population was considered to be increasing statewide. A 1989 approximation included 70,654 square miles or about 67% of the total area of Colorado. Mountain lion harvest laws and regulations are discussed. The total harvest quota for 1988 was 334 mountain lions to be taken in about 60 game management units. Mountain lions of either sex may be taken, but no kittens or mountain lion accompanied by a kitten may be taken. The mountain lion carried a bounty from 1929 to 1965, when it became a protected big game species. At least 1775 lions were taken by federal, state, and private entities from 1916 to 1965. From 1966-1987, 4,974 licenses were purchased and at least 1,831 mountain lions were killed by 3,674 sport hunters. Significantly more males than females were reported killed from 1980-1987. The state of Colorado became liable for damage to real or personal property caused by mountain lion in July, 1965. From 1976 to 1987, damage claim payments comprised 62% of total hunting license sale revenues. Increasing the statewide harvest of mountain lions does not appear to be a feasible method of reducing damage claim payments statewide. Total benefits to the state's economy from direct and indirect expenditures by hunters was estimated to be approximately $520,000 annually.

Anderson, A.E., D.C. Bowden, and D.M. Kattner. 1988. Dynamics of Home Range Size of Unhunted Mountain Lions (Felis concolor hippolestes) in Southwestern Colorado. Pg. 57 In: R.H. Smith (ed.) Proc. of the Third Mountain Lion Workshop. Arizona Chapter, The Wildlife Society & Arizona Game and Fish Department, Prescott, Arizona. 88pp.

Five adult female and 2 adult male mountain lions were radio collared and aerially located at approximate weekly intervals on Uncompahgre Plateau, over periods ranging from 23 to 49 months each. Home range size was estimated for years and periods using the minimum convex polygon (MCP) as an application of the non-parametric tolerance region (NPT) technique and by the harmonic mean (HM). Multi-response permutation procedures were used to detect temporal differences in their spatial distribution, which were described by dispersion and median location concentration estimators. At the 90% confidence interval, the proportion (P) of times 5 female puma spent within MCP regions of size (A, square km's) were at least (P,A) (.908, 219.5), (.867, 140.0), (.873, 238.0), (.841, 186.0), and (.875, 128.0). During the period of maximum female home range (November 16- May 15) (P,A) were (.793, 186.5), (.795, 92.0), (.713, 164.0), (.737, 175.5), and (.708, 104.5) at the 90% confidence level. Among female mountain lions, use was most concentrated during the heavy snowfall year of 1985 and during the May 16 to November 15 period. Shifts in location of females were more than twice as large between periods as between years. For the total sample of 519 female locations, median MCP and HM home ranges approximated 186 square km's. Home range size (MCP) of 2 male mountain lions were 596.5 square km's and 279.0 square km's who spent at

least 0.842 and 0.790, respectively, of their time within those home ranges at the 90% confidence interval.

Anderson, A.E., D.C. Bowden, and D.M. Kattner. 1988. Survival in an Unhunted Mountain Lion (Felis concolor hippolestes) Population in Southwestern Colorado. Pg. 57 In: R.H. Smith (ed.) Proc. of the Third Mountain Lion Workshop. Arizona Chapter, The Wildlife Society and Arizona Game and Fish Department, Prescott, Arizona. 88pp.

Twenty male and 21 female mountain lion were captured on a 3,263km^2 portion of the Uncompahgre Plateau and fitted with transmitters equipped with mortality switches, 1981-88. Gross approximations of their ages at capture based on dental and physical characteristics ranged from 2 to 84 months. Animals were monitored with aerial telemetry at approximate weekly intervals over periods ranging from 0.2 to 79 months per individual. The survival of each sex was examined separately by the life regression procedure (LIFEREG) in SAS which allows for censored observations (animals alive at the end of the study). Tests of goodness of fit for each sex between the Weibull and exponential models indicated that the Weibull model did not provide a significant improvement of fit over the exponential model. Sexes were combined because a statistical comparison of male and female data suggested similarity (Z=1.006, P=0.32) assuming an exponential model and Multi-response permutation procedures (a non-parametric test) indicated that ages at mortality of each sex were similar. A Q-Q Plot did not reveal any serious departure of the data from an exponential model. Thus, 25%, 50%, 75%, 90%, and 95% of male and female mountain lions have died by (X± s.e.) 27.35 ± 6.27, 65.90± 15.12, 131.80 ± 30.24, 218.92 ± 50.22 and 284.82 ± 65.34 months of age, respectively. Fifty percent of the mountain lions died by 65.9 months of age with 95% confidence limits of 42.0-103.3 months. The annual survival rate was 88.1% with approximate 95% confidence limits of 82.1-92.3%. Although closed to sport hunting of mountain lion in 1982, 11 mountain lions marked on the study area were killed; 1 illegal and 2 livestock depredation kills within the study area, and 1 illegal and 7 legal outside the study area.

Anderson, A.E. 1991. Frequency of Mountain Lion Sightings by Residents and Employees of a Housing Development. Pg. 19 In: Mountain Lion-Human Interaction Symposium, C.E. Braun (ed.) Col. Div. Wildl., Denver. 114pp.

Questionnaires about observations of marked and unmarked mountain lions were mailed to 40 residents of an upscale and isolated housing development expanding on the southeastern Uncompahgre Plateau, Colorado, since 1979. I also interviewed three employees of that development. Contacts with a few residents and employees from 1982 to 1988 suggested a retirement community that generally accepted the mountain lion and other wildlife as a welcome part of their environment. The housing development was about 8 km^2 and on land with a high density of mule deer and a lower summer and upper winter range of elk. The plant community was a heterogenous mixture of Pinus ponderosa, P. edulis, Juniperus osteosperma, Quercus gambelii, and Artemisia tridentata. The annual home range boundaries (95% Harmonic Mean) of five radio-collared mountain lions were estimated from weekly aerial surveys, 1984-1988. The home range of two mountain lions (one male, one female) overlapped the development during some years. Seven of the 17 respondents reported 27 observations of mountain lions during about 260 months of residence: 15 large size, no radio collar (NC); 7 small size (NC); 1 large size, collared; 1 large size, collar presence uncertain; 2 unclassified size (NC); and 1 unclassified size, collar presence uncertain. Ten respondents saw no mountain lion during about 476 months of residence. Two of three employees reported eight observations: one large size (NC); six small size (NC); one large size (collared) during 1988. Thus, of 35 observations of mountain lions, only 2 of 5 were positively identified as radio-collared from February 1984 to August 1989. No mountain lions were observed during January, October, or December. Speculatively, these results reflect the generally cryptic behavior of mountain lions, the probable presence of transient and additional resident mountain lions that we failed to capture and radiomark, and possibly variable levels of outdoor activity, visual acuity, and interest in wildlife among respondents. Only one instance of aggressive mountain lion behavior was reported. In that instance, the individual suddenly encountered a radio-collared mountain lion with two small cubs. The mother responded by growling and advancing slowly until the individual retreated a few steps; the mountain lion then retreated and disappeared with her cubs into nearby cover.

Anderson, A.E., D.C. Bowden, and D.M. Kattner. 1992. The Puma on Uncompahgre Plateau, Colorado. Colorado Div. Wildl. Tech. Publ. No. 40. Fed. Proj. W-53-R. 116pp.

Puma were studied with aerial telemetry on the 3,426 km^2 eastern slope of the Uncompahgre Plateau from April 1981 to July 1988. Sport hunting of puma was banned on this area during the study. A total of 26 male and 31 female puma were captured in successive years from about mid-November through April on the 1,688-km^2 big game winter range. Four drug mixtures were dart-delivered 64 times to immobilize 44 puma; 2 mixtures of ketamine hydrochloride (KHCL) and xylazine hydrochloride (48 and 11 times, respectively), KHCL (2 times) and KHCL + Valium^R (3 times). Mean induction, duration,

recovery times, and additional dosages required were highly variable within and among these mixtures. Comparisons of mean induction times showed that females greater than or equal to 34kg body mass required more (P = 0.036) induction time than <34 kg females. Males of greater than or equal to 44kg body mass had greater (P = 0.047) pursuit times than greater than or equal to 34kg females but their mean induction times did not differ (P = 0.28). Among 44 puma of all ages darted 64 times, 24 were lowered from tree by rope or hand, 24 fell from trees (resulting in 2 probable fatalities) and 16 were not immediately immobilized but jumped from trees. There were no significant gender differences in estimated age at capture (P =0.63). Sex ratios did not differ from equality (P = 0.60) in the total sample of 57 comprised of 66.7% <24-month-old and 33.3% greater than or equal to 24 month-old puma. Twenty-one of 49 radio-collared puma died and 18 of those deaths were man-caused; primarily by sport hunting outside the study area (7) and in relation to capture (6). Based on 42 puma of both sexes, the estimated annual survival rate (%) with 90% confidence limits was 88.0 (83.1-91.5). Mean (± SD) litter size was 2.41 ± .80 from 17 litters. During 1987, the minimum mean (± SE) density of residents was 1.1 ± 0.15 pumas/100 km^2). Indexes of mean annual .95 Harmonic Mean (HM) home range sizes ranged from 436 km^2 to 732 km^2 for 3 males and 190 km^2 to 463 km^2 for 7 females. The .95 HM estimator yielded values 2 to 3 times greater than did the minimum convex polygon (MCP). Male home ranges averaged larger than female home ranges for all comparisons and significantly so during 1985 (P = 0.036) and 1985-86-87 combined (P = 0.018). Home range sizes did not differ for either sex (P = 0.21 - P = 0.69) between Period 1 (16 Nov - 15 May) and Period 2 (16 May - 15 Nov). Period home ranges overlapped for each of 7 puma. The mean (± SD) and extreme distances (km) between their period activity centers were 7.5 ± 3.9 (2.1-14.1). The direction of their period shifts were largely southerly from big game winter range of Period 1 to the higher elevations of big game summer ranges in Period 2. Mean location elevations of 14 puma, however, were below the upper elevational limit of big game winter range yearlong. Mean location elevations of 7 resident pumas for 6 periods over 3 years differed significantly by year (P = 0.0258) and period (P = 0.0002) with no interaction. Among 38 puma, extremes of mean (± SD) linear distances between locations obtained at 6-8 day intervals were 2.3 ± 1.7 km and 17.7 ± 17.00 km. The dispersion distance quantile uses the median (defined as that point of a sample of locations in 2 dimensions which has minimum average distance from the locations) and estimated that 1.5-11.7 km from their median location included 50%, and 5.0-45.0 km, 90% of their aerial locations. Comparisons of distance quantiles from the median locations for 6 male and 7 female pumas over a 5-year period revealed that only during 1985 did the distributions of male and female .95 quantile distances differ significantly (P = 0.036). Four of 12 male and 5 of 10 female radio-collared pumas reached the age of potential dispersal but did not disperse. Gender and dispersal were not significantly (P = 0.67) related. The means and extremes of dispersal distances (km) were 86.2 (23-151) for 8 males, 10-13 months old and 37.0 (17-54) for 4 females, 11-31 months old. Interactions among puma pairs were indexed by annual home range overlaps and near-simultaneous aerial locations. There were 3-100% home range overlaps for 57 overlapping pairs among 6 males and 9 females as well as 56 overlapping pairs among 9 females. Among 5 males there were 10-66% home range overlaps for 14 overlapping pairs. The overlapping home ranges of 2 males also overlapped the overlapping ranges of 5 females but each male used different elevational strata, 1985-87. Near-simultaneous aerial locations indicated that mature male-mature female and mother-dependent young were the major associations among 84 radio-collared pairs. Of 69 locations of mother-young pairs, 21 were 0 km apart and 10 were about 2.2 km apart. The maximum distance apart recorded for mother-young pairs was 6 km. A male-male association resulted in the death of the presumably smaller, radio-collared male. Cannibalism was not observed. The total number of aerial locations of 7 puma and subjective estimates of relative deer-elk density categories on each of 726 square miles of winter range were used to assess puma-deer-elk interactions, 1985-87. About one-half of 40 tests of significance of the puma location-deer density/square mile relationship were significant at very small probabilities. During 1987, resident puma killed an estimated 1,885 to 2,060 mule deer or about 8-12% of the estimated wintering deer population. Damage claims paid for puma-killed livestock were limited to sheep. There were no records of livestock depredation prior to 1980. From 1980 to 1989, the State of Colorado paid 26 damage claims for 366 sheep (82.4% lambs) killed by puma totaling $25,962.30. There were 199 sheep killed during 1986-87 and 125 of those were killed in 3 episodes on 2 square miles in close proximity. Among puma, greater than or equal to 24 months old, 8 males weighed (kg) (mean ± SD) 61.6 ± 5.7 and 14 females 44.5 ± 3.6. Male body mass and 18 body measurement means were significantly larger (P = 0.0329 - P = 0.00000) than those of females. Multiple linear regression equations for predicting body mass (Y) from 2 body measurements (X) from 18 males and 24 females yielded R^2 values of .927 and .676, respectively. Fragmentary data on perirenal fat indices, organ-gland masses and dimensions, genetics, spermatozoa, cellular and chemical constituents of blood, and injuries, diseases, and parasites are tabulated and discussed with reference to the meager literature.

Anderson, C.R.. Jr., and F.G. Lindzey. 2000. A Photographic Guide to Estimating Mountain Lion Age Classes. Wyoming Cooperative Fish and Wildlife Research Unit, Laramie, Wyoming.

Mountain lion age classes are depicted based on reliability for kittens (<12 months of age), subadults (1-2.5 years of age),

young adults (3-4 years of age), and older adults (>4 years of age). Additional photographs provide tooth eruption, staining and wear examples as well as genital spots and nipple sizes and shapes reflecting lactation status.

Anderson, C.R. Jr. and F.G. Lindzey. 2003. Estimating Sex Reporting Bias in Mountain Lions Using DNA Analyses. Page 52 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Changes in the sex ratio of mountain lion (Puma concolor) populations can be an important parameter for documenting population trend where excessive harvest of females can result in population decline. Genetic samples were collected from 198 mountain lions in Wyoming between 1996 and 1999 that died from human caused mortality. We determined sex from gender assays analyzing chromosomal DNA to evaluate accuracy of reported sex during mandatory inspection. Sex was incorrectly recorded for 17 of 198 (9%) mountain lions. Sex ratio between correctly (m:f = 100:79) and incorrectly (m:f = 100:70) sexed mountain lions did not differ (P = 0.81). Juveniles (<3 years old), however, were more likely to be misclassified than adults (P = 0.005) and comprised 82% (14 of 17) of misclassified mountain lions. Closer examination of juvenile mountain lions should enhance accuracy of sex ratio data for management and improve inferences on mountain lion population trend.

Anderson, C.R. Jr. and F.G. Lindzey. 2003. Using GPS Collars to Estimate Mountain Lion Predation Rates and Selection of Large Prey. Page 53 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

We collared 10 mountain lions (Puma concolor) with Global Positioning System (GPS) transmitters between September 1999 and April 2000 to identify detailed winter movement patterns and evaluate prey selection and predation rates. GPS collars were fitted on 2 adult males (3 years old), 3 juvenile females (1.5-2.5 years old), and 5 adult females. We retrieved collars during spring 2000 and plotted GPS locations on 1:100,000-scale topographic maps in Arc-ViewTM to identify potential predation sites from location clusters. GPS positions averaged 3-5 locations/day/individual of the 6 programmed location attempts. We are verifying predation sites using hand-held GPS navigation units to locate clusters from GPS collars. We have detected prey remains at 53 location clusters (34 mule deer (Odocoileus hemionus), 14 elk (Cervus elaphus), and 5 pronghorn (Antiliocapra americana)), and mean error from cluster center to prey remains was 39 m (range: 0-90 m). Preliminary results suggest that location clusters with nocturnal locations for 2 nights exhibit a high probability of being a predation site. Efficacy of GPS collars to estimate mountain lion predation rates and prey selection, and methods of estimation will be presented.

Anderson, C.R. and F.G. Lindzey. 2003. Estimating Cougar Predation Rates from GPS Location Clusters. J. Wildl. Manage. 67(2):307-316.

Abstract

We examined cougar (*Puma concolor*) predation from Global Positioning System (GPS) location clusters (>2 locations within 200 m on the same or consecutive nights) of 11 cougars during September-May, 1999-2001. Location success of GPS averaged 2.4-5.0 of 6 location attempts/night/cougar. We surveyed potential predation sites during summer-fall 2000 and summer 2001 to identify prey composition (n = 74; 3-388 days post predation) and record predation-site variables (n = 97; 3-270 days post predation). We developed a model to estimate probability that a cougar killed a large mammal from data collected at GPS location clusters where the probability of predation increased with number of nights (defined as locations at 2200, 0200, or 0500 hr) of cougar presence within a 200-m radius (P< 0.001). Mean estimated cougar predation rates for large mammals were 7.3 days/kill for subadult females (1-2.5 yr; n = 3, 90% CI: 6.3 to 9.9), 7.0 days/kill for adult females (n = 2, 90% CI: 5.8 to 10.8), 5.4 days/kill for family groups (females with young; n = 3, 90% CI: 4.5 to 8.4), 9.5 days/kill for a subadult male (1-2.5 yr; n = 1, 90% CI: 6.9 to 16.4), and 7.8 days/kill for adult males (n = 2, 90% CI: 6.8 to 10.7). We may have slightly overestimated cougar predation rates due to our inability to separate scavenging from predation. We detected 45 deer (*Odocoileus* spp.), 15 elk (*Cervus elaphus*), 6 pronghorn (*Antilocapra americana*), 2 livestock, 1 moose (*Alces alces*), and 6 small mammals at cougar predation sites. Comparisons between cougar sexes suggested that females

selected mule deer and males selected elk (P< 0.001). Cougars averaged 3.0 nights on pronghorn carcasses, 3.4 nights on deer carcasses, and 6.0 nights on elk carcasses. Most cougar predation (81.7%) occurred between 1901-0500 hr and peaked from 2201-0200 hr (31.7%). Applying GPS technology to identify predation rates and prey selection will allow managers to efficiently estimate the ability of an area's prey base to sustain or be affected by cougar predation.

Anderson, C.R. Jr., F.G. Lindzey and D.B. McDonald. 2003. Genetic Structure of Cougar Populations Across the Wyoming Basin: Metapopulation or Megapopulation. Page 109 *in* S.A. Becker, D.D. Bjornlie, F.G. Lindzey, and D.S. Moody, eds. Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming.

Abstract

Using microsatellite DNA analyses at 9 loci, we examined genetic structure of 5 geographically distinct cougar (*Puma concolor*) populations separated by the Wyoming Basin and a distant cougar population from southwest Colorado. Observed heterozygosity was similar among populations (H_{obs} = 0.49-0.59) and intermediate to that of other large carnivores. Estimates of genetic structure (F_{ST} = 0.029, R_{ST} = 0.028) and number of migrants per generation (N_em) suggested high gene flow across the central Rocky Mountains. Estimates of the number of migrants per generation were lowest between the southwest Colorado cougar population and cougar populations north of the Wyoming Basin (northwest WY, north-central WY, and the Black Hills, SD; N_em = 2.9-3.0) and highest among cougar populations from adjacent mountain ranges (N_em = 10.2-30.2), suggesting an effect of both isolation by distance and of habitat matrix. We applied a model-based clustering method to infer population structure from individual genotypes and noted that both males and females from throughout the region were best described as a single panmictic population. Estimates of relatedness (r_{xy}) did not differ (P >0.05) between males and females. Estimated relative effective population size did not differ significantly among populations (P > 0.05), but the higher estimates were from contiguous mountain ranges (i.e., northwest WY, southwest WY, and southwest CO) and lower estimates were from less contiguous terminal mountain ranges (i.e., north-central WY and Snowy Range WY). Based on measures of gene flow we examined, extinction risk in the near future appears extremely low, even for the relatively isolated Black Hills cougar population. Cougars in the central Rocky Mountains appear to constitute a large panmictic population rather than a metapopulation. Estimated effective population size for cougars in the central Rocky Mountains ranged from 1,797 to 4,532 depending on analysis method and the mutation model assumed.

Anderson, C.R. Jr. and F.G. Lindzey. 2003. Monitoring Changes in Cougar Sex/Age Structure with Changes in Abundance as an Index to Population Trend. Page 137 *in* S.A. Becker, D.D. Bjornlie, F.G. Lindzey, and D.S. Moody, eds. Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming.

Abstract

Cougar (*Puma concolor*) management has traditionally been plagued by the inability to identify population trends for adequate assessment of management strategies. Monitoring changes in harvest sex-age structure as an index to population trends appears useful in tracking black bear populations and may be applicable to cougar management, especially given their strict social structure and territorial behavior. We documented changes in cougar harvest structure (sex-age) through experimental population reduction and recovery to better understand the relationship between sex-age composition and population trend in exploited populations. The cougar population in the Snowy Range, southeast Wyoming, declined from 58 (90% CI = 36 to 81) in the fall of 1998 to 20 (90% CI = 14 to 26) independent cougars (>1 year old) by the spring of 2000 following 2 years of increased exploitation (mean exploitation rate = 43%) and increased to 46 (90% CI = 33 to 60) by the spring of 2003 following 3 years of reduced harvest levels (mean exploitation rate = 18%). Pre-treatment harvest composition was 63% subadults (1.0-2.5 years old), 24% adult males, and 14% adult females (2 seasons; n = 22). A reduction in subadult harvest, an initial increase followed by a reduction in adult male harvest, and a steady increase in adult female harvest was consistent with hypothesized harvest vulnerability for a declining population. Harvest composition was similar at high and low densities with light harvest, but the proportion of male subadults increased at low density as adult males removed during the treatment period (high harvest) were replaced. Examining cougar sex ratios (m:f) alone appears to be of limited utility for identifying population change. Including age class, however, provides a useful metric in monitoring cougar population trend. We feel this approach could be applied to adaptively manage cougar populations where adequate sex and age data are collected from harvested animals.

Anderson, C.R. Jr., F.G. Lindzey and N.P. Nibbelink. 2003. Estimating Cougar Abundance Using Probability Sampling: An

Evaluation of Transect Versus Block Design. Page 142 *in* S.A. Becker, D.D. Bjornlie, F.G. Lindzey, and D.S. Moody, eds. Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming.

Abstract

We used GPS data records of cougar track sets (*n* = 5-6 locations/night) to evaluate accuracy and precision of Transect Probability Sampling (TPS) and Block Probability Sampling (BPS) from spatial simulations of varying cougar densities, sampling efforts, and number of track set nights. GPS data records yielded 446 1-night track sets and 225 2-night track sets from 12 cougars (2 adult males, 6 adult females, and 4 subadults) for simulations. Accuracy and precision of TPS and BPS estimates generally improved with increased cougar density, sampling effort, and number of track set nights, but TPS estimates were vulnerable to extremely short track sets (e.g., cougars at kill sites) and BPS estimates were exceedingly imprecise. To address these problems, we adjusted TPS estimates based on the proportion of cougar track sets estimated to be at kill sites and used bootstrap techniques to estimate 90% confidence intervals (CIs) around BPS estimates. TPS estimates adjusted for cougars at kill sites typically improved accuracy, precision, and estimator reliability (CIs approaching 90% coverage). Bootstrapping greatly reduced variance around BPS estimates but exaggerated precision (i.e., CI coverage typically below 90%), likely due to low cougar detection rates. Comparisons of adjusted TPS and BPS estimates suggested higher cougar detection rates and improved accuracy from TPS surveys, with more reliable CI coverage. TPS simulations suggested reliable cougar population estimates could be obtained from high-effort surveys (~2 km transect spacing) regardless of cougar density or number of track set nights, or from medium-effort surveys (~3 km transect spacing) of medium-high density populations (2.3-3.5 independent cougars/100 km^2) sampling 2-night track sets. Ninety-percent CIs suggested population changes of 27-30% could be detected using high effort surveys of 1-night track sets, 20-24% from medium effort surveys of 2-night track sets, and 15-18% from high effort surveys of 2-night track sets. Because of the time and expense required to conduct high effort TPS surveys, we propose sampling cougar track sets without intense tracking efforts and applying perpendicular track lengths we measured to estimate cougar population parameters.

Anderson, C.R. Jr., F.G. Lindzey and D.B. McDonald. 2004. Genetic Structure of Cougar Populations Across the Wyoming Basin: Metapopulation or Megapopulation. J. Mammal. 85(6):1207-1214.

Abstract

We examined the genetic structure of 5 Wyoming cougar (Puma concolor) populations surrounding the Wyoming Basin, as well as a population from southwestern Colorado. When using 9 microsatellite DNA loci, observed heterozygosity was similar among populations (H_o = 0.49-0.59) and intermediate to that of other large carnivores. Estimates of genetic structure (F_{ST} = 0.028, R_{ST} = 0.029) and number of migrants per generation (N*m*) suggested high gene flow. N*m* was lowest between distant populations and highest among adjacent populations. Examination of these data, plus Mantel test results of genetic versus geographic distance (P <= 0.01), suggested both isolation by distance and an effect of habitat matrix. Bayesian assignment to population based on individual genotypes showed that cougars in this region were best described as a single panmictic population. Total effective population size for cougars in this region ranged from 1,797 to 4,532 depending on mutation model and analytical method used. Based on measures of gene flow, extinction risk in the near future appears low. We found no support for the existence of metapopulation structure among cougars in this region.

Anderson, C.R. Jr., F.G. Lindzey, D. Bjornlie, H. Sawyer, R. Neilson and D.S. Moody. 2005. Exploring Source-Sink Dynamics of Wyoming Cougar Populations. Pages 202-203 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

The Cougar Management Guidelines Working Group, consisting of cougar *(Puma concolor*) experts from throughout North America, recently proposed managing cougars in terms of source or sink subpopulations, where areas exhibiting positive growth would be considered a source and those exhibiting negative population growth would be considered a sink. As a first step toward this effort, we developed a cougar habitat use model to delineate suitable cougar habitat and evaluated model predictions using historic harvest locations (1997-2005). We then plotted female harvest locations (1999-2005) relative to suitable cougar habitat predicted by the model to identify unexploited cougar habitat in Wyoming (i.e., defacto refuges or potential source areas). We developed a cougar habitat use model following the resource selection function approach of

Manley et al. (2002) using cougar GPS locations (<=6/night) collected in the Snowy Range, southeast Wyoming, from 10 cougars (Nov-May, 1999-2001) representing the range of sex and age (subadult, adult) classes and well distributed throughout the population. We treated individual cougars as the experimental unit and applied stepwise AIC (Venables and Ripely 2002) logistic regression analyses to select model parameters. Variables considered for model development included distance to edge (timber and tall shrub), distance to the forest- grassland interface (defined as ecotone), slope, aspect, elevation, vegetation type, and whether or not the location was within cover or within the ecotone. Ecotone was selected for all 10 models, distance to edge for 8 of 10, slope for 7 of 10, and aspect, elevation, vegetation type, and within ecotone were selected for 5 of the 10 models evaluated, while within cover and interaction terms were rarely or never included. We selected the best global model based on model performance when applied to historic statewide cougar harvest locations and found the model including ecotone, distance to edge, and slope performed as well or better than the more complex models. Thus far, we have evaluated 3 mountain ranges including the Bighorn Mountains and the Snowy and Laramie Ranges in east-central Wyoming and found high-use areas predicted by the model included 85-98% of cougar harvest locations, depending on the area examined. Model predictions of suitable cougar habitat relative to female harvest locations from the past 6 years suggest adequate refuge areas exist in the Laramie and Snowy Ranges; these areas are inaccessible due to land ownership and limited road access. Some unexploited habitat sufficient to sustain adult females also occurred in the Bighorns, but unexploited habitat was relatively less extensive than other 2 mountain ranges. Efforts will continue to delineate suitable cougar habitat and evaluate refuge areas statewide, but completion will depend upon adequate vegetation layers to provide the necessary resolution (30m x 30m; e.g., Landsat data).

Anderson, C.R. Jr. and F.G. Lindzey. 2005. Experimental Evaluation of Population Trend and Harvest Composition in a Wyoming Cougar Population. Wildl. Soc. Bull. 33(1):179-188.

Abstract

Cougar (*Puma concolor*) management has been hindered by inability to identify population trends. We documented changes in sex and age of harvested cougars during an experimentally induced reduction in population size and subsequent recovery to better understand the relationship between sex–age composition and population trend in exploited populations. The cougar population in the Snowy Range, southeast Wyoming, was reduced by increased harvest (treatment phase) from 58 independent cougars (>1 year old) (90% CI=36–81) in the autumn of 1998 to 20 by the spring of 2000 (mean exploitation rate=43%) and then increased to 46 by spring 2003 following 3 years of reduced harvests (mean exploitation rate=18%). Pretreatment harvest composition was 63% subadults (1.0–2.5 years old), 23% adult males, and 14% adult females (2 seasons; *n*=22). A reduction in subadult harvest, an initial increase followed by a reduction in adult male harvest, and a steady increase in adult female harvest characterized harvest composition trends during the treatment phase. Harvest composition was similar at high and low densities when harvest was light, but proportion of harvested subadult males increased at low density as they replaced adult males removed during the treatment period (high harvest). While sex ratio of harvested cougars alone appears of limited value in identifying population change, when combined with age class the 2 appear to provide an index to population change. Composition of the harvest can be applied to adaptively manage cougar populations where adequate sex and age data are collected from harvested animals.

Anderson, E.M., A.P. Wydeven and R. Holsman. 2006. Distribution of Cougar Sightings in Wisconsin 1994-2003. Pages 35-40 in H.J. McGinnis, J.W. Tischendorf and S.J. Ropski editors. Proceedings of the Eastern Cougar Conference 2004, Morgantown, West Virginia, USA.

Abstract

Historically, the cougar (Puma concolor) occurred throughout Wisconsin but was probably extirpated from the state during the early 1900s. Despite numerous sightings of “cougar-like” animals since then, there has been no definitive evidence of their occurrence. Since 1991, the Wisconsin Department of Natural Resources (WDNR) has collected information on cougar observations in the state as part of their rare mammal observation program. Analysis of the possible and probable sightings from 1994-2003 (n=345) revealed the majority occurred in the northern half of the state. Six major hot spots were identified. The 4 northern concentrations were in Lincoln, Langlade, Price, Oneida, and Florence Counties. Two areas emerged in southern Wisconsin since 2000: Vernon County in 2002 and Green Lake County in 2003. The majority of observations were made in July-November (67.7%) and generally increased from 1994-2003. In 1997, an opinion survey

was also mailed to all WDNR wildlife biologists and conservation officers regarding cougars in their areas of responsibly. A majority (60.8%) of total respondents (n= 97) felt it was not likely that cougars occurred in their counties of primary responsibility; however, 63.9% were reluctant to entirely discount cougar occurrence within the state. About one quarter (26.8%) of respondents indicated they were aware of captive illegal cougars in their area during the past 5-10 years. Twelve field personnel (12.4%) were aware of captive cougars being illegally released in the past 5-10 years. Despite the lack of direct evidence of cougar presence in Wisconsin, it is likely that they will be in the state within the near future and may already occur here. Recent information on dispersal from the closest reproducing population, in the Black Hills of South Dakota, suggests that Wisconsin is within dispersal range of that population. The state should be proactive in developing And implementing a management plan for the species and should be educating the public in anticipation of their reappearance.

Anderson, M., E.R. Pope, and G.M. Constantinescu. 1992. Perineal Hernia in a Cougar. J. Am. Vet. Med. Assn. 201(11):1771-1772.

An eight-week-old female cougar had possessed perineal swelling for 2 days prior to evaluation. A hard but movable subcutaneous mass (2x2 cm) was palpated just lateral to the anus on the left side. A fine needle aspirate yielded material that was believed to be feces and palpation of the rectum revealed a hard fecal ball and a perineal hernia. Corrective surgery is detailed and the cougar recovered normally. It was believed that this cougar had a congenital hernia.

Angelo, C.D., A. Paviolo and M.S. Di Bitetti. 2010. Traditional Versus Multivariate Methods for Identifying Jaguar, Puma, and Large Canid Tracks. J. Wildl. Manage. 74(5):1141-1153.

Abstract

The jaguar (Panthera onca) and puma (Puma concolor) are the largest felids of the American Continent and live in sympatry along most of their distribution. Their tracks are frequently used for research and management purposes, but tracks are difficult to distinguish from each other and can be confused with those of big canids. We used tracks from pumas, jaguars, large dogs, and maned wolves (Chrysocyon brachyurus) to evaluate traditional qualitative and quantitative identification methods and to elaborate multivariate methods to differentiate big canids versus big felids and puma versus jaguar tracks (n = 167 tracks from 18 zoos). We tested accuracy of qualitative classification through an identification exercise with field-experienced volunteers. Qualitative methods were useful but there was high variability in accuracy of track identification. Most of the traditional quantitative methods showed an elevated percentage of misclassified tracks (=20%). We used stepwise discriminant function analysis to develop 3 discriminant models: 1 for big canid versus big felid track identification and 2 alternative models for jaguar versus puma track differentiation using 1) best discriminant variables, and 2) size-independent variables. These models had high classification performance, with <10% of error in the validation procedures. We used simpler discriminant models in the elaboration of identification keys to facilitate track classification process. We developed an accurate method for track identification, capable of distinguishing between big felids (puma and jaguar) and large canids (dog and maned wolf) tracks and between jaguar and puma tracks. Application of our method will allow a more reliable use of tracks in puma and jaguar research and it will help managers using tracks as indicators of these felids' presence for conservation or management purposes.

Anonymous. 1938. Mountain Lion's Roam Pennsylvania Hill? Pennsylvania Game News 9(3):19.

The natives of Potter and Tioga Counties insisted that there was a panther roaming the hills of northern Pennsylvania. After many reports, the Game Commission made several inquiries and found that a party from Williamsport had secured two mountain lions four or five years earlier and that they may have been liberated. In addition, Game Officers had received reports of panthers in that section every two or three years.

Anonymous. 1948. Mountain Lion Killed in St. Clair County. Alabama Conservation. 19(10):11.

A mountain lion was killed in Ashville, St. Clair County, by A.D. Hare on March 16, 1948. The lion was estimated to be two years old and weighed 109 pounds. It stood more than two feet tall and measured over 5 feet long from the head to the tip of the tail. The lion was shot with the help of Hare's Black and Tan hound dog.

Anonymous. 1956. Here and There. Alabama Conservation. 27(5):26.

Within the past few months, accounts of panthers had occurred in Alabama. One young panther was caught in a steel trap in Dale County which had been set near the carcass of a cow which the panther had supposedly killed. Tracks were identified of another panther in Washington County which had apparently preyed upon a deer.

Aranda, M. and V. Sánchez-Cordero. 1996. Prey Spectra of Jaguar (*Panthera onca*) and Puma (*Puma concolor*) in Tropical Forests of Mexico. Studies on Neotropical Fauna and Environment 31(2):65-67.

Abstract

At the Calakmul Biosphere Reserve in Campeche, Mexico, the prey spectra of sympatric jaguars (*Panthera onca*) and pumas (*Puma concolor*) were studied by examination of their scats. 10 vertebrate species were identified for jaguars and 7 for pumas, mainly mammals and some birds. Based on these diet analyses, we conclude that jaguars and pumas coexist at Calakmul by means of different food habits.

Ashman, D. 1975. Mountain Lion Investigations. Perf. Rep., Proj. No. W-48-6, Study S&I, Job 5. Nevada Dept. Fish and Game, Reno. 18pp.

SUMMARY

A total of nine new mountain lions were captured and marked during this period. The total number marked during the four year study was 33 animals. The total known mortality was eight lions all killed either by sport hunters or on depredation complaints. Four different mountain ranges were surveyed this past winter. A total of 54 days of field work was accomplished with 35 days in the Ruby Mountains, 9 days in the Cherry Creek Range, 6 days in the Snake Range and 4 days in the Maverick-Bald Mountain area. The remaining resident male population was harvested by sport hunters this year in the Ruby Mountains. One resident female was killed with small kittens which were not recovered. The known population at present is four resident females, no resident males and an estimated 6 to 8 juveniles and transients. Approximately one-half of the Cherry Creek Range was surveyed with a total of 5 lions captured and marked. The estimated population for the area surveyed was 7-8 lions. The South Snake Range was surveyed and two lions were captured and marked. The total estimated population for this area is 5-8 lions. No aerial flights were conducted this year. Total harvest by sport hunters, F.W.S., and miscellaneous totaled 100 animals for the entire state.

Ashman, D. 1975. Mountain Lion (Felis concolor). Nevada Outdoors Wildl. Review 9(1):12-14.

The population of mountain lions in Nevada was estimated at between 600 and 800 animals. Mountain lion appearance and distribution, territory, food habits, habitat preference, breeding habits, voice, population control, and management are described. Studies had shown that an adult cougar needed no more than 14 to 20 average-sized mule deer per year and less if the diet is supplemented by other prey. The annual harvest of cougar in Nevada averages about 90 lions per year.

Ashman, D. 1977. Mountain Lion Investigations. Performance Report. Proj. No. W-48-8, Study S&I, Job 5 and Study RV, Job 1. Nevada Dept. of Fish and Game. 11pp.

SUMMARY

Five new mountain lions were captured and marked in the Ruby and Pine Nut Mountains during the winter and spring survey period. Three of the five lions caught were males (2 yearlings and 1 adult) and two were females (1 yearling and 1 young adult). Light winter snows and widely distributed lion populations hindered capture work again this year. Most lions were using summer home ranges as well as some winter ranges. Mule deer were never concentrated to any extent on their normal winter ranges. Known mortality this year on the Ruby Mountain lion population was one adult female and three kittens. Two or possibly three adult male residents have now reoccupied home ranges, with at least one more vacancy still present in the Rubies. Adult resident females still have not reoccupied all vacancies as indicated by sign and aerial surveys. Helicopter surveys were limited again this year. However, the one survey made in the Ruby Mountains was the

most successful yet conducted. During this flight in early March, when snow cover was nearly 100 per cent, over half the Ruby Mountains (1,100 square miles) was flown. Approximately 700 square miles were covered in 12.1 hours of actual flight time. A total of 17 tracks were observed on this survey, with 14 nonduplicate tracks. Dick Hall and Mike Laughlin of the U.S. Fish and Wildlife Service assisted in all phases of the survey. Track and sight record data were gathered by personnel of the Department, United States Fish and Wildlife Service, United States Forest Service, and other interested individuals. These data showed a total of 124 observations of tracks or actual sightings from 35 different mountain ranges throughout the state. Many of the tracks were probably duplicates, but the data does show the widespread distribution of the mountain lion in the state. More intensive ground surveys were made in seven mountain ranges last winter, with a total of 24 tracks observed. Poor snow conditions prevented any reliable population estimates from this survey. The reported harvest for the state was the lowest on record with a total of 33 lions taken. This decrease was probably due to the restricted quota system and the lack of adequate snow cover for tracking and hunting.

Ashman, D. 1978. Mountain Lion Investigations. Perf. Rep., Proj. No. W-48-9, Study S&I, Job 5 and Study RV, Job 1. Nevada Dept. Fish and Game, Reno. 10pp.

SUMMARY

A total of 11 mountain lions were captured and marked during the past winter's work period. To date, a total of 58 lions have been captured in the state. Mortalities from the marked sample of 58 lions indicated a minimum loss of 29.3 percent covering a six year period (1972-1978). The overall mortality rate for the marked population in the Ruby Mountains for the six year period (1972-1978) is 39.5 percent with a probable rate of 47.4 percent which includes 3 unreported kills or natural mortalities. Six radio collars were placed on 5 adults and I juvenile lion in 3 mountain ranges. A total of 72 different locations have been made to date. One lion (No. 35) died after being followed for a 5 month period from December, 1977 through May, 1978. The remaining 5 lions are being monitored at least once each month in order to determine home range distribution. A limited amount of scratch site monitoring was accomplished during this segment with only partial success due to man-time limitations. Ten mountain ranges were surveyed by three Department biologists in an attempt to locate tracks or other lion sign. This effort resulted in 16 tracks being located in 6 mountain ranges. A helicopter survey was made in the Monitor Range in order to locate tracks in the snow and estimate the total lion population. A total of 9 individual tracks were found in the 850 square miles flown. The 1977-78 season was the second one under the total quota harvest program. Final harvest figures show a sport hunter harvest of 16 male lions and 6 female lions from 18 of the 24 mountain lion management areas in which tags were available. Of the total 151 tags available, 145 were sold and 22 lions were harvested for a 15.2 percent hunter success rate. The 1977-78 harvest was exactly double that of the 1976-77 season. As was the case in 1976-77 under the total quota harvest system, mountain lion harvest was very well distributed throughout the state's mountain lion management areas, and the proportion of males in the harvest remained high at 73 percent. The take by the U.S. Fish and Wildlife Service of lions implicated in domestic livestock depredations decreased by one lion from the 19 lions taken in fiscal 1977 (July 1, 1976-June 30, 1977). A total of 6 other mortalities were found including the illegal take of 2 young female lion in the Ely area, 2 road kills and 2 natural mortalities.

Ashman, D. 1979. Mountain Lion Investigations. Performance Report. Proj. No. W-48-10, Study S&I, Job 5 and Study RV, Job 1. Nevada Dept. of Fish and Game. 16pp.

SUMMARY

A total of 18 mountain lions were captured and marked during this work segment (1978 and 1979 as of July 1, 1979). Eight of these lions were fitted with radio collars in order to follow their movements and to gain additional insight into population dynamics. Lions were taken through accidental captures from bobcat trappers and by George Daum (on contract), Jim Buhler and Richard Holcomb (USF&WS). Overall mortality rates from the marked sample of 76 animals indicates 32.9% are known dead. The U.S. Fish and Wildlife Service, Animal Damage Control Division have removed 13 of the 25 mortalities resulting from domestic sheep depredations. A cooperative project designed to better understand depredations associated with domestic sheep losses was initiated this past year. A total of eight lions were radio-collared and, to date, four of these animals have been destroyed due to sheep depredations in the Egan and Ruby Mountain Ranges. Winter track counts and scratch site monitoring were accomplished on a small scale. Total statewide mortality during the 1978-79 fiscal year was 54 mountain lions. Of these, 50 were taken by sport hunters and U.S. Fish and Wildlife Service on depredation complaints.

Ashman, D. 1981. Mountain Lion Investigation. Job Perf. Report. Proj. No. W-48-12, Study S&I, Job 5 and Study R-V, Job 1. Nevada Dept. Wildlife. 7pp.

SUMMARY

A total of six new lions were captured this past winter and spring in the Ruby and Schell Creek Mountain ranges in eastern Nevada. Four of these lions were radio-collared with two being monitored at the present time. A total of 95 captures have been made during the 9 years of this study. A total of 617 locations have been made on 32 radio-collared lions over a period of 8 years. Home range parameters have been determined by 10 adult lions over this same period with female ranges averaging approximately 62 square miles and males 248 square miles. At the present time 12 lions are still alive and being monitored through either aerial or ground location. From the marked sample of 95 lions a total of 42 (44.2%) are known mortalities. Statewide sport hunting and depredation harvest this year was 61 lions compared to last year when 72 were taken.

Ashman, D.L., G.C. Christensen, M.L. Hess, G.K. Tsukamoto, and M.S. Wickersham. 1983. The Mountain Lion in Nevada. Nevada Dep. Wildlife, Proj. No. W-48-15, Study S&I 1, Job 5 and Study R-V, Job 1. Final Report. 73pp.

In 1972, the Nevada Department of Wildlife initiated a study of the mountain lion to determine status and relationships to deer populations. As the study progressed, the Department moved toward the development of a Unit Harvest Management scheme. The principal study areas were located in the Ruby Mountains (853 mi^2) and in the Monitor Range (335 mi^2) and all areas were grouped in northeastern and central Nevada. Data was obtained through lion capture, marking and recapture, and from radio-telemetry monitoring. Ninety-seven lions were captured and marked between March 1972 and February 1982. The age composition was 57 males and 40 females of which 46 were classified as adults, 16 sub-adults, and 35 kittens. Fifty-two of the 97 lions were captured and recaptured 116 times and located 695 times through radio-telemetry monitoring. It was estimated that the average age of first conception for 9 female lions examined was 29 months, with a range of 22-40 months. Prenatal monthly age classes were based on crown-rump measurements and were as follows: 1) first month- 25mm or less; 2) second month- 26-125mm; 3) third month- 126mm or larger. Kittens were born in every month of the year with a June-July peak. Seventy percent of the litters were born during April-September (94 litters) as opposed to 30% born during the remainder of the year (41 litters). The time between litters (N=12) averaged 17.4 months and ranged from 11.5-24 months. Average prenatal litter size (N=36) averaged 3.08 kittens and varied from 1 to 5. It was suspected that the actual birth rate was between 2 and 2.8 kittens due to losses from birth through 12 months of age. It appeared that under moderate to heavy exploitation (30%-50% removal) Nevada lion populations have the recruitment capability of rapidly replacing annual losses. Criteria is provided for a general classification of mountain lion age groups and estimation of age and sex of lions by tooth eruption and wear sequences. Average male adult weight (N=2l) was 137 pounds with a range of 112 to 162 pounds. Average female adult weight (N=13) was 98 pounds with a range of 84 to 115 pounds. The average age of separation of kittens from mothers was 14 months (N=8 family groups) with a range of 10.5 to 19 months of age. Male lions had home ranges 3 times as large as females averaging 224 mi^2 as compared to 69.5 mi^2. Males were observed to fight and were not generally tolerant of each other in regard to intrusions into their home ranges. There were no obvious differences, in regard to home range size between unexploited and exploited lion populations. Two-hundred lion scats were examined and the following food items (listed in approximate order of importance) were found: mule deer, porcupine, cottontail rabbit, jackrabbit, feral horse, beaver, domestic sheep, wood rat, blue grouse, coyote, bobcat, unknown rodents, and elk. The history of livestock depredation in Nevada is presented, especially depredations involving sheep. The lion's classification was changed from unprotected predator to game animal in 1965 and subsequent management protocols are described. Populations were estimated, depending on local circumstances, by analysis of harvest data, track counts, and home range sizes. It was computed that 792 mountain lions occupy 27,811 mi^2 in 104 mountain ranges in Nevada. Harvest quota calculations were made on a sustained yield basis, utilizing a 25% harvest factor which compensates for sport hunting and depredation losses.

Atwood, T.C., E.M. Gese and K.E. Kunkel. 2007. Comparative Patterns of Predation by Cougars and Recolonizing Wolves in Montana's Madison Range. J. Wildl. Manage. 71(4):1098-1106.

Abstract

Numerous studies have documented how prey may use antipredator strategies to reduce the risk of predation from a single

predator. However, when a recolonizing predator enters an already complex predator–prey system, specific antipredator behaviors may conflict and avoidance of one predator may enhance vulnerability to another. We studied the patterns of prey selection by recolonizing wolves (*Canis lupus*) and cougars (*Puma concolor*) in response to prey resource selection in the northern Madison Range, Montana, USA. Elk (*Cervus elaphus*) were the primary prey for wolves, and mule deer (*Odocoileus hemionus*) were the primary prey for cougars, but elk made up an increasingly greater proportion of cougar kills annually. Although both predators preyed disproportionately on male elk, wolves were most likely to prey on males in poor physical condition. Although we found that the predators partitioned hunting habitats, structural complexity at wolf kill sites increased over time, whereas complexity of cougar kill sites decreased. We concluded that shifts by prey to structurally complex refugia were attempts by formerly naïve prey to lessen predation risk from wolves; nevertheless, shifting to more structurally complex refugia might have made prey more vulnerable to cougars. After a change in predator exposure, use of refugia may represent a compromise to minimize overall risk. As agencies formulate management strategies relative to wolf recolonization, the potential for interactive predation effects (i.e., facilitation or antagonism) should be considered.

Aune, K.E. 1991. Increasing Mountain Lion Populations and Human-Mountain Lion Interactions in Montana. Pgs. 86-94 In: Mountain Lion-Human Interaction Symposium, C.E. Braun (ed.), Col. Div. Wildl., Denver. 114pp.

During 1989 and 1990, the number of conflicts between humans and mountain lions (Felis concolor) increased. These encounters included one serious mauling of a 9-year-old boy and the fatality of another boy. The perceived increase in mountain lion populations as a factor in recent interactions with humans was investigated. Information was compiled from 52 case reports of conflicts in 1989 and 1990. Nineteen (36.5%) of the conflicts involved attacks on livestock. Other conflicts included predatory/aggressive behavior toward humans (32.7%), nuisance situations (15.4%), attacks on pets (11.5%), and attacks on humans (3.9%). Age and sex of the animals were ascertained in 29 cases, and 16 carcasses were examined to identify the relative health of offending mountain lions. The examined specimens were healthy but young. The sex ratios of mountain lions that attacked humans were about even (45%F/50%M, n=20), whereas ratios were skewed toward males (20%F/80%M, n=10) in mountain lions that attacked livestock. Potential population indicators such as harvest trend, trend of animal damage complaints, and nonhunting mortality were examined. Harvest trend strongly correlated with license sales (correl. coef. = 90.7, r^2=82.43). All indicators had upward trends for 1971-1990. The relation of these trends to supposed increasing populations is discussed. The hypothesis that increasing mountain lion populations were a significant factor in recent encounters was generally supported. However, critical population survey data are not available for analysis. Other causes for increased conflict, including human encroachment into mountain lion habitat, are discussed.

Austin, M. 2003. Mountain Lion Status Report: British Columbia. Page 87 *in* S.A. Becker, D.D. Bjornlie, F.G. Lindzey, and D.S. Moody, eds. Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming.

Abstract

Mountain lions are classified as “Big Game” in British Columbia under the provincial *Wildlife Act*. There is no provincial mountain lion management plan, however, there is a species account within the provincial Wildlife Harvest Strategy. The harvest management goal for mountain lions is “to optimize population sustainability within ecosystems while allowing for options and opportunities associated with hunting and viewing.” Mountain lions occupy all suitable habitats within BC. The distribution of mountain lions has been expanding northward in recent years due deer population increases resulting from less severe winters. The current provincial mountain lion population estimate is 4,000-6,000 and likely declining after peaking in the late 1990s. Declines are related to the severe winter in 1996/97 that reduced deer populations. Population estimates are based on the “best guesses” of regional biologists based on anecdotal and harvest/conflict information. Confidence in the population estimate is low but we have greater confidence in the trend estimate. Mountain lion hunting is allowed under General Open Seasons in all but two northern regions with negligible populations. There are no explicit harvest criteria or objectives aside from quotas for female harvest in one region. Both harvest and mortalities resulting from conflicts increased from 1985 until 1996 and then declined through 2002. Conservation Officers respond to conflicts with mountain lions through education, translocation or destruction; compensation is not provided for losses. Known mountain lion attacks increased during the 20th century, peaking in the 1990s.

Austin, M. 2005. British Columbia Mountain Lion Status Report. Page 3 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

Mountain lions are classified as “Big Game” in British Columbia under the provincial *Wildlife Act*. Recently, harvest of any spotted mountain lion or any mountain lion in its company has been restricted. Mountain lions occupy all suitable habitats within BC. The distribution of mountain lions has been expanding northward in recent years due to deer population increases resulting from less severe winters. The current provincial mountain lion population estimate is 4,000-6,000 and the trend is believed to be stable. Mountain lion population declines from a peak in the mid-1990s are related to the severe winter in 1996/97 that reduced deer populations. Mountain lion population estimates are based on the “best guesses” of regional biologists based on anecdotal and harvest/conflict information. Confidence in the population estimate is low but we have greater confidence in the trend estimate. Mountain lion hunting is allowed under General Open Seasons in all but one northern region with a negligible population. There are currently no explicit harvest criteria or objectives aside from quotas for female harvest in a portion of one region. Both harvest and mortalities resulting from conflicts increased from 1985 until 1996 and then declined through 2003. Conservation Officers respond to conflicts with mountain lions through education, translocation or destruction; compensation is not provided for losses. Known mountain lion attacks increased during the 20th Century, peaking in the 1990s. A draft harvest management plan has been prepared that includes the use of refugia to ensure conservation of mountain lion populations, defining the role of mountain lions in ecosystems, setting population objectives that are not based on population estimates, standard harvest prescriptions, allowing liberalized harvest in areas where mountain lions are impacting wildlife populations of concern (while also targeting the primary prey of mountain lions) and establishing pursuit-only seasons such that when combined with normal hunting seasons a minimum period is open to either normal hunting or pursuit-only hunting in all regions (i.e. December 1 – March 31). A draft non-detriment finding has been prepared to defend British Columbia’s issuance of export permits for harvested mountain lions under the Convention on the International Trade in Endangered Species of Wild Fauna and Flora. It is speculated that climate change may benefit mountain lions in British Columbia due to milder winters allowing deer populations to increase and reducing mountain lion vulnerability to harvest.

Avila-Villegas, S., R. Martinez-Gallardo, A. Bueno-Cabrera and J. Alaniz-Garcia. 2003. Mountain Lion Predation on Cattle in Sierra San Pedro Martir, Baja California, Mexico. Page 77 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Mountain lion (Puma concolor) is a well studied species in North America; its wide distribution implies a great adaptability to diverse habitats and for prey use. Basic and applied research, which involves rural communities, has sociological, ecological and economic importance, and is useful for generating management plans aimed to reduce conflicts with human activities and economic losses. The study area is located in northwestern Baja California, between 30° 15' 00” and 31° 15' 00” N, and 115 00' 00” and 116 00' 00” W; and is 360,000 ha. approximately. Our aims were to determine the impact of mountain lion predation on livestock. We used scat analysis; surveyed human population to know their relationship and conflicts with wildlife, and generated descriptive maps to identify the potential conflict areas with human activities. From June1999 trough July 2000, we collected 29 scats, and registered mountain lion evidence. Seven food items were identified from hair characteristics; cattle and horse accounted for 50% of the diet; mule deer hair was not found on the scats. We surveyed 28% of land owners to know about their interest and involvement with wildlife, to identify the causes of cattle loses and their recommendations to reduce those losses. Principal causes of cattle loss are drought (23%), predation (23%), rustling (18%) and diseases (15%). Mountain lion and cattle management recommendations were generated according to people needs and researchers opinions; as well as future research topics on mountain lion as a key species in Sierra San Pedro Mártir, Baja California.

Backus, B. 1956. Persistent Reports Brings Us the Mountain Lion. New Jersey Outdoors 6(7):12-13.

The author tells of a local architect from West Englewood, New Jersey, that spotted a mountain lion while pheasant hunting about three miles from Lebanon, New Jersey. A few other reports of mountain lion sightings are mentioned.

Bacon, M.M. and M.S. Boyce. 2008. Ecology of a Re-established Cougar Population in Southeastern Alberta and Southwestern Saskatchewan. Page 244 in Toweill, D. E., S. Nadeau and D. Smith, editors. Proceedings of the Ninth Mountain Lion Workshop, May 5-8, 2008, Sun Valley, Idaho, USA.

Abstract

Cougars (*Puma concolor*) were distributed throughout Alberta historically, but in the early 1900s, likely due to predator control and agricultural expansion, became limited to the southwest region of the province. Not until the late 1990s had cougars begun re-populating their eastern Alberta range, and have now crossed over the Saskatchewan border through Cypress Hills Interprovincial Park, an oasis of forest surrounded by prairie. Formerly carnivore-free, the park supports numerous mammals including an abundant ungulate population, which, prior to the return of cougars, was controlled only by a yearly elk hunt. The expansion of cougars' eastern range means that management and conservation strategies are needed to protect the human, livestock, and wildlife interests of the area. This research project is designed to determine the habitat and prey selection of the newly re-established cougar population in Cypress Hills Interprovincial Park. The objectives are to: 1) determine the composition and distribution of the population of cougars in this region, 2) evaluate the seasonal and human effects on movement and range of the cougars, and 3) determine the composition of prey-including livestock killed by cougars in this region. We will use GPS radio collars to track movement and investigate kill sites. Digital remote cameras and historical aerial survey data will help us assess prey abundance and distribution. We will create habitat models using GPS telemetry data to demonstrate the relative probability of use by cougars of the Cypress Hills landscape. There are currently no management guidelines for cougars in eastern Alberta or Saskatchewan, and as the current laws allow private landowners to kill cougars on their property, it is important to quantify the population of the region so that managers can make informed decisions. Evaluating this isolated population also will help gain an understanding of factors that contribute to the restoration of a large carnivore, and will provide insight into potential expansions of cougars into more eastern parts of North America.

Baker, R.H. 1949. Mountain Lions in Southeastern Texas. J. Mammal. 30(2):199.

The author states that the mountain lion occurs in small numbers and is confined principally to areas bordering the Republic of Mexico and the western mountainous country. An adult male was shot in Colorado County in 1948, and a comparison of the skull showed it was referable to Felis concolor stanleyana Goldman. There had not been any records of the taking of mountain lions in southeastern Texas in recent years.

Bangs, 0. 1899. The Florida Puma. Proc. Biol. Soc. Wash. 8:15-17.

The name Felis coryi sp. nov. was proposed for the Florida puma. The type was taken from the wilderness back of Sebastian, Florida, and general characteristics are described. The Florida puma was restricted to peninsular Florida and could no longer intergrade with any other form. Its long limbs, small feet, and rich ferruginous color are the best characters by which to distinguish it from all other pumas. The Florida puma is huge, but is a little smaller than the Rocky Mountain puma, Felis hippolestes Merriam.

Bank, M.S., R.J. Sarno, N.K. Campbell and W.L. Franklin. 2002. Predation of Guanacos (*Lama guanicoe*) by Southernmost Mountain Lions (*Puma concolor*) During a Historically Severe Winter in Torres del Paine National Park, Chile. Journal of Zoology 258(2):215-222.

Abstract

The effects of mountain lion *Puma concolor* predation on guanaco *Lama guanicoe* mortality was investigated during the historically severe winter of 1995 in Torres del Paine National Park, Chile. The 45 guanaco carcasses located represented 3% of the entire guanaco population of which 74% were mountain lion kills, 13% died from malnutrition, 2% died from fence entanglement and 11% died from unknown causes. Depleted bone marrow fat was observed in 20% of all carcasses. The number of guanaco deaths differed among sex and age classes, particularly in juveniles (< 1 year of age), which died more often than expected ($P < 0.001$). Fresh guanaco carcasses (n= 19) killed by mountain lions were located in tree and shrub habitats 79% of the time and were significantly greater than expected values based on the relative availability of these habitats ($P < 0.001$). Observations of the spatial distribution of mountain lion kills and guanaco mixed-sex groups were similar ($P= 0.10$), suggesting that mountain lions responded to winter migratory movements made by guanacos. Overall, adult guanacos experienced surprisingly lower levels of mortality (adult male = 1%, adult female = 2%) than expected, despite the severe winter conditions, while juveniles experienced higher levels of mortality (13%) than expected. In comparison to other years (1991–96), the severe winter of 1995 (i.e. this investigation) had the greatest total mortality for juveniles, although the proportion of deaths caused by mountain lion predation for juveniles was greatest during other

winters.

Barnes, W.C. 1928. Does the Mountain Lion Scream? American Forests 34(414):340-342.

Differing opinions and historical accounts on determining if the cougar screams are presented. Most accounts indicated that the cougar does scream.

Barnhurst, D., and F.G. Lindzey. 1984. Utah-Cougar Research Report. Pgs. 185-188 In: J. Roberson and F. Lindzey (eds.), Proc. of the Second Mountain Lion Workshop. Utah Div. Wildl. Res. and Utah Coop. Wildl. Research Unit. Zion National Park. 271pp.

The Boulder-Escalante cougar study began in the winter of 1978-79. The study area encompassed 4500km^2 of the Boulder, Canaan, and Escalante Mountains in southern Utah. All sex and age classes are represented in the 38 cougars radio-collared and they had been monitored for a total of 630 cougar months. Average annual home area size for resident adult females was 685km^2 and 826km^2 for males. Resident density was between 0.4 and 0.5 per 100km^2 and this low density may reflect the low density of deer during the study. Several female kittens stayed and established home areas adjacent to or overlapping their maternal home areas whereas there was no evidence that male kittens remained on the study area after gaining independence. A strong fall birth peak was noted. Mule deer comprised 81% of the biomass consumed but only 15% of the animals eaten. It was estimated that a single adult cougar would have to kill and consume 1 deer every 8-16 days to meet their energy demands and that a female with three large kittens would require 1 deer every three days. This amounted to a predicted kill of about 417 deer/year for a population of 8 adult cougars and associated kittens or an average of one deer/week/adult cougar.

Barnhurst, D. 1986. Vulnerability of Cougars to Hunting. M.S. Thesis. Utah State Univ., Logan. 73pp.

Forty radio-collared cougars (Felis concolor) were monitored for 630 cougar months. Track searches were conducted and tracking information was gathered over a 20-month period. Vulnerability was estimated to be greatest for 0 to 6-month-old kittens. This age class is the most susceptible to starvation after being orphaned, or being killed by hounds when the hunter is unaware of their presence, since their tracks were found with their mother's tracks only 19 percent of the time. Tracks of 7 to 12-month-old kittens were found with their mother's tracks 43 percent of the time. Relative road-crossing frequencies of seven classes of transients and resident adults were derived from sequential, aerial telemetry locations. Significant differences ($P < 0.043$) in crossing frequencies were found among these classes. A relative vulnerability index, based on road-crossing frequencies, was calculated for each class. Compared to an average vulnerability index of one for all classes, resident females without kittens, and those with 0 to 6-month, 7 to 12-month, and 13 to 18-month-old kittens, had??? after two years of experimental hunts, where the average density of harvestable cougars (kittens and females accompanied by kittens excluded) was 0.71/100km^2, hunters found an average of 1.3 tracks per day and started their hounds on 1 in 3.8 of these tracks. Treeing a cougar required an average of 8.7 hunting days and covering 559 km of road during track searches. The level of experience of the hunter and his hounds appeared to be very important in determining hunting success. How the differential vulnerability between cougar classes may affect the composition of the hunter harvest was also discussed.

Barnhurst, D., and F.G. Lindzey. 1989. Detecting Female Mountain Lions with Kittens. Northwest Science 63(l):35-37.

Mountain lion (Felis concolor) hunting programs typically include prohibitions against killing females with kittens. It may be difficult, however, for hunters to differentiate females with kittens from other mountain lions because young are often not with their mothers. We investigated the association between female mountain lions and their kittens in southern Utah, using radio-telemetry locations and examination of tracks of females known to have kittens. Females were with their kittens on 67 percent of the occasions radio-collared families were located, but kitten tracks were found with their mother's only 25 percent of the time. Because tracks are the sign most available to hunters, 75 percent of females with kittens would not be recognized. The effectiveness of regulations designed to protect female mountain lions with young is limited by the ability of hunters to identify these individuals.

Baron, D. 2006. The Beast in the Garden: A Case Study of Lions in Suburbia. Pages 132-137 in H.J. McGinnis, J.W. Tischendorf and S.J. Ropski editors. Proceedings of the Eastern Cougar Conference 2004, Morgantown, West Virginia, USA.

Abstract

In the late 1980s, after a decades-long absence, cougars returned in large numbers to Boulder, Colorado, and they quickly adapted to suburban life. Though historically described as timid and nocturnal, the cougars of Boulder wandered backyards at midday, hunted deer among homes, preyed on dogs, and began stalking people. This talk will explore how changes in human attitudes and in the human-dominated landscape caused Boulder's cougars to change their behavior in dangerous ways. Boulder's experience highlights the difficulties many communities now face, or will soon face, as cougars return to their former range and find homes in what was once their habitat.

Barone, M.A., M.E. Roelke, J. Howard, J.L. Brown, A.E. Anderson, and D.E. Wildt. 1994. Reproductive Characteristics of Male Florida Panthers: Comparative Studies from Florida, Texas, Colorado, Latin America, and North American Zoos. J. Mammal. 75(1):150-162.

Testicular volume, semen traits, and pituitary-gonadal hormones were measured in populations of Felis concolor from Florida, Texas, Colorado, Latin America, and North American zoos. More Florida panthers (Felis concolor coryi) were unilaterally cryptorchid (one testicle not descended into the scrotum) than other populations (43.8 versus 3.9%, respectively). Florida panthers also had lower testicular and semen volumes, poorer sperm progressive motility, and more morphologically abnormal sperm, including a higher incidence of acrosomal defects and abnormal mitochondrial sheaths. 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 were detected in mean-circulating follicle-stimulating hormone, luteinizing hormone, and testosterone were similar between cryptorchid and noncryptorchid Florida panthers. Animals with F. concolor coryi ancestry were categorized on the basis of amount of genetic variation (low = type A; medium = type B; high = captive Piper stock). Compared to counterparts, type A Florida panthers had the lowest testicular volume and sperm motility ratings and were the only animals exhibiting unilateral cryptorchidism. These results demonstrate the existence of major morphological and physiological differences among populations of F. concolor, a finding potentially related to differences in genetic diversity.

Barone, M.A., D.E. Wildt, A.P. Byers, M.E. Roelke, C.M. Glass, and J.G. Howard. 1994. Gonadotrophin Dose and Timing of Anaesthesia for Laparoscopic Artificial Insemination in the Puma (Felis concolor). J. Reprod. Fert. 101(1):103-108.

Ovarian response to equine chorionic gonadotrophin (eCG) and human chorionic gonadotrophin (hCG), the effect of timing of anaesthesia relative to hCG injection and the use of laparoscopic intrauterine artificial insemination were examined in the puma (Felis concolor). In Experiment 1, females were treated with 100 (N=6) or 200 (N=8) iu eCG (i.m.) followed 8^0h later by 100 iu hCG (i.m.) and were then anaesthetized 40-43 h after hCG injection for ovarian assessment. Although there was no difference ($P>0.05$) in the number of unovulated ovarian follicles, females treated with 200 iu eCG had more ($P<0.05$) corpora lutea per female and more corpora lutea as a percentage of the total number of ovarian structures. In Experiment 2, all females were treated with 200 iu eCG and 80h later with 100 iu hCG, and then anaesthetized either 31-39 h (Group A; N=8) or 41-50 h (Group B; N=6) after hCG injection for ovarian assessment. All Group B pumas ovulated compared with only three (37.5%) Group A females ($P<0.05$). Compared with Group A, Group B pumas had more corpora lutea per female, more corpora lutea as a percentage of the total number of ovarian structures, and fewer unovulated follicles ($P<0.05$). One of the nine post-ovulatory females laparoscopically inseminated *in utero* with 16×10^6 motile spermatozoa became pregnant and delivered a healthy cub. Administration of 200 iu eCG and 100 iu hCG followed by anaesthesia no earlier than 41 h after hCG treatment is most likely to result in ovulation in pumas, and laparoscopic artificial insemination can be used to produce pregnancy in this species.

Barrett, R.H. 1986. Population Models for Black Bear and Mountain Lion in California. Final Rep., Proj. C-1421. Ca. Dept. Fish and Game, Sacramento. 10pp.

This report documents the construction of preliminary population models for black bear and mountain lion in California. The models are in the form of "templates" or "spreadsheets" for use with 1-2-3 (Lotus Development Corp., Cambridge, MA). The primary use is to predict the response of statewide or regional bear and lion populations to given harvest schemes. Although based on previously published information, it had not been validated by field testing.

Bartnick, T., D. McCarthy, M. Cuthill, D. Reed, H. Quigley and D. Craighead. 2008. Generating an Index of Relative Abundance for Cougars Throughout the Jackson Hole, Wyoming, Area Using Winter Tracking Methods. Pages 245-246 in Toweill, D. E., S. Nadeau and D. Smith, editors. Proceedings of the Ninth Mountain Lion Workshop, May 5-8, 2008, Sun Valley, Idaho, USA.

Abstract

Although traditional techniques of field naturalists are sometimes overshadowed by newer and more technology-intensive methods, slight adaptations in these traditional techniques often can meet the demands of modern wildlife science (Beauvais and Buskirk 1999). Track monitoring on a snow substrate may be a useful method, especially for monitoring rare and wide-ranging mammalian species in northern latitudes where adequate snow conditions may persist for several months of the year. Species found in these areas are generally very difficult to survey with any statistical validity at any other time of the year due to rugged terrain, inconsistent tracking medium, and the ability of many species to traverse through the habitat without leaving easily detectible sign. Species are readily identified by characteristics of tracks (single footprints) and trails (sequences of tracks made by single animals) (Murie 1974). Snow preserves a relatively continuous record of animal movements between successive snowfalls (Beauvais and Buskirk 1999). Furthermore, snow tracking surveys have been used to generate indices of relative abundance for rare or wide-ranging species such as cougars. Managers and researchers have often found it difficult to monitor changes in cougar populations because cougars are largely nocturnal, secretive, and occur at low densities (Beier and Cunningham 1996). The Rocky Mountain region of the western United States and Canada is especially difficult for researchers to successfully conduct reliable surveys of cougar populations. The vast, rugged terrain and expansive, unbroken wilderness found throughout the region make accurate survey results nearly impossible without the allocation of large amounts of time, money, and effort. To monitor cougar populations at the lowest cost, managers have used collaborative data from hunter harvest, depredation rates, and track surveys (Beier and Cunningham 1996). Recent studies have tested the use of remote camera stations (Kelly et al. 2008). Confirmed sightings by the public have also been included in assessing cougar abundance. Several studies have applied and tested the use of snow tracking methods (Choate et al. 2006, Stephens et al. 2006, Beauvais and Buskirk 1999, Hayward et al. 1996, Halfpenny et al. 1995, Van Sickle and Lindzey 1991) for monitoring low-density populations of large carnivores. Those studies have helped determine conditions required to increase the usefulness of such surveys. Two design variables have been determined to explain a high amount of variability in track detection rates: route length and the number of days since the last snowfall (Hayward et al. 1996). These 2 variables play important roles in the accuracy and reliability of survey data.

Bass, O.L. and D.S. Maehr. 1991. Do Recent Panther Deaths in Everglades National Park Suggest an Ephemeral Population? National Geographic Research and Exploration 7(4):427.

In June and July 1991 the last known resident female panthers in the Everglades National Park were found dead after their radio-collars indicated mortality. Although two closely related males remain in and around the Park, the deaths may mean that this segment of the Florida panther population has become effectively extirpated. Mercury appears to have contributed to the death of one female and the other died with a severe bacterial infection and an unknown pathogen as well.

Bates, B. 1988. Status of the Cougar in Utah. Pgs. 32-34 In: R.H. Smith (ed.), Proc. of the Third Mountain Lion Workshop. Arizona Chapter, The Wildlife Society and Arizona Game and Fish Department, Prescott, Arizona. 88pp.

The cougar was bountied in Utah from 1888 until 1960. Animal Damage Control and bounty hunters killed an average of 106 cougars per year from 1913 to 1967. The cougar became a protected animal in 1967 and a license and permit have been required since 1969. All cougars killed must be checked by a Division officer within 48 hours of the kill. Cougars are found statewide except for low desert and salt flat areas in western Utah. It was estimated that 1,070 cougars inhabit 36,869 mi^2 in Utah. Interest in cougar hunting has increased from a low of 92 hunters in 1972 to 662 in 1988. The harvest has averaged 207 per year since 1979. In 1988, 45% of the hunters were guided and took 65% of the harvest. Pursuit seasons allow hunters to chase, but not kill, cougar statewide.

Bates, J.W. 1987. Utah Cougar Harvest, 1985-86. P-R Proj. No. W-65-R-D-34, Job A-7, Publication No. 87-7. Utah Dept. Nat. Resources.

There were 503 cougar permits sold in 1985-86, compared to 562 in 1984-85 and 529 in 1983-84. Utah residents purchased

369 permits and 134 were bought by non-residents (28% non-resident). Questionnaires or harvest reports were received from 345 hunters, or 69%. Nine percent of residents who obtained permits and 1% of non-residents did not hunt, resulting in 469 hunters afield, compared to 488 in 1984-85, and 484 in 1983-84. Hunters spent 3,785 days attempting to take cougar in 1985-86. Hunters harvested 200 cougars. Residents harvested 113 (34% success) and non-residents harvested 92 (69% success). Non-residents were significantly more successful than were residents (P=0.999). Non-residents were also more likely to use a guide; of those who returned questionnaires, 96 were guided and 9 were not. All non-residents harvesting a cougar used a guide. Only 61 residents responding to the questionnaire used guides, while 136 did not. Two-thirds of the residents harvesting a cougar did not use a guide. Those using guides, both residents and non-residents, took significantly more cougar than those who did not (P=0.999). Fifty-two percent of the total hunters used guides and harvested 73% of the cougars. Adult males dominated the harvest, accounting for 45% of the total harvest. Adult females comprised the smallest portion of the harvest, representing 17%. Overall the harvest consisted of 65% males and 62% adults. There was no significant difference in harvest of different age or sex classes by residents versus non-residents, or guided versus non-guided (P=0.25). As expected, the majority of the harvest by sportsmen occurred in January, February, and March. Snow conditions for tracking lions and running hounds are best at that time. About 85% of the sportsmen harvest occurred during this period. This represents a shift to a later harvest, a result of delaying the opening from November to January. Depredating cougars taken by Animal Damage Control were removed 10 months of the year, with an early summer peak. Although hunter success was only 43%, the majority of cougar hunters had an opportunity to take a cougar. Of 469 hunters, 425 (90%) treed or cornered at least one cougar. An estimated total of 1,772 cougars were treed or cornered by hunters and holders of pursuit permits in 5,247 hunter days. It took an average of three days for each cougar treed. The Nebo and Fish Lake units had the most cougars treed in them, 214 and 157 respectively. Those were the units that received the most use by hunters as well. There were 90 pursuit permits sold in 1986. Of these, 49 returned questionnaires and 48 pursued cougar. Ninety percent of those who pursued treed at least one cougar. A projected total of 549 cougars were treed in 1,470 pursuit days, or 0.373 treed per day. Animal Damage Control harvested 19 depredating cougar in 1985-86. One was also taken by a livestockman with a depredation permit. Age of the cougars was not reported, however, 10 were reported as male and 10 as female. The total of 20 cougar taken for depredation was the highest since 1978 when 26 were taken.

Baudy, R.E. 1976. Breeding Techniques for Felines Destined for Release in the Wild. Pgs. 99-108 In: Pritchard, P.C.H., (ed.), Proc. Florida Panther Conf., Orlando, Florida. 121pp.

For the previous 26 years, the Rare Feline Breeding Station in Center Hill, Florida, studied the captive behavior of 23 species and subspecies of Felidae and successfully reproduced all but three. It was believed that any of these species could be favorably introduced to the wild providing the following conditions were met: 1) The conditions, but not the raising, must be done in large enclosures with an absolute minimum of human contact or exposure. A suggested enclosure requirement for a trio of Florida panthers would be about 5 acres; 2) The young would have to be exclusively raised by the mother; 3) The mother should be allowed, at least twice weekly, to display her own stalking and killing techniques to the young; 4) Culling of the species must be done by an expert breeder to duplicate the harsh, natural elimination of the unfit in their native environment. Beside a thorough field study, the capture, measurement, tagging and examination of blood, urine and feces samples of at least five different wild-caught specimens from widely separated areas would have to be accomplished prior to any detailed planning of captive or semi-captive management of the Florida panther.

Bauer, J.W., K.A. Logan, L.L. Sweanor and W.M. Boyce. 2003. Are Pumas Opportunistic Scavengers? Page 124 *in* S.A. Becker, D.D. Bjornlie, F.G. Lindzey, and D.S. Moody, eds. Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming.

Abstract

We examined scavenging on mule deer (*Odocoileus hemionus*) carcasses by pumas (*Puma concolor*) in the Peninsular Ranges of Southern California. Between 23 January 2001 and 21 November 2002, a total of 42 deer carcasses from road kills, depredation permits, and euthanized deer were used to determine scavenging events. Seventeen of 42 deer carcasses (40.5%) were scavenged by 7 to 10 different pumas. Two of the scavenging pumas (males) were previously telemetered, while 4 pumas (3 male, 1 female) were captured and instrumented at the scavenging site. Telemetered pumas ranged in age from 11 months to 9 years. Deer carcasses were found and scavenged by pumas within 1 to 14 days, when carcass conditions ranged from fresh to rotting and maggot infested. Pumas treated scavenged carcasses as they would their own kills, dragging untethered carcasses to preferred sites and caching, as well as depositing scats and making scrapes in the area. However, pumas did not always attempt to cache tethered carcasses. During the course of our fieldwork we also

discovered that one telemetered puma was repeatedly visiting a domestic livestock graveyard and scavenging on surface-discarded horse and cattle carcasses. While pumas are known to be opportunistic predators, our results would suggest that they are opportunistic scavengers as well. Due to pumas' propensity to scavenge, it is likely that some perceived puma kills may in fact be scavenging events. Frequent monitoring and timely field investigation of mortality signals detected from telemetered prey species will help investigators identify those events. Scavenging behavior should be considered when evaluating or predicting the effects of puma predation on prey species.

Bauer, J.W., K.A. Logan, L.L. Sweanor and W.M. Boyce. 2005. Scavenging Behavior in Puma. Southwest Naturalist 50(4):466–471.

Abstract

We examined scavenging on mule deer (*Odocoileus hemionus*) carcasses by puma (*Puma concolor*) in the Peninsular Ranges of San Diego County, California. Between January 2001 and October 2003, we placed 44 deer carcasses at 23 sites and used them to examine scavenging events. We also documented 2 additional deer carcasses, not placed as bait, that were scavenged by puma. Eight to 12 puma (6 males, 2 to 5 females, and 1 of unknown sex) scavenged 20 of 46 deer carcasses (43.5%) at 12 of the 25 sites. Six puma (4 males, 2 females) were captured 7 times at scavenging sites. We identified 7 scavenging puma (5 males, 2 females) through captures and telemetry, and 1 unmarked, scavenging male from a camera trap. The 7 telemetered puma that scavenged ranged in age from 11 months to 9 years, and each individual scavenged on 1 to 6 deer (mean = 2.3). Deer carcasses were found and scavenged by puma from 1 to 14 days (mean = 5 days) after deposition, when carcass conditions ranged from frozen and fresh to rotting and maggot infested. Puma treated scavenged carcasses as they would their own kills, dragging carcasses to preferred sites, caching, depositing scats, and making scrapes in the area. However, puma did not always attempt to cache tethered carcasses. During fieldwork, we also discovered that 1 telemetered puma repeatedly visited a domestic livestock graveyard and scavenged on surface-discarded horse and cattle carcasses. Puma are known to be opportunistic predators, but our results indicate that they are opportunistic scavengers as well. Due to the propensity of puma to scavenge, it is likely that some perceived kills might be scavenging events. Frequent monitoring and timely field investigation of mortality signals detected from telemetered prey species will help investigators identify those events. Scavenging behavior should be considered when evaluating or predicting the effects of puma predation on prey species.

Bavin, R. 1976. Mountain Lion Research. Proj. No. W-93-18, Work Plan 15, Job 1. New Mexico Game & Fish Dept. 8pp.

SUMMARY

Eight lions were captured during the past segment, three males and five females. Six of these lions were captured with dogs, and two were caught in snares. Of the three males captured, one died from infection and another died from a punctured lung, which resulted from a broken rib sustained while fighting the snare in which he was captured. The remaining six lions (1 male, 5 females) were radio collared and released. Radio tracking furnished a total of 150 air-to-ground lion locations and 12 ground locations. Since the time of release, three of the radio collars have quit working. Home range data resulting from the air and ground locations has been plotted on a master map of the study area. Adult male number 27 was located 65 times from the air and twice from the ground since his capture on January 10, 1976. Until June 5, 1976, he had confined his movements to an area south of state highway 90. Starting in June, he has made three trips north of the highway into country that he had not previously occupied. No other adult males are known to presently utilize this area. He has also made one long trip approximately 15 miles southeast of his normal range. Prior to this expansion to the north, his normal home range covered an area of about 55 to 60 square miles. Adult female number 28, captured on February 10, 1976 has been located 36 times from the air. She has been utilizing a home range of approximately 40 to 50 square miles. She has also made several trips outside of her primary home range area. Adult female number 29 was captured on January 11, 1976 and 23 air locations were made before her radio malfunctioned in early March. During that time, her home range was estimated to cover an area of close to 40 square miles. Adult female number 31, captured on April 21, 1976 has been located 18 times from the air and seven times from the ground. She is known to have two cubs traveling with her, and has been using a home range of about 16 square miles. Insufficient locations were made on the other lions before the radios quit to be able to predict the size of their home ranges. The home ranges that are being developed do not show a significant amount of overlap for the four lions which have had functional radio collars. The home ranges for these lions have all been separated from each other. Some degree of overlap has been indicated, but the data collected to date has not been sufficient to make any estimate of overlap. The observation of tracks in the areas known to be used by collared lions indicate

that there is some overlap in home ranges with lions that are not presently radio collared. An attempt will be made to capture some of these individuals in an effort to fill in some of the home range data. One radio collared female is known to have two young cubs traveling with her within her home range. All of the other radio collared females do not have cubs. Two other uncollared female lions within the study area are known to have young cubs traveling with them. Only one attempt at monitoring the activity of a collared lion over a 24 hour period was made during this segment, with fair success. Activity is also recorded for each time that a ground location is made. It appears that a problem that may arise in the collection of activity data is that of being able to stay within radio range of the lion during the night. Twenty lion prey kills were located on the study area during this segment. Sixteen of these were mule deer, 2 hereford calves, 1 porcupine, and 1 gray fox. Two of the mule deer kills were attributed to radio collared lions, one to male number 27 and one to female number 31. Of the mule deer kills, five were bucks, 6 does, 2 fawns of the year, and three were unclassified. Most of the kills were too completely consumed or decomposed when located to allow an accurate determination of the animals condition at the time of death. However, no indications of any malformations or poor condition were found in any of the kills.

Bavin, R. 1978. Mountain Lion Research (1976-77). Performance Report. Proj. No. W-124-R-l, Job 1. New Mexico Dept. of Game and Fish. 5pp.

SUMMARY

Two lions were captured during this segment, one juvenile female and one adult male. Four tagged lions were recaptured to replace malfunctioning radio telemetry collars. Two radio-collared lions were lost to the study due to death. There were a total of 272 air locations and 49 ground locations, for a total of 321 locations during this segment. Female #28 was the only lion that was radio-tracked on a continuous basis throughout this study segment. She was observed to utilize a total area of roughly 145 square miles although her monthly movements were generally confined to an area of 40-70 square miles within this total home range area. Her movements had been consistent with those observed during the previous segment. Female #31 was the only radio-collared lion known to have cubs. It was observed that, as the cubs increased in age, her home range increased in size to the north. During this segment, the overlap among the home ranges for the three radio-collared adult females was quite considerable and all used an area of approximately 35 square miles. In addition, a male lion also used much of this same area. Only 123 hours of activity data was collected during this segment. It appeared that the normal daily activity pattern for an adult lion consisted of active movement beginning around 1600 and continuing through most of the night, with the lion generally becoming inactive around 0700-0800 in the morning and generally remaining inactive throughout the daylight hours. Twelve lion prey kills were located on the study area during this segment. Eleven of these were deer and one was a Hereford calf. Of the deer kills, one was an adult buck, eight were unclassified adults, one female fawn, and one unclassified fawn.

Beausoleil, R.A. 2003. Status of the Mountain Lion in New Mexico, 1971-2000. Pages 14-21 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

The mountain lion (Puma concolor) is an important species in New Mexico. A long-range plan for mountain lion management in New Mexico was developed in 1997. New Mexico currently conducts 2 mountain lion control programs. There were 156 (58F, 98M) mountain lion pelts tagged from 63 game management units during the 1999-2000 hunt season. Hunter survey cards, implemented since the 1984-85 hunt season, have provided New Mexico Game and Fish (NMDGF) with information to aid in managing cougar populations. Currently, NMDGF is designing a population study to estimate the statewide mountain lion population using a DNA technique. The NMDGF received $100,960 in revenue from mountain lion hunting license sales during the 1999-2000 license year.

Beausoleil, R.A., K.I. Warheit and D.A. Martorello. 2005. Using DNA to Estimate Cougar Populations in Washington: A Collaborative Approach. Pages 81-82 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

To better understand population dynamics of cougars, wildlife managers need long-term data sets collected using standard methods. Short-term studies, while useful for management, are only “snapshots in time”, and provide little information about

year-to-year variability and long-term status. Given that it is unlikely WDFW would successfully undertake a statewide census of cougars, it is imperative that an effective sampling regime be developed to estimate population size. The objectives of this project were to acquire a population estimate for cougars in northeast Washington, address management goals for effective cougar management, and to test the efficacy of using DNA techniques to estimate cougar population size. The 5,480 km^2 project area in northeast Washington was chosen because it represents a region that has been designated as a reduction zone (i.e. the public would like to see a reduced cougar population); being able to identify the decrease in the population without reducing it to collapse is imperative. Also, this region is close to another project area where cougars are being captured to estimate population demographics. Therefore, it provides a means of corroborating estimates and, if successful, a valuable link for estimating cougar abundance and demographics in NE Washington. Between 15 November and 31 December 2003 and 2004, approximately 15 hound handlers were deployed throughout the project area to tree cougars using hounds and obtain tissue samples using a biopsy dart fired from a CO_2-powered rifle. Three biopsy dart types were tested during the first year of the project, a 1.5 and 2.0 cm biopsy tip that used barbed broaches to retain the tissue sample, and a 2.0 cm tip- that used a crimped barrel to retain the sample. Within the project area, each hound handler was assigned a specific work area with an identifiable border (i.e. roads or rivers) and required to work a minimum of 20 days. By doing so, we insured that the entire project area was sampled equally and each animal had the same opportunity of capture. There was no physical handling required and once the biopsy sample was retrieved, all research personnel immediately left the area while the cougar was still in the tree (in some instances, the animal jumped and ran off after being sampled). We referred to these initial samples as the “capture-period” samples, and the individuals from whom the samples were taken as “marked” individuals. The “recapture” period (i.e., the general hunting season) immediately followed this “capture” period to ensure a relatively high probability that these “marked” cougars were in the area and available for “recapture”. During the hunt season, WDFW personnel collected tissue samples from all known cougar mortalities via a mandatory reporting/sealing system. To confirm that WDFW obtained samples from all “marked” cougars that were killed during the hunting season (i.e. to account for possible emigration), samples were collected from an area approximately 5-times the size of the initial project area (~25,000 km^2). Upon completion of the hunting season, all cougar DNA samples from both "capture" and "recapture" sessions were sent to WDFW's DNA lab for analysis. The tissue samples were analyzed using microsatellite analysis. In this project, the fingerprint analysis consisted of positively identifying 36 alleles (2 alleles x 18 loci) for each tissue sample. Samples that did not produce at least 30 alleles were censored. A comparison was made to determine how many individuals made up each sample and if any individuals were in both samples. In 90 days of "capture" sampling over the two year period, the hound handlers retrieved 96 cougar samples. Of those 96 samples, 69 (72%) samples were uniquely identifiable and 54 individuals were identified. However, the success rate (i.e. efficiency) of identifying the necessary number of alleles increased from 60% success in 2003 to 89% in 2004. This was due to a superior design dart being identified during the first year and used exclusively in the second. Therefore, increased efficiency is likely to continue in subsequent years. During the "recapture" sessions, 182 samples were retrieved, of which 164 (90%) were uniquely identifiable. Thirty-two cougars were killed within the project area over the two-year period and 6 were "marked". While that supported the use of a closed-population estimator such as Lincoln-Petersen for a within-year estimate, the recapture rate of "marked" individuals was too low to generate a population estimate (i.e. <7 recaptures). Nonetheless, we can say for sure that, within 1 year (before the hunt), there was a minimum of 44 unique individuals occupying the project area equating to a density of .80 cougars/ 100 km^2. No emigration was observed. As many as 28 cougars still remain "marked" on the landscape and will contribute to future within- and across-year population estimates. Continuation of this project can answer important questions including: What is the cougar population size in northeast and north-central Washington? Is this DNA monitoring technique a good technique for cougars? Is the precision of the method consistent with WDFW's management needs? And, if so, are management objectives being met? The longer the project is conducted, the smaller the confidence intervals will be around the population estimate, thus producing a robust estimate of population size and reduced bias.

Beausoleil, R.A. and D.A. Martorello. 2008. Washington Mountain Lion Status Report. Pages 18-22 in Toweill, D. E., S. Nadeau and D. Smith, editors. Proceedings of the Ninth Mountain Lion Workshop, May 5-8, 2008, Sun Valley, Idaho, USA.

Abstract

This status report focuses on cougar management developments since the 8th Mountain Lion Workshop. Readers

interested in regulations, seasons, harvest statistics, or status and trend reports can obtain that information online by visiting Washington Department of Fish and Wildlife's internet website at:
http://www.wdfw.wa.gov/hunting/game_species/bear_cougar/index.html

Beausoleil, R.A., K.A. Warheit, W. Chang, D.A. Martorello and J.D. Pierce. 2008. Using DNA to Estimate Cougar Populations: a Collaborative Approach. Pages 160- 161 in Toweill, D. E., S. Nadeau and D. Smith, editors. Proceedings of the Ninth Mountain Lion Workshop, May 5-8, 2008, Sun Valley, Idaho, USA.

Abstract

To better understand population dynamics of cougar, agency managers need long-term data sets collected using standardized methodologies. Short-term studies, while useful for management, are only "snapshots in time", and provide little information about year-to-year variability or long-term status. Nonetheless, wildlife agencies are typically only able to conduct population estimation projects for 5 years or less because of expenses associated with current research methodologies. The objectives of this project were to: (1) acquire a scientific population estimate of cougars in northeast Washington; (2) test the efficacy and practicality of using DNA capture techniques to estimate cougar population size; (3) manage project costs to allow agencies interested in the technique to potentially conduct the research for decades. We used a capturerecovery methodology but instead of using conventional markers (i.e., radio collars, eartags and tattoos), we used DNA from tissue samples collected from treed cougar as our "capture" and DNA samples collected from harvested cougar as our "recovery". We tested 5 biopsy dart types from 3 different manufacturers to collect the samples from treed cougars. For the "capture" sample, volunteer hound handlers were deployed throughout the project area between 01 November and 31 December (2003-current) to tree cougars using hounds and obtain a DNA sample via a biopsy dart and CO2 powered rifle. There was no physical handling required and once a sample was retrieved, the cougar was immediately left in the tree. Each hound handler was assigned to a specific portion of the project area and each was required to work 20-25 days within the allotted timeframe. The "recovery" phase immediately followed the "mark" period (01 January to 31 March) each year. During the hunting season agency personnel collected a tissue sample from all cougar mortalities statewide via a mandatory reporting system. DNA from both samples was analyzed using micro-satellite analysis. The DNA fingerprint analysis consisted of positively identifying 28-36 alleles (14-18 loci) for each tissue sample. Samples that did not produce a minimum of 14 loci were censored. We extracted the specified number of loci from 128 of 163 cougar samples resulting in identification of 100 individual cougars in the "capture" sessions. In the "recovery" sessions, over 62 tissue samples were collected and analyzed from within the project area. Sixteen of the 62 recoveries were previously "captured". We used Program MARK to estimate population size, which resulted in an average within-year population estimate of 43 cougars (CI 34-58) or 0.87 (CI = 0.65-1.1) cougars per 100km^2. Over the 4 years, it appears that the cougar population has declined. The cost of the DNA project in year 1 was $24,110. However because that included microsatellite plates (a one-time expense) and CO2 rifles and biopsy darts (both re-usable), the cost for the following 3 years was $10,885 per year. We believe the technique was successful at generating reliable, repeatable population size estimates at an affordable cost. As such, we believe it may be a useful technique for other cougar managers to utilize.

Beier, P. 1991. Cougar Attacks on Humans in the United States and Canada. Pg. 3 In: Mountain Lion-Human Interaction Symposium, C.E. Braun (ed.), Col. Div. Wildl., Denver. 114pp.

I examined historical records of unprovoked attacks by cougars on humans in the U.S. and Canada during the last century (1890-1990) to determine historical trends and characteristics of victims and attackers. Nine attacks on humans were fatal and at least 41 were nonfatal. Attacks on humans increased markedly during the last 2 decades, during which cougar density and human use of cougar habitats also increased. Most victims (62%) were children; the modal age class was 5-9 years. Of 34 child victims, 28% were alone, 50% were in groups of children, and 22% were accompanied by adults; 9 of 15 adult victims (57%) were alone at the time of attack. Half of 26 offending cougars were estimated to be 12-23 months old. Eight of 10 attacking yearlings, 2 of 8 attacking adults, and 2 of 3 attackers of unknown age were markedly underweight. Aggressive responses by intended victims may avert an impending attack and repel an attack in progress.

Beier, P. 1991. Cougars, Corridors, and Conservation. Pg. 23 In: Mountain Lion-Human Interaction Symposium, C.E.

Braun (ed.), Col. Div. Wildl., Denver. 114pp.

SYNOPSIS

Human developments nearly surround the cougar (Felis concolor) population in the Santa Ana Mountain Range, threatening to isolate it from other populations in southern California. The Santa Margarita River is the last potential corridor for immigration and emigration. From April 1988 through April 1989, adult males were absent from the southern half of the range and none of the females reproduced. A computer simulation model was built to evaluate the probability of population persistence in the remaining 1,554 km^2 of habitat. The model predicted frequent vacant territories for adult males and complete absences of adult males about six times per century, temporarily halting reproduction until juvenile males matured. However, the model predicted the population would not go extinct. Human developments also threaten to reduce and fragment the remaining habitat. As the area of habitat decreased to about 906 km^2, the model usually predicted extinction, brought on by the absence of males. However, if even one male per decade immigrates into the population, the model predicted population persistence in as little as 518 km^2 of habitat. The result suggests that preservation of the Santa Margarita River corridor is important for conservation of this population. Movement corridors in the Santa Ana Mountain Range are also important because without them, human developments will continue to isolate large areas of otherwise suitable habitat, making these areas useless to cougars. Large-scale land use planning is weak at the county level and nonexistent at the regional level. County plans, like the plans mandated for federal lands under the National Forest Management Act (NFMA) and the Federal Land Policy and Management Act (FLPMA), often specify how many hectares are given to each use, but usually fail to specify which hectares and how the residual wild areas will be connected. As a result, wildlife reserves in the U.S. have increasingly become islands of habitat, isolated in human-dominated, high-speed landscape. To reverse this trend, future planning should be integrated with a Geographic Information System to create a vision of the desired landscape. Because the cougar is a wide-ranging animal, capable of generating large amounts of data on movement corridors, and because it is an area-sensitive species, biological information from mountain lion research is ideal for planning development. For example, data from over 100 24-h radio-tracking sessions defined many travel routes of cougars in the Santa Ana Mountains. If the local transportation agency uses these data in the routing and design of the planned 21-km Foothill Freeway, the agency can minimize harm to the cougar population and provide corridors for many other plant and animal species as well.

Beier, P. 1991. Cougar Attacks on Humans in the United States and Canada. Wildl. Soc. Bull. 19:403-412.

SUMMARY

I examined historical records of unprovoked attacks by cougars on humans in the U.S. and Canada during the last century (1890-1990) to determine historical trends and characteristics of victims and offending cougars. There were 9 attacks resulting in 10 human deaths and at least 44 nonfatal attacks. Attacks on humans increased markedly during the last 2 decades, during which cougar numbers and human use of cougar habitats also increased. Most victims (64%) were children; the modal age class was 5-9 years. Of 37 child victims, 35% were alone, 43% in groups of children, and 22% were accompanied by adults; 11 of 17 adult victims were alone at the time of attack. The data suggest that yearlings and underweight cougars were most likely to attack humans. Aggressive responses on the part of intended victims may avert an impending attack and repel an attack in progress.

Beier, P. 1993. Puma: A Population Simulator for Cougar Conservation. Wildl. Soc. Bull. 21(3):356-357.

The author describes a computer program, PUMA, which simulates cougar population dynamics and quantifies the risk of extinction for small populations under various scenarios. Intended as a teaching tool, users can examine the importance of both biological factors and land-use decisions.

Beier, P. 1993. Determining Minimum Habitat Areas and Habitat Corridors for Cougars. Cons. Biol. 7(1):94-108.

I simulated population dynamics of cougars to predict the minimum areas and levels of immigration needed to avoid population extinction caused by demographic and environmental stochasticity for a period of 100 years. Under most plausible parameter values, the model predicted very low extinction risk in areas as small as 2200 square km, and (in the absence of immigration) increasing risk as area decreased below 2200 square km. If as few as one to four animals per

decade could immigrate into a small population, the probability of population persistence increased markedly. Thus a corridor for immigration will benefit a small population in an area where further loss of habitat will occur. The model was applied to the cougar population in the Santa Ana Mountain Range of southern California (2070 square km, with about 20 adults). Field data support the model's conclusion that this population is demographically unstable. There will be a high risk of extinction if the habitat is reduced to currently protected and connected areas (1114 square km). A movement corridor allowing immigration from the adjacent population and intra-range corridors would greatly enhance the prognosis. However, the last corridor for immigration has been degraded by recent human activity. Within the mountain range, cougars recently became extinct in a 75 square km habitat fragment recently isolated by development, and cougars will become extinct in another 150 square km of habitat if a proposed housing project occludes a critical corridor. Radio tracking has confirmed use of this and other important corridors. Neither the model nor the field data alone would have much influence in the face of development pressure; together they have stimulated interest in restoring and protecting critical corridors in this range. Nonetheless, the long-term prognosis for this population is bleak, because 22 local governments review potential impact on a case-by-case basis.

Beier, P. 1995. Dispersal of Juvenile Cougars in Fragmented Habitat. J. Wildl. Manage. 59(2):228-237.

There is little information on the spatiotemporal pattern of dispersal of juvenile cougars (Felis concolor) and no data on disperser use of habitat corridors. I investigated dispersal of radio-tagged juvenile cougars (8 M, 1 F) in a California landscape containing 3 corridors (1.5, 4.0, and 6.0 km long) and several habitat peninsulas created by urban growth. Dispersal was usually initiated by the mother abandoning the cub near an edge of her home range. The cub stayed within 300 m of that site for 13-19 days and then dispersed in the direction opposite that taken by the mother. Mean age at dispersal was 18 months (range 13-21 months). Each disperser travelled from its natal range to the farthest part of the urban-wildland edge. Dispersing males occupied a series of small (<30% the area used by ad M in the same time span), temporary (10-298 days) home ranges, usually near the urban-wildland interface, and often with its longest border along that edge. Each of the 3 corridors was used by 1-3 dispersers, 5 of the 9 dispersers found and successfully used corridors, and 2 dispersers entered but failed to traverse corridors. Dispersing cougars will use corridors that are located along natural travel routes, have ample woody cover, include an underpass integrated with roadside fencing at high-speed road crossings, lack artificial outdoor lighting, and have <1 dwelling unit/16 ha.

Beier, P., D. Choate and R.H. Barrett. 1995. Movement Patterns of Mountain Lions During Different Behaviors. J. Mammal. 76(4):1056-1070.

We used radiotracking and other observations to describe nocturnal movement patterns of mountain lions (Felis concolor) during six different behaviors and attempted to estimate behavior rates by inference by such patterns. When hunting, mountain lions apparently stalked or sat in ambush for periods averaging 0.7 h and then moved a mean distance of 1.4 km (over 1.2 h) to another area; this pattern repeated about six times on nights when no prey was killed. When a mammal was killed, this pattern was suspended until the carcass was consumed (4-6 h for a small mammal, 2-5 days for a large mammal). When feeding on a large mammal, mountain lions minimized spoilage and loss to scavengers by dragging the kill 0-80 m to a cache site, burying the carcass under leaves and debris during the daytime, and feeding only at night. Mountain lions increased the risk of loss to scavengers by locating diurnal rest sites up to 4.2 km (mean = 400 m, SD = 787) from the carcass. Mating associations lasted 2-5 days, during which mountain lions travelled little, vocalized frequently, and apparently did not feed. Mothers of neonates hunted from dusk to midnight and then returned to the den; mothers spent increasing amounts of time at greater distances from the den during the first 8 weeks after giving birth. Dens were located in nearly impenetrable vegetation and den sites lacked feces, prey remains, or modifications of the site. On average, an adult mountain lion killed ca. 48 large and 58 small mammals/year and fed for an average of 2.9 days (S.D. = 1.1) on a single large mammal. Although movement patterns differed markedly among behaviors, discriminant functions failed to accurately predict behavior from movement patterns.

Beier, P., and S.C. Cunningham. 1996. Power of Track Surveys to Detect Changes in Cougar Populations. Wildl. Soc. Bull. 24(3):540-546.

Little is known about the ability, or statistical power, of track surveys to detect a change in abundance of cougars (Puma concolor). We examined monitoring schemes that would have 80% power to detect a 30% or 50% change in track abundance between 2 survey periods. We used data from track transects in southeastern Arizona to evaluate survey

designs for 8-km transects in first- and second-order dry washes. Track density (number of 0.5-km segments with tracks along an 8-km transect) followed a Poisson distribution, with no serial correlation between consecutive surveys of a given transect. We used simulated Poisson data to determine how power varied in response to number of 8-km transects, risk of Type I error, direction of change (increase or decrease), magnitude of change (30% or 50%), and whether track density between surveys changed uniformly or patchily across transects. Power decreased only slightly when change in track density was patchy. Track transects had low power to detect increases in track density (e.g., about 190 transects would be needed to detect a 30% increase with 80% power and " = 0.05), but somewhat more power to detect decreases (about 140 transects would detect a 30% decrease with 80% power at " = 0.05). Managers can increase the power of surveys (or decrease the number of transects) if a 10-20% risk of Type I error is acceptable, i.e., about 140 transects would be needed to detect a 30% decrease in track density with 80% power at " = 0.05, 110 transects at " = 0.10, and 85 transects at " = 0.20. If surveys need to detect only large decreases (50%), track surveys are more powerful, with only about 50 transects needed for 80% power at " = 0.05, and 30 transects at " = 0.20. Thus, track surveys usually will not detect small annual changes, but may reveal large changes more efficiently than other methods.

Beier, P. and K. Penrod. 2003. Using Cougars to Design a Wilderness Network in California's South Coast Ecoregion. Page 149 *in* S.A. Becker, D.D. Bjornlie, F.G. Lindzey, and D.S. Moody, eds. Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming.

Abstract

The groundbreaking "Missing Linkages" report published in fall 2001 (www.scwildlands.org) identified over 200 linkages needed to prevent isolation of wildlands in California. South Coast Wildlands Project (SCWP) immediately spearheaded an effort to prioritize, protect and (where necessary) restore linkages in the South Coast Ecoregion. SCWP first assessed the ecoregion's 69 linkages with respect to biological irreplaceability (size and quality of core areas served by a linkage were important criteria) and vulnerability (to urbanization and roads). This process identified 15 linkages as top priorities. We are now in the process of conducting a series of action workshops for each linkage. At the first workshop, local biologists, government agencies and conservation NGO representatives developed lists of focal species and ecological processes that a linkage is intended to serve. Thus, although carnivores helped to initially identify important linkage areas, we are designing each linkage to serve broader biodiversity goals. Our personnel are researching the needs of the focal species, obtaining high-resolution photographs and parcel maps, and conducting field visits. One or more linkage designs will be presented at a second workshop, where participants will volunteer for various tasks (e.g., procuring easements, acquiring land, changing zoning, restoring habitat, or mitigating transportation projects) to preserve and enhance the linkage. By partnering with agencies and NGOs from the start rather than developing a plan on our own and asking others to unite under us, our effort has attracted funding and cooperation from diverse sources and is making rapid progress.

Beier, P., M.R. Vaughan, M.J. Conroy, and H. Quigley. 2003. An Analysis of Scientific Literature Related to the Florida Panther. Final Report. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida, USA.

Abstract

We critically reviewed scientific literature on Florida panthers to identify strengths and weaknesses of existing research, and to recommend future analyses and research priorities. A quarter-century of research strongly supports many published conclusions, including that forests are important as daytime rest sites of panthers, that white-tailed deer and feral hogs are the most important panther prey, that the most important threats to panther persistence include limited habitat area and continued habitat loss and fragmentation, and that recovery of the panther depends most critically on establishing additional populations outside of south Florida. For about a century, loss of fitness due to erosion of genetic material was also a serious threat to the panther population. The genetic outcrossing program begun in 1995 seems to have remedied this problem for now; we recommend rigorously documenting this apparent success as a service to conservation science. Research on juvenile dispersal by Florida panthers ranks among the most detailed for any large carnivore species. Although panther numbers have been estimated only once and only in one study area, we believe that obtaining a rigorous estimate of population size would drain resources from more important research needs.

On the other hand, we also found poorly supported inferences. The conclusions that panthers prefer large forest patches and are reluctant to travel from forests are unreliable because the analyses excluded (without mention or rationale) a large fraction of the available data, ignored errors inherent in telemetry data, and did not rigorously compare used habitats to

habitats available to the radio-tagged panthers. Reanalysis of existing data can address most issues related to habitat use. The conclusion that Everglades National Park and most of Big Cypress National Preserve are poor habitat for panthers is not scientifically supported; future performance of panthers in these areas will resolve this issue. Population Viability Analyses (PVA) conducted to date have used relatively inflexible software, and the most recent PVA used an unwarranted estimate of 80% annual survival of newborn panthers. We recommend analysis of existing data to estimate vital rates and variation in those rates.

Finally, some important aspects of research have received insufficient attention in recent years. Despite some early and meritorious experimental work on panther reintroduction, during the last decade progress has lagged on ecological and social research needed to reintroduce panthers outside of south Florida. Biomedical data have apparently been collected, but have not yet been analyzed to determine if mercury prevalence, and panther condition and reproduction, have continued to follow trends suggested a decade ago.

To guide the re-analysis of existing data on contentious issues (such as habitat preference), we recommend that stakeholders develop research protocols in a workshop setting. To address the longer-term issues of future research and monitoring, the Scientific Review Team recommends the creation of a Scientific Steering Committee that would be encouraged to communicate directly with the public, and to which researchers, agency employees, and other stakeholders would have direct access. As an appendix to this report, we provide an annotated bibliography of literature on the Florida panther.

Beier, P., M.R. Vaughan, M.J. Conroy and H. Quigley. 2006. Evaluating Scientific Inferences about the Florida Panther. J. Wildl. Manage. 70(1):236-245.

Abstract

At the request of the U.S. Fish and Wildlife Service (USFWS) and the Florida Fish and Wildlife Conservation Commission (FWC), we provide an independent assessment of the reliability of the scientific literature used to support conservation of Florida panthers (*Puma concolor coryi*). We independently reached similar conclusions about unreliable scientific inferences before discussing the issues with each other or with others. Although a quarter-century of research supports many published conclusions, 2 sets of unreliable inferences may compromise efforts to conserve the species. The first is a set of 4 unreliable inferences that underlie the Panther Habitat Evaluation Model (PHEM), used by agencies to evaluate projects that may affect panther habitat. Specifically, the following assertions are unreliable: 1) panthers are forest obligates, 2) panthers require large (>500 ha) forest patches, 3) panthers are reluctant to cross 90-m gaps of nonforest habitat, and 4) the value of potential panther habitat declines linearly with distance to a population core in south Florida, USA. These assertions are unreliable because the analyses excluded (without mention or rationale) almost half the available data, compared used habitats to an inappropriate set of available habitats, made inferences about habitat preference without any data on available habitats, were based only on panther locations during daytime, ignored telemetry error, or suffered from other flaws. The second is a set of 2 unreliable inferences about panther demography prior to the genetic restoration effort initiated in 1995. Inferences that neonate survival was ≥0.84 and that the panther population was demographically vigorous prior to 1995 are flawed because the survival analysis ignored mortality during the first 4 months and because other inferences were based on numbers of births and deaths in samples of convenience rather than appropriate vital rates. These faulty inferences about panther demography brought unwarranted credibility to challenges of the genetic restoration program. Faulty inferences of both sets were repeated in subsequent scientific and popular articles; in several instances, previously published work was mis-cited. In its current (2002–2005) version, PHEM is unreliable and should not be used in decisions about panther habitat. Biologists should obtain better demographic estimates and fully analyze how the introgression program has affected these rates.

Belant, J.L., S.E. Yancho and K.S. Struthers. 2006. Does the Cougar Inhabit Sleeping Bear Dunes National Lakeshore? Natural Areas Journal 26(4):370-375.

Abstract

Increasing numbers of cougars (*Puma concolor*) have been documented in Great Plains and Midwestern states in recent years. This includes numerous reports of cougars in Michigan; however, evidence of a natural population has not been obtained. We conducted track surveys and operated camera stations from November 2004 through April 2005 in Sleeping

Bear Dunes National Lakeshore (SBDNL), Michigan. We obtained no images of cougars during 863 camera nights and did not observe cougar tracks or associated sign (e.g., scats, hair, kill sites) during 493 km of track surveys. Presence of 10 carnivore species, including bobcat (*Lynx rufus*), coyote (*Canis latrans*), and domestic dog (*Canis familiaris*) was documented. We also investigated four cougar sightings and one report of cougar tracks within and adjacent to SBDNL. We were unable to locate any cougar sign at the sighting locations but did observe sign of coyote and bobcat. A domestic dog made the reported cougar tracks. We found no evidence supporting the presence of cougars at SBDNL.

Belden, R.C., and L.E. Williams, Jr. 1976. Survival Status of the Florida Panther. Pgs. 78-92 In: Proceedings of the Florida Panther Conference, P.C.H. Pritchard (ed.), Orlando, Fl. 121pp.

This paper summarizes the few recent definite panther records in Florida and makes recommendations for the establishment of a clearinghouse for Florida panther records. Confirmed reports were in two categories, the first of which was dead or live-captured specimens and secondly, plaster track casts, photographs of panthers or their tracks, or other documented Panther sign. Unconfirmed reports were divided into two categories as well and a fifth "observation" category that contained completely uncredible reports and was considered of no value. Only seven "confirmed records" were filed and four represented category 1 records. Twenty-nine "unconfirmed reports" were filed. Using only confirmed records, it appeared that there were probably 20 or fewer panthers remaining in Florida. It was felt that the six captive reared panthers released in the Everglades National Park at various times since 1964 accounted for a large portion of the observations in south Florida. It was believed that Florida panthers are mainly in the north and south-central parts of the state. A clearinghouse will be established in the Wildlife Management Laboratory for the keeping of all Florida panther records. Instructions and a standard form were developed for recording panther observations. These instructions give procedures to follow when panthers or sign are seen as well as how to make a plaster cast of tracks.

Belden, R.C. 1977. If You See a Florida Panther. Florida Wildlife 31(3):31-34.

As early as 1832, even before Florida became a state, a law was passed which permitted a panther bounty to be paid by the county courts. An 1887 law authorized a statewide bounty of $5.00 for panther scalps. When deer were nearly eradicated in lower Florida in the 1930's to control the fever tick, panthers strayed from their normal haunts in search of prey. This resulted in more hunting pressure by ranchers and almost lead to their final doom. Partial protection was given to the panther in 1950 and panthers could only be hunted during the open season for deer and panthers found destroying livestock could be taken by special permit at any time. The panther was given complete legal protection in 1958. Human commercial developments and long term economic projects have continually encroached upon the diminishing critical panther habitat. It is not known if a viable or reproducing population of panthers still occurs in Florida. Systematic field searches and a Florida Panther Record Clearinghouse are attempting to locate any extant panther populations. The smallest track of a free-ranging panther is 2-3/4 inches which is larger than even the largest bobcat track. There has never been any conclusive evidence to prove that there has ever been a black panther in Florida. If the prey of the panther is a deer, the killing bite will be on the back of the neck or the base of the skull--the canine tooth holes will be two inches apart. The bobcat attacks by leaping on the animal and riding it while biting into the throat to suffocate it or sever the jugular vein and the canines are only one inch apart at most.

Belden, R.C. 1978. How to Recognize Panther Tracks. Proc. Ann. Conf. S.E. Assoc. Fish & WildI. Agencies. 32:112-115.

Experience in investigating panther (Felis concolor coryi) reports showed that most people, including wildlife biologists, cannot readily and accurately distinguish panther tracks from those of other species, particularly from large dogs. Characteristics by which to identify panther tracks are presented.

Belden, R.C. 1978. Florida Panther Investigations. Progress Rep., Florida Game and Fresh Water Fish Commission, Tallahassee.

The Florida Game and Fresh Water Fish Commission initiated a Florida panther investigation in October, 1976, by establishing a Florida panther record clearing house to investigate panther reports and conduct special field searches. At least one panther population was found in the vicinity of the Fakahatchee Strand, Big Cypress Swamp, and the Everglades National Park. Additional studies were required to determine its geographic limits and to determine whether it is truly viable in the sense that it contains the necessary number and age and sex structures for continued existence.

Belden, R.C. 1978. Florida Panther Investigation-- a 1978 Progress Report. Pgs. 123-133 In: R.R. Odum and L. Landers (eds.), Proc. of the Rare and Endangered Wildl. Symposium. Ga. Dept. Nat. Resour. Tech. Bull. WL4, 184pp.

The Florida Game and Freshwater Fish Commission initiated a Florida panther investigation in October 1978 by establishing a Florida Panther Record Clearinghouse, investigating panther reports and conducting special field searches. At least one panther population was found in the vicinity of the Fakahatchee Strand, Big Cypress Swamp, and the Everglades National Park. Additional study is required to determine its geographic limits and to determine whether it is truly viable in the sense that it contains the necessary number and age and sex structure for continued existence.

Belden, R.C., and D.C. Forrester. 1980. A Specimen of Felis concolor coryi from Florida. J. Mammal. 61(1):160-161.

The carcass of a 44-kg sub-adult male panther which was illegally killed in the Big Cypress Preserve was confiscated on March 12, 1978 in Homestead, Florida. The specimen was taken within the area in Collier and Dade Counties for which there was evidence of their continued existence. Measurements for the specimen are provided and it was noted that the testes contained spermatogonia, but no spermatozoa were present. The stomach contained 770 grams of hair and pieces of bone from Odocoileus virginianus and Dasypus novemcinctus, leaves of wax myrtle and bald cypress and an unidentified monocot, either a grass or a sedge. The skull, hide, and skeleton were deposited in the Florida State Museum (UF-1939).

Belden, R.C. 1981. It Was The Hunt of a Lifetime. Florida Wildlife. May-June.

The author initiated the Florida Game and Fresh Water Fish Commission's panther investigation in October 1976. Attempts were being made to capture two panthers, attach radio transmitter collars, and track the panthers to gain information on specific habitat needs. Highly specialized cat dogs were utilized to track the panthers and the first one (a male) was captured and radio-collared on February 10, 1981. This capture, tranquilization, and related procedures are described in detail. On February 20, 1981, the capture team radio-collared a second male panther.

Belden, R. C., and J.C. Robosky. 1984. Florida Panther Status Report. Pgs. 29-36 In: J. Roberson and F. Lindzey (eds.), Proc. of the Second Mountain Lion Workshop. Utah Div. Wildl. Res. and Utah Coop. Wildl. Research Unit. Zion National Park. 271pp.

The Florida Panther (Felis c. coryi) is considered to be Florida's most endangered species with an estimated population of 30-50 animals. The only documented breeding populations are in South Florida from Lake Okeechobee southward, primarily in the Big Cypress and Everglades regions. A bounty existed in Florida as early as 1832 (even before Florida became a state). In 1950, panthers could only be hunted during open season for deer and could be taken when found destroying livestock by special permit at any time. Complete protection was granted in 1958 and the panther became an official endangered species in March of 1957, at which time the Florida Panther Recovery Team was appointed. The Florida Panther Technical Advisory Council was established by the 1983 Florida State Legislature. In 1982, the Florida Panther was proclaimed the state animal of Florida by the school children. Since 1976, 12 panther deaths had been documented; five were road kills, four were illegally taken, two died of unknown causes, and one died during a recapture operation. A "Florida Panther Record Clearinghouse" was established in 1976 which disseminated information into "confirmed" and "unconfirmed" report categories and which complemented systematic field searches for mountain lion sign. Most of the valid evidence came from Lake Okeechobee southward. The Big Cypress Swamp/Everglades region remained relatively inaccessible to man until the late 1940's. Most of the region was logged and this, coupled with wildfires, created ideal habitat for deer until the forest canopy began closing in the mid 1960's. The panther population boomed at this time and most of the panthers that exist today are offspring of this time period. The construction of Alligator Alley (State Highway 84) in 1966-67 led to eventual relatively unlimited access to the area which left very little wilderness. Eight research studies which are to be conducted by the Florida Game and Fresh Water Fish Commission's Florida Panther Recovery Plan Implementation Project are outlined.

Belden, R.C., J.C. Robosky, and D.K. Jansen. 1984. Florida Mountain Lion Research. Pgs. 149-166 In: J. Roberson and F. Lindzey (eds.), Proc. of the Second Mountain Lion Workshop. Utah Div. Wildl. Res. and Utah Coop. Wildl. Research Unit. Zion National Park. 271pp.

There were eight studies involved in the Florida Game and Fresh Water Fish Commission's Florida Panther Recovery Plan

Implementation Project. This paper describes these studies and lists the objectives of each project.

Belden, R.C. and W.B. Frankenberger. 1985. Panther Population Survey (July 1 1984 - June 30 1985). Annual Performance Report, Study No. E-I-09 II-E-1, Florida Game and Fresh Water Fish Commission. 9pp.

The Florida Game and Fresh Water Fish Commission initiated a Florida panther investigation in October 1976 by establishing a Florida Panther Record Clearinghouse, investigating panther reports, and conducting field searches. At least one panther population was documented in the Big Cypress/Everglades physiographic region. The number of panther reports generated appears to be more a function of the number of people in an area and their activity patterns rather than related to panther density or activity. The primary usefulness of sighting reports is in assigning priorities to areas to be searched for field sign. Priorities are given to areas in Florida that should be field searched based on information gained in this study.

Belden, R.C., W.B. Frankenberger, S.T. Schwikert, and B.H. Williams. 1985. Status of the Panther in Flagler and Volusia Counties, Florida. Appendix 1, Panther Population Survey (July 1 1984 - June 30 1985). Annual Performance Report, Study No. E-1-09 II-E-1, Florida Game and Fresh Water Fish Commission. 8pp.

A covered deer kill was discovered near Rima Ridge Road, approximately five miles north of US 92, Volusia County, Florida and showed all the characteristics of being killed by a panther. This study describes the presence, geographic limits, and viability of any panther population in this area. Approximately 474 man-hours were expended along 1,394 miles (2,243 km) searching woods roads and fire lanes from May 1984 through April 1985. No panther sign of any kind was found, however, panther tracks were found on August 10, 1984 in the Relay Wildlife Management Area by officials conducting a deer track count survey. This location was approximately 11 miles northwest of the March 31, 1984 panther sign found on the Lighter Knots Hunt Club area and was determined to have been the tracks of the same animal. The study area did not appear to be a suitable reintroduction site.

Belden, R.C. 1986. Distribution, Habitat Preferences, and Activity Patterns of the Florida Panther. Pg. 7 In: Survival of the Florida Panther; A Discussion of Issues and Accomplishments. W.V. Branan (ed.), Florida Defenders of the Environment. 67pp.

The Florida Game and Fresh Water Fish Commission initiated a Florida panther investigation in October 1976 by establishing a Florida Panther Record Clearinghouse, investigating panther reports, and conducting field searches. In February 1981, a study was initiated to determine the feasibility of capturing, radio-instrumenting, and tracking panthers in Florida, and a full scale radio-telemetry project was subsequently begun in January 1982. It appears that the number of panther reports generated is more a function of the number of people in an area and their activity patterns rather than related to panther density or activity. At least one population of Florida panthers has been documented in the Big Cypress/Everglades physiographic region. It is estimated that 30-50 animals remain at this time. In this area, panthers have large home areas (range = 276-766 km for males and 103-302 km for females), and tend to select habitats that offer thick cover (mixed swamps and hammocks) in association with their primary prey (white-tailed deer). There is considerable overlap in ranges, but the animals are not located together except when mating. During this time, they are promiscuous. During the winter they appear to move almost as much in the daytime as at night, but in the summer they normally do not move very much in the daytime. Individuals on occasion move as much as 30 kilometers overnight or at other times stay in the same location for a week or more. Panthers frequently cross highways and swim canals or move from one tree-island to another.

Belden, R.C. 1986. Florida Panther Recovery Plan Implementation- A 1983 Progress Report. In Cats of the World: Biology, Conservation, and Management. S.D. Miller and D. Everett (eds.). National Wildlife Federation, Wash. D.C.

The Florida Panther Recovery Team was appointed by the U.S. Fish and Wildlife Service in July 1976 to prepare and assist in coordinating the implementation of a recovery plan for the Florida panther. The step-down outline for the plan was completed in October 1976. The goal of the plan is to prevent the extinction and re-establish viable populations of Florida panthers in as much of the former range as is feasible. Three objectives are identified to attain this goal: to find and maintain any existing populations of Florida panthers, to improve public opinion and behavior regarding the existence of Florida panthers, and to re-establish populations where feasible. In the past 7 years, progress has been made toward the

accomplishment of these objectives. Activities include the operation of a Florida Panther Record Clearinghouse, investigating sighting reports, field searches for panther sign, radio-telemetry studies to determine movements and habitat preferences, food habits studies, public education programs, and evaluation of present regulations and land management policies.

Belden, R.C., and D.S. Maehr. 1986. Florida Panther Food Habits. Perf. Rep., Study No. E-1-10 II-E-3. Florida Game and Fresh Water Fish Commission. Tallahassee. 2pp.

Florida panther (Felis concolor coryi) scats continue to be collected and a few kills have been located as a result of field searches. Deer, hog, and raccoon continue to be the main prey items. Geographic location of scats may not reflect meal origins.

Belden, R.C., T.C. Hines, and T.H. Logan. 1986. Florida Panther Re-establishment, A Discussion of the Issues. Florida Game and Fresh Water Fish Commission. 13pp.

It is the intent of the Florida Game and Fresh Water Fish Commission to re-establish at least one experimental population of Florida panthers (Felis concolor coryi) in northern Florida. The best way to determine if an area is suitable for panthers is to introduce panthers into it and monitor their behavior. Because of the endangered status of Florida panthers, these preliminary evaluations will be done using a sterilized non-endangered subspecies. The two primary methods to be considered in obtaining stock for re-establishment are the translocation of adult or subadult animals directly from the wild to the reintroduction area and the translocation of wild caught stock into captivity where they may be bred to produce properly conditioned offspring for introduction into the wild. Major issues that are addressed are: (1) genetic quality of the reintroduction stock, (2) the availability of suitable areas for re-establishment, (3) landowner attitudes and management priorities, and (4) public attitudes and concerns.

Belden, R.C., T.C. Hines, and T.H. Logan. 1986. Florida Panther Re-establishment- A Discussion of the Issues. Proc. 6th National Wildlife Rehabilitators Assoc. Symp., Clearwater Beach, Fl. 6:115-123.

This paper describes the Florida Game and Fresh Water Fish Commission's plans regarding the re-establishment of at least one experimental population of panthers in Florida. Panthers exist and reproduce in the Big Cypress and Everglades Physiographic Regions of South Florida. Periodic occurrences have been documented in areas as far north as Glades County east to Palm Beach County and most recently along the St. Johns River drainage. The Commission intends to re-establish at least one experimental population of taxonomically "pure" Florida panther (Felis concolor coryi) in northern Florida. Preliminary studies indicate that Florida panthers are seriously inbred resulting in low genetic diversity and it may be biologically prudent to introduce outside genetic material into existing populations. This could mean the loss of funding from the Endangered Species Act. The suitability of habitat outside of South Florida will be determined by introducing non-endangered subspecies into suitable prioritized areas. The estimated minimum area needed for re-establishment was 518 km^2 (200 mi^2), which does not take into account area needed for expansion by offspring. The total deer population necessary on the 518 km^2 minimum area would be 430-593 or 9 deer per 87-121 ha (216-298 acres). If one or more of the females had yearlings with her, the number of deer required would rise to 430-1416 or a deer per 36-121 ha (90-298 acres). Wild hogs (Sus scrofa) would also be utilized as prey and would take some of the pressure off deer. Sites for re-establishment should have little or no human use, low human populations, and low densities of roads. Eight panthers had been killed on hard-surfaced roads in South Florida in the past 6 years. Landowner attitudes and management priorities must be considered when choosing reintroduction sites. Public attitudes and fears must be examined and public education efforts should be directed toward improving public acceptance of the program. Two primary methods in obtaining panther stock for re-establishment were discussed. These were: 1) translocation of adult or subadult animals directly from the wild to the area of reintroduction and (2) the translocation of wild-caught stock into captivity where they may be bred to produce properly conditioned offspring for introduction to the wild. The most time-consuming, but more conservative, approach would be to first capture kittens in the wild and hand-raise them for use as breeding stock. Studies in South Florida indicate that if a female loses her kittens, she will recycle and produce a second litter. Conditioning techniques will include training in the killing of prey animals and the avoidance of man. After proper conditioning, they would be sterilized and released into suitable areas and monitored and evaluated. Once the best alternative has been determined, appropriate Florida panthers would be captured for translocation or for use in the captive breeding program.

Belden, R.C. 1987. Florida Panther Captive Breeding/Reintroduction Feasibility. Perf. Rep., Study E-1-11 II-E-7 (7507). Florida Game and Fresh Water Fish Commission. Tallahassee. 14pp.

In order to re-establish populations where feasible, Florida panther (Felis concolor coryi) stock will have to be introduced into suitable habitat where re-establishment is socially and ecologically sound from the standpoint of the human population. Panther habitat evaluation criteria were developed for use in evaluating tracts of land for their potential as panther reintroduction sites. Captive breeding facilities were built at White Oak Plantation and the captive male Florida panther was moved to these new facilities. Three female mountain lions from Texas were brought to Florida for use as surrogates in the captive breeding project. The study is on schedule.

Belden, R.C. 1988. The Florida Panther. Pgs. 514-532 In: W.J. Chandler (ed.) Audubon Wildlife Report 1988-89. National Audubon Soc., NY, NY. 817pp.

Panther kittens are gray with dark brown or blackish spots and have 5 bands around the tail. White flecks of hair appear on the shoulder and neck and sometimes on the back of the head only on the pelage of the adult. This seems to be age related and is possibly the result of scar tissue forming at the site of a tick bite (Ixodes sp.). A whorl or "cowlick" at the middle of the back appears in both sexes from birth. The third from the last vertebrae in the tail is reduced in size, slightly curved, and angled at 90 degrees from the preceding vertebrae (crooked tail). The last two vertebrae are reduced in size with the last one apparently vestigial and appears in both sexes from birth. Mature males and females weigh an average of 120 pounds and 75 pounds, respectively. Males and females measure nearly 7 feet and 6 feet, respectively, from the nose to the tip of the tail. The skull possesses a distinctive shortened rostrum and corresponding expanded and inflated nasals ("Roman" nose). In the previous 10 years, 13 panthers had been hit by motor vehicles on highways, with 10 fatalities. In addition, 7 panthers were illegally shot (5 mortalities) and 2 died as a result of intraspecific aggression, 2 died of unknown causes, and one was a capture-related mortality. Neonatal and early juvenile mortality is possibly occurring and it was hypothesized that most were due to starvation, diseases, and parasites, and possibly by adult male panthers which kill and occasionally eat young kittens. Twenty species of parasites have been found in Florida panthers and all examined have shown infections with at least 6 species. Analysis of panther scats revealed that white-tailed deer, wild hogs, and raccoons are the principal prey items. Panthers feeding primarily on small mammals were underweight, anemic, and possessed a lower reproductive rate than those feeding on a diet of primarily large prey. A female with three cubs which are one year old would require a deer approximately every three days to fulfill her energy needs and those of her young. The mixed swamp and hammock forests of southern Florida are used to a greater extent by the Florida panther. Historically, the Florida panther has been viewed as a dangerous animal that needed to be exterminated or controlled due to its threat to livestock and people. The history of the panther in Florida and habitat loss is presented. The current estimated population of 30-50 animals are equally distributed on public and private lands. It appeared that the major factor limiting panther numbers in south Florida was the availability of suitable habitat. The Florida Game and Fresh Water Fish Commission's management plans and objectives are presented. Panther reintroduction is discussed and recovery plan recommendations are stated.

Belden, R.C., W.B. Frankenberger, R.T. McBride, S.T. Schwikert. 1988. Panther Habitat Use in Southern Florida. J. Wildl. Manage. 52(4):660-663.

We captured six Florida panthers (Felis concolor coryi) in southern Florida and radiolocated them 1630 times from February 1981 through August 1983. Mean home area for four males and two females was 435 ± 231 (SE) km^2 and 202 ± 141 km^2, respectively. Mixed swamp forests and hammock forests were used more than expected based on the availability of these habitats within the panthers' home areas. Based on the availability of mixed swamp forests and hammock forests, we estimate that south Florida can support 30-40 panthers. The major factor limiting the panther population in south Florida appears to be availability of suitable habitat.

Belden, R.C. 1988. Florida Panther Reintroduction Feasibility Study. Pg. 52 In: R.H. Smith (ed.), Proc. of the Third Mountain Lion Workshop. Arizona Chapter, The Wildlife Society and Arizona Game and Fish Department, Prescott, Arizona. 88pp.

Maintaining existing Florida panther (Felis concolor coryi) populations is the top priority in the recovery effort, however, successfully reintroducing Florida panthers into other areas of suitable habitat would help reduce the risk of extinction for the subspecies. In order to re-establish populations where feasible, Florida panther stock will have to be introduced into suitable

habitat where re-establishment is socially and ecologically sound from the standpoint of the human population. The best way to determine if an area is suitable for panthers is to introduce panthers into it and monitor their behavior. Because of the endangered status of Florida panthers, these preliminary introductions need to be done using a non-endangered subspecies as a surrogate. Two methods being evaluated for obtaining panther stock for re-introduction are the translocation of adult or subadult animals directly from the wild to the reintroduction area and the translocation of wild caught stock into a captive breeding program with the properly conditioned offspring being introduced into the wild. Five mountain lions (Felis concolor stanleyana) were captured in west Texas and brought to Florida to be used as surrogates in evaluating the feasibility of translocating panthers. They were surgically sterilized, fitted with radio-transmitter collars, released, and monitored on a daily basis. Two Florida panthers and three Texas mountain lions were maintained at the captive breeding facilities at White Oak Plantation. Although these animals have adapted well to these facilities, no kittens have been produced. An attempt was made this year to impregnate the females with embryo transplants.

Belden, R.C., B.W. Hagedorn, and W.B. Frankenberger. 1989. Florida Panther Captive Breeding/Reintroduction Feasibility. Perf. Rep., Study No. E-1-13 II-E-7. Florida Game and Fresh Water Fish Commission, Tallahassee. 47pp.

Seven mountain lions (Felis concolor stanleyana) captured in west Texas and brought to Florida for use as surrogates in evaluating the feasibility of translocating panthers (F. c. coryi) were monitored on a daily basis through April of this year. These lions established overlapping home ranges, made kills of large prey at a predicted frequency and generally adapted well to their new environment prior to the hunting season. Once the hunting season began, however, the lions were either killed or disturbed to the extent that they left their established home ranges. Subsequent wanderings resulted in their encountering urban areas and livestock operations that probably would not have otherwise been encountered. We cannot recommend the introduction of Florida panthers into north Florida at this time, but recommend further study to develop techniques for successfully establishing viable populations that are compatible with the ever-expanding human environment. A Florida panther male, two captive born male cougars, and 3 female Texas mountain lions were maintained at the captive breeding facilities at White Oak Plantation. No kittens have been produced.

Belden, R.C., B.W. Hagedorn, and W.B. Frankenberger. 1990. Panther Captive Breeding/Reintroduction Feasibility (July 1, 1985 - June 30, 1990). Final Performance Report. Study No. 7507, Federal No. E-1 II-E-7. Florida Game and Fresh Water Fish Commission. 62pp.

Potential panther (Felis concolor) habitat evaluation forms were mailed to Florida Game and Fresh Water Fish Commission Division of Wildlife biologists. Those returned were grouped by major areas, and the scores were averaged for each characteristic and overall for each area. The Apalachicola National Forest and surrounding area and the Okefenokee National Wildlife Refuge/Osceola National Forest and surrounding area were considered the two best candidate sites for panther reintroduction feasibility studies. Seven mountain lions (F.c. stanleyana) were captured in west Texas and released into the Okefenokee National Wildlife Refuge/Osceola National Forest and surrounding area. Those animals were brought to Florida for use as surrogates for evaluating the feasibility of translocating panthers (F.c coryi). They were monitored on a daily basis from 15 June 1988 to 19 April 1989. These lions set up overlapping home ranges, made kills of large prey at a predicted frequency, and adapted well to their new environment before the hunting season. Once the hunting season began, however, the lions were either killed or disturbed to the extent that they left their established home ranges. Subsequent wanderings resulted in their encountering urban areas and livestock operations that probably would not have otherwise been encountered. These encounters necessitated the early removal of study animals. We can not recommend the introduction of Florida panthers into north Florida at this time, but recommend further study to develop techniques for successfully establishing viable populations that are compatible with the ever-expanding human environment. A Florida panther male and female, two captive born male cougars, and 3 male and 3 female Texas mountain lions were maintained at the captive breeding facilities at White Oak Plantation. No kittens were produced.

Belden, R.C., W.B. Frankenberger, and J.C. Roof. 1991. Florida Panther Distribution. Final Report. Study No. 7501, Fed. No. E-l II-E-1. Florida Game and Fresh Water Fish Commission. Tallahassee. 26pp.

The Florida Panther Record Clearinghouse received 4,620 panther (Felis concolor) reports from October 1976 through June 1990. Supporting evidence was supplied with only 404 of the reports. Ninety-one of these proved conclusively to be from panthers. Field surveys were conducted on 52 areas. During these surveys 4,427+ man hours were spent searching in excess of 15,219 km of dirt roads, trails, and firelanes. Panther sign was found consistently in south Florida and sporadically

along the St. Johns River watershed. The only resident breeding population of panthers in Florida occurs in the Big Cypress and Everglades physiographic region, primarily in Dade, Collier, and Hendry Counties.

Belden, R.C., B.W. Hagedorn, and W.B. Frankenberger. 1991. Responses of Translocated Mountain Lions to Human Disturbance. Pg. 26 In: Mountain Lion-Human Interaction Symposium, C.E. Braun (ed.), Col. Div. Wildl., Denver. 114pp.

Seven mountain lions (F.c. stanleyana) were captured in west Texas and released into the Osceola National Forest and surrounding area, Columbia County, Florida. These animals were brought to Florida as surrogates for evaluating the feasibility of reintroducing native mountain lions (F.c. coryi). They were monitored daily from 15 June 1988 to 19 April 1989. These mountain lions set up overlapping home ranges, killed large prey at a predicted frequency, and adapted well to their new environment before the hunting season. When the hunting season began, however, the mountain lions were either killed or disturbed to the extent that they left their established home ranges. Subsequent wanderings resulted in their encountering urban areas and livestock operations that they probably would not have otherwise encountered. These encounters necessitated the early removal of study animals. Plans to reintroduce the Florida panther into as much of its former range as feasible will have to address both human disturbance on panther populations and the potential threats of panthers to humans.

Belden, R.C. and B.W. Hagedorn. 1993. Feasibility of Translocating Panthers into Northern Florida. J. Wildl. Manage. 57(2):388-397.

Seven mountain lions (Felis concolor stanleyana) captured in western Texas were released in northern Florida and used as surrogates for evaluating the feasibility of translocating Florida panthers (Felis concolor coryi). Using radio telemetry, they were monitored daily, except Sundays, from 15 June 1988 to 19 April 1989. The lions established overlapping home ranges, killed large prey at a predicted frequency, and settled into routine movement and feeding patterns before the hunting season. However, during the hunting season the lions were either killed, or they abandoned their home ranges. Subsequent wanderings into urban areas and livestock operations necessitated the early removal of study animals. We cannot recommend the introduction of Florida panthers into northern Florida at this time. Instead, we recommend further study of techniques for establishing viable populations that are compatible with the expanding human population.

Belden, R.C., W.B. Frankenberger and J.C. Roof. 1994. Florida Panther Distribution. Proc. Florida Panther Conference, D.B. Jordan, Editor. Ft. Myers, Florida. Florida Panther Interagency Committee.

Abstract

The Florida Panther Record Clearinghouse received 4,620 panther (*Felis concolor*) reports from October 1976 through June 1990. Supporting evidence was supplied with only 404 of the reports. Ninety-one of these proved conclusively to be from panthers. Field surveys were conducted on 52 areas. During these surveys 4,427+ man-hours were spent searching in excess of 15,219 km of dirt roads, trails, and firelanes. Panther sign was found consistently in south Florida and sporadically along the St. Johns River watershed. The only resident breeding population of panthers in Florida occurs in the Big Cypress and Everglades physiographic region, primarily in Dade, Collier, and Hendry Counties.

Belden, R.C. and J.W. McCown. 1994. Florida Panther Captive Breeding/Reintroduction Feasibility. Proj. No. E-1 II-E-7, Study 7507. Final Report. Florida Game and Fresh Water Fish Commission. 48pp.

Eight additional mountain lions were released into northern Florida during this reporting period. These included 5 females and 3 males. Three of these additional mountain lions were born in captivity at Gillman Paper Company's White Oak Plantation near Yulee, Florida, and were released with their mothers. These animals were radio-monitored 3 days/week (M, W, F) and daily during the first 9 days of the general gun hunting season. An initial stocking of at least 10 mountain lions can be used to establish a population in northern Florida. The 7 animals that remained in northern Columbia County, FL, established a social structure, and, if the males had not been sterilized, nearly all of the females would be raising kittens as of the end of this reporting period. The captive-raised mountain lions appear to have adapted more quickly and easily to the study area.

Belden, R.C. and J.W. McCown. 1997. Feasibility of Using Captive-Raised Mountain Lions for Establishing Populations. Page 84 *in* W.D. Padley, ed., Proc. Fifth Mountain Lion Workshop: 27 February- 1 March 1996; San Diego, California.

Abstract

Nineteen mountain lions (*Puma concolor stanleyana*) were released into northern Florida as surrogates for evaluating the feasibility of reintroducing Florida Panthers (*P. c. coryi*) into unoccupied areas of their historic range. These included 11 females and 8 vasectomized males. Six of the released mountain lions were born and raised in captivity at Gillman Paper Company's White Oak Plantation near Yulee, Florida, 10 were captured in the wild in western Texas and translocated to Florida and 3 were captured in the wild in western Texas and held in captivity in Florida for 2-8 years prior to release. Animals were monitored using radio-telemetry at least 3 days/week from 22 February 1993 to 30 June 1995. Fifteen lions established one or more home ranges. Nine (60%) home ranges overlapped one or more other home ranges. This population was made up of predominately captive-born and wild-caught/captive-held animals in an area that varied in size from 127 to 418 km^2 (1.5 to 3.1 lions/100 km^2). Mountain lions that established home ranges outside of this population had a higher excursion rate than did animals within it. Excursions were more frequent during the breeding season than during the rest of the year. Captive-raised animals tended to establish home ranges more quickly and were more likely to be in association with other animals than were wild-caught animals. However, captive-raised animals, particularly males, were more likely to be seen and caused most of the human/lion interactions that created negative attitudes toward the program. The mean distance from the release site to the home range center and the mean home range size were significantly greater for wild-caught males. Reestablishment of additional Florida panther populations is biologically feasible. It would require incorporating the advantages and planning around the disadvantages of both captive-raised and wild-caught translocated animals. However, it must first be decided whether the tremendous costs involved (economical, political, social, etc.) in the reestablishment of additional Florida panther populations can be offset by the benefits gained in reducing the risk to the present Florida panther population due to random fluctuation.

Belden, R.C. and R.T. McBride. 2005. Potential for Florida Panther Range Expansion into Central Florida. Page 85 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

Following the success of genetic restoration in 1995, the documented Florida panther *(Puma concolor coryi)* population has tripled. This population is currently located on 8903 km^2 of' public and private land south of the Caloosahatchee River in southern Florida. Whether or not panthers can expand this population north of the Caloosahatchee River into central Florida is of obvious importance for the continuation of panther recovery. The objectives of this study were to determine the occurrence and status of panthers in central Florida and to evaluate the potential for expansion. Field surveys were conducted in 53 areas in 13 counties. Results of the survey concluded that a resident breeding population of panthers does not currently exist in central Florida. Even though some suitable panther habitat remains in central Florida, it is widely scattered and fragmented into small tracts. Dispersing males from the southern Florida population have immigrated into central Florida, but natural recolonization has been frustrated by an absence of females. Major highways and urban or agricultural development isolate the remaining small tracts of suitable habitat, which is rapidly being lost to the same development that threatens southern Florida. The larger segments of remaining panther habitat could possibly support several isolated small populations, but the viability of these populations without periodic translocations are questionable. The certainty of highway mortalities, coupled with an increase in politically sensitive interactions between panthers, humans, and small livestock, may prove insurmountable for population expansion.

Benson, D.E. 1991. Bridging Philosophy and Management for Lions and People. Pgs. 83-85 In: Mountain Lion-Human Interaction Symposium, C.E. Braun (ed.), Col. Div. Wildl., Denver. 114pp.

Proactive management can help redistribute mountain lions (Felis concolor) away from people and people away from mountain lions, and can effect having people and mountain lions live together harmoniously. Humans and mountain lions can benefit from training about each other's behavior. Recreational pursuits are recommended as the most unique of five ways to reduce aggressive interactions between mountain lions and people. Aversive stimulation can be administered to mountain lions by systematically chasing them with humans and dogs. Proactive management also uses recreation to

benefit local communities, including rural landowners, by offsetting losses from damages to livestock by mountain lions.

Benson, J.F., M.A. Lotz and D. Jansen. 2008. Natal Den Selection by Florida Panthers. J. Wildl. Manage. 72(2):405-410.

Abstract

Information regarding habitat types selected by federally endangered Florida panthers (*Puma concolor coryi*) at natal den sites is needed because habitats used for parturition and kitten rearing potentially influence fitness of individuals and viability of the population. We located 51 natal den sites of 30 female panthers and performed a Euclidean distance analysis to determine which habitat types were selected and avoided at dens in south Florida, USA. Panther dens were closer to upland hardwoods, pinelands, and mixed wet forests (P = 0.003) and farther from freshwater marsh–wet prairie (P = 0.009). We recommend that habitat protection efforts prioritize blocks of land that have abundant patches of upland hardwood, pinelands, and mixed wet forests to maintain preferred panther denning habitat.

Benson, J.F., J.A Hostetler. D.P. Onorato, W.E. Johnson, E. Warren, M.E. Roelke, S.J. O'Brien, D. Jansen, and M.K. Oli. 2011. Intentional Genetic Introgression Influences Survival of Adults and Subadults in a Small, Inbred Felid Population. J. Animal Ecology 80(5):958-967.

Abstract

1. Inbreeding and low genetic diversity can cause reductions in individual fitness and increase extinction risk in animal populations. Intentional introgression, achieved by releasing genetically diverse individuals into inbred populations, has been used as a conservation tool to improve demographic performance in endangered populations.

2. By the 1980s, Florida panthers (Puma concolor coryi) had been reduced to a small, inbred population that appeared to be on the brink of extinction. In 1995, female pumas from Texas (P. c. stanleyana) were released in occupied panther range as part of an intentional introgression programme to restore genetic variability and improve demographic performance of panthers.

3. We used 25 years (1981-2006) of continuous radiotelemetry and genetic data to estimate and model subadult and adult panther survival and cause-specific mortality to provide rigorous sex and age class-specific survival estimates and evaluate the effect of the introgression programme on these parameters.

4. Genetic ancestry influenced annual survival of subadults and adults after introgression, as F_1 generation admixed panthers (<inlineGraphic alt="inline image" href="urn:x- wiley:00218790:JANE1809:JANE_1809_mu1" location="equation/JANE_1809_mu1.gif"/>=0·98) survived better than pre-introgression type panthers (<inlineGraphic alt="inline image" href="urn:x-wiley:00218790:JANE1809:JANE_1809_mu2" location="equation/JANE_1809_mu2.gif"/>= 0·77) and other admixed individuals (<inlineGraphic alt="inline image" href="urn:x-wiley:00218790:JANE1809:JANE_1809_mu3" location="equation/JANE_1809_mu3.gif"/>= 0·82). Furthermore, heterozygosity was higher for admixed panthers relative to pre-introgression type panthers and positively influenced survival.

5. Our results are consistent with hybrid vigour; however, extrinsic factors such as low density of males in some areas of panther range may also have contributed to higher survival of F_1 panthers. Regardless, improved survival of F_1 subadults and adults likely contributed to the numerical increase in panthers following introgression, and our results indicate that intentional admixture, achieved here by releasing individuals from another population, appears to have been successful in improving demographic performance in this highly endangered population.

Berg, R.L. 1981. A Mail Survey for Information on the Distribution of Mountain Lions in the State of Wyoming. M.S. Thesis, Univ. of Wyoming, Laramie. 94pp.

A total of 3,005 surveys were returned, representing a 42.7% overall return rate. Return rates ranged from 70.9% for biologists to 35% for ranchers. A total of 999 different individuals provided 2,574 locations, of which 1,133 were observations. When the 16 Kuchler potential vegetation types were ranked by density of observations, the Douglas fir forest

had the highest density and the Grama-buffalo grass and Saltbush-greasewood had the lowest. There had been a significant increase in the reports of lions in the Big Horn Mountains. The state was divided on the basis of mule deer herd units and ranked from highest to lowest density. A significant relationship between mule deer and elk numbers and numbers of lion observations was apparent in the survey. Records of mountain lions harvested in the state of Wyoming supplemented the lion location data in the survey. The mountain lion was classified as a predator until gaining trophy game animal status in 1974.

Berg, R.L., L.L. McDonald, and M.D. Strickland. 1983. Distribution of Mountain Lions in Wyoming as Determined by Mail Questionnaire. Wildlife Society Bulletin 11(3):265-268.

A total of 3,005 questionnaires were returned which represented a 42.7% overall return rate. A total of 999 individuals provided 2,574 locations, of which 1,133 were sightings of lions. The range in density was from 22.52 lion sightings/1000 km^2 to 0.38 lion sightings/1000 km^2. When the Kuchler potential vegetation types were ranked by density of observations, the Douglas Fir forest had the highest density and grama-buffalo grass and saltbush-greasewood had the lowest densities. Lion sightings were correlated with mule deer and elk densities and were consistent with the hypothesis that lion density is affected by the density of these prey species.

Berg, W.E. 1984. Mountain Lions in Minnesota? The Minnesota Volunteer. 47(274):2-7.

The author provides accounts of mountain lion sightings in Minnesota. In 1981 the Minnesota legislature granted the cougar full protection. Most of the sightings were in the northern half of the state.

Bergstrom, A.S. 1979. The Puma in the Adirondack Park- A Preliminary Problem Analysis and Recommendations. Proj. No. E-1-3, Wk. Pl. 9, Job 1. N.Y. Div. Fish and Wildl. 3pp.

SUMMARY

Three unconfirmed puma reports were recorded for 1976, seven were recorded for 1977, and three were recorded for 1979. Further details on these sightings are available in the E-1-2 report of this job and in the Endangered Species Unit files. A literature search for historic sightings and kill reports was done to determine when the puma became extirpated from New York. A puma killed for bounty in 1894 was apparently the last documented native wild puma in New York. Arrangements were made for two studies to be conducted on the puma, relative to its biology, its habitat requirements, and its population characteristics, the results of which will be used in decisions regarding the potential reestablishment of the puma in New York. One of these studies is a contractual agreement with the State University of New York, College of Environmental Sciences and Forestry Adirondack Ecological Center. The other is a graduate project arranged with the Mathematics Department of Rensselaer Polytechnic Institute. New York also became a cooperator with the United States Department of Interior (Fish and Wildlife Service), and the Department of Agriculture (Forest Service) in their Eastern North American Cougar Investigation.

Bertrand, A.S., L. Vasseur, E. Tremblay, R. Wissink and J. Bridgland. 2005. Eastern Cougar Sightings: Myth or Reality? Revisiting the Issue. Page 212 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recently classified the cougar *(Puma concolor)* as 'endangered' in all Atlantic Canada. A lack of information prevents us from developing any local conservation strategy to restore or protect large carnivores' suitable habitat. Thus, our objective for now is to verify where cougars remain present in Eastern Canada. We installed scent-lure posts equipped with triggered 35-mm cameras with infrared sensors in strategic locations (i.e., hotspots). We are still collecting sighting reports (and other evidences) all across the Maritimes so that we will soon be able to map cougars' movements within this mosaic landscape (i.e. forestry and agriculture). A better understanding of cougars' use of the habitat could help to define conservation plans to maintain this species in the northeastern part of its

range.

Betrand, A.S. 2007. Cougar Update for New Brunswick & Nova Scotia. Page 2 in Abstracts of Presentations of the 3rd Midwestern-Eastern Puma Conference, Trent University, Peterborough, Ontario.

Abstract

The subspecies referred to as Eastern cougar (Puma concolor couguar) was known to occur in Nova Scotia [NS], New Brunswick [NB], Quebec, Michigan, Tennessee, and South Carolina. Populations in northeastern America drastically declined at the beginning of the last century. Causes to this decline, e.g. timber harvest, urbanization, agriculture, or hunting, remain unclear. Due to the secretive habits of the species and the highly fragmented regions where few scattered individuals possibly remain, solid evidence is difficult to collect. Provincially, cougars are listed as endangered in NS, and data deficient in NB. The purpose of this 4-year study was to collect physical evidence of cougars using passive detection methods. Fourteen baited hair-traps combined with camera-traps were installed in New Brunswick and Nova Scotia. DNA analyses on two hair samples confirmed that the species was present in southern New Brunswick in 2003. As the major concern of provincial wildlife agencies is whether the reported animals are native or feral escaped or released captives, additional data is required to determine the status of cougars in the northeastern part of its historic range. To do so, it would be valuable to establish a systematic monitoring programme supervised by an expert team for the eastern cougar population.

Betrand, A.S. 2007. Conservation in the Americas: Contrasts Between North and South. Pages 6-7 in Abstracts of Presentations of the 3rd Midwestern-Eastern Puma Conference, Trent University, Peterborough, Ontario.

Abstract

There is no ecosystem that does not need to be preserved. Obstacles to conservation are numerous and vary from place to place. Using the same target species (i.e. puma), this talk intends to present some of the contrasts of the conservation reality in North and in South America. The puma is known to occur from southern Alaska to Patagonia, Argentina. Across the Americas, human communities contrast in their access to comfort and services, as well as in the level of technological and economic development they have reached. Obviously, threats to biodiversity vary according to the economic, social and politic contexts of the human communities living next to it. By knowing better the forces and weaknesses of both realities, we are opening a gap in which solutions can be found to enforce conservation efforts on both sides.

Biek, R., C.R. Anderson, T.K. Ruth, K.M. Murphy, M.R. Johnson, C.M. Gillin and M. Poss. 2003. Viral Diseases and Cougar Demography. Page 53 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Viruses are commonly detected in free-ranging cougars (Puma concolor) but little is known about the demographic implications of these infections. While viral pathogens can obviously have an effect on cougar survival and fecundity, cougar population parameters such as size and movement in turn are likely to influence the temporal and spatial dynamics of virus infections. Examining the patterns of virus occurrence might thus provide important insights into cougar population characteristics. We tested serum from more than 120 cougars from 2 locations, Northern Yellowstone (MT) and Snowy Range (WY), for evidence of exposure to several viral pathogens of wild felines. In addition, we used polymerase chain reaction (PCR) to detect current infections with feline immunodeficiency virus (FIV) in those animals. Samples were taken over periods of several years and included a high proportion of family groups as well as a number of sequential samples from the same individuals. We present results on the observed patterns of virus exposure and infection in the 2 populations and discuss possible implications for cougar demography. Furthermore, we introduce the idea of using the phylogenetic relationships of FIV, a retrovirus that genetically changes at extraordinary rates, to make inferences on cougar population structure and disease transmission history.

Biek, R. and M. Poss. 2003. Ecological Significance and Evolution of a Common Cougar Retrovirus. Page 110 *in* S.A. Becker, D.D. Bjornlie, F.G. Lindzey, and D.S. Moody, eds. Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming.

Abstract

As for most wildlife species, little is known about the organisms that infect cougars in the wild. In an ongoing project, we are studying a retrovirus related to domestic cat-FIV that is naturally found in North American cougars with the aim of assessing the virus' possible demographic consequences on the cougar host as well as its epidemiology and short-term evolution. Tests for possible effects on survival and reproduction as well as secondary exposure to other pathogens in infected individuals are conducted based on a large data set compiled from several intensively studied cougar populations. In addition, DNA sequences of virus obtained from infected individuals are used to determine the genetic population structure of cougar-FIV in the Rocky Mountain region. We determined that that this virus is changing its genetic composition within a matter of decades. Because restrictions of cougar movement will be reflected in the distribution of closely related viruses, distributional data for the virus are thus likely to contain information about current patterns of connectivity among cougar populations. A preliminary analysis of these data indicates that spread of the virus occurs mainly locally but also showed evidence for recent transmission events over distances > 300 km. These results show that studying the ecology of cougar-FIV can provide important insights into the ecology of the cougar host even beyond immediate disease impacts.

Biek, R., A.G. Rodrigo, D. Holley, A. Drummond, C.R. Anderson Jr., H.A. Ross and M. Poss. 2003. Epidemiology, Genetic Diversity, and Evolution of Endemic Feline Immunodeficiency Virus in a Population of Wild Cougars. J. Virology 77(17):9578-9589.

Abstract

Within the large body of research on retroviruses, the distribution and evolution of endemic retroviruses in natural host populations have so far received little attention. In this study, the epidemiology, genetic diversity, and molecular evolution of feline immunodeficiency virus specific to cougars (FIVpco) was examined using blood samples collected over several years from a free-ranging cougar population in the western United States. The virus prevalence was 58% in this population (n = 52) and increased significantly with host age. Based on phylogenetic analysis of fragments of envelope (*env*) and polymerase (*pol*) genes, two genetically distinct lineages of FIVpco were found to cooccur in the population but not in the same individuals. Within each of the virus lineages, geographically nearby isolates formed monophyletic clusters of closely related viruses. Sequence diversity for *env* within a host rarely exceeded 1%, and the evolution of this gene was dominated by purifying selection. For both *pol* and *env*, our data indicate mean rates of molecular evolution of 1 to 3% per 10 years. These results support the premise that FIVpco is well adapted to its cougar host and provide a basis for comparing lentivirus evolution in endemic and epidemic infections in natural hosts.

Biek, R., N. Akamine, M.K. Schwartz, T.K. Ruth, K.M. Murphy and M. Poss. 2006. Genetic Consequences of Sex-Biased Dispersal in a Solitary Carnivore: Yellowstone Cougars. Biology Letters 2(2):312-315.

Abstract

Male-biased dispersal is a common trait in mammals, including carnivores, but its genetic consequences at the population level have been rarely considered for solitary species. We used long-term genetic data from cougars (Puma concolor) in and around Yellowstone National Park to test predictions based on differences in dispersal behaviour among males and females. Consistent with frequent long-distance dispersal of males, we found support for our prediction of less than expected allele sharing in pair-wise comparisons. In contrast, female residents present at the same time and females separated by few generations failed to share more alleles than expected, contrary to our predictions based on limited female dispersal. However, we find that genetic contributions of females with higher reproductive success were still noticeable in subsequent generations, consistent with female offspring showing fidelity to their natal area. These results highlight the importance of male dispersal for inbreeding avoidance, but do not indicate that short-distance dispersal or philopatry in female cougars results in spatial clustering of related individuals.

Biek, R., A.J. Drummond and M. Poss. 2006. A Virus Reveals Population Structure and Recent Demographic History of its Carnivore Host. Science 311(5760):538-541.

Abstract

Directly transmitted parasites often provide substantial information about the temporal and spatial characteristics of host-to-

host contact. Here, we demonstrate that a fast-evolving virus (feline immunodeficiency virus, FIV) can reveal details of the contemporary population structure and recent demographic history of its natural wildlife host (Puma concolor) that were not apparent from host genetic data and would be impossible to obtain by other means. We suggest that rapidly evolving pathogens may provide a complementary tool for studying population dynamics of their hosts in "shallow" time.

Biek, R., T.K. Ruth, K.M. Murphy, C.R. Anderson Jr. and M. Poss. 2006. Examining Effects of Persistent Retroviral Infection on Fitness and Pathogen Susceptibility in a Natural Feline Host. Can. J. Zool. 84:365–373.

Abstract

Many animal populations carry endemic (i.e., permanently present) viruses but few studies have assessed the demographic consequences of these infections under natural conditions. We examined the effects of chronic infection with FIVPco, a feline retrovirus, on the fitness and pathogen susceptibility of its natural host, the cougar (*Puma concolor* (L., 1771)), in the wild. Based on data obtained through intensive monitoring of 160 cougars from two populations, we estimated survival and different measures of host fecundity of infected and uninfected individuals. In addition, we used serological data collected from 207 cougars to test whether FIVPco predisposes individuals to a higher probability of infection with other pathogens. We found no evidence for an overall reduction in survival due to FIVPco when accounting for other sources of demographic variation (age, sex, and population). There was a consistent but nonsignificant trend towards poorer reproductive performance in FIVPco-infected females. We found no serological evidence for a higher probability of secondary infections associated with FIVPco. Overall, these results support the premise that chronic FIVPco infection is asymptomatic in its natural cougar host, probably because of a long evolutionary association between virus and host. However, results of stochastic simulations indicate that only larger reductions in annual survival (>20%) can be excluded with confidence. Also, the possibility of a so far unrecognized cost of FIVPco infection on cougar fecundity remains.

Biek, R., T.K. Ruth, K.M. Murphy, C.R. Anderson Jr., R. DeSimone, R. Gray, M.G. Hornocker, C.M. Gillin and M. Poss. 2006. Factors Associated with Pathogen Seroprevalence and Infection in Rocky Mountain Cougars. J. Wildl. Dis. 42(3):606-615.

Abstract

Serological and genetic material collected over 15 years (1990-2004) from 207 cougars (Puma concolor) in four populations in the Rocky Mountains were examined for evidence of current or prior exposure to feline immunodeficiency virus (FIV), feline parvovirus (FPV), feline coronavirus (FCoV), feline calicivirus (FCV), canine distemper virus (CDV), feline herpesvirus (FHV), and Yersinia pestis. Serologic data were analyzed for annual variation in seroconversions to assess whether these pathogens are epidemic or endemic in cougars, and to determine whether family membership, age, sex, or location influence risk of exposure. FIV and FPV were clearly endemic in the studied populations, whereas exposure to FCoV, FCV, CDV, and Y. pestis was more sporadic. No evidence was found for FHV. Age was the most consistent predictor of increased exposure risk, often with no other important factors emerging. Evidence for transmission within family groups was limited to FIV and FCoV, whereas some indication for host sex affecting exposure probability was found for FIV and Y. pestis. Overall, cougar populations exhibited few differences in terms of pathogen presence and prevalence, suggesting the presence of similar risk factors throughout the study region.

Biknevicius, A.R. and S.R. Leigh. 1997. Patterns of Growth of the Mandibular Corpus in Spotted Hyenas (*Crocuta crocuta*) and Cougars (*Puma concolor*). Zoological Journal of the Linnean Society 120(2):139-161.

Abstract

Differences in jaw morphology among adult carnivorans are well established, but the ontogenetic mechanisms by which these differences arise are largely unexplored. Mandibular ontogeny in *Crocuta crocuta* and *Puma concolor* is analysed biomechanically using principles of beam theory. In each species, the development of cross-sectional properties of the mandibular corpus associated with rigidity under loading follows a biphasic pattern of growth. In early postnatal growth, deposition of cortical bone appears to be constrained by the overall weaker tissue with which juvenile skeletons are constructed and by the need to volumelrically accommodate the developing teeth within their bony crypts. Thus, this stage of growth is characterized by a net periosteal deposition of bone and a swelling of the medullary cavity. In late postnatal growth, the constraints on endosteal deposition of bone are relieved as the permanent teeth erupt; thus, cortical thicknesses increase sharply by periosteal expansion as well as medullary contraction. Finally, it is noted that basic differences in jaw

construction between *Crocuta* and *Puma* appear to develop prenatally as they are largely in place at birth. Hence, postnatal development enhances, but does not soley contribute to, the biomechanical differences in the jaws of these species.

Bischof, R., and B. Morrison. 2003. Status Report on Mountain Lions in Nebraska. Pages 11-13 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

From 1991 to 2000, 8 confirmed observations of mountain lions were made in the state of Nebraska. Several hundred additional, unconfirmed reports were submitted throughout the state. This status report evaluates confirmed and unconfirmed observations with respect to distribution, type of observation, and response.

Conclusion

The majority of confirmed mountain lion observation reports come from the panhandle area in close proximity to Colorado, Wyoming or South Dakota, all states with extant mountain lion populations. On the other hand, the majority of reports that could not be confirmed coincide with areas of high human population density. Two factors may be responsible for this clustering of unconfirmed reports in areas with denser human population. First, the more people live in an area the greater the number of possible observations and thus reports. Second, an initial report that becomes public (regardless of whether it is confirmed or not) can cause biases in future observers, thus potentially causing a chain reaction of additional "observations". This illustrates the importance of appropriate responses to the public, even if reports are unconfirmed. Considering the recent confirmed sightings of mountain lions and the large number of deer in the state, it is likely that additional mountain lions will be encountered in Nebraska. It is doubtful that a population will establish itself in areas where human population density and associated habitat disturbance is high. Encounters, however, in those areas are not impossible considering the large distances that individual animals, especially young males, can travel. In addition, it is possible that some animals were released or escaped from captivity. A frequently updated management plan will continue to provide protocols for handling a variety of situations from a biological, emergency, and public relations point of view.

Bischoff-Mattson, Z. and D. Mattson. 2009. Effects of Simulated Mountain Lion Caching on Decomposition of Ungulate Carcasses. Western North American Naturalist 69(3):343-350.

Abstract

Caching of animal remains is common among carnivorous species of all sizes, yet the effects of caching on larger prey are unstudied. We conducted a summer field experiment designed to test the effects of simulated mountain lion (Puma concolor) caching on mass loss, relative temperature, and odor dissemination of 9 prey-like carcasses. We deployed all but one of the carcasses in pairs, with one of each pair exposed and the other shaded and shallowly buried (cached). Caching substantially reduced wastage during dry and hot (drought) but not wet and cool (monsoon) periods, and it also reduced temperature and discernable odor to some degree during both seasons. These results are consistent with the hypotheses that caching serves to both reduce competition from arthropods and microbes and reduce odds of detection by larger vertebrates such as bears (Ursus spp.), wolves (Canis lupus), or other lions.

Bisque, R.E. 2004. Lions of the Lyons – Colorado Cougars in a Modern Predator/Prey Drama. West By Southwest, 912 Twelfth Street, Golden, CO 80401. ISBN 0-9702513-1-9. www.bisque.com/cougar

Over the past three decades, local cougars have conducted a field course for the author in the area of the Lyons Hogback at the mouth of Coal Creek Canyon, near Golden, Colorado. The surge in cougar activity since the late eighties is documented and illustrated with color photos taken by family and residents. The author's "lessons" are described in vivid and informative detail. The predator/prey balance involving mule deer is well developed.

Bjornlie, D.D., and D.S. Moody. 2003. Wyoming Mountain Lion Status Report – 2001. Pages 30-33 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Mountain lions (Puma concolor) are distributed widely throughout Wyoming in all types of habitats. The status of the mountain lion in Wyoming has changed considerably since the nineteenth century. Wyoming is currently divided into 28 mountain lion hunt areas with a quota system. Wyoming statutes allow any mountain lion damaging private property to be killed by the owner, employee, or lessee of the property. Information collected from harvested mountain lions is presently the primary source of data used to monitor lion populations in Wyoming.

Blake, D.J., J. Graham and M. Poss. 2006. Quantification of Feline Immunodeficiency Virus (FIVpco) in Peripheral Blood Mononuclear Cells, Lymph Nodes and Plasma of Naturally Infected Cougars. J. Gen. Virol. 87(4):967-975.

Abstract

Infection of domestic cats with Feline immunodeficiency virus (FIV) results in a fatal immunodeficiency disease, similar to Human immunodeficiency virus 1 (HIV-1) in humans. Elevated plasma viral loads in domestic cats are correlated to decreased survival time and disease progression. However, FIV is also maintained as an apathogenic infection in other members of the family Felidae including cougars, Puma concolor (FIVpco). It is not known whether the lack of disease in cougars is a result of diminished virus replication. A real-time PCR assay was developed to quantify both FIVpco proviral and plasma viral loads in naturally infected cougars. Proviral loads quantified from peripheral blood mononuclear cells (PBMC) ranged from 2.90 x 10(1) to 6.72 x 10(4) copies per 10(6) cells. Plasma viral loads ranged from 2.30 x 10(3) to 2.81 x 10(6) RNA copies ml(-1). These data indicate that FIVpco viral loads are comparable to viral loads observed in endemic and epidemic lentivirus infections. Thus, the lack of disease in cougars is not due to low levels of virus replication. Moreover, significant differences observed among cougar PBMC proviral loads correlated to viral lineage and cougar age (P=0.014), which suggests that separate life strategies exist within FIVpco lineages. This is the first study to demonstrate that an interaction of lentivirus lineage and host age significantly effect proviral loads.

Bleich, V.C., B.M. Pierce, J.L. Davis and V.L. Davis. 1996. Thermal Characteristics of Mountain Lion Dens. Great Basin Nat. 56(3):276-278.

We used radiotelemetry and searched with a trained hound to locate the dens of 3 recently parturient mountain lions (*Felis concolor*). These dens were located in dense riparian vegetation along the same stream in the bottom of a steep canyon. We monitored the circadian temperatures of 2 dens at 1-h intervals and compared them to ambient temperatures recorded simultaneously. We found mountain lion dens to effectively moderate high ambient temperatures, but these dens failed to provide a thermal advantage at the lowest ambient temperatures recorded in this investigation. We conclude that mountain lion dens provide effective protection from thermal maxima for young, immobile kittens.

Blum, S.A. and J. Laundre. 2003. A Test of Optimal Foraging: Mountain Lions and Mule Deer. Page 54 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Optimal foraging theories are based on the assumption that fitness is maximized by the most efficient use of resources and that selection will tend to favor optimal foragers. Traditional foraging models based on the relationship between active foragers seeking relatively inert forage are not suitable to describe a behaviorally complex relationship wherein an active predator pursues reactive prey. The interaction between mountain lions (Puma concolor) and mule deer (Odocoileus hemionus) in south central Idaho is one such complex relationship. Mule deer exhibit foraging behaviors consistent with predictions of optimal foraging theory, utilizing open areas to forage and forested areas to rest. This study will test optimal foraging predictions for mountain lions. Mountain lions are predicted to spend time in locations which optimize their hunting success by increasing their encounters with mule deer in areas providing adequate cover. Mountain lion locations determined by radio telemetry will be analyzed in a GIS by plotting them on USGS Digital Orthophoto Quadrangles digitized to delineate forested patches. Relative use of forest, edge, and open areas will be determined and compared to foraging theory predictions concerning patch size selection, patch use in optimizing hunting success, and time spent within patches. Techniques employed in testing these predictions and some preliminary results will be presented.

Bogue, G., and M. Ferrari. 1976. The Predatory "Training" of Captive Reared Pumas. The World's Cats 3(1):36-45.

The Alexander Lindsay Jr. Museum in Walnut Creek, California investigated two main areas of puma rehabilitation: 1) the raising and training of captive-reared kittens from an early age; and 2) taking older, captive-reared "pet" pumas and attempting to retrain them for release. In teaching the kitten to hunt, the first kill was made at 4 weeks of age and consisted of a live newborn rat. Care was taken not to use game that was capable of inflicting damage to the kitten. Gradually the size of the rats and mice offered the kitten was increased with the exception of large rats because of their aggressiveness. At 3-1/2 months of age the kitten was quite proficient at killing guinea pigs, and at this time rabbits were introduced. When the puma was 4-1/2 months old, wild game in the form of brush rabbits and jack rabbits was offered. At 6 months of age the kitten was introduced to larger game in the form of road-killed deer which were hidden in the brush. Teaching an older, captive-reared puma to kill followed the same pattern as with the younger kitten, but was noticeably more time consuming and difficult because of the inherent deficiencies and acquired behavioral shortcomings. The hunting chirp, fear chirp, greeting chirp, ear, eye, and body postures, as well as other miscellaneous behavioral characteristics are discussed.

Boland, M. and L. Briden. 1985. Food Habits of the Mountain Lion on the North Kings Deer Herd Range, Eastern Fresno County, California. Report to the Cattlemen's Association. 24 pp.

Mountain lion (Felis concolor) scats were collected between February 1984 through May 1985 on the North Kings deer herd range, eastern Fresno County. Scats were collected primarily during the spring and late summer months and because of inaccessibility to the study area during winter, no scats were collected between October through February of 1985. Sixty two scats were collected, four stomach samples from tranquilized lions were obtained, one stomach sample was obtained from a lion found dead and one food sample was that of a lion killed dog. California mule deer (Odocoileus hemionus californicus) occurred in 61.8 percent of the samples with small mammals and livestock occurring in 17.6 and 5.9 percent of the samples respectively.

Bolgiano, C. 1991. Texas' Outcast Cats. Defenders 66(3):10-15.

Texas lions are offered no protection at all and can be killed by anyone at any time. According to Roy McBride, lion tracker and researcher for over 30 years, the lion in Texas was reduced to less than 2 dozen animals by the early 1960's due to lion control. Without lions moving into Texas from Mexico, it would have been eliminated. It was saved by the decline of sheep ranching and the subsequent reduction in predator control. In the 1980's, two visitors to Big Bend National Park were attacked by lions and several other attacks have occurred elsewhere in the West. It was thought that most problems are associated with young dispersing male lions. There was no indication that Texas plans to change the status of the lion from that of varmint.

Bolgiano, C. 1991. Of Panthers and Prejudice. Buzzworm 3(3):47-51.

In 1896, scientist and hunter Charles Cory described the small feet, dark red-brown color and white flecking around the neck which established the Florida panther as the subspecies of cougar Felis concolor coryi. In 1950, Florida became one of the first states to afford protection and the panther became federally protected in 1973 under the Endangered Species Act. Radio-telemetry of panthers in Florida since 1981 has revealed that adult males will range up to 400 mi^2 in the wettest and poorest habitats of the Everglades and Big Cypress Swamp. The slightly higher and drier country west and south of Lake Okeechobee is the best ranch land around and is also where the fattest and healthiest panthers are found. After road kills, poaching is the second leading cause of death of Florida panthers. The 30-50 panthers estimated alive today are too few to keep genes vigorous and adaptive and if left on their own would likely be extinct in 25 to 40 years. There appeared to be no other recourse than to remove some animals from the wild for selective breeding in captivity. Utilizing methods of mitochondrial DNA analysis, Dr. Melody Roelke and Stephen O'Brien showed conclusively that the Everglades population of panthers had at least one maternal ancestor from Central or South America. Most of the Big Cypress population did not show any foreign gene indicators, but if they mate with the Everglades cats, they too will become hybridized. The captive breeding plan will strive to achieve a studbook managed zoo population of several hundred panthers within 20 years and another couple hundred in the wild. In the first year of the plan, up to six kittens will be taken. An experiment to determine whether suitable habitat for panthers still exists outside of south Florida was undertaken when seven cougars were captured in western Texas and released in the Osceola National Forest in June of 1988. The reintroduction was successful, although they had to be recaptured earlier than planned. The overall disturbance from the sheer numbers of hunters in the woods was one of the main problems and the state commission did not restrict hunting in any way on behalf of the panther. Chris Belden, in charge of the reintroduction, wants to introduce more cats so that a widespread social web would hold them in

their own territories. To date, the commission had not granted approval for the introduction of a greater number of cougars and the greater problem of losing panther habitat every day continues largely unaddressed. The federal government has expanded national parklands in southern Florida and established the new Florida Panther National Wildlife Refuge. The state of Florida recently legislated the spending of about $300 million a year for 10 years for public land acquisition. Conversion of the state road known as Alligator Alley to interstate in 1992 and the placement of 10-foot chain-link fences parallel to the highway which will guide wildlife to 36 underpasses at known panther crossings should make travel for the panther safer.

Bolgiano, C. 1995. Do Cougars Exist in the East? American Forests 101(1&2):29-30, 58.

A scat found in 1992 in New Brunswick was determined to be that of a cougar. John Lutz, founder of the Eastern Puma Network News in Baltimore, has compiled over 2000 sightings, the bulk of which are in Pennsylvania, Maryland, and West Virginia. Vermont and Maine both confirmed cougar signs in 1994. Controversy continues over how many of these cougars are escaped pets, immigrants from the West, or otherwise.

Bolgiano, C., T. Lester, D.W. Linzey and D.S. Maehr. 2003. Field Evidence of Cougars in Eastern North America. Pages 34-39 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Confirmed physical field evidence of cougars living wild in several regions of eastern North America is beginning to accumulate. Related issues of legal status, habitat management, and social acceptance are also emerging. We document twelve instances in which various items of field evidence have been confirmed by biologists: three cases involving live animals, a dead body or body part; four cases of scats; three cases of tracks; and two videos. The geographic range of these incidents is New Brunswick, Canada to Missouri, and the date range is 1976 to 2000. Each case entails consideration of significant details, including the history of cougars in the local area, the circumstances of local habitat and prey, evidence of reproduction, credentials of confirming biologists and the possibility of fraud. Possible sources of these animals include remnant natives, escaped or released captives, and colonizers from known cougar populations in Florida, Texas and elsewhere. Since spring of 1998 at least 3 radio-collared Florida panthers have crossed north of the Caloosahatchee River for the first time since fieldwork began 20 years ago. The potential for reestablishment of a viable breeding population is more likely to be limited by human intolerance than biological constraints, especially in rural communities near public lands. An ecological benefit of a cougar population in the east might be to return an evolutionary selection force and population check on over-abundant deer. Outdoor recreationists and hunters are also likely to express interest in cougars.

Bonier, F., H. Quigley and S.N. Austad. 2004. A Technique for Non-Invasively Detecting Stress in Cougars. Wildl. Soc. Bull. 32(3):711-717.

Abstract

The ability to non-invasively monitor stress hormone levels in free-ranging animals could significantly aid in conservation and management efforts. Our objective in this study was to demonstrate the effectiveness of assay of fecal corticoid metabolites in detecting a stress response in cougars (*Puma concolor*). Fecal samples were collected from 9 captive cougars before and after an artificial stressor. Steroid hormones were extracted from the samples. Adrenal corticoid metabolite concentrations of the resulting extracts were quantified using cortisol and corticosterone assays. Results indicated that fecal glucocorticoid metabolite levels increased significantly 24 hours after the stressor in 6 of the 9 individuals. Behavior correlated with the hormonal response; all cougars that displayed a flight response to the stressor also had elevated stress hormone measures. Elevated levels of stress hormones were not observed in individuals that did not attempt to flee. We have demonstrated with this study that measurement of fecal hormone metabolites is sufficiently sensitive to detect an adrenal response to stress in cougars and could be applied in the field to monitor stress levels in free-ranging populations.

Bonney, R.C., H.D.M. Moore, and D.M. Jones. 1981. Plasma Concentrations of Oestradiol-17 Beta and Progesterone, and Laparoscopic Observations of the Ovary in the Puma (Felis concolor) During Oestrus, Pseudopregnancy and Pregnancy. J.

Reprod. Fert. 63:523-531.

SUMMARY

Plasma levels of oestradiol and progesterone in 3 pumas during oestrus and artificially induced pregnancy and pseudopregnancy were determined by radioimmunoassay. During oestrus, basal levels of oestradiol (5-30 pg/ml) were interrupted by surges of 30-375 pg/ml at intervals of 17 to 25 days. Considerable variation occurred between and within animals. Periods of oestrus and follicular development were confirmed by laparoscopy and vaginal smear patterns. Absence of an increase in plasma progesterone following elevated levels of oestradiol and failure to observe corpora lutea in the ovary indicated that ovulation was probably not spontaneous. Plasma oestradiol values rose dramatically in response to PMSG but were low during pseudopregnancy until the return to oestrus. During pregnancy, surges of oestradiol occurred at mid-term and immediately before parturition. Ovulation, confirmed by laparoscopy, occurred 24-48 hours after hCG and progesterone levels (usually <2ng/ml) then increased to reach 150-300 ng/ml on Days 24-28. In the pseudopregnant animals progesterone concentrations had returned to baseline by Days 45-50 but during pregnancy progesterone remained elevated, declining only gradually to basal values by Day 85. A minor peak of progesterone, coincident with the pre-partum oestradiol surge, occurred on Day 87, 1 week before parturition on Day 95.

Bowns, J.E. 1976. Field Criteria for Predator Damage Assessment. Utah Science 37(1):26-30.

The cougar kills sheep with a bite to the neck inflicted from above and often severs the vertebral column which results in a broken neck. There have also been instances where cougars bite through the skull. Cougars, like coyotes, kill sheep on their bedgrounds and the bite is the primary criterion to distinguish between the two predators. Cougars appear to kill in areas of thick brush or trees more often and frequently drag their prey from the kill site to a more remote area and cover the partially eaten carcass with leaves or loose soil which causes problems in location and verification.

Bowns, J.E. 1984. Predation-Depredation. Pgs. 204-215 In: J. Roberson and F. Lindzey (eds.), Proc. of the Second Mountain Lion Workshop. Utah Div. Wildl. Res. and Utah Coop. Wildl. Research Unit. Zion National Park. 271pp.

Nationwide the single greatest problem involves the impact of coyotes on sheep, but other predators can cause losses and they can be locally significant. Depredation by cougars is often random, unpredictable, and large numbers of livestock are often killed in a short period of time. Typically cougars kill lambs with a bite over the top of the neck which often separates the vertebrae and severs the spinal cord. Mature ewes are often killed by a bite on the side of the neck and throat. Adult male and female cougars are implicated in most depredation incidents.

Boyd, D. and B. O'Gara. 1985. Cougar Predation on Coyotes. Murrelet 66(1):17.

The authors documented five cases of cougar predation on coyotes for food and to protect food caches.

Boyd, D.K. and G.K. Neale. 1992. An Adult Cougar, Felis concolor, Killed by Gray Wolves, Canis lupus, in Glacier National Park, Montana. Can. Field Nat. 106(4):524-525.

An adult female cougar (Felis concolor) was killed by a pack of eight wolves (Canis lupus) in Glacier National Park, Montana. Tracks indicated the wolves treed the cougar and killed it when it came down. They did not feed on the carcass.

Branch, L.C. 1995. Observations of Predation by Pumas and Geoffroy's Cats on the Plains Vizcacha in Semi-arid scrub of Central Argentina. Mammalia 59(1):152-156.

Observations of predation by puma (Puma concolor) and attempted predation by Geoffroy's cat (Oncifelis geoffroyi) on the plains vizcacha (Lagostomus maximus, family Chinchillidae), a large nocturnal rodent of central Argentina, are presented. Observations were made in Lihue Calel National Park, La Pampa Province, Argentina.

Branch, L.C., M. Pessino and D. Villarreal. 1996. Response of Pumas to a Population Decline of the Plains Vizcacha. J.

Mammal. 77(4):1132-1140.

We examined the dietary response of pumas (*Puma concolor*) to a population decline of the plains vizcacha (*Lagostomus maximus*), and compared the diet of pumas in semi-arid scrub of Argentina to predicted patterns based on a biogeographic analysis of the diet of this species throughout the Americas. Feces of pumas were collected in Lihue Calel National Park in 1985-1988 and in 1994, and populations of vizcachas were monitored during the same period by direct observation of marked animals and burrow surveys. Vizcachas were the most abundant prey in feces of pumas during all years and composed 51.6-84.9% of the diet. During 1986-1994, the population of vizcachas declined >90% in Lihue Calel National Park, and greater than or equal to 14% on surrounding ranches. The proportion of vizcachas in feces of pumas declined by 33%, and consumption of ungulates increased. Weight of prey and breadth of diet of pumas were lower in our study site than in almost all other areas in North and South America. We hypothesize that pumas are selectively foraging on vizcachas because this species provides a clumped resource that is spatially predictable, easy to handle, and, at times, abundant.

Brazda, A.R. 1956. A Three-year Experiment with a "Home Brew" Deer Repellent- Cougar and Lion Excrement. North Dakota State Game and Fish Dept., Proj. No. W-37-R-13, Job 8. 21pp.

Experiment divided into two phases: winter, and spring--summer. Data from 14 areas, representing 16 tests, supplied information for winter phase, while material from three tests was available for spring and summer. Raw materials were obtained from a zoo. The repellent is prepared by first creating a paste. This then is diluted with water, about one gallon of paste to three of water. A half teaspoon of mecuric chloride to the gallon was added to the concentrated solution to prevent decomposition. On application, the solution is diluted still further to one to ten, and one pint to one quart of glycerine is added to each ten gallons of repellent to reduce evaporation and act as a "sticker". This paper describes method of application, what applied to, game species concerned, weather conditions, short of history of deer in specific damage area and results. Thirteen tests were made on alfalfa stacks, two corn piles, one on corn silage, one-alfalfa field, one flax-field and one on an orchard. Control areas were observed when possible. Game species concerned with were white-tailed deer, Odocoileus virginianus macrorus, with the exception of one case in which antelope, Antilocapra americana americana, were involved. The results are not conclusive, but they do suggest possible uses, limitations, and future phases to be worked on.

Brazier, F. 1960. A Mountain Lion Near Regina. Blue Jay 18:182-183.

The author recounts sighting a young mountain lion near Bredin Siding in the Boggy Creek valley approximately 12 miles northwest of Regina. A large green-eyed cat with a long tail which drooped and with no tufts on the tips of the ears was observed. It was estimated to stand about 20 inches at the shoulder. Dark circles faintly showed on its tawny coat, indicating that the cat could not have been more than a few months old. One excellent track was found in the mud and looked about 2-3/4 inches across. The following evening, a cast was made of the print by the Director of the Museum of Natural History.

Brent, J.A. 1983. Colorado Mountain Lion Population Investigations: Game Management Units 33 and 40. Colorado Div. Wildl., Phase III. 14pp + Appendix.

RESULTS AND CONCLUSION

During the course of the study period, 18 lion captures were made, with 11 new lions being marked. There were three recaptures and four lions that had to be dispatched on one of the study areas due to a game damage depredation situation to domestic sheep. Of the newly captured 11 lions, seven lions were marked and released in Game Management Unit 33 and 4 lions were marked and released in GMU 40. The three recaptures of marked lions occurred in GMU 33 while the four lions killed on the depredation complaint (an adult female and three partially grown kittens) occurred in GMU 40. Viable lion populations continue to be present in both Game Management Units 33 and 40. Lion densities have remained relatively stable in both the units during the last three years, with only Unit 40 showing a somewhat lower lion per square mile average during the last phase of the three year period. While lion mortality has remained stable in the study area of Unit 33, Unit 40's study area has shown a steady and significant increase in numbers of lions removed from the population. For the first time the sport-harvest quota of six lions was reached in Unit 40 for the 82-83 mountain lion season. In addition, the mortality of seven lions was reported with five taken on game damage complaints, one was a natural mortality, and one kitten was accidentally killed by dogs. One area worthy of mention is the apparent lack of significant numbers of large trophy sized

male lions in both Game Management Units. Although adult males are sport-harvested and game-damage harvested out of both lion populations annually, the number of older age-class males does not seem to be present to any degree. It is possible that sport hunting is selectively targeting out males for trophies and that they are relatively young when harvested and never attain the status of the older age class. Of the 19 lions reported as killed in both units, 11 were females and 8 were males. In Phase II, twice as many females were harvested than males. Three females and three males were removed from Unit 33 in this Phase where eight females and five males were removed from Unit 40. While the total of 19 lions harvested out of Units 33 and 40 is a significant increase over the past two years, the statewide lion harvest in Colorado dramatically increased in the 1982-83 lion season to a statewide record of 149 lions. An update of this study was provided by Divisional Correspondence in 1986 by Gene Byrne: There were 22 different lions captured, marked and released between Jan. 9, 1981 and Aug. 30, 1983. The age and sex ratio of marked lions was: 1 male kitten, 5 female kittens, 1 male yearling, 1 female yearling, 7 male adults, and 7 female adults for a total of 22 lions. The disposition of marked lions as of Dec. 1, 1986 was: sport harvest: 8 lions and 1 probable for a total of 9 lions (40%); depredation harvest: 1 lion (5%); illegal harvest: 1 lion (5%); recaptured and accidentally killed by dogs: 1 lion (5%); accidentally killed in coyote snare: 1 lion (5%); unaccounted for: 9 lions (40%). Game Management Unit of capture: GMU 33 = 11 lions; GMU 40 = 11 lions. Long distance movements by two of the marked lions: one young male moved approximately 247 km which represented the fourth longest documented movement of a mountain lion in North America. Another young male moved approximately 260 km which represented the third longest documented movement of a mountain lion in North America.

Brittell, J.D., and D.J. Pierce. 1984. Washington Cougar Status Report. Washington Department of Game. 13pp.

The cougar is found throughout Washington except in the dry, open steppe and shrub-steppe areas east of the Cascade Mountains. Cougars are closely associated with coniferous forests, which in eastern Washington are generally restricted to the more mesic mountain slopes and highlands. Mule deer, whitetail deer, and elk are the major prey species east of the Cascades with blacktail deer and elk predominating to the west. The cougar was classified as a predator in 1933 with bounties paid from 1935 to 1960. The cougar was classified as a game animal in 1966 and regulations and seasons, including pursuit, were enacted to facilitate management. A valid hunting license, species tag, and hound stamp (if dogs are used) are required to hunt cougar. Nonresidents must obtain a permit at least 14 days prior to hunting. The bag limit is one cougar/season and it is unlawful to kill or possess spotted kittens or adults accompanied by spotted kittens. A harvest report card must be returned and the pelt tagged within 10 days after the kill. A cougar hunting report, initiated in 1973, is filled out when the tag is affixed to the hide. Harvest estimates and compliance factors are determined by comparing the hunting reports submitted to game personnel following pelt tagging with the report cards submitted by successful hunters. An average of 68% of the statewide harvest occurs in eastern Washington. Snowfall assisted hunters locate and kill cougars and hound hunters normally take 70% or more of the cougar. Almost 50% of the mortality was from unregulated (including poaching) killing of radiocollared cougars in the study. Hunting pressure was unevenly distributed throughout the cougar's range and excessive harvest occurs in local areas when weather conditions are "just right". A permit hunting system was thought to be the only way to address management concerns and ensure the cougar populations are not over exploited. Various tables detail Washington cougar hunting seasons, estimated harvests, distribution of harvest, sex composition, and usage of hounds in the hunt.

Brittell, J.D. 1984. Washington-Cougar Status Report. Pgs. 80-87 In: J. Roberson and F. Lindzey (eds.), Proc. of the Second Mountain Lion Workshop. Utah Div. Wildl. Res. and Utah Coop. Wildl. Research Unit. Zion National Park. 271pp.

Bounties were paid on mountain lions in Washington until 1961 even though it remained classified as a predator at that time. In 1966, the mountain lion was classified as a game mammal and seasons and regulations were enacted to facilitate management. A hunting license and species tag are required to hunt mountain lions and a hound stamp is required if dogs are used. The bag limit was set at one cougar in 1984-85 and it was unlawful to take spotted kittens or adults accompanied by spotted kittens. As of 1973, a harvest report card must be filled out and returned to the Department and each pelt must be tagged by a Department representative within 10 days after each kill. Actual harvest averaged 150 lions per year for the 12 years (1973-1985).

Brocke, R.H. 1979. Have We Closed the "Barn Door" Too Late for the Eastern Puma? Pgs. 4-5 In: Eastern Cougar Newsletter, R.L. Downing (ed.), USDI, Fish and Wildl. Service, Dept. Forestry, Clemson Univ., Clemson, SC. January.

The eastern puma (Felis concolor couguar) was accorded endangered status in 1973, perhaps 80 years too late. The author

had received preliminary approval from the U.S. Fish and Wildlife Service to initiate a study to determine the eastern puma's status in the northeast. The lack of undisturbed and inaccessible space appeared to be the main reason that pumas were extirpated over most of their eastern range. It is possible that recent sightings of pumas in the northeast may represent escaped animals from captivity and there was no evidence that a breeding population exists.

Brocke, R.H. 1981. Reintroduction of the Cougar (Felis concolor) in Adirondack Park: A Problem Analysis and Recommendations. Final Report, Fed. Proj. No. E-1-3. New York State Dept. Env. Cons. 112pp.

SUMMARY

The northeastern distributional limit of cougars in pre-colonial times probably coincided with the southern distributional limit of the Canadian life-zone. The cougar declined throughout eastern North America in a broad sweep during the late 1700s and early 1800s. Cougars survived into the late 1800s in pockets of marginal land bypassed by settlers, such as the Adirondacks. Cougars were essentially extirpated throughout eastern North America by the early 1900s, with the exception of the Florida population. It appears that cougars died out in the northeast before the major deer decline of the 1800s. However, scarcity of deer prey may have hastened extirpation of surviving cougars. In the Adirondacks, cougars were probably scarcer than the State bounty records indicate because of apparent bounty fraud. It appears that cougars held out longest in the northwestern Adirondacks. Currently, viable cougar populations are probably absent in eastern North America, with the exception of the Florida population. There is evidence that a few nomadic, occasionally breeding cougars exist in the eastern United States, principally in the Carolinas and Virginia. There are recent valid cougar sightings reported from Minnesota. There are apparently no free-living, resident cougars in New York. Cougar sighting reports are usually invalid. It is essential that a structured reporting system is instituted involving agency biologists and selected amateur naturalists to screen reports. Standard reporting procedures with emphasis on verifiable evidence such as photos or tracks or casts would be most effective. The Florida panther has survived in southern Florida in spite of persecution, largely protected by the wetland habitat of the Everglades which has resisted human settlement. Models of stable cougar populations indicate that the annual exportable surplus is small. Apparently, small closed populations cannot sustain large losses without affecting population health. The models suggest that the Florida population's apparent lack of expansion is explainable on the basis of a low level of attrition due by highway death and poaching. Man-induced mortality is the most important negative factor (or group of factors) influencing cougar survival. Habitat penetration by humans and density of the human population appear to be critical. Other habitat requirements of cougars are met by a variety of conditions within its range. It appears that the white-tailed deer was the principal prey of cougars in the Adirondacks and the northeast. Cougars were probably scarce in the central Adirondacks in pre-colonial times as this region is similar to the Canadian life-zone. Cougars were largely extirpated from the Adirondacks before the deer population expansion into the central Adirondacks, following disturbance by logging in the late 1800s. Although snow depths are relatively great in the central Adirondacks, cougars can probably survive there (with current availability of deer prey) because snow crusting conditions may aid predation. A Hypothetical Cougar Area (H.C.A.) was circumscribed in the central Adirondacks including the lowest relative human densities and road penetration in Adirondack Park. Mean estimated deer density in the H.C.A. is 8.5 deer/mi^2 (3.3 deer km^2). Assuming a mean hypothetical cougar density of 1 cougar/25 mi^2 (1 cougar/ 65km^2), then the estimated ratio of cougars to deer in the H.C.A. would be 1 cougar/250 deer, a value which is comparable to that of other areas. The potential impact of cougars in the H.C.A. on deer prey would not be large, namely somewhat in excess of the annual legal buck harvest. Elsewhere, cougars have had minimal impact on deer populations. The principal sources of cougar mortality are man-induced. Almost half of the cougar kill in Washington State has been attributed to incidental mortality causes such as road-kills, illegal hunting and nuisance incidents. Highway death may be a potentially important factor in Adirondack Park. The man-hound combination was responsible for 71 percent of total cougar mortality (legal and illegal) in Washington where cougars occur near settled areas, some level of livestock predation is predictable and attacks on humans are not impossible. These interactions, including the level of man-induced cougar mortality, are proportional to human density and road penetration within cougar range. The mean human density for the H.C.A. (2900 mi^2, 7500 km^2) is 3.35 humans/mi^2 (1.29 humans/km^2) compared to 0.5 humans/mi^2 (0.19 humans/km^2) in the southern Florida estimated range (3400 mi^2, 8800 km^2) of the Florida panther. Mean road density in the H.C.A. is 0.67 miles of road/mi^2 (0.42 km of road/km^2) in the H.C.A. versus 0.06 miles of road/mi^2 (0.04 km of road/km^2) in the southern Florida panther range. Comparisons of H.C.A. statistics with those of other areas are similar. There are 12 villages within the H.C.A., while settlements tend to be clustered on the periphery of areas where cougars occur. For reasons of high human density and road penetration in the H.C.A. and Adirondack Park in general, I believe that potential man-induced cougar mortality would exceed the level that a potentially reintroduced cougar population could sustain and still survive.

Brookman, A.M. 2006. The Investigation of Three Midwestern National Forests for Possible Habitat and Current Management Strategies of Mountain Lion (*Felis concolor*). M.S. Thesis. Southern IL. Univ., Carbondale.

Abstract

The Nebraska, Nicolet (Wisconsin), and Ouachita (Arkansas) National Forests were investigated for suitability to incoming mountain lion from the West. Biologists defined the forests as suitable for mountain lion, and stated that mountain lions pose no threat to visitors. The GARP model predicted presence for the Nebraska N.F. in 19-20 (90-100%) model outputs, for the Nicolet N.F. in 9-14 (50-70%) model outputs, and for the Ouachita in 3-16 (20%-80%) model outputs. State classification is protecting mountain lions in Nebraska and Wisconsin. In Arkansas state classification is overridden by the United States Fish & Wildlife Service. Based on environmental needs and a prey base, all three national forests are suited to mountain lion existence. Presence of mountain lion in the national forests is documented, but data are inconsistent. Despite environmental suitability and proper forest management human activities in the forests do not allow significant mountain lion populations.

Brown, D. 1984. Arizona-Cougar Status Report. Pgs. 9-22 In: J. Roberson and F. Lindzey (eds.), Proc. of the Second Mountain Lion Workshop. Utah Div. Wildl. Res. and Utah Coop. Wildl. Research Unit. Zion National Park. 271pp.

Bag limits were one lion per calendar year of any age or sex. Data from questionnaires and lion harvest results are provided. In 1971, the Arizona Legislature made the lion a Big Game animal and abolished the bounty law. The history of lion management before and after the bounty was repealed is reviewed. Research initiated in 1971 determined that livestock losses could probably be almost eliminated if deer levels were adequate and only steers were grazed in lion habitat. In 1981 it became mandatory that all lions taken be checked in through the Department within 10 days. In 1983, each successful lion hunter had to loan the skull or lower jaw of the lion to the Department in order to allow for determination of age classes of the harvest. Arizona has always been the most permissive state when it comes to taking lions.

Brown, D.E. 1991. Looking for The Yuma Puma. Defenders 66(3):16-25.

The Yuma puma, Felis concolor browni was described as a new subspecies by C.H. Merriam after Herbert Brown, Superintendent of the Territory's prison in Yuma sent a skull to him. Between 1903 and 1929, three other specimens from the Colorado River area were added to museum collections. The Yuma puma was considered smaller, paler, and more yellowish than other races. However, questions of whether the Yuma puma should remain classified as a separate race have been asked. Only two lions were known to have been killed along the Colorado River since 1971 and no specimen has been added to a museum collection since 1946. The Yuma puma was listed as a Category Two species by the U.S. Fish and Wildlife Service in 1982. This meant that population status and/or taxonomic questions must be resolved before it could be listed as a threatened or endangered species. However, both California and Arizona have designated the Yuma puma as endangered species. Matt Peirce, Wildlife Manager for the Arizona Game and Fish Department, initiated a study to locate, radio collar, and study movement activities of the desert lions. During 2 years (1989-1991), one male covered an area of 550 square miles while another male covered a 250 square mile area. The study needed to be expanded to take in all of the suspected range of the Yuma puma and more lions needed to be collared, especially females, to determine the habits of these desert lions.

Brown, E.M., A.F. King, and D.B. Houston. 1988. Natural Mortality of a Cougar. Murrelet 69(l):38.

A dead cougar was found in a remote area of the Hoh River drainage, Olympic National Park, Washington, on April 3, 1986 by a park visitor. Upon examination it was found that the entire left side of the head (both nasals, both frontals, and the anterior left parietal bones) of the approximately 11-year-old male cougar had been crushed by a powerful blow. It appeared that the cougar had been kicked and killed by an elk.

Bruce, J. 1925. The Problem of Mountain Lion Control in California. Ca. Fish and Game 11(1):1-17.

Jay Bruce, California State Lion Hunter in the early 1900's provides his account of lion hunting in California. Information on bounties, distribution, population size, natural history, and the dangers and methods of lion hunting are presented.

Bruscino, M. 1989. Evaluating Mountain Lion Depredation of Domestic Sheep. Pgs. 32-33 In: Ninth Great Plains Wildlife Damage Control Workshop, Fort Collins, CO.

In 1987, 171 domestic sheep (Ovis aries) killed by mountain lions (Felis concolor) were examined in the Bighorn mountains of north-central Wyoming. Lions typically killed the sheep by attacking the head or neck regions. Feeding usually started with entering through the brisket and consuming the heart, lungs, and liver. Feeding continued with the leg bones sheared above the hock and knee. Most of the carcasses that were moved by the lion were found in shrub or timber type vegetative habitat and in relation to rimrock topography.

Buchwald, K. 1978. Wildcat! The Minnesota Volunteer. 41(236):8-15.

The cougar was never common in Minnesota. The last cougar taken was killed in Becker County in 1897. Robert Nero, a Canadian wildlife biologist, estimated a total population of 50 mountain lions in nearby Manitoba. The last authenticated sighting was in 1975 in extreme northwestern Minnesota.

Buck, W.B. 1989. Effects of Mercury on Florida Panthers. Appendix A In: Status Report on Mercury Contamination in Florida Panthers. U.S. Fish and Wildlife Service, Atlanta, Ga. 6pp.

Approximately 100 ppm (wet weight basis) mercury was found in the liver and 130 ppm in the hair of Florida panther #27 that was found dead in south Florida in 1989. Analyses of liver and hair in archived specimens from other panthers taken since 1985 revealed mercury concentrations greater than 20 ppm in 6 panthers and greater than 10 ppm in 5. The forms of mercury and the potential of biomagnification in the ecosystem are discussed. There were fewer than 1 dozen good reports in the literature on cats and all were on the domestic cat. The comments and suggestions presented were based upon the unsubstantiated assumption that the effects of mercury on Florida panthers are comparable to domestic cats.

Bue, G.T. and M.H. Stenlund. 1952. Are There Mountain Lions in Minnesota? The Conservation Volunteer 15(89):32-37.

The authors provide sight records of mountain lions in Minnesota which seem to be authentic for the previous 7 years. All of these observations were of single animals. These records could indicate the presence of one or two mountain lions which have been sighted many times. The latest acceptable record for the state prior to these observations was one killed in Becker County in 1897.

Bue, G.T. and M.H. Stenlund. 1953. Recent Records of the Mountain Lion, Felis concolor, in Minnesota. J. Mammal. 34:390-391.

The authors reported receiving more than twenty records of sight observations of mountain lions in Minnesota. Five of the observations were made by individuals whose training in zoology, forestry, and wildlife management, is such that the authenticity of their reports can not be ignored. On March 7, 1951, Gerald T. Bue examined footprints in the snow near Ghent, Lyon County, Minnesota, which appeared to be those of a mountain lion. Measurements of the prints were taken as follows: width, 4-1/2 to 5 inches; length, 4-1/2 inches; length of stride, 15 to 17 inches; and the distance laterally from the center line through the left prints to a center line through the right prints, 6 to 7 inches. Plaster casts were made of two of the better imprints. They were sent to Mr. Stanley P. Young of the U.S. Fish and Wildlife Service for identification. In a letter dated April 9, 1951, Mr. Young stated that "there is no question but these casts made of the track are those of a puma." On June 8, 1951 a lion was seen on the Crow Creek Valley Road, Lake County, Minnesota. A mountain lion was seen along the road a quarter of a mile west of Peter Blackbird's resort north of Cass Lake, Cass County, on September 20, 1950. On January 22, 1950 an unfamiliar track was seen and was determined to be that of a mountain lion. Another mountain lion was seen near Two Harbors, Lake County, in 1948. The lion, crouched on a down tree, was watching a muskrat swim the stream below. It was first detected by the twitching and jerking of the tip of its tail. Two shots fired with light bird shot loads had no noticeable effect on the big cat.

Bueno-Cabrera, A., R. Martinez-Gallardo, S. Avila-Villegas and J. Alaniz-Garcia. 2003. Mountain Lion Food Habits in Sierra San Pedro Martir, Baja California, Mexico. Pages 54-55 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Mountain lion (Puma concolor) is one of the most widely distributed mammals in Mexico, however, its food habits and influence on its main prey have been poorly studied. Mountain lion diet was studied from June 1999 trough July 2000 in Sierra San Pedro Mártir, a semiarid area in Baja California, México. Resident ungulates within the study area include mule deer (Odocoileus hemionus), desert bighorn sheep (Ovis canadensis), and livestock. We examined 29 scats from 8 different locations and detected 49 prey items finding an array of 11 vertebrate species. Mammals comprised 98% of the diet and only 2% were birds. Livestock (cattle and horses) comprised 50% of items detected and occurred in 92% of all scats. Small rodents (3 species) comprised 28.8% and lagomorphs 13.3% of items detected. Mean weight of vertebrate prey (88.3 lb) was similar to North American studies in contrast with Central and South American patterns. Livestock represented 80% of biomass consumed whereas rodents made up only 0.5%. Neither mule deer nor bighorn sheep were found in scats, although for the latter, this may be an artifact of the sampling locations. A Generalized Linear Model revealed differences ($P < 0.05$) within preys used and locations. The high incidence of predation on livestock on the study area may be explained both by husbandry practices and low mule deer densities. We recommend an evaluation of the availability of the main prey to better understand the switch from natural to introduced preys and the role of lagomorphs as alternative preys.

Bueno-Cabrera, A., L. Hernandez-Garcia, J. Laundre, A. Contreras-Hernandez and H. Shaw. 2005. Cougar Impact on Livestock Ranches in the Santa Elena Canyon, Chihuahua, Mexico. Pages 141-149 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

Few studies try to clarify the different sources of livestock loses. This is a critical knowledge to make a fair evaluation of the effect of a predator involved in human productive activities. The Santa Elena Canyon, a Northern Mexican Protected Area was the ideal study site because of its socioeconomic conditions, associated with several cougar predation claims. Our objectives were to determine the cougar impact on the livestock industry, to identify the factors associated with livestock kills and to generate management recommendations. We identified three groups of cattle losses: by cougars, with 8% of total economic loss, by other animals (25%) and by other factors (67%). We found a positive relationship between cougar cattle predation and the amount of mountain terrain, forest vegetation and relative abundance of cougar in each ranch. Apparently, there is no relationship between livestock husbandry and the kill's frequency, although we discuss the role of other variables. We concluded that current cougar impact on livestock ranches in the Santa Elena Canyon is very low. However, we recognize the need to improve livestock husbandry in the area in order to avoid cattle mortality and further reduce cougar impact on this human activity.

Bueno-Cabrera, A., L. Hernandez, J. Laundre and A. Contreras-Hernandez. 2005. Perceptions and Attitudes about Mountain Lion as a Livestock Predator in the “Canon De Santa Elena”, Chihuahua, Mexico. Page 225 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

When human activities are harmed by wildlife, a conflict between these two actors arises. This scene becomes more complex when it happens in a protected natural area, where goals of conservation and productive interest, like the livestock industry coexist. Our objectives were: 1) to describe the perceptions and attitudes of the Santa Elena ranchers towards pumas and 2) to determine if these perceptions are related to the puma damage assessed in each studied farm. We used interviews, surveys and local workshops. We found most ranchers have a very strong negative perception about the puma as a livestock predator, independently of its real impact. This perception is originated mainly by the livestock attacks, and in smaller proportion by the attacks to game species, and even to human attacks. Some positive values are recognized for this predator, for example as a regulator of potentially harmful species. Also, it was detected that the rancher perception agreed with the puma damages; nevertheless, the hostile actions towards this species were independent of its real impact evaluated on each flock. Finally, the puma is not seen as a permanent problem, although it can become important according to the season of the year, and also to the social and economic conditions of each producer. Our conclusion is that the social impact of the puma in the Santa Elena is located in an upper-middle scale of importance; nevertheless, it was not detected

as the most serious problem for the local livestock industry. The management recommendations to reduce this conflict are centered in environmental education campaigns at different levels, and in the construction of reliable databases about predation events.

Buotte, P.C. and T.K. Ruth. 2003. Using GPS Collars to Determine Cougar Kill Rates, Estimate Home Ranges, and Examine Cougar-Cougar Interactions. Page 163 *in* S.A. Becker, D.D. Bjornlie, F.G. Lindzey, and D.S. Moody, eds. Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming.

Abstract

Single-species approaches to large carnivore conservation limits our understanding of carnivore assemblages and interactions at a community level and obtaining data on wide ranging, secretive species such as cougars and wolves can be particularly challenging. Beginning in 2001, we collaborated with the Yellowstone Wolf Project and Interagency Grizzly Bear Team in applying GPS technology to examine patterns of resource use among cougars, wolves, and grizzly bears. In this paper, we address three topics relative to future analysis of GPS data on all three carnivores: 1) the efficacy of finding cougar-killed elk and deer carcasses through GPS locations, 2) differences in home range estimation from GPS versus VHF locations with implications to analysis of species overlap; and 3) interaction between two cougars with implications to addressing spatial-temporal interactions between cougars, wolves, and bears. We deployed store-on-board GPS collars (GPS Generation II, Telonics, Inc.) on two adult male cougars (M137 and M127) during the winter of 2001. Male M137's collar acquired 612 GPS locations between Feb 11 and June 13, with a successful fix rate of 59.9%. Male M127's collar acquired 370 GPS locations between Feb 27 and May 1, with a successful fix rate of 73.4%. Each collar was programmed to attempt a GPS fix every third hour, or eight times per day. We identified clusters of locations by calculating distance moved between consecutive GPS locations and by selecting groups of locations within 200 meters of each other. Identified clusters were located and searched in the field utilizing a hand-held GPS. For cougar M127, we additionally documented kill rate via intensive daily ground-based VHF telemetry sampling between March 5 and April 10. Both ground and GPS methods yielded four kills during that time span. To examine differences in identification of home ranges we calculated home ranges using fixed kernel analysis. Male M137's GPS data included a disjunct area of approximately 15 km^2 that was not identified from VHF locations. Preliminary analysis of interaction indicated two times when both cougars were at the same location, after which the subordinate male M127 moved away from the dominant male M137. During winter 2003, we deployed 5 Televilt Simplex GPS collars on cougars. The collars allow for remote downloads of data and are programmed to acquire locations simultaneous to locations of GPS collared wolves. Our goals during the next two years are to: 1) develop correction factors for both ground-based and GPS collected kill rates and, in collaboration with the Yellowstone Wolf Project and the Interagency Grizzly Bear Team to, 2) quantify spatial-temporal interactions between cougars, wolves and bears via subsequent moves analyses and utilize these data to develop a predictive model of carnivore movement and landscape use.

Buotte, P.C., T.K. Ruth, K.M. Murphy, M.G. Hornocker and H.B. Quigley. 2005. Spatial Distribution of Cougars (*Puma concolor*) in Yellowstone National Park Before and After Wolf (*Canis lupus*) Reintroduction. Page 176 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

The reintroduction of wolves *(Canis lupus)* into Yellowstone National Park (YNP) has the potential to alter how other native large carnivores use that landscape. We conducted a study of the resident cougar *(Puma concolor)* population on the Northern Range of YNP to assess, in part, cougar spatial distribution before and after wolf reintroduction. Pre-wolf data were collected from 1988 through 1994, and post-wolf data from 1998 through 2004. We based the spatial analysis on adult cougar aerial telemetry locations, split into summer and winter seasons (Pre-wolf summer n = 956; Post-wolf summer n = 1157; Pre-wolf winter n = 756; Post-wolf winter n = 645). The re-location interval averaged 10 days in both time-periods. We assessed changes in spatial distribution with Multi-Response Permutation Procedures (MRPP) and fixed kernel (FK) estimates of 95% and 50% range use areas. The habitat characteristics topographic roughness, distance to high topographic roughness, edge density, and elevation of the 95% and 50% range areas were compared for each season using t-tests. Cover class composition was compared with Chi-square analysis. MRPP showed significant differences between Pre-wolf and Post-wolf cougar spatial distributions for both seasons. The fixed kernel Post-wolf cougar range use areas were consistently smaller than Pre-wolf range areas for both seasons (summer 50% area = 78% smaller; summer 95% area

= 52% smaller; winter 50% area = 37% smaller; winter 95% area = 43% smaller). During summer and winter, cougars used areas with greater topographic roughness, greater edge density, lower elevations, and areas closer to high topographic roughness in the 50% FK areas after wolf reintroduction. Cover composition in the 50% FK areas and all habitat characteristic patterns in the 95% FK areas were variable between seasons. We suspect the shifts observed at the 50% FK level are an expression of cougars seeking escape and hiding cover. These patterns are likely not evident in the 95% ranges because the larger areas include a substantial amount of unused habitat. We will continue our habitat analysis with characteristics at point locations. These results suggest the reintroduction of a large carnivore can have noticeable effects on the distribution of existing carnivore populations.

Buotte, P.C., T.K. Ruth, H.B. Quigley and M.G. Hornocker. 2008. Wolf and Bear Detection of Cougar-Killed Ungulates on the Northern Range of Yellowstone National Park. Page 154-155 in Toweill, D. E., S. Nadeau and D. Smith, editors. Proceedings of the Ninth Mountain Lion Workshop, May 5-8, 2008, Sun Valley, Idaho, USA.

Abstract

The use of common habitat and prey resources can lead to both exploitative and interference competition between cougars and other large carnivores. Cougars generally require extended periods, typically 3 to 6 days, to consume a kill. Although caching and concealing the kill in thick cover minimizes detection, other carnivores do detect and encounter cougars at cougar-killed prey. If other carnivores displace cougars, loss of biomass may potentially affect cougar predation rates, survival, and success of rearing offspring. Alternatively, detection of kills potentially benefits other carnivore species. But what factors influence detection of cougar kills by wolves and bears, the cougar's main competitors in northern latitudes? As part of an 8-year study of cougar-wolf interactions on the Northern Range of Yellowstone National Park, we examined factors that may influence whether wolves and bears detected a cougar kill. Between 1998 and 2005 we cataloged 427 positive or probable cougar-killed ungulates. Wolves visited 87 (20%) of these kills and displaced the cougar from 27 (6%). We limited bear detection data to 234 kills made during spring/summer and fall when bears were active. Bears visited 110 (47%) of these kills and displaced the cougar from 43 (18%) of them. Because there were instances when we could not determine whether visitation was simply scavenging or if displacement occurred, we collapsed visitation and displacements into detections and analyzed wolf detections separate from bear detections. We used logistic regression and multi-model inference to assess a number of models including explanatory covariates of habitat, prey type and size, topography, and season. The odds of wolf detection clearly increased with increasing wolf use and decreasing slope. We suspect slope had a modifying effect on the wolf use variable, which was created from a 95% utilization distribution of wolf locations and therefore does not account for terrain differences. Elevation, topographic roughness, season, prey size, and distance to roads all had 95% confidence intervals around beta estimates that bounded zero. Therefore given the variation in this dataset we cannot be sure of these parameters' true influence. The odds of bear detection were higher for large prey than small prey and in the spring than in the fall, and decreased sharply with the availability of more winter-kill carcasses. Slope, cover type at kill site, and distance to roads all had 95% confidence intervals around beta estimates that bounded zero. An index of bear use was not available for this analysis. Even in high carnivore use areas, terrain features may hinder wolf or bear access and allow cougar kills to remain undetected. These analyses illuminate factors that influence detection of cougar kills, which may indirectly influence cougar survival through loss of prey biomass, or directly when cougars are killed during encounters, and promote understanding of habitats that may enhance coexistence of cougars and other large carnivores.

Burdett, C.L., K. Crooks, D.M. Theobald, K. Wilson, W. Boyce, E. Boydston and L. Lyren. 2008. Puma Movements Relative to Housing Density in Southern California. Page 116 in Toweill, D. E., S. Nadeau and D. Smith, editors. Proceedings of the Ninth Mountain Lion Workshop, May 5-8, 2008, Sun Valley, Idaho, USA.

Abstract

The puma (*Puma concolor*) is widely distributed throughout the western U.S. However, expanding human development is

increasingly encroaching on puma habitat throughout the western U.S., which may isolate breeding populations and increase the potential for human-puma conflicts. We studied the movements of pumas relative to a gradient of human housing densities (public, undeveloped private, rural, exurban, suburban, and urban land uses) in southern California. Our goal was to better understand how the regional puma population will be affected by increased development projected to occur in future decades. We collected over 43,000 locations from 31 pumas wearing global positioning system (GPS) telemetry collars in Orange, Riverside, San Diego, and Imperial Counties in southern California. Current estimates of housing density were developed from U.S. Census Bureau data. Projections of future housing densities were developed with a supply-demand-allocation approach using patterns estimated from historical development patterns and parameters reflecting accessibility to human infrastructure like roads. Most puma locations were associated with public land (65%), undeveloped private land (14%), and rural land (14%). At the study-area scale, pumas selected for public land, used undeveloped private and rural areas in proportion to their availability, and selected against areas with housing densities that had less than 40 acres per unit. Approximately 9% of our puma locations occurred in areas that were projected to become suburban or urban areas in 2030. Not surprisingly, the future of pumas in the southern California landscape is dependent on public land. Therefore, maintaining functional connectivity between patches of public land should be a high conservation priority in this highly urbanized landscape. For example, a critical linkage between pumas inhabiting the Santa Ana Mountains and the Laguna Mountains appears highly threatened by development projections by 2030. Future analyses include: (1) examining the response to human development and other habitat features at finer spatial scales, and (2) using these empirical results to build a habitat model to predict how human development will affect puma distribution at a broader spatial scale that encompasses the western U.S.

Burruss, J.S. 1979. Utah Cougar Harvest (1977-78). Perf. Rep., Proj. No. W-65-R-D-26, Job A-7. Publication 79-1. Utah Div. Wildl. Res. 17pp.

SUMMARY

During this report period, 482 cougar harvest permits were sold-- 368 permits to residents of the state of Utah and 114 permits to nonresidents. Of the 482 cougar permits that were sold, 31 permits (29 resident and 2 nonresident) were for a second cougar. Each permit included a postcard section to be filled in with the details of the hunt. This card was to be returned to the Division of Wildlife Resources within 10 days after the close of the cougar season. Following the 10-day deadline, questionnaires were mailed to all permittees who had not returned the postcard section. A response was received from 399 permittees representing 83 percent of all permit holders. In addition to the questionnaire, all successful hunters were required to report to a conservation officer or Wildlife Resources office within 48 hours after the date of kill, for purposes of obtaining physical measurements. The harvest statistics varied from the 1976-77 harvest results. The popularity of cougar hunting increased during the 1977 season. This was shown by an increase in cougars harvested and hunters afield. A projected total of 236 cougars were harvested during this report period. Of the projected total, 31 were taken as a second cougar and 26 were depredating animals. During the 1977 season, there were 408 hunters afield, an increase of 64 hunters from the 1976 season. The history of cougar management in Utah is presented.

Burruss, J.S., and S. Aune. 1981. Utah Cougar Harvest (1979-1980). Proj. No. W-65-R-D-28, Job A-7, Public. 80-17. Utah Div. Wildl. Res. 17pp.

SUMMARY

During the 1979-1980 cougar hunting season, Davis, Rich, Salt Lake and that portion of Utah County other than Spanish Fork Canyon were closed to hunting. Also, a portion of Garfield County, most of which is in unit 51B and the north part of unit 60B, was closed for a cougar study being conducted in cooperation with the Utah Cooperative Wildlife Research Unit. The remainder of the state was open to hunting from November 1, 1979 through April 15, 1980, except on antelope, bighorn, buffalo, elk and moose hunting units during their respective seasons. Box Elder, Cache, Morgan, Summit and Weber counties which have been included in the northwestern area closed to hunting were open to hunting with a limited number of permits per county. Any cougar was legal game during the open season, except any kitten with spots or lion accompanied by young. The season limit was one cougar in all areas of Utah open to cougar hunting. During this report period, 556 cougar harvest permits were sold--362 permits to residents of the state of Utah and 169 permits to nonresidents. Each

permit included a postcard section to be filled in with the details of the hunt. This card was to be returned to the Division of Wildlife Resources within 10 days after the close of the cougar season. Following the 10-day deadline, questionnaires were mailed to all permittees who had not returned the postcard section. A response was received from 388 permittees representing 70 percent of all permit holders. In addition to the questionnaire, all successful hunters were required to report to a conservation officer or Wildlife Resource office within 48 hours after the date of kill, for purposes of obtaining physical measurements. Deer herd unit boundaries were also used as cougar management areas. A sample of a deer herd unit map was displayed. Cougar harvest permit sales increased again during the 1979 season. Five hundred fifty-six permits were sold in 1979 as compared to 502 permits in 1978. Twenty-five of the 556 permits were validated to be used only in specified counties in the northern and central portions of the state. A reported harvest of 222 cougars for 1979 included 17 cougars taken due to livestock depredation problems and eight cougars taken in the counties having a restricted number of permits. This is a decrease of 22 cougars from the 244 reported in 1978. There were 442 hunters afield in 1979, an increase of six from the previous year.

Butt, M.T., D. Bowman, M.C. Barr and M.E. Roelke. 1991. Iatrogenic Transmission of Cytauxzoon felis from a Florida Panther (Felis concolor coryi) to a Domestic Cat. J. Wildl. Dis. 27(2):342-347.

A laboratory cat died 12 days after intraperitoneal inoculation of a 1 ml suspension containing 1.5×10^6 blood mononuclear cells from a Florida panther (Felis concolor coryi). Gross, histologic and ultrastructural investigations revealed the cause of death to be infection by Cytauxzoon felis, a protozoal parasite known to cause a rapidly fatal disease (cytauxzoonosis) in domestic cats. The bobcat (Felis rufus) has been identified as a natural host for C. felis. This report implicates the Florida panther as another possible host for C. felis.

Cabbage, H., and T. Spillan. 1985. This Time, the Panther Survived. Florida Wildl. (Jan./Feb.) Pgs. 16-19.

A Florida panther survived a collision with a vehicle on US 41 in the Everglades National Park on November 2, 1984. Both hind legs and one hind foot were broken. The panther was transported to the University of Florida College of Veterinary Medicine in Gainesville. A one-liter blood transfusion from a captive panther from a small zoo at High Springs was performed. Veterinarians estimated that he was about three and a half years of age and weighed 125 pounds. Since March, 1978, 15 panthers were known to have died in Florida. Collisions with traffic represented the major cause of death. Fewer than 30 panthers had been documented as surviving in Florida.

Cabbage, H.P. 1991. Panther Capture Team Brings in Kittens. Florida Wildlife 45(3):9-14.

It was confirmed that Florida panther No. 31 had kittens estimated to be about 6-7 months old. No. 31 and five other founder females had litters this year and these kittens are the ones planned to be captured to initiate a breeding program for reintroduction to the wild. The first of six kittens to be taken from the wild was darted and successfully relocated to White Oak Plantation, site of the panther captive breeding facility. Later, the team captured a female kitten from the same litter and two more males from a litter born to panther No. 9. Two additional female kittens are planned to be captured in the near future.

Cahalane, V.H. 1943. King of Cats and His Court. National Geographic 83(2):217-259.

The male mountain lion's average weight is given as 140 pounds with a range of from 100 to 165 or more. The female weighs pounds or more. The spotting on the body and barring of the tail in kittens becomes dimmed when they are two months old. for horse thieving, the geographic race known as "hippolestes" means horse pirate. Additional general information on the mou and other cat species is provided.

Cahalane, V.H. 1964. A Preliminary Study on the Distribution and Numbers of Cougar, Grizzly, and Wolf in North America. New York Zool. Soc., l2pp.

The cougar population was estimated at 3300 to 11,000 in Canada west of the 100th meridian. The western U.S. population was estimated at 500 or more in the wilderness regions of 6 states. Maximum estimates were Arizona with 1500 and Idaho and California with 1000 each. The total estimated population in the western United States was a minimum of 4000 and a

maximum of 6500. A table is provided which lists the states and provinces of the U.S. and Canada and their estimated populations.

Cahalane, V.H. 1965. Cougars in the U.S. are Barely Holding Their Own. Audubon 67:108-109.

The cougar has been eliminated from much of its eastern range except for an estimated 100-300 animals in Florida and an estimated 25 in New Brunswick, Canada. Optimistic observers believe that no more than 10 still inhabit the swamps of east and west Louisiana. A minimum of 3300 to a maximum of 11,000 are estimated to live in Canada. The total population in the western U.S. is estimated at a minimum of 4000 to a maximum of 6500 plus. A cougar distribution table is provided for selected states and provinces of the U.S. and Canada and estimated populations are furnished.

Cahill, J.L. 1971. Puma. Sierra Club Bull. 56(3):18-22.

Cougars have been reported to high-jump at least 14 feet, broad-jump more than 40 feet, and kill and drag away prey weighing more than 750 pounds. Records exist in the United States for the cougar in every state except Indiana and Alaska, and possibly the province of Manitoba in Canada. Cougars have been recorded above 15,500 feet in the Andes of South America. The most recent estimate (1963) of lion numbers in North America (north of Mexico) was between 7000 and 17,500 animals, with 10,000 of the maximum total from British Columbia alone. In Arizona, 5454 lions were reported killed between 1947 and 1969 with $350,685 in bounties paid on 4954 animals. The California Division of Fish and Game paid $388,730 in bounties for 12,461 mountain lions from 1907 to 1963. Bounties were discontinued in British Columbia in 1955; Utah and Idaho in 1959; Oregon and Washington in 1961; Montana in 1962; California in 1963; Colorado in 1965; and Arizona in 1970.

Calkins, F.W. 1902. About the Cougar. Outing 40:448-455.

The author disputed that the cougar was not found in Michigan and Indiana and believed it was almost equally certain that there was no territory covered by any State in the Union which did not harbor cougars at the earliest date of settlement. The cougar was heard to scream in 1875 by the author and the entire prospecting camp and was located upon a point of rock 60-80 feet above their heads. Many fired upon the cat and he was brought down and measured, laying a string along the curves, four feet eleven inches from tip of nose to root of tail. The largest cougar that the author had ever seen unknowingly came upon him near French Creek, South Dakota. The cougar appeared not afraid but rather astonished at the sight of the author and trotted noiselessly away down the gulch, stopping now and then to look back. The author also discovered a newly abandoned lair under a bush-grown edge of a rock with just enough of a shelf to keep the rain off. There was no bone or sign of feasting about the lair because the dam had carried her kill to the creek bench in every instance. The diet consisted mostly of minor game, rabbits, marmots, grouse and an occasional small deer and a family of badgers. The cougar sneaks close or lies in wait upon the level and goes from cover in a straight rush and seizes the lower throat or shoulder with its teeth and twists the prey's head in its forearms until the neck is broken. The largest specimen of cougar authentically reported was killed in Texas and measured eight feet three inches. The author discounted the statement made by W.A. Perry, quoted by Lydekker, that the cougar may sometimes reach a total length of eleven feet. The biggest lions are found where the rigors are great and strenuous effort is necessary to support life such as the Tetons and Bitter Root mountains and on the elevated lands of Washington and British Columbia. The worst enemy of the cougar is the gray wolf and in bitter cold weather the wolves will watch a treed cougar until the cougar's feet are frozen, and powerless to cling, the cougar falls into the wolves waiting jaws. Cougars will tree everywhere in wolf country by the smallest dogs, but in South America where there are no wolves, the cougar will attack any number of dogs.

Campbell, D. 1976. California Cougars are Not Threatened. Outdoor California. March/April, Pgs. 1-4.

It was determined that the cougar in California is not threatened with extinction and that their status was good. This report was the result of a two-phase study conducted by the California Department of Fish and Game over a four and a half year period. Legislation in 1971 changed the status of the cougar from game animal to protected nongame mammal and established a four-year moratorium on the taking of lions which was extended in 1974 to January 1, 1977. There was approximately 74,000 square miles of lion habitat in California with an approximate population of 2400 cougars. Fourteen lions were collared and two cubs were ear tattooed only. Radio locations of collared lions were made 334 times from February 10, 1974 through November 1975. Ranges, as determined from radio-reported locations, was about 50 square

miles for males and 30 square miles for females including occasional wanderings and 25-35 square miles for males and 18-25 square miles for females excluding wanderings. Exclusive ranges for either males or females were not encountered.

Campbell, M. and Betty-Lou Lancaster. 2010. Public Attitudes Toward Black Bears *(Ursus americanus)* and Cougars *(Puma concolor)* on Vancouver Island. 2010. Society and Animals 18(1):40-57.

Abstract

The sharp increase in the human population of Vancouver Island; the urban development policy favoring forest fragmentation and smaller, scattered settlements; and the relatively sizable population of large predatory mammals have contributed to one of the highest human-large predator contact zones in North America. Although some studies have evaluated public attitudes toward larger carnivores from urban/rural, gender, and generational perspectives, few have focused on black bears and cougars on the British Columbia coast. In this study, four hundred people in the densely populated southeast corner of Vancouver Island were interviewed about their attitudes toward black bear and cougar presence and behavior. The majority of interviewees had positive attitudes toward both bears and cougars, and were opposed to the shooting of carnivores, preferring trapping and removal. Contrary to expectation, few respondents saw carnivores as threats to livestock, companion animals, or children. Both black bears and cougars were perceived as serving useful functions as part of the island's heritage and cultural development (through hunting, tourism, and recreation).

Carlstead, K., J.L. Brown, S.L. Monfort, R. Killens and D.E. Wildt. 1992. Zoo Biology 11(3):165-176.

The potential of assessing adrenal responses to psychological stressors through the radioimmunoassay of free cortisol in urine was examined in the domestic cat (Felis catus) and in three nondomestic felid species (Felis geoffroyi, Felis bengalensis, and Felis concolor). To determine the approximate clearance rate of an acute increase in glucocorticoid secretion, serial plasma and bladder urine samples were collected from eight domestic cats after a 0.125 mg adrenocorticotropic hormone (ACTH) challenge. Within 30 min of administration, mean serum cortisol concentrations increased tenfold. Urinary cortisol concentrations increased twofold by 2 hr post-ACTH and were correlated with the serum responses. Also, 16 domestic cats were anesthetized, injected with 0.125 mg ACTH, and serially bled for 3 hr. All urine was collected for 24 h post-ACTH. Urinary cortisol concentrations were significantly elevated compared to pretreatment concentrations and were correlated to the serum cortisol response (net area under the response curve). In another experiment, urine was collected daily for a 7-day baseline period from 16 domestic cats housed in standard laboratory cages. Subsequently, 8 cats were subjected to 8 consecutive days of "stress," consisting of relocation, physical restraint, and jugular venipuncture. The other 8 cats were neither moved, nor handled, nor bled for the same period of time. Two patterns of response were observed among the "stressed" cats: urinary cortisol concentrations either increased or decreased between baseline and treatment periods. These response profiles differed from those of controls, which remained basal and unchanged over time. A fourth experiment involved relocating a female Geoffroy's cat, 4 leopard cats, and 2 pumas to a novel environment for 8-10 days. Urinary cortisol concentrations rose on the first day of relocation and remained elevated above baseline for 5-7 days. Overall, these data suggest that adrenal responsiveness to psychological stressors in these four felid species can be assessed noninvasively by measuring cortisol in 24-hr urine samples. This research strategy may be useful for optimizing captive habitats to improve overall animal welfare and/or reproductive performance.

Carney, T.R. 2006. Michigan Cougars and ‘Voodoo Science’. Pages 142-147 in H.J. McGinnis, J.W. Tischendorf and S.J. Ropski editors. Proceedings of the Eastern Cougar Conference 2004, Morgantown, West Virginia, USA.

Abstract

Unlike in several other mid-continent states---Illinois and Missouri, for instance---any discussion of the possible existence of cougars in Michigan quickly shifts from the concrete to the abstract. A major reason for this is that unlike the other states, in recent years Michigan has not produced an actual cougar for study, such as one trapped, treed, or vehicle-killed. Nevertheless, one private group claims it has proven the existence of a remnant---thus wild---breeding population of cougars in Michigan. Questions about the group’s methods, conclusions, and the validity of the evidence it has, or purports to have, have elicited responses that neither satisfy the scientific community nor clarify the situation for the general public. The purpose of this paper is to suggest that such satisfaction and clarification result from interpreting the available evidence according to the concepts of Voodoo

Science. Each facet of Voodoo Science presented is illustrated by one or more examples from the Michigan case.

Carpenter, M.A., E.W. Brown, M. Culver, W.E. Johnson, J. Pecon-Slattery, D. Brousset and S.J. O'Brien. 1996. Genetic and Phylogenetic Divergence of Feline Immunodeficiency Virus in the Puma (*Puma concolor*). J. Virol. 70(10):6682-6693.

Feline immunodeficiency virus (FIV) is a lentivirus which causes an AIDS-like disease in domestic cats (Felis catus). A number of other felid species, including the puma (Puma concolor), carry a virus closely related to domestic cat FIV. Serological testing revealed the presence of antibodies to FIV in 22% of 434 samples from throughout the geographic range of the puma. FIV-Pco pol gene sequences isolated from pumas revealed extensive sequence diversity, greater than has been documented in the domestic cat. The puma sequences formed two highly divergent groups, analogous to the clades which have been defined for domestic cat and lion (Panthera leo) FIV. The puma clade A was made up of samples from Florida and California, whereas clade B consisted of samples from other parts of North America, Central America, and Brazil. The difference between these two groups was as great as that reported among three lion FIV clades. Within puma clades, sequence variation is large, comparable to between-clade differences seen for domestic cat clades, allowing recognition of 15 phylogenetic lineages (subclades) among puma FIV-Pco. Large sequence divergence among isolates, nearly complete species monophyly, and widespread geographic distribution suggest that FIV-Pco has evolved within the puma species for a long period. The sequence data provided evidence for vertical transmission of FIV-Pco from mothers to their kittens, for coinfection of individuals by two different viral strains, and for cross-species transmission of FIV from a domestic cat to a puma. These factors may all be important for understanding the epidemiology and natural history of FIV in the puma.

Carr, W.H. 1971. Living with Lions. Am. Forests 77:4-5, 52-54.

The author tells stories about a male and female mountain lion housed at the Ghost Ranch Museum. This outdoor living museum is located along the main highway sixty-five miles northwest of Santa Fe, New Mexico.

Carrel, W.K. 1980. Aging Arizona Game Animals by Annuli in Dental Cementum. Final Rep., P-R Proj. W-78-R. Wk. Pl. 1, Job 8. Arizona Game and Fish Dep. 7pp.

This report describes in detail recent developments in procedures for cutting, cleaning, staining, and mounting sections of teeth from Arizona ungulates, javelina, and carnivores. A summary is given of the use of cementum annuli counts for aging elk, deer, bighorn sheep, javelina, and carnivores. Research procedures are suggested for determining the annular regularity of cementum incremental lines. It was noted that the canine was the preferred tooth for extraction and sectioning in the mountain lion. Tetracycline should be administered to captured mountain lions to better understand the deposition of cementum, because it is a proven calciphic marker in bone and teeth that fluoresces under ultra-violet light. The marker is used as a known date reference point in interpreting tooth sections of an animal recaptured or killed later. With the known interval from injection to extraction of the tooth, the deposition rate and annular nature of annuli can be determined to verify present readings.

Carter, C.H., R.G. Rummel, A. Huffman, and P.D. Hartfield. 1979. Status of the Florida Panther in Mississippi. Mississippi Acad. Sci. 24:112.

The existence of the Florida panther Felis concolor coryi has long been a subject of debate in many southern states. In recent years extensive surveys have been conducted in some of these states to determine the existence and status of the panther. To date, the presence of cougars Felis concolor sp. has been confirmed in Florida, South Carolina, Arkansas, and Louisiana. The present status of this species in Mississippi, however, is unknown. Although the last confirmed specimen taken in the state was in 1900, continued sightings are reported on an irregular basis to the Natural Science Museum. The Mississippi Museum of Natural Science began its search for conclusive evidence of the presence of the Florida panther in September 1978. Our approach has been through an appeal to the public, including newspaper articles and posters, as well as the compilation of existing data. To this date, the results have been favorable, with reports coming in from 23 Mississippi counties. The most reliable reports have generally come from a strip of appropriate habitat paralleling the Mississippi River and across the coastal swamps. To date, intensive field searches have failed to provide conclusive evidence of the panther's existence in the form of tracks, scrapes, scat, or kills.

Casey, A.L., P.R. Krausman, W.W. Shaw and H.G. Shaw. 2005. Knowledge and Attitudes Toward Mountain Lions: A Public Survey of Residents Adjacent to Saguaro National Park, Arizona. Human Dimensions of Wildlife 10(1):29-38.

Abstract

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

Cashman, J.L., M. Peirce and P.R. Krausman. 1992. Diets of Mountain Lions in Southwestern Arizona. Southwestern Naturalist 37(3):324-326.

The authors monitored the movements of 3 mountain lions and collected scats in the Lower Sonoran Desert where ungulate densities were reported to be low in the Harquahala Mountains in southwestern Arizona. Five mountain ranges and surrounding areas were searched and >=15 vertebrate food items were identified in 159 mountain lion scats. Desert mule deer (*Odocoileus hemionus crooki*) was the primary food source followed by collared peccary (*Tayassu tajacu*), cattle, small rodents, lagomorphs, and Mexican mountain sheep (*Ovis canadensis mexicana*) based on frequency of occurrence. Other food items included Gila monster (*Heloderma suspectum*) in two scats, chuckwalla (*Sauromalus obesus*) in one scat, and beetles (*Chrysomelidae* family) in three scats. Although ungulate densities in the mountain ranges examined were low (<100 mountain sheep, <1 deer/km^2, scattered herds of collared peccaries and limited grazing by cattle) it appeared that there was sufficient biomass to support a small number of lions.

Cawthon, J. 1957. The Day the Panther Prowled. West Virginia Conservation. November, p. 13.

An account of a panther hoax in Richwood, West Virginia is presented. Evidently a panther was shipped from New Mexico and was rumored to be a trapped wild panther from West Virginia until the truth was made public about the stunt.

Chandler, J.D. 1962. Red Fox and Possible Mountain Lion at Shaunavon. Blue Jay 20(4):166.

A report of a mountain lion being sighted seven miles northeast of Shaunavon as it passed within 50 yards of an oil drilling rig. It was later rumored that it was roaming Pine Creek Park, 18 miles southwest of Shaunavon.

Charlton, E.R. Jr. 1976. Just Lion Around. Virginia Wildlife 37(5):23.

A pair of full grown cougars were sighted by the author and his brother while bowhunting on top of Potts Mountain in Craig County, Virginia. The pair of cougars were first spotted in the middle of the road about 150 yards away. The Chief Warden was notified and they were told that he and two other wardens had observed one for a half hour two years before on Potts Mountain in the same general area.

Chetkiewicz, C.L.B. and M.S. Boyce. 2009. Use of Resource Selection Functions to Identify Conservation Corridors. J. Applied Ecology 46(5):1036-1047.

Summary

Corridors are commonly used to connect fragments of wildlife habitat, yet the identification of conservation corridors typically neglects processes of habitat selection and movement for target organisms. New technologies and analytical tools make it possible to better integrate landscape patterns with behavioural processes. We illustrate the integration of resource selection functions (RSFs) and least-cost path (LCP) analyses for the purpose of corridor planning for two large carnivores.

We used RSFs developed from Global Positioning System telemetry data to predict the seasonal distribution of two large carnivores: grizzly bears *Ursus arctos* and cougars *Puma concolor*. We then applied LCP analyses to identify potential corridors in two fragmented montane landscapes - Canmore and Crowsnest Pass - in Alberta, Canada.

Grizzly bear habitat selection in both areas positively correlated with greenness in all seasons and soil wetness and proximity to water in the summer when both variables were associated with bear forage. During spring, grizzly bear occurrence in Canmore inversely correlated with road density.

For cougars, habitat selection varied by region: it negatively correlated with road density in Canmore during non-winter and positively correlated with terrain ruggedness in Crowsnest Pass. Cougar occurrence during the non-winter season in Canmore positively correlated with greenness.

For each species, seasonal RSFs were used to develop a cost surface for LCP analyses to identify potential corridor locations in each study area. Overlaying the paths for the two species highlighted where the landscape could support corridors for both species and potential highway crossing zones. The telemetry data supported some of these modelled crossings.

Synthesis and applications. We show how to integrate RSFs and least-cost modelling to identify corridors for conservation. We focus on two large carnivores in the Canadian Rocky Mountains to identify potential corridors in Canmore and provide a framework for corridor planning in Crowsnest. We suggest that our approach is applicable to many other target species in addition to large carnivores in human-dominated landscapes.

Choate, D.M., M.L. Wolfe and G.E. Belovsky. 2003. An Evaluation of the Accuracy and Efficacy of Cougar Population Estimators. Page 55 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Although numerous techniques have been proposed for the enumeration of cougar (Puma concolor) populations, few have been simultaneously applied and rigorously evaluated for their relative efficacy and accuracy. We evaluated the application of multiple census techniques to a cougar population in southern Utah. Capture-mark-release methods using radio-collared animals were used to determine cougar population size for the primary study site. We then compared this population size with indices derived from ground-based track counts, scent station visitation rates, aerial track surveys, hunter harvest, and catch-per-unit-effort. Over 600 scent station nights with different lures were monitored over 2 years; this effort yielded a single visitation by a cougar. Track-based indices each reflected a 54-69% reduction in population size, however absolute indices varied among techniques. Aerial helicopter surveys required sufficient fresh snowfall accumulations for adequate tracking coverage of a given unit. Since 1996 these conditions were met only once for the study site in each of 3 years. Population estimates derived from helicopter survey probability sampling exceeded minimum population estimates by 120-284%. Jackknife estimates of standard deviations were 43-60% of the population estimates (e.g., 5.6 3.4 cougar/100 km^2). Low and high cougar population estimates predicted by the Utah Division of Wildlife Resources for the primary study site exceeded capture and radio-telemetry population estimates by 12.8 % and 79.5 %, respectively. We discuss changes in survivorship and age structure of cougars in relation to the efficacy of current management models, and their implications for future cougar management and conservation.

Choate, D.M., G.E. Belovsky and M.L. Wolfe. 2003. Cougar-Induced Indirect Effects: Does the Risk of Predation Influence Ungulate Foraging Behavior on the National Bison Range? Page 125 *in* S.A. Becker, D.D. Bjornlie, F.G. Lindzey, and D.S. Moody, eds. Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming.

Abstract

Ecologists have long debated whether predators (“top-down”) or nutrients/food (“bottom-up”) limit prey populations. Evidence supporting the importance of predation is frequently based on the number of prey killed by predators – a direct effect. By examining only this direct effect many predation studies fail to consider behavioral changes arising from the risk of predation - indirect effects. Furthermore, these behavioral indirect effects can be more important than the direct effect of predator-caused mortality, influencing both top-down and bottom-up processes. In this study we capitalize on a “natural

experiment" on a suite of large mammalian herbivores, in a system (National Bison Range, MT) where the behavior and population dynamics of ungulate prey species (whitetail deer, *Odocoileus virginianus*; mule deer, *O. hemionus*; elk, *Cervus elaphus*) can be compared before and after an increase in risk of predation by cougar (*Puma concolor*). We present preliminary data demonstrating that cougars can influence several aspects of prey behavior. With an increase in predation risk, mule deer and elk total daily activity time has declined by 35.9% and 31.8% ($P<0.05$, ANCOVA) respectively. In addition, deer and elk have reduced their activity levels during crepuscular periods and reduced the use of shrub vegetation which may provide cougar with better stalking cover. We also compare current ungulate habitat use and behavior with concurrent habitat use of resident cougars using radio-telemetry techniques. Implications for how the reintroduction of predators may indirectly impact their prey will provide insights for future conservation efforts for large mammals.

Choate, D.M., M.L. Wolfe and D.C. Stoner. 2006. Evaluation of Cougar Population Estimators in Utah. Wildl. Soc. Bull. 34(3):782-799.

Abstract

Numerous techniques have been proposed to estimate or index cougar (Puma concolor) populations, but few have been applied simultaneously to populations with reliable estimates of population size. Between 1996 and 2003, we evaluated the relative efficacy and accuracy of multiple estimation and index techniques for populations at 2 locations in Utah, USA: Monroe Mountain and the Oquirrh Mountains. We used radiotagging followed by intensive monitoring and repeated capture efforts to approach a complete enumeration of the populations. We used these benchmarks to evaluate other population estimates (Lincoln–Petersen mark–recapture, helicopter-survey probability sampling, catch-per-unit-effort) and indices (scent-station visits, track counts, hunter harvest). Monitoring over 600 scent-station-nights using different attractants June–September in 1996 and 1997 yielded a single cougar visit. Summer track-based indices reflected a 54–69% reduction in population size on the Monroe site and a numerically stable population on the Oquirrhs, but relationships between indices and the benchmark population estimates varied among techniques. Aerial track surveys required sufficient fresh snowfall accumulations for adequate tracking coverage of a given unit, conditions that were met only once on one study site in each of 3 years. Population estimates derived from helicopter-survey probability sampling exceeded reference population estimates by 120–284%, and bootstrapped estimates of standard error encompassed 25–55% of the population estimates (e.g., 5.6 ± 1.4 cougars/100 km^2). Despite poor performance in predicting cougar population sizes, track-based estimates may provide better indices for monitoring large changes in population trends (i.e., with low precision). However, we recommend using multiple indices after determination of a more rigorous initial population estimate for managing populations of conservation concern and when considering connectivity to determine potential refuge sites for regional management (e.g., management by zones).

Choate, D.M., M.L. Wolfe and D.C. Stoner. 2008. Evaluation of Cougar Population Estimators in Utah. Page 168 in Toweill, D. E., S. Nadeau and D. Smith, editors. Proceedings of the Ninth Mountain Lion Workshop, May 5-8, 2008, Sun Valley, Idaho, USA.

Abstract

Numerous techniques have been proposed to estimate or index cougar (*Puma concolor*) populations, but few have been applied simultaneously to populations with reliable estimates of population size. Between 1996 and 2003, we evaluated the relative efficacy and accuracy of multiple estimation and index techniques for populations at 2 locations in Utah, Monroe Mountain and the Oquirrh Mountains. We used radio-tagging followed by intensive monitoring and repeated capture efforts to approach a complete enumeration of the populations. We used these benchmarks to evaluate other population estimates (Lincoln-Petersen mark–recapture, helicopter-survey probability sampling, catch-per-unit-effort) and indices (scent-station visits, track counts, hunter harvest). Monitoring over 600 scent-station-nights using different attractants, June–September in 1996 and 1997, yielded a single cougar visit. Summer track-based indices reflected a 54–69% reduction in population size on the Monroe site and a numerically stable population on the Oquirrhs, but relationships between indices and the benchmark population estimates varied among techniques. Population estimates derived from helicopter-survey probability sampling exceeded reference population estimates by 120–284%, and bootstrapped estimates of standard error encompassed 25–55% of the population estimates (e.g., 5.6 ± 1.4 cougars/100 km^2). Despite poor performance in predicting cougar population sizes, track-based estimates may provide better indices for monitoring large changes in population trends (i.e., with low precision). However, we recommend using multiple indices after determination of a more rigorous initial population estimate for managing populations of conservation concern and when considering connectivity to determine

potential refuge sites for regional management (e.g., management by zones).

Choate, D.M., G.E. Belovsky and M.L. Wolfe. 2008. Cougar-Induced Vigilance in Ungulate Prey: Does Predator Proximity Matter? Page 255 in Toweill, D. E., S. Nadeau and D. Smith, editors. Proceedings of the Ninth Mountain Lion Workshop, May 5-8, 2008, Sun Valley, Idaho, USA.

Abstract

Trading foraging time with increased vigilance is widely attributed to the threat of predation. Numerous studies examining the relationship between vigilance and other factors (e.g., prey's herd size, habitat use) suggest that clear patterns are elusive and that vigilance per se may be highly plastic. If vigilance is costly by reducing feeding time, prey should reduce vigilance as the distance to a predator (or threat) increases, resulting in a scaled response even within factors (e.g., specific habitat types). In this study we used focal sampling of foraging bouts by 3 species of ungulates that differed in body size and anti-predator defenses (elk, *Cervus elaphus*; mule deer, *Odocoileus hemionus*; and white-tailed deer, *O. virginianus*), to determine whether proximity of a stalking/ambush predator (cougar, *Puma concolor*) influences time spent vigilant while foraging. For all 3 species males spent less time vigilant than females. There was no evidence for a herd-size effect on vigilance for any species, but white-tails displayed a significant decline in vigilance with increasing distance to cougars. Both deer species responded to the presence of a cougar within the same drainage or "viewshed", by decreasing vigilance levels with increasing distance. When cougar were outside of the viewshed, there was no longer a relationship between cougar proximity and vigilance levels. Prey-specific anti-predator responses to cougar, a stalking predator, suggest that generalizations of vigilance to other predator types (e.g., coursing predators) is inappropriate, and that vigilance as a metric for determining population levels of predation risk may be less appropriate for communities with low-density solitary felids such as cougar, except at very small (i.e., within viewshed) temporal-spatial scales.

Chow, L. 2003. Mountain Lion-Human Interactions in Yosemite National Park. Page 55 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

In 1994, the National Park Service (NPS) recorded more than 55 reported sightings of mountain lions (Puma concolor) in Yosemite Valley, a 1428 ha area visited by more than 4 million people annually. Most of these sightings occurred in densely populated areas. In an effort to provide Yosemite's managers with information on the potential threat to human safety, we initiated a 4-year study to determine why lions had increased their use of Yosemite Valley, how much time lions were spending there, and what activities lions were engaged in. We captured and installed radio telemetry collars on 7 mountain lions in areas surrounding Yosemite Valley. We monitored their daily movements and activity patterns for two years. In addition, we established and monitored track and scat transects. Fieldwork for this study concluded in May 2000. We present the preliminary results of our work and possible implications for mountain lion management in Yosemite.

Chupasko, J.M. 2006. The Importance of Scientific Natural History Collections as a Repository for Voucher Specimens: the Massachusetts Quabbin Reservoir Puma concolor Skull as an Example. Pages 44-58 in H.J. McGinnis, J.W. Tischendorf and S.J. Ropski editors. Proceedings of the Eastern Cougar Conference 2004, Morgantown, West Virginia, USA.

Abstract

In the fall of 2002 the cranium and mandibles of a mountain lion were reportedly found near the Quabbin Reservoir in Franklin County, Massachusetts. The skull possibly represents the first skeletal evidence of mountain lion presence in the northeast USA in over 100 years. The specimen could be from an eastern cougar (Puma concolor couguar), a subspecies that falls under state and federal wildlife protection laws. It was donated to the MCZ. If this specimen had not been deposited into a collection, it would be unavailable to researchers. Having it curated in an accredited collection will allow researchers to pursue further studies and analyses. Measurements of this skull, photographic images, and comparisons to other Puma concolor specimens in the MCZ collection are presented.

Clark, D.W., S.C. White, A.K. Bowers, L.D. Lucio and G.A. Heidt. 2002. A Survey of Recent Accounts of the Mountain Lion (*Puma concolor*) in Arkansas. Southeastern Naturalist 1(3):269-278.

Abstract

We collected physical evidence (scats and tracks) that suggested the presence of 1 or more mountain lions (*Puma concolor*) in Arkansas from 1998-1999, and conducted a survey of mountain lion occurrences in Arkansas from 1996-2000. Mountain lions were reported statewide, with most in the Ozark and Ouachita Mountains. In addition to the surveys, we collected 7 pieces of tangible evidence (e.g., scats, tracks, and video) from 1996-2000. A survey of the U.S. Department of Agriculture, state veterinarians, and an Arkansas Game and Fish Commission (AGFC) internal survey of their wildlife officers documented at least 101 captive *P. concolor* in the state. The origins of reported free-ranging animals could not be determined.

Clark, D.W., S.C. White, A.K. Bowers, L.D. Lucio and G.A. Heidt. 2003. A Survey of Recent Accounts of the Mountain Lion in Arkansas. Page 56 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

In 1998, we documented (through tracks and fecal material) the presence of one or more mountain lions (Puma concolor) in Arkansas. In this study, we examined 16 Arkansas Game and Fish Commission records of reported sightings and/or sign over the past 5 years. We also solicited information on mountain lion occurrences from hunting clubs, and mailed 850 sighting and sign surveys to professional biologists, county agriculture agents, and Arkansas trappers in an effort to determine presence and localities of mountain lions in Arkansas within the past 5 years. A large number of reports were followed-up by personal telephone conversations. From these inquiries, we received 284 responses indicating the presence of mountain lions. Data were analyzed using Geographical Information Systems. While occurrences were reported state-wide, there were concentrations in Washington and Crawford counties in the Ozark Mountains, Yell and Logan counties in the Ouachita Mountains, and near the confluence of the Saline and Ouachita rivers in the southern part of the state. Few occurrences were reported from the Mississippi Delta. We also surveyed the USDA, Arkansas wildlife officers, and state veterinarians in an effort to locate captive animals. Over 170 captive animals were reported to occur in the state. It is not known whether reported free-ranging animals were released or escaped mountain lions or their descendants. The taxonomy of mountain lions in the state is not known.

Clark, J., and H. Vriend. 1980. History of Cougar Management in Alberta. Energy and Natural Resources, Fish and Wildl. Div., Lethbridge, Alberta, Canada. 20pp.

A bounty was placed on cougars in Alberta in 1937 and continued until 1964. The average number taken during these years was 41 with a range of 22-73 annually. There are no known records of harvest from 1964 to 1970. The first hunting season was initiated in 1969. The cougar received official status as a game animal in 1971 and it became mandatory to register cougar kills and a limit of 1 cougar per year was imposed on hunters. Since 1971 the annual harvest steadily increased from 11 to 44 in 1977 with a slight decline in the 1978 and 1979 season. Since 1975 the success rate for resident hunters has remained at approximately 20% and non-residents usually over 50%. Since 1971 approximately 75% of the cougars harvested were taken in the foothills region south of the North Saskatchewan River. Since 1971, 53 of 104 cougars registered have been females. Forty-two and 51% of the population, respectively, were in the subadult and young adult age classes. Management implications are presented.

Clinite, E.W. 1981. Biochemical Analysis of Mountain Lion and Bobcat Scat: Differences Between Species and Sex. M.A. Thesis, San Jose State Univ., 27pp.

In order to study sex-specific food habits, it is necessary to know the species and sex of the animal which deposited each scat. Before this investigation began there was no reliable, consistent method for this determination. This research attempted to identify the species of felid depositing a scat using thin layer chromatography (TLC) to compare banding patterns of fecal steroids from bobcats and mountain lions. A banding pattern was found more frequently in bobcats than in mountain lions. Androgens were removed from the TLC plate and quantified using gas chromatograph techniques. Levels of androgens in the plasma should differ between males and females, and a portion of these androgens are excreted in the

bile. The amount of androgen in scats were found to be significantly different between males and females.

Clyde, V.L., G.V. Kollias, Jr., M.E. Roelke, and M.R. Wells. 1990. Disseminated Coccidioidomycosis in a Western Cougar (Felis concolor). J. Zoo and Wildl. Medicine 21(2):200-205.

Examination of a juvenile western cougar (Felis concolor) presented for routine vasectomy revealed thoracic and abdominal effusions. After a thorough diagnostic workup, the cause of the effusions remained unclear and the animal was euthanized. Coccidioidomycosis was diagnosed on necropsy, and postmortem serologic testing was positive for precipitating antibodies to Coccidioides immitis. Twenty other cougars from the same population were negative for precipitating antibodies to C. immitis. Coccidioidomycosis is a rare disease in cats, and this is believed to be the first case reported in a cougar. The unusual findings of thoracic and abdominal effusions presented similarities to feline infectious peritonitis and made antemortem diagnosis difficult.

Coggin, J.L. and L. Crane. 1977. Cougar Investigations, Virginia. Perf. Rep., Virginia Comm. of Game and Inland Fisheries. Proj. No. E-l-R-l, Wk. Pl. 6, Job A. 3pp.

SUMMARY

One week was spent by Larry Crane, Refuge Supervisor, in an area where cougar reports have been frequent on Potts Mountain in Craig County, Virginia. Scent stations were established and the area was searched thoroughly for evidence of cougars, but no evidence was found. Cougar sightings that appeared reliable were recorded and mapped.

Coggin, J.L. and L. Crane. 1979. Endangered Species Investigations: Cougar Investigations. Proj. No. E-001-R-03/Wk. Pl. 06, Job A. VA. Comm. Of Game and Inland Fisheries. 3pp.

SUMMARY

Seventeen new reports of cougars were received through June 1979 and added to our list of sightings. No tracks or evidence could be found to confirm the sightings although scent stations were operated in Botetourt and Bedford Counties.

Coles, F. 1984. Harvest Strategies. Pgs. 230-266 In: J. Roberson and F. Lindzey (eds.), Proc. of the Second Mountain Lion Workshop. Utah Div. Wildl. Res. and Utah Coop. Wildl. Research Unit. Zion National Park. 271pp.

Since harvesting seasons vary throughout the western United States, the author invited three representatives to discuss year-round hunting, restricted hunting, and quota systems in Arizona, Montana, and Nevada, respectively. A question and answer session follows which provides more in-depth information.

Colorado Division of Wildlife. 1969. Colorado Big Game Harvest; Mountain Lion Regulations and Harvest. Fort Collins, Colorado.

A total of 58 lions were harvested by 450 licensed hunters during the 1969 calendar year. This is the same number of lions taken during 1967 and is 11 animals above the average of 47 lions bagged 1957 through 1964. Last year only 50 lions were taken by license holders. The Division of Wildlife Services reported taking only 3 lions, the same as in 1968. Thirty males and 17 female lions were taken by 23 resident and 24 non-resident hunters. The average successful hunter spent 3.87 days hunting. All of the hunters used dogs. For 36 years, 1929 to 1965, the Division was required to pay a $50 bounty for each lion harvested. In 1965, the lion was declared a protected animal (except when in the vicinity of livestock) and the mountain lion license was established.

Colorado Division of Wildlife. 1970.

Forty-seven lions were harvested in 1970 by licensed hunters, one more than the average of 46 lions which were bagged annually the previous five years, 1965-1969 by licensed hunters. The 1970 lion harvest was down 11 animals from the 58

taken in 1969 and three less than the 1968 harvest of 50 lions. Three reports were received of individuals taking lions according to the provisions of the game damage law. The Division of Wildlife Services reported only taking one lion in 1970 compared to three in 1968 and 1969. Twenty-four lions were taken on sportsman's licenses. The average successful hunter spent 4.57 days hunting. All guides used dogs, as did all but three of the successful hunters. Thirty male and 27 female lions were taken by 31 resident and 29 non-resident hunters.

Colorado Division of Wildlife. 1971.

Twenty-nine lions were harvested by licensed hunters, twenty-three less than the average of 52 lions which were bagged annually the previous five years, 1966-1970 by licensed hunters. The 1971 harvest was down 18 animals from the 47 taken in 1971 and exactly half the 1969 harvest of 58 lions. Six reports were received of individuals taking lions according to the provisions of the game damage law. The Division of Wildlife Services reported taking no lion in 1971 compared to one in 1970 and 3 in 1969. Five lions were taken on resident sportsman's licenses. The average successful hunter spent 2.9 days hunting. All guides used dogs, as did all but two of the successful hunters who reported. On a statewide basis, 65.5 percent of the lions harvested were males. Nineteen males and 10 female lions were taken by 8 resident and 21 non-resident hunters.

Colorado Division of Wildlife. 1972.

Thirty-five lions were harvested by licensed hunters, 6 more than in 1971 but 13 less than the average of 48 lions which were bagged annually the previous five years, (1967-1971). Residents harvested 11 lions while non-residents took 24, or 68 percent of the total harvest. Only six lions were harvested by the 6,900 resident sportsman's license holders. The average successful hunter spent 3.2 days hunting. All guides used dogs, as did all but 5 of the successful hunters who reported. On a statewide basis, 82.9 percent of the lions harvested were males. Of these, 24 were mature males, 2 were yearlings, and three were of unknown age. Four mature females, one yearling female and one female of unknown age were also taken. None of the females were lactating. Four reports were received of individuals taking lions according to the provisions of the game damage law. The Division of Wildlife Services took one lion in 1972, compared to none in 1971, one in 1970, and three in 1969. Fieldmen estimated the weight of 31 lions taken to average 145 pounds. The 24 mature males weighed an estimated 155 pounds, while 4 mature females averaged 126 pounds. Weight estimates ranged from 70 pounds for a yearling female to 195 for a mature male. Lengths varied from 5'6" for a yearling male to 9' for a mature male.

Colorado Division of Wildlife. 1973.

Sixty lions were harvested by an estimated 115 licensed hunters, for a 52 percent success ratio. The mountain lion season provided 584 days of recreation for an average of 5.1 days per hunter and 9.7 days per animal harvested. Thirty-three male and 27 female lions were taken by 31 resident and 29 non-resident hunters.

Colorado Division of Wildlife. 1974.

Fifty-two lions were harvested by licensed hunters. Twenty-seven male and 25 female lions were taken by 24 resident and 28 non-resident hunters.

Colorado Division of Wildlife. 1975.

A record high of 90 mountain lions were taken in 1975 by 143 lion hunters, affording 1,016 recreation days in total. Forty-seven male and 43 female lions were taken by 41 resident and 49 non-resident hunters.

Colorado Division of Wildlife. 1976.

The state population is estimated to be around 1,100 lions. In 1976, 81 percent of the guided hunters were successful, accounting for 69 percent of the total annual harvest. Thirty-seven percent of all lion hunters were professionally guided. Sixty-five lions were harvested in 1976, with 152 hunters having a success rate of 43 percent. An average of 16 days per animal harvested and 1,062 total recreational days were reported. Forty-four males and 21 females were taken by 38

resident and 27 non-resident hunters. Two male lions were taken under game damage law and are not included in the above figures.

Colorado Division of Wildlife. 1977.

The state population is estimated to be around 1,100 lions. Eighty-three lions were harvested in 1977, with 195 hunters having a success rate of 43 percent. An average of 16 days per animal harvested and 1,331 total recreational days were reported. Two female lions taken (one under game damage law; the other was a road kill) were not included in the above figures. Forty-four males and 39 females were taken 45 resident and 38 non-resident hunters.

Colorado Division of Wildlife. 1978.

The state population is estimated to be around 1,100 lions. In 1978 a record of 91 lions were taken by 243 hunters for a 37 percent success ratio. An average of 18 days per animal harvested and 1,660 total recreational days were reported. Forty-eight males and 43 females were taken by 52 resident and 39 non-resident hunters.

Colorado Division of Wildlife. 1979.

Seventy-four lions were harvested in 1979 by 209 hunters having a success rate of 35 percent. An average of 19 days per animal harvested and 1,425 total recreational days were reported. Forty-nine male and 25 female lions were taken by 39 resident and 35 non-resident hunters.

Colorado Division of Wildlife. 1980.

Eighty-two lions were harvested in 1980 by 200 hunters having a success rate 41 percent. An average of 19 days per animal harvested and 1,565 total recreational days were reported. Forty-one males and 41 female lions were taken by 53 resident and 29 non-resident hunters. The above information does not include 11 lions taken by the Fish and Wildlife Service, animal damage control.

Colorado Division of Wildlife. 1981.

One hundred and seven lions were harvested in 1981 by 248 hunters having a success rate of 43 percent. An average of 17 days per animal harvested and 1,824 total recreational days were reported. Sixty-seven male and 40 female lions were taken by 72 resident and 35 non-resident hunters. The above information does not include six lions taken by Fish and Wildlife Services, animal damage control.

Colorado Division of Wildlife. 1982.

One-hundred and thirty-seven lions were harvested in 1982 by 327 hunters having a success rate of 42 percent. An average of 17 days per animal harvested and 2,363 total recreational days were reported. Seventy-seven male and 60 female lions were taken by 92 resident and 45 non-resident hunters. The above information does not include six lions taken by Fish and Wildlife Services, nor 2 game damage, 2 road kills, one by snare, and one of starvation.

Colorado Division of Wildlife. 1983.

One hundred and twenty-five lions were harvested in 1983 by 362 hunters having a success rate of 28 percent. A total of 453 licenses were sold and 2,606 recreation days were reported. Seventy-eight male and 47 female lions were taken by 69 resident and 56 non-resident hunters. The above figures do not include game damage.

Colorado Division of Wildlife. 1984.

The estimated statewide population is listed at 2,000 to 3,000 mountain lions. One hundred and one lions were harvested in

1984 by 257 hunters spending an average of 6.7 days per hunter. Recreational days were reported at 1,742, with 359 licenses being sold.

Colorado Division of Wildlife. 1986.

One hundred and fifty-five lions were harvested in 1985 by 363 hunters spending an average of 7.2 days per hunter. Recreational days were reported at 2,614, with 460 licenses sold. One hundred and sixty-six lions were harvested in 1986 by 310 hunters spending an average of 7.2 days per hunter. Recreational days were reported at 2,232, with 386 licenses sold.

Comiskey, E.J., O.L. Bass, Jr., L.J. Gross, R.T. McBride and R. Salinas. 2002. Panthers and Forests in South Florida: An Ecological Perspective. Conservation Ecology 6(1):18.

Abstract

The endangered Florida panther (*Puma concolor coryi*) survives in an area of pronounced habitat diversity in southern Florida, occupying extensive home ranges that encompass a mosaic of habitats. Twenty-one years of daytime monitoring via radiotelemetry have provided substantial but incomplete information about panther ecology, mainly because this method fails to capture movement and habitat use between dusk and dawn, when panthers are most active. Broad characterizations of panther habitat suitability have nonetheless been derived from telemetry-based habitat selection studies, focusing narrowly on forests where daytime resting sites are often located. The resulting forest-centered view of panthers attributed their restricted distribution and absence of population growth in the mid-1990s to a scarcity of unfragmented forest for expansion. However, the panther population has doubled since the beginning of genetic restoration in 1995, increasing five-fold in public areas described as unsuitable based on forest criteria. Although the forest-centered view no longer explains panther distribution, it continues to shape management decisions and habitat conservation policies. The assumptions and limitations of this view therefore merit critical examination. We analyze the role of forests in the ecology of the Florida panther. To address the absence of nighttime telemetry data, we use innovative telemetry mapping techniques and incorporate information from field observations indicating habitat use during active hours (e.g., tracks, scats, urine markers, and kill sites). We consider daytime telemetry data in the context of panther home ranges and breeding units. We analyze home range size in relation to the amount of forest within each range, concluding that percent forest cover is a poor predictor of size. We apply fractal analysis techniques to characterize the relative density of forest cover associated with daytime locations and interpret the results in terms of spatial landscape patterns, highlighting the limitations of daytime telemetry data for characterizing overall habitat use. We conclude that the forest-centered view of panther habitat selection is based on an uncritical evaluation of telemetry data collected prior to the recent population expansion and on the unsupported assumption that day bed habitats are representative of nighttime habitat use. We find that numerous factors contribute to habitat suitability and population density and distribution, and that *P. concolor* in Florida, as elsewhere in their range, are habitat generalists, exploiting the broad spectrum of available habitats for hunting, resting, mating, travel, denning, and dispersal. Whereas panthers readily use forested habitat with understory and prey, we find no support for the view that only the forested land within a habitat mosaic is potential panther habitat, or for the contention that only forested habitats are used by panthers within existing home ranges. We suggest a more ecologically consistent management and recovery paradigm based on maintaining the integrity of the system of overlapping home ranges that characterizes panther social structure and satisfies breeding requirements. Such a paradigm focuses on the requirements for reproductive success of a small population in a changing environment.

Comiskey, E.J., A.C. Eller Jr. and D.W. Perkins. 2004**.** Evaluating Impacts to Florida Panther Habitat: How Porous Is the Umbrella? Southeastern Nat. 3(1):51–74.

Abstract

The endangered Florida panther (*Puma concolor coryi*) shares its shrinking habitat with agriculture, surface mining, and rapid urban growth. Although panthers have extensive home ranges and use diverse land covers, methods that dominate panther habitat evaluation for Endangered Species Act (ESA) consultations and regional land use planning consider only forested day-use elements within the landscape mosaic. Maehr and Deason (2002) present a Panther Habitat Evaluation Model (PHEM) that, in addition to excluding nonforested habitat, reduces the assessed value of forest patches based on criteria for

patch size, forest type, proximity to a "core" area, and connectivity to other patches. An examination of the foundations of PHEM is therefore warranted. Building on earlier work that included an evaluation of panther habitat selection studies (Comiskey et al. 2002), we examine PHEM in light of data quality criteria and the panther's known life history requirements. We conclude that the precepts and rules of the PHEM methodology are based on unwarranted assumptions, nonstandard methods of analysis, and exclusion of relevant data, leading to an undue emphasis on day-use land cover and forest patches larger than 500 ha. Large areas of southern Florida that have abundant prey and are intensively used by panthers would score low in PHEM habitat assessments because they lack large forest patches. We discuss the conservation implications of applying a methodology that discounts substantial portions of occupied panther habitat as unsuitable, and describe an alternative approach to habitat definition and evaluation that is both consistent with panther habitat requirements and applicable to conservation decision-making. Conserving sufficient habitat for recovery of the panther extends an umbrella of protection to the many species that dwell within its range.

Conforti, V.A. and F.C.C. de Azevedo. 2003. Local Perceptions of Jaguars (*Panthera onca*) and Pumas (*Puma concolor*) in the Iguaçu National Park Area, South Brazil. Biological Conservation 111(2):215-221.

Abstract

Jaguars (*Panthera onca*) have been killed by local residents within the boundaries and lands surrounding Iguacu National Park (INP), Brazil. Both jaguars and pumas (*Puma concolor*) occur in the region, however, livestock predation by pumas has rarely been reported. Our objective was to assess the local perceptions about jaguars and pumas. We identified two major factors that distinguished the perceptions towards the two species: less people feared the puma than the jaguar; and most people believed that jaguars, but not pumas, were released into INP by local authorities. Interestingly, despite those major differences in these perceptions, feelings towards the two species tended to be the same. Perceptions towards jaguars were not influenced by the predation history of the properties, suggesting that the predation impact was not remarkable enough to influence local perceptions towards carnivores. This is apparently the first study on local perceptions towards large carnivores in Brazil.

Conger, E. 2007. A2A - The Algonquin to Adirondacks Conservation Association. Pages 10-11 in Abstracts of Presentations of the 3rd Midwestern-Eastern Puma Conference, Trent University, Peterborough, Ontario.

Abstract

Animals like the puma must have healthy, connected habitat to achieve healthy populations. The Algonquin to Adirondacks Conservation Association’s purpose is to protect, enhance and connect plant and animal habitat between Eastern North America's two largest parks: Algonquin Park in Ontario and Adirondack State Park in New York. The narrowest part is the Frontenac Arch, which widens out to join the Algonquin portion of the Canadian Shield to the north and the Adirondack Mountains to the south. The Adirondack Mountains, in turn, connect related biological communities with those in the Appalachians, making the A2A initiative continental in scale. Due to favourable geography and climate, the A2A region is at the junction of five overlapping biological regions, making it one of the most biodiverse areas in Canada and the Northern United States. It is home to the greatest variety of vascular plants in Canada and to the animal species which depend on them. The A2A area is mostly privately owned, which means that the responsibility for preserving it can not simply be passed on to governments. A2A works both with governments and private landowners. Its motto is “Connect with Respect”. The A2A mission is to encourage the maintenance, restoration and enhancement of ecological connectivity, ecosystem function and native biodiversity, while respecting sustainable human land uses in the A2A area. There are numerous threats to the continued natural functioning of the A2A region, especially where it is at its narrowest: near the St. Lawrence River. Of particular concern are inappropriate development, global warming and invasive species. Education and initiating landscape-wide environmental planning are key to minimizing these threats. The A2A Conservation Association will be working on several major projects in the coming years: environmental planning on the Gananoque River System, decreasing the barrier effect of the 401 Highway, research on how global warming impacts can be minimized on forest species in the area and public education about the special nature of the region and its need for protection. A2A is a “Big Picture” organization, coordinating and providing assistance to partnering groups. It is also an inclusive organization, having a membership of people with diverse backgrounds, who represent a large number of groups, such as hunters and cottagers, trappers, environmentalists and First Nations. Some have divergent, even conflicting, views about conservation, but they have come together in an atmosphere of respect to achieve the common essential goal of preserving and enhancing wildlife habitat.

Conger, W.B. 1938. The Real Cougar. Nature 31(8):491-492.

The author states that of all the large animals of this country, the cougar is the most maligned and has been the victim of misinformation and false tales. There had been less than a dozen authentic accounts of attacks on human beings.

Connolly, E.J. Jr. 1949. Food Habits and Life History of the Mountain Lion (Felis concolor hippolestes). M.S. Thesis., Univ. of Utah, Salt Lake City. 176pp.

Mountain lions were tracked in the snow from January 8, 1948 until May 8, 1948 and from December 19, 1948 until January 26, 1949 in the Lost Creek area of Morgan County, Utah. They were tracked from January 27, 1949 until March 18, 1949 in the Book Cliff Mountains, Carbon County, Utah for a total of 87 days of cougar activity. A mature lion killed an average of one deer every 9.67 days and one porcupine every 7.2 days. Possibly the role of the mountain lion as a livestock predator during the winter months has been highly overrated. Hair of mature deer, fawn, porcupine, rabbits, and rodents, in order of decreasing quantities, has been found in lion stomachs and scats. No special preference for sex or age classes or the physical condition of the deer was observed. Deer seem to be chosen on the basis of proximity and accessibility.

Conrad, L. 1992. Cougar Attack: Case Report of a Fatality. Journal of Wilderness Medicine 3(4):387–396.

Abstract

The case of an 18-year-old adult male killed by a cougar (mountain lion) is presented. Cougars rarely attack humans, but inflict serious injury. Large bite or claw wounds, frequently to the head and neck, require emergency medical management with attention to deep structure injury, as well as potential *Pasteurella multocida* or rabies infection. Cougar-human interactions are increasing as rural housing developments and recreation in wilderness areas expand. Understanding cougar predator-prey behavior may help prevent attacks and injuries, particularly to children.

Conroy, M.J., P. Beier, H. Quigley and M.R. Vaughan. 2006. Improving the Use of Science in Conservation: Lessons from the Florida Panther. J. Wildl. Manage. 70(1):1-7.

Abstract

In a companion article (Beier et al. 2006), we identified 2 sets of unreliable inferences that may compromise efforts to conserve the Florida panther (*Puma concolor coryi*). In spite of serious flaws in methodology and interpretation, these unreliable conclusions have appeared in prominent, peer-refereed scientific journals and have been repeatedly cited and miscited in support of panther conservation. Future editors and referees may reduce these errors by insisting on adherence to an Introduction, Methods, Results, and Discussion (IMRAD) format; checking improbable assertions attributed to earlier papers; and refusing to allow scientific inference in publication formats not subject to scientific peer review (e.g., editorials). We urge conservation biologists to view science as an adaptive process and to use the method of multiple working hypotheses (Chamberlin 1890) that are now a central feature of adaptive resource management (Walters 1986, Williams et al. 2002). We advocate a workshop approach, similar to that used for analysis of data for the northern spotted owl (*Strix occidentalis*; Anderson et al. 1999), to deal with scientific disagreement where, as in the case with panthers, stakeholders have entrenched points of view. Finally, we recommend the creation of an independent Scientific Steering Committee to address long-term issues of future research and monitoring of Florida panthers.

Cooley, H.S., G. Koehler, B. Maletzke and R.B. Wielgus. 2008. Dynamics and Demography of a Central Washington Cougar Population. Page 169 in Toweill, D. E., S. Nadeau and D. Smith, editors. Proceedings of the Ninth Mountain Lion Workshop, May 5-8, 2008, Sun Valley, Idaho, USA.

Abstract

From 2002 – 2007, we monitored a cougar population in central Washington to investigate demographic effects and dynamics of a relatively light harvest regime (removals = 0.09 – 0.47%), and to test the hypothesis that cougars are selfregulating. We recorded fecundity through den site investigation and snow tracking, and mortality by weekly telemetry.

We estimated survival rates for collared kittens (0-1 yr), juveniles (1-2 yr), and adult (2+ yr) males and females, and input the parameters in a dual-sex Leslie Matrix population model to predict deterministic and stochastic growth. We then compared modeled growth to the observed growth rate, which we estimated by constructing life histories of all known cougars (collared, harvested, and other uncollared mortalities) in the study area. Annual densities were calculated based on the 95% kernel composite female home range. Preliminary results show that despite a high female survival rate (0.908) and a high stochastic growth rate (1.10), densities of cougars did not increase (mean average density = 1.72 adults/100km^2) in our study area. We believe that cougars are compensating for high growth through emigration. Results will be updated.

Cooley, H.S., H.S. Robinson, R.B. Wielgus and C.S. Lambert. 2008. Cougar Prey Selection in a White-Tailed Deer and Mule Deer Community. J. Wildl. Manage. 72(1):99-106.

Abstract

Widespread mule deer (Odocoilus hemionous) declines coupled with white-tailed deer (O. virginianus) increases prompted us to investigate the role of cougar (Puma concolor) predation in a white-tailed deer, mule deer, and cougar community in northeast Washington, USA. We hypothesized that cougars select for and disproportionately prey on mule deer in such multiple-prey communities. We estimated relative annual and seasonal prey abundance (prey availability) and documented 60 cougar kills (prey usage) from 2002 to 2004. White-tailed deer and mule deer comprised 72% and 28% of the total large prey population and 60% and 40% of the total large prey killed, respectively. Cougars selected for mule deer on an annual basis (mule deer = 0.63 vs. white-tailed deer = 0.37; P = 0.066 – Manly's preference index). We also detected strong seasonal selection for mule deer with cougars killing more mule deer in summer (mule deer = 0.64) but not in winter (mule deer = 0.53) – Manly's preference index). Cougars showed no seasonal selection for white-tailed deer despite their higher relative abundance. The mean annual kill interval of 6.68 days between kills varied little by season (winter = 7.0 days/kill, summer = 6.6 days/kill; P = 0.78) or prey species (white-tailed deer = 7.0 days/kill, mule deer = 6.1 days/kill; P = 0.58). Kill locations for both prey species occurred at higher elevations during summer months (summer = 1,090 m, winter = 908 m; P = 0.066). We suspect that cougars are primarily subsisting on abundant white-tailed deer during winter but following these deer to higher elevations as they migrate to their summer ranges, resulting in a greater spatial overlap between cougars and mule deer and disproportionate predation on mule deer.

Cooley, H. S., R.B. Wielgus, G. Koehler and B. Maletzke. 2009. Source Populations in Carnivore Management: Cougar Demography and Emigration in a Lightly Hunted Population. Animal Conservation 12(4):321-328.

Abstract

Wildlife agencies typically attempt to manage carnivore numbers in localized game management units through hunting, and do not always consider the potential influences of immigration and emigration on the outcome of those hunting practices. However, such a closed population structure may not be an appropriate model for management of carnivore populations where immigration and emigration are important population parameters. The closed population hypothesis predicts that high hunting mortality will reduce numbers and densities of carnivores and that low hunting mortality will increase numbers and densities. By contrast, the open population hypothesis predicts that high hunting mortality may not reduce carnivore densities because of compensatory immigration, and low hunting mortality may not result in more carnivores because of compensatory emigration. Previous research supported the open population hypothesis with high immigration rates in a heavily hunted (hunting mortality rate=0.24) cougar population in northern Washington. We test the open population hypothesis and high emigration rates in a lightly hunted (hunting mortality rate=0.11) cougar population in central Washington by monitoring demography from 2002 to 2007. We used a dual sex survival/fecundity Leslie matrix to estimate closed population growth and annual census counts to estimate open population growth. The observed open population growth rate of 0.98 was lower than the closed survival/fecundity growth rates of 1.13 (deterministic) and 1.10 (stochastic), and suggests a 12-15% annual emigration rate. Our data support the open population hypothesis for lightly hunted populations of carnivores. Low hunting mortality did not result in increased numbers and densities of cougars, as commonly believed because of compensatory emigration.

Corbett. 2003. Investigating Cougar Attacks on Humans: The British Columbia Approach. Page 56 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

An increasing number of cougar (Puma concolor) and bear (Ursus spp.) attacks on humans prompts British Columbia (BC) conservation officers to develop better procedures for doing investigations. Photographs from 2 cougar attacks and one murder mistaken for a cougar attack will be shown and discussed. Lack of procedure resulted in unfounded speculation and loss of evidence in the murder. Contents and highlights of the procedure and investigation form will be discussed. Copies of the procedure as handouts. Photographs and description of kit contents. Photographs of the kit in use. Training for the kit has been done by CD-ROM. Photos and excerpts from the training will be shown. Sample CDs will be available as handouts. Description of the function and purpose of attack teams. Photos of attack teams in training. Description of training and special equipment. We are willing to share our knowledge and learn from other agencies.

Corts, K.E. and F.G. Lindzey. 1984. Basal Metabolism and Energetic Cost of Walking in Cougar. J. Wildl. Manage. 48(4):1456-1458.

Two cougars (one male and one female) were raised in captivity and were familiarized with experimental equipment and procedures. The first set of trials were conducted at six months of age and continued for four months. The male and female ranged from 24.5 to 32.7 kg and 24.1 to 27.7 kg, respectively, over this period. The second set of trials was conducted at 17 months of age when the male weighed 59.1 kg and the female 43.6 kg. The cost of walking 1.6 km/hour ranged from 3.85 to 5.90 kcal/kg$^{0.75}$/hour for the female and 3.94 to 5.92 kcal/kg$^{0.75}$/hour for the male. The average cost to the male for locomotion was 0.11 kcal/kg$^{0.75}$ less than the female probably because of a general decrease in heat production with increasing body size.

Cosper, P.M. 1971. The Status and Management of the Cougar in Arizona. Pgs. 93-95 In: Jorgensen, S.E. and L.D. Mech (eds.), Proc. of a Symposium on the Native Cats of North America, Their Status and Management. U.S. Dept. Int., Fish and Wildlife Service, Twin Cities, Minnesota.

Much of the information in this paper was taken from a paper prepared by John Russo and John Carr and presented at the Western Association of State Game and Fish Commissioners Conference at Victoria in 1970. The total estimated lion population was 1440 animals in 1969.

Coss, R.G., E.L. Fitzhugh, S. Schmid-Holmes, M.W. Kenyon and K. Etling. 2009. The Effects of Human Age, Group Composition, and Behavior on the Likelihood of Being Injured by Attacking Pumas. Anthrozoos: A Multidisciplinary Journal of The Interactions of People & Animals, 22(1):77-87.

Abstract

Documentation from the years 1890 to 2000 of 185 instances of pumas (*Puma concolor*) attacking humans in the United States and Canada has provided statistical evidence that pumas are less likely to kill or injure humans in certain circumstances. We identified incidents of fatal attacks, severe injuries, light injuries, and no injuries as a function of human age class, group size, body posture, and conspicuous action, such as noise making, running, or shooting. Ordinal multinomial regression revealed that age class (< 13 years old vs. older) was not a statistically reliable predictor of attack severity. This statistical method also revealed that there was no reliable association between the number of individuals present during the attack and attack severity. Nevertheless, examination of specific attack outcomes indicated that the likelihood of escaping injury increased when two or more people were present. The speed that individuals moved during the attack did not predict attack severity, but it was apparent that the lowest likelihood of escaping injury (26%) and greatest frequency of severe injuries (43%) occurred when individuals remained stationary. In contrast, half of the individuals who ran when they were attacked escaped injury, whereas running was associated with only a small increase in the frequency of fatal attacks (28%), compared with remaining stationary (23%). Evidence that half of the individuals who ran escaped injury suggests that pumas are assessing immobility in humans as they might with other prey, using it as an index of prey inattention or disablement and hence greater vulnerability.

Cowan, I.M. 1971. Summary of the Symposium on the Native Cats of North America. Pgs. 2-8 In: Jorgensen, S.E. and L.D. Mech (eds.), Proc. of a Symposium on the Native Cats of North America, Their Status and Management. U.S. Dept. Int., Fish and Wildlife Service, Twin Cities, Minnesota.

At the time of European colonization of North America, the cougar occurred in every Canadian province except Manitoba and Newfoundland. In British Columbia, it was found north to the 58th parallel of latitude and possibly into extreme southern Yukon territory. Cougars occur in very small numbers in southern Ontario, Quebec, south of the St. Lawrence River, New Brunswick, Nova Scotia, Maine, and Pennsylvania. No recent sightings have occurred for New York state, even though much suitable habitat exists. Although apparently eliminated before 1900 in New Hampshire, recent reports of sightings may be authentic. A self-maintaining population of 50-100 cougars exists in Florida with a few animals sighted and killed in Georgia, Alabama. and Louisiana. However, there is no evidence to indicate that these populations are surviving. When the approximate mean annual recorded kill for each of the political areas with major populations is converted into figures of square miles per cougar killed per year, the densities represented by continuing kill are: Arizona, 456 square miles per kill; Washington, 460 square miles; Oregon, 647 square miles; and British Columbia and California each with 790 square miles per kill per year. There was no basis for converting kill figures into total population, however, an attempt was made in Washington where it was estimated to vary from one in ten to one in four. It seemed unlikely from cougar population vital statistics that a kill of 20% could be sustained. Under some circumstances, a large bounty system ($40-$75) can bring about a decrease in cougar populations.

Cox, J.J., D.S. Maehr and J.L. Larkin. 2006. Florida Panther Habitat Use: New Approach to an Old Problem. J. Wildl. Manage. 70(6):1778-1785.

Abstract

Although the Florida panther (*Puma concolor coryi*) has a history of study spanning more than 2 decades, some researchers have criticized previous habitat analyses of the panther for using daytime telemetry locations to infer 24-hour habitat use, selective use of radiotagged animals, comparison of animal locations to an inappropriate set of available resources, use of land cover maps for time periods that poorly matched some animal locations, use of locations instead of the individual animal as the sampling unit, and failure to account for telemetry error. To address all but the first of these concerns, we analyzed over 57,000 radiolocations of 100 Florida panthers and 8 introduced Texas cougars (*Puma concolor stanlyana*) collected from 1981 to 2003 using a Euclidean distance-based analysis (EDA), a technique that measures linear distances between telemetry locations and habitat types to determine nonrandom habitat use. We matched panther locations to 1 of 3 land cover maps reflecting cover conditions spanning 23 years to determine second- and third-order habitat selection. Panthers selected a mosaic of habitats when establishing a home range, and selected forests and avoided open wetlands within their home range. We recommend that managers give forests highest consideration when conserving this endangered species and suggest the further evaluation of the habitat value of natural openings that occur in close proximity to forested panther range.

Cox, M.K. and S. Stiver. 1997. Status and Management of Mountain Lions in Nevada. Pages 17-18 *in* W.D. Padley, ed., Proc. Fifth Mountain Lion Workshop: 27 February- 1 March 1996; San Diego, California.

Mountain lions (*Puma concolor*) are found throughout Nevada primarily on mountain ranges that are surrounded by low elevation valleys. Using data from harvested lion numbers, the population trend for mountain lions from 1990-1995 is stable to increasing. The Nevada Division of Wildlife (NDOW) in 1994-1996 developed a comprehensive mountain lion management plan. Over the last five years, there have been less than ten reported cases of lions attacking humans in Nevada. An average of 161 mountain lions were taken by sport hunters from 1993-1995. NDOW encourages research that can be directly applied to management of lion populations.

Craig, D.L. 1986. The Seasonal Food Habits in Sympatric Populations of Puma (Puma concolor), Coyote (Canis latrans), and Bobcat (Lynx rufus) in the Diablo Range of California. M.A. Thesis. San Jose State Univ., 61pp.

Eighty-one puma scats were collected and analyzed from July, 1983 to September, 1985. Most were found in creek drainages, primarily on benches. Ungulates were the most frequently-occurring item in the annual sample, the majority being black-tailed deer. Non-sciurid rodents were the second most common prey item. The annual average number of items per scat was 1.42. Seasonal differences in utilization were not statistically significant for any food item. Pig and opossum were the second most common food items in the wet season and small rodents were the second most common in the dry season. Non-sciurid rodents occurred in 12% of the scats, representing 10 scats. All but two of the ten scats were scrape-associated. Cow remains occurred in a small percentage of the scats and sheep remains were not observed in any scats. The annual frequency of occurrence for deer obtained in this study was consistent with those found in other studies but the

percentage was higher than all others in the literature except for 2 studies in California (Dixon, 1925; Smith, 1981). Absence or limited distribution of alternate prey found in other states may account for the comparatively high utilization of deer. A possible trend was that pigs were primarily preyed upon in the wet season. Small rodents may be more prevalent in the diet of pumas because they had recently increased in density or vulnerability due to the burn of 1983. This prevalence may also be linked to the decreased utilization of pigs as alternate prey. Elk remains occurred in one scat. Four scats contained the remains of opossum. No other published study had found opossum to be a food item of pumas.

Cramer, P.C. 1999. Modeling Florida Panther Movements to Predict Conservation Strategies in North Florida. Ph.D. Thesis. University of Florida.

Abstract

The Florida panther (*Puma concolor coryi*) is one of the most endangered mammals in North America. Reintroducing the panther to portions of its former range has been deemed critical to the species' future existence. The north Florida-south Georgia region is a prime candidate site for such reintroductions. Modeling the movements of Florida panthers is used as a tool to identify specific regional landscape features and conservation strategies that would be most critical to panthers, other species, and the ecosystems upon which they depend. The spatially explicit model PANTHER was created based on results from a state sponsored reintroduction feasibility study and ongoing studies of south Florida panthers. It mimics panther behavior and movement over Geographic Information Systems (GIS) maps representing natural communities, roads, deer densities, human densities, and human attitudes. Potential future effects of human development were also modeled, based on data derived from county and regional comprehensive plans, population projections, and development patterns. The model was validated by comparing output estimates with those from previous Florida panther studies. The model identified high probability use locations within the 7,000 square kilometer study area. The majority of these locations are also places of high development pressure, especially along the Suwannee River. Model output indicates panthers used private property approximately 67 percent of all moves. Model outputs were compared with data from a public education program conducted earlier in the research process. Over 70 percent of panther moves were in Hamilton and north Columbia Counties, areas of lowest public support for panther reintroductions. Landscape connections for panthers and specific areas of high panther use along Interstates I-75 and I-10 were also identified. These and other model results support conservation approaches that include a continued commitment to regional and county planning in environmentally sensitive areas, possible public purchase of environmentally sensitive lands, and financial incentives to owners of private properties deemed critical to panthers. Model results support targeting landowners and residents of Hamilton and Columbia counties for future education programs and inclusion in conservation processes.

Cramer, P.C. and K.M. Portier. 2001. Modeling Florida Panther Movements in Response to Human Attributes of the Landscape and Ecological Settings. Ecological Modelling 140:51-80.

Abstract

This paper describes the development and results of an individual-based spatially explicit model created to assist in the potential reintroduction of the Florida panther *(Puma concolor coryi*) to northern Florida, an area within its former range. The PANTHER model was created to incorporate human attributes of the landscape with ecological attributes to evaluate and identify landscape features and conservation strategies that will be critical to a population of panthers. The model mimics panther movement behavior using a C++ program, and implements panther moves over Geographic Information Systems (GIS) maps depicting land cover, roads, deer densities, and human densities. Sensitivity analysis revealed home range sizes were most sensitive to how panthers perceived the landscape, their place of reintroduction on the landscape, and gender-based rules. Panther interactions were dependent on perception distances. Home range placement within the study area was most similar to field studies when panthers ranked cypress as a tertiary rather than a secondary preferred land cover type. Model simulation results indicated locations along the Suwannee River where Florida panthers and humans would prefer to reside, both under 1990s landscape conditions, and under two possible future scenarios that predicted future human development. As human density and development were increased the use of hardwood hammocks (a land cover preferred by panthers) was predicted to decrease. Simulation results also indicated that panthers increased use of several other land cover types, were subjected to increased mortality on roads, and constricted their home ranges as human density and development increased. Model results can be used to support conservation actions that restrict development in areas along rivers and identify landowners who own land panthers would most likely use.

Crane J. 1931. Mammals of Hampshire County, Massachusetts. J. Mammal. 12:270.

The author reports that the Adirondack cougar is generally considered extinct in the state but presents a record of its recent appearance in the mountainous country around Huntington in Hampshire County. The Reverend Mr. J. Chapin told the author that on January 18, 1926, he had a good view of an animal, undeniably a cougar, as evidenced by the cat-like form, the size, the color, and the very long tail. Dogs set upon the trail refused to follow it. The following morning the animal was seen by a neighbor. Tracks have been seen since at wide intervals, but a specimen has not yet been taken. Cougars were undoubtedly once more or less common in New England. John Josselyn refers to occasional "lyons" seen on Cape Ann and killed by the Indians. Wood, 1634, mentions "Plimouth Men" hunting for "lyon skins." One was killed by Northampton hunters in 1764, at which time a bounty of four pounds was in force, which bounty would indicate that they were still numerous enough to cause some apprehension. Their best and last stronghold was in the Adirondacks, so that their appearance in Massachusetts is quite believable.

Creekmore, C. 1991. The Paradox. National Wildlife 30(1):22-25.

The research of John Laundre, Idaho State University biologist, is highlighted. A portion of this research investigates why lions in some parts of the country kill livestock. Some ranches in Graham County, Arizona, may lose between 25 and 45 percent of their calves to hunting cats as opposed to other areas of the country where lions have not taken a head of livestock in more than 30 years. Wildlife officials estimate the United States population at between 16,000 and 20,000 cats. Maurice Hornocker, biologist with the Wildlife Research Institute in Idaho explained that mountain lions throughout the U.S. feed on livestock in only a few areas and that taxpayers spend more money controlling these lions than the ranchers lose to depredation. Harley Shaw, retired Arizona Game and Fish biologist suggested that ranchers move their calves out of lion country and onto safer pastures during the calving season. Hornocker's studies indicate that killing off large numbers of lions may create vacant territories where transient lions (usually younger and less experienced) may be more inclined than older, more mature cats to feed on livestock. Allowing a lion population to stabilize into set territories may reduce depredation. Laundre's research involves 11 to 15 adult lions in southeastern Idaho. They will study patterns of lion movements and activities and survey kill sites. Genetic relationships will also be determined by DNA "fingerprinting" of mountain lion tissue samples.

Criffield, M., D. Onorato, M. Cunningham, D. Land and M. Lotz. 2008. Daily Movement Distances of Florida Panthers (*Puma concolor coryi*) Assessed With GPS Collars. Page 121 in Toweill, D. E., S. Nadeau and D. Smith, editors. Proceedings of the Ninth Mountain Lion Workshop, May 5-8, 2008, Sun Valley, Idaho, USA.

Abstract

We are reporting a preliminary assessment of movement distances of Florida panthers (*Puma concolor coryi*) as part of an ongoing GPS collar study in southwest Florida. To date, fine-scale movements of panthers have not been investigated and as such, we used datasets from 6 collars deployed on female (n = 2) and male (n = 4) panthers with schedules set to obtain fixes at 1 or 2 hour intervals. We analyzed the daily movement distance (DMD) for each panther by randomly selecting 4 24-hour periods within each month. Collars averaged 75.8% successful locations on the 253 selected days. Panther DMDs averaged 7.90 km (range 0.30-24.6 km, SE = 2.7) per day traveling 0.33 km/hour. Male and female DMDs averaged 9.30 (SE =1.9) km at 0.387 km/h and 5.09km (SE = 1.7) at 0.212 km/h, respectively. We found no statistical difference between the sexes (Wilcoxon rank sum W test, W = 18.0, P = 0.1052), likely an artifact of our currently small sample size. Collection of data from additional panthers will improve DMD estimates, define travel routs within home ranges, and assist in differentiating individuals by track survey and sign.

Cronemiller, F.P. 1948. Mountain Lion Preys on Bighorn. J. Mammal. 29(l):68.

Portions of a recently killed desert bighorn (Ovis canadensis nelsoni) including the complete head were found in the San Bernardino National Forest in southern California. The tracks of a mountain lion were found in the immediate vicinity and showed that a struggle had taken place before the bighorn had been killed.

Cruickshank, H.S., H.S. Robinson, C. Lambert and R.B. Wielgus. 2003. Functional Response of Cougars and Prey Availability in Northeastern Washington. Page 164 *in* S.A. Becker, D.D. Bjornlie, F.G. Lindzey, and D.S. Moody, eds. Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming.

Abstract

Within the last ten years, a major change in the population structure of deer in western North America has taken place. Mule deer populations are sharply declining, while white-tailed deer populations are increasing. Researchers have suggested that cougar predation is a possible reason for the decline. The purpose of this project is to investigate cougar predation in a community where substantial populations of white-tailed deer, mule deer, and cougars overlap. We are testing two alternative hypotheses of cougar prey selection. H1, or the apparent selection hypothesis, states that equal selection by cougars for white-tailed deer and mule deer, but a higher reproductive rate by white-tailed deer is causing a decline in the mule deer population. H2 proposes that higher selection by cougars for mule deer is causing a decline in the population. Preliminary results suggest H2. The effect of predation on prey is determined by two factors: 1) functional response, and 2) prey availability. Functional response of cougars is quantified by the number of kills, per cougar, per unit time, and prey availability provides an estimate of the number and distribution of each prey species. The combination of these two factors may offer a more complete understanding of cougar prey selection. This research is in support of a larger study, which will use the apparent competition theory to examine alternative cougar management strategies.

Cruickshank, H.S. 2004. Prey Selection and Kill Rates of Cougars in Northeastern Washington. M.S. Thesis. Washington State University. Dept. Nat. Res.

Abstract

We investigated prey selection and kill rates of cougars in northeastern Washington from 2002-2004, in a sympatric white-tailed deer and mule deer system. We tested two competing hypotheses of prey selection, “prey switching” and “apparent competition”. We developed a sightability model which corrected ground counts of white-tailed deer and mule deer using life-sized deer decoys to calculate relative prey availability. A logistic regression sightability model tested for effects of group size, distance, and habitat on deer sightability, then predicted relative numbers (availability) of both deer species on transects. To estimate use of prey by cougars, we examined 60 cougar kills. White-tailed deer comprised 60% of the kills (mule deer comprised 40%), a proportion larger than the study area’s prey population (70% white-tailed deer vs. 30% mule deer). Cougars selected for mule deer across the entire study area. We also detected strong seasonal changes in prey selection, with cougars strongly selecting for mule deer in summer, but not during winter. Mean annual kill rate was 6.68 days per deer killed. Kill rates did not differ between seasons or deer species. Habitat characteristics of kill sites did not differ significantly between white-tailed deer and mule deer kills. These findings are consistent with the apparent competition hypothesis and suggest that the current decline in mule deer numbers in northeastern Washington is caused by an abundant invading primary prey species (white-tailed deer) and a related increase in predation on the secondary prey species (mule deer) during summer months.

Cruickshank, H.S., H. Robinson and R. Wielgus. 2005. Prey Selection and Functional Response of Cougars in Northeastern Washington. Page 157 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

We investigated prey selection of cougars in northeastern Washington during 2002-2004, where sympatric white-tailed deer and mule deer are the available primary prey. We also tested two competing predation hypotheses, the "prey switching" hypothesis, and the "apparent competition" hypothesis. White-tailed deer comprised the greatest proportion of cougar kills (60%) and prey population (70%) across the study area; however use/availability results in all cases show either selection for mule deer or neutral selection. 2nd and 3rd order selection results indicate that cougars select for mule deer across the entire study area ($p = 0.05$ and $p = 0.07$), however within the study area, selection varies geographically. We detected strong seasonal fluctuations in selection, with cougars strongly selecting for mule deer in summer ($p = 0.02$), but showing neutral selection during winter ($p = 0.49$). Mean annual functional response of cougars was 6.68 days per deer kill. Kill rates did not differ between seasons ($p=0.78$) or deer species ($p = 0.58$), and we found no differences in habitat characteristics

between white-tailed deer and mule deer kills. These findings are consistent with the apparent competition hypothesis, suggesting that the mule deer decline, although directly attributed to cougars, is ultimately caused by an abundance of invading primary prey (white-tailed deer).

Culbertson, N. 1978. Status and History of the Mountain Lion in the Great Smoky Mountains National Park. National Park Service, Management Report #15. 70pp.

Forty-three reliable lion sightings were gathered for the park vicinity. It is believed that there were three to six mountain lions living in the park in 1975, and other lions were reported to the southeast and northeast of the park as well. Lions were seen most frequently near areas of high deer density. There are probably enough high deer density areas in the park vicinity to support as many as 60 lions, but it is doubtful that the population will ever reach this level. The greatest risk to the present lion population will be the public's attitude towards the animal. Any management programs should emphasize that a few lions will not harm deer or other game species in this area and may benefit the herd and range through dispersal of herds. Visitors to the park should be encouraged to report any lions or lion sign they see, and all such reports should be investigated. Future studies should try to provide a more accurate population count of lions in the park, and should try to assess the reproductive success of these lions.

Cullens, L.M. and C.M. Papouchis. 2003. Community-Based Conservation of Mountain Lions. Page 147 *in* S.A. Becker, D.D. Bjornlie, F.G. Lindzey, and D.S. Moody, eds. Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming.

Abstract

The western United States is experiencing a rapid growth in human population, with a commensurate loss and fragmentation of wildlife habitat. As the only top predator with viable populations throughout the West, the long-term conservation of this species is vital for maintaining the health and integrity of the region's native ecosystems. Unfortunately, populations of mountain lions in areas subjected to intensive human development or activity may become threatened unless conservation efforts are implemented and realized. For example, in several regions of California, including the West slope of California's Sierra Nevada Mountains, the number of mountain lions killed as the result of conflicts with domestic animals (e.g., goats and pets) has increased dramatically over the past decade. According to California Dept. of Fish and Game, mountain lions may be extirpated from this area within 40 years due to habitat loss and excessive human caused mortality. Accordingly, a substantial policy shift is needed. In other areas, such as Southern California, few lions remain in fragmented wildlands, and different conservation strategies are required to reach urban and suburban residents who live on the edge of wildlife areas. We review efforts to conserve mountain lions at the community level and elaborate new approaches that stress science to establish a factual basis for dialogue, community involvement to identify shared goals, and developing partnerships with diverse organizations and professions to broaden conservation efforts.

Cullens, M. 2005. Practical Methods for Reducing Depredation by Mountain Lions. Page 151 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

Mountain lion depredation on domestic livestock and pets is of great concern to many individuals and communities. For the last five years, the Mountain Lion Foundation has explored practical community-based methods for reducing mountain lion depredation across a variety of landscapes and human demographics. A review of the scientific literature reveals relatively little hard data regarding the efficacy for various methods of depredation avoidance. Methods such as fencing or enclosure of domestic animals, shed-birthing, lighting, frightening devices, herding, guard animals, corridor redirection, and harassment are detailed. Variables of mountain lion behavior and biology, which may affect the value of these methods, are explored, and the social, economic, and legal challenges to implementation are considered. An outline for research is provided, along with sample forms and a database for detailed mountain lion depredation accounting.

Culver, M., W.E. Johnson, J. Pecon-Slattery and S.J. O'Brien. 2000. Genomic Ancestry of the American Puma (*Puma concolor*). Journal of Heredity 91(3):186-197.

Abstract

Puma concolor, a large American cat species, occupies the most extensive range of any New World terrestrial mammal, spanning 100 degrees of latitude from the Canadian Yukon to the Straits of Magellan. Until the recent Holocene, pumas co-existed with a diverse array of carnivores including the American lion (*Panthera atrox*), the North American cheetah (*Miracynonyx trumani*), and the saber toothed tiger (*Smilodon fatalis*). Genomic DNA specimens from 315 pumas of specified geographic origin (261 contemporary and 54 museum specimens) were collected for molecular genetic and phylogenetic analyses of three mitochondrial gene sequences (*16S rRNA, ATPase-8,* and *NADH-5*) plus composite microsatellite genotypes (10 feline loci). Six phylogeographic groupings or subspecies were resolved, and the entire North American population (186 individuals from 15 previously named sub-species) was genetically homogeneous in overall variation relative to central and South American populations. The marked uniformity of mtDNA and a reduction in microsatellite allele size expansion indicates that North American pumas derive from a recent (late Pleistocene circa 10,000 years ago) replacement and recolonization by a small number of founders who themselves originated from a centrum of puma genetic diversity in eastern South America 200,000-300,000 years ago. The recolonization of North American pumas was coincident with a massive late Pleistocene extinction event that eliminated 80% of large vertebrates in North America and may have extirpated pumas from that continent as well.

Culver, M., W. Johnson, J. Pecon-Slattery and S.J. O'Brien. 2003. A Phylogeographic Study of Pumas (Puma concolor) Using Mitochondrial DNA Markers and Microsatellites. Page 57 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

In this research project, several molecular markers were used to ascertain the level of genetic differentiation among natural puma (Puma concolor) populations, and also use this differentiation to understand genetic structure and infer natural history and evolution of the puma. Samples were obtained from throughout the geographical multi-habitat range of pumas and encompass all 32 described subspecies. Population level genetic differentiation in the puma was assessed using 2 independent molecular markers. These are several regions of mitochondrial DNA and 10 feline nuclear microsatellites. Results from both mitochondrial and nuclear markers indicate a low level of genetic variation in North American pumas relative to abundant variation observed in South American pumas. Regional differences are observed for Central and South American pumas with a total of 6 phylogeographic groups identified using both mitochondrial and nuclear markers. Furthermore, extant puma lineages appear to have originated in South America. The North American genetic lineage is younger than the South American lineages and younger than the North American fossil record. This indicates the potential occurrence of an historic extinction and recolonization event among North American pumas.

Culver, M. 2006. Puma Phylogeography and How Genetics is Applied to Identifying Eastern Puma. Pages 114-116 in H.J. McGinnis, J.W. Tischendorf and S.J. Ropski editors. Proceedings of the Eastern Cougar Conference 2004, Morgantown, West Virginia, USA.

Abstract

Genetic characteristics of pumas from different geographical areas were examined using mitochondrial and nuclear DNA markers to examine the level of subdivision and gene flow among puma populations. The results indicated that pumas north of Nicaragua are not genetically distinguishable using this set of 11 independent markers. Additional analyses were performed using the highly variable mitochondrial control region, which also supported the conclusion of genetic homogeneity for North American pumas. These results will be discussed, along with the implications that these results have for eastern pumas, and the outcome of species identifications tests performed for hair and scat samples collected from potential eastern pumas.

Culver, M., P.W. Hedrick, K. Murphy, S. O'Brien and M.G. Hornocker. 2008. Estimation of the Bottleneck Size in Florida Panthers. Animal Conservation 11(2):104-110.

Abstract

We have estimated the extent of genetic variation in museum (1890s) and contemporary (1980s) samples of Florida panthers *Puma concolor coryi* for both nuclear loci and mtDNA. The microsatellite heterozygosity in the contemporary sample was only 0.325 that in the museum samples although our sample size and number of loci are limited. Support for this estimate is provided by a sample of 84 microsatellite loci in contemporary Florida panthers and Idaho pumas *Puma concolor hippolestes* in which the contemporary Florida panther sample had only 0.442 the heterozygosity of Idaho pumas. The estimated diversities in mtDNA in the museum and contemporary samples were 0.600 and 0.000, respectively. Using a population genetics approach, we have estimated that to reduce either the microsatellite heterozygosity or the mtDNA diversity this much (in a period of c. 80 years during the 20th century when the numbers were thought to be low) that a very small bottleneck size of c. 2 for several generations and a small effective population size in other generations is necessary. Using demographic data from Yellowstone pumas, we estimated the ratio of effective to census population size to be 0.315. Using this ratio, the census population size in the Florida panthers necessary to explain the loss of microsatellite variation was c. 41 for the non-bottleneck generations and 6.2 for the two bottleneck generations. These low bottleneck population sizes and the concomitant reduced effectiveness of selection are probably responsible for the high frequency of several detrimental traits in Florida panthers, namely undescended testicles and poor sperm quality. The recent intensive monitoring both before and after the introduction of Texas pumas in 1995 will make the recovery and genetic restoration of Florida panthers a classic study of an endangered species. Our estimates of the bottleneck size responsible for the loss of genetic variation in the Florida panther completes an unknown aspect of this account.

Culver, M. and P. Hedrick. 2008. Estimation of the Bottleneck Size in Florida Panthers. Page 163 in Toweill, D. E., S. Nadeau and D. Smith, editors. Proceedings of the Ninth Mountain Lion Workshop, May 5-8, 2008, Sun Valley, Idaho, USA.

Abstract

An estimate of genetic variation in museum samples (1890s) and contemporary (1980s) samples for Florida panthers (*Puma concolor*) was obtained at both nuclear and mitochondrial DNA loci. Although the sample size and number of loci was limited, for microsatellite diversity, contemporary samples had 32.5% of the heterozygosity of that found in museum samples. The mitochondrial DNA diversity was 0.60 in museum samples and 0.00 in contemporary samples. Using a population genetics approach, we have estimated that to reduce diversity at microsatellite and mitochondrial DNA loci to this extent, an effective bottleneck size of approximately two individuals for several generations is required. Given the ratio of effective population size to census population size (Ne/N) of 0.315, estimated from Yellowstone pumas, this translates into a census size of 6.2. Overall, the census population was 41 in non-bottleneck generations and 6.2 for the two bottleneck generations. This low population size is likely to be responsible for the reduction in fitness, or inbreeding depression, observed in Florida panthers prior to the genetic restoration that introduced Texas individuals into Florida.

Cumberland, R.E. and J.A. Dempsey. 1994. Recent Confirmation of a Cougar, Felis concolor, in New Brunswick. Can. Field Nat. 108(2):224-228.

The presence of cougar (Felis concolor) in the northeast, specifically New Brunswick, has been a controversial topic for decades, due primarily to an abundance of reports and sightings confounded by a lack of physical evidence. However, on 16 November, 1992, characteristics and measurements of tracks and identification of hair from a scat found near Deersdale New Brunswick were determined to be that of a cougar. Confirmation of the endangered subspecies, the eastern cougar (Felis concolor couguar) is not possible with the collected data.

Cunningham, E. B. 1971. A Cougar Kills an Elk. The Canadian Field Naturalist 85:253-254.

On December 19, 1967, a cougar, Felis concolor killed an adult male elk, Cervus canadensis in Banff National Park. The carcass and kill site were examined in detail the following day. Fresh snow permitted reconstruction of the probable sequence of events leading up to the kill. These events and the manner in which the cougar fed on the elk are described in detail. The six point elk was in poor physical condition. The skin, portions of the left rib cage and associated musculature had been eaten. An estimated 4 pounds of flesh had been eaten from the back, as well as portions of the posterior upper shoulder and anterior hind quarter. There was no evidence that any attempt was made to feed on any of the internal organs. The elk's neck was cleanly broken at the atlas. It was speculated that the cougar had been on the back and had hooked the elk in the muzzle with its right paw and bent the head back until the neck broke. There was no evidence of claw or teeth marks in the throat region or back of the neck. From the point of initial physical contact to the kill-site was estimated

to be about 250 yards. The cougar continued to visit the kill-site for over a month. During this time it removed or consumed all portions of the elk except the hair and paunch.

Cunningham, M.W., M.R. Dunbar, C.D. Buergelt, B.L. Homer, M.E. Roelke-Parker, S.K. Taylor, R. King, S.B. Citino and C. Glass. 1999. Atrial Septal Defects in Florida Panthers. J. Wildl. Dis. 35(3):519-530.

Abstract

Ostium secundum atrial septal defects (ASDs) were observed in six (3 M, 3 F) of 33 (20 M, 13 F) (18%) Florida panthers (Puma concolor coryi) necropsied by veterinary pathologists between 1985 and 1998. A seventh ASD was found in a female panther necropsied in the field and is included in the pathological description but not the prevalence of ASDs in Florida panthers. One panther (FP205) with severe ASD also had tricuspid valve dysplasia (TVD). Atrial septal defects and/or TVD are believed to have caused or contributed to the deaths of three (9%) Florida panthers in this study. Mean diameter +/- SD of ASDs was 9.0 +/- 4.7 mm (range 3 to 15 mm). Gross pathological changes attributed to ASDs/TVD in severely affected panthers (ASD > or = 10 mm) (n = 4) included mild right ventricular dilatation (n = 3) and hypertrophy (n = 2), mild to severe right atrial dilatation (n = 2), and acute pulmonary edema (n = 3). Panthers with mild ASDs (ASD < or = 5 mm) (n = 3) had no other detectable gross pathological changes associated with the ASDs. Histological examination of lungs of three panthers with severe ASDs revealed mild to moderate dilatation with fibrosis and smooth muscle atrophy of the tunica media of medium to large caliber arteries (n = 2), interstitial and/or pleural fibrosis (n = 2), perivascular fibrosis (n = 1), and acute to chronic edema (n = 3). Twenty-six necropsied panthers were examined one or more times while living; medical records were retrospectively evaluated. Antemortem radiographic, electrocardiographic, and echocardiographic examinations were performed on two panthers with severe ASDs (FP20 and FP205). Thoracic radiographic abnormalities in both included right heart enlargement, and in FP205 (severe ASD and TVD), mild pulmonary overperfusion. Electrocardiographic examination of FP205 revealed a right ventricular hypertrophy pattern, while FP205 had a normal electrocardiogram. Echocardiographic examination of FP20 revealed marked right atrial dilatation; a bubble contrast study indicated regurgitation across the tricuspid valve. Echocardiographic abnormalities in FP20 included right atrial and ventricular lilatation, atrial septal drop-out, and severe tricuspid regurgitation; non-selective angiography revealed significant left to right shunting across the ASD. All panthers with severe ASDs ausculted (n = 3) had systolic right or left-sided grade I-V/VI murmurs loudest at the heart base. All male panthers with ASDs (n = 3) (100%) and 9 of 17 (53%) male panthers without ASDs in this study were cryptorchid.

Cunningham, M.W. 2005. Feline Leukemia Virus in the Florida Panther: Investigation, Management, and Monitoring. Page 137 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

With the growing human-wildlife interface there is increasing exposure of wildlife to domestic animal diseases. Feline leukemia virus (FeLV) is an often fatal infectious disease, common to domestic cats, that is quite rare in non-domestic felids. Routine FeLV antigen testing in Florida panthers *(Puma concolor coryi)* was negative for almost 20 yrs; however, since November 2002, five panthers have tested positive - all in the northern portion of panther range. All infected panthers have died, three due to what were believed to be FeLV-related diseases. Retrospective determination of FeLV antibody titers in archived serum indicated significant exposure beginning in the late 1990's and also concentrated in the northern portion of panther range. Preliminary results for antibody titers and PCR (M. Brown, unpublished data) also suggested that some panthers can be exposed to the virus and recover. The infection in panthers likely originated from an infected domestic cat and testing of cats in panther habitat is currently underway. Vaccination using a killed whole virus vaccine (Fort Dodge Fel-O-Vax® Lv-K) has been the primary management tool to control FeLV in panthers. As of 15 February 2005, 30 free-ranging FeLV-negative panthers have received at least 1 inoculation; 13 of these have been boostered. Test-removal (to captivity) has been added to the management plan. Managers of mountain lion populations can monitor for FeLV by ELISA antigen testing of serum or whole blood collected at capture, or hemolyzed blood and other fluids collected from harvested or necropsied mountain lions. PCR testing of scat may be a suitable non-invasive method of monitoring for FeLV in free-ranging populations.

Cunningham, S.C., L.A. Haynes, C. Gustavson and D.D. Haywood. 1995. Evaluation of the Interaction Between Mountain Lions and Cattle in the Aravaipa-Klondyke Area of Southeast Arizona. Final Report. Proj. No. W-78-R; Ariz. Game and Fish Dept., Tech. Rep. 17, Phoenix. 64pp.

We investigated the ecology of mountain lions (Felis concolor) from February 1991 to September 1993 near Klondyke, Arizona, with respect to prey selection and the effects of predation on commercial cattle operations. We found that mountain lion track surveys have value for comparing mountain lion density among areas despite some inherent biases. Mountain lion track survey indices from our study area were higher than any recorded elsewhere in the state. During our study, mountain lions selected deer (Odocoileus spp.) less frequently than their availability would suggest, selected calves slightly more their availabilty, and took javelina (Tayassu tajacu) as expected. We speculate that lions selected calves because they were more vulnerable to predation than deer. Radio-collared mountain lions in our study experienced the lowest overall annual survival rate (0.55) found in any lion study; depredation control was the leading cause of mortality. Male mountain lions were more likely to be killed in depredation cases than females. Mountain lion density and predation on calves remained high despite losses of substantial numbers of mountain lions to depredation control. The sex ratio within our study population was almost even; the age structure was similar to that reported in unexploited populations.

Cunningham, S.C. 1997. Population Demographics of an Exploited Mountain Lion Population. Page 85 *in* W.D. Padley, ed., Proc. Fifth Mountain Lion Workshop: 27 February- 1 March 1996; San Diego, California.

We investigated the population demographics of an exploited mountain lion (*Puma concolor*) population in the Aravaipa-Klondyke Area of southeastern Arizona from February 1991 to September 1993. By comparing mountain lion track surveys on the Aravaipa-Klondyke study area with surveys from around Arizona, we found lion density on our study area was as high as any recorded in the state. Radio-collared mountain lions in our study experienced the lowest overall annual survival rate (0.55) found on any lion study; depredation control was the leading cause of mortality. Male mountain lions were more likely to be killed in depredation cases than females. The sex ratio within our study population was almost even, and mountain lion age structure was similar to that reported in unexploited populations.

Cunningham, S.C. 1997. Prey Availability and Selection by Mountain Lions in the Aravaipa-Klondyke Area of Arizona. Page 85 *in* W.D. Padley, ed., Proc. Fifth Mountain Lion Workshop: 27 February- 1 March 1996; San Diego, California.

Cunningham, S.C., C.R. Gustavson and W.B. Ballard. 1999. Diet Selection of Mountain Lions in Southeastern Arizona. J. Range Manage. 52(3):202-207.

Prey selection by mountain lions (*Puma concolor*) in the Aravaipa-Klondyke area in southeastern Arizona was studied from February 1991 to September 1993. Overall diet as determined from frequency of occurrence in 370 scats was 48% deer (*Odocoileus virginianus cousi* and *O. hemionus* combined), 34% cattle, 17% javelina (*Tayassu tajacu*), 6% rabbit (*Sylvilagus* spp. and *Lepus californicus* combined), 4% rodent, and 2% desert bighorn sheep (*Ovis canadensis mexicanus*). With respect to biomass consumed, cattle composed 44%, deer 40%, javelina 10.9%, rabbits 2.9%, and rodents 0.02%. Based on mean weights of prey consumed, the proportion of individuals killed and eaten changed to rabbits 52.7%, deer 16.3%, rodents 12%, javelina 10%, cattle 8%, and desert bighorn sheep 0.5%. Mountain lions selected deer less frequently than their availability would suggest, selected calves slightly more than their availability, and javelina as expected. We speculated that lions selected calves because they were more vulnerable to predation than deer.

Cunningham, S.C., W.B. Ballard and H.A. Whitlaw. 2001. Age Structure, Survival, and Mortality of Mountain Lions in Southeastern Arizona. Southwestern Naturalist 46(1):76-80.

Abstract

Reliable estimates of survival and mortality rates for mountain lions (*Puma concolor*) have been difficult to obtain because of their low densities and secretive behavior. We estimated annual survival and cause-specific mortality rates for a heavily exploited mountain lion population in southeastern Arizona from February 1991 to April 1994. We monitored 24 adult radio-collared mountain lions weekly. We used MICROMORT to determine daily, annual, and overall survival rates. Radio-

collared mountain lions had low annual survival (0.62). Depredation control was the leading cause of mortality. Survival rates of female (0.67) and male (0.58) lions did not differ. Because of the high mortality in the area of depredation control, this area may represent a mortality sink.

Currier, M.J.P. 1976. Characteristics of the Mountain Lion Population Near Canon City, Colorado. M.S. Thesis. Colorado State Univ., Fort Collins. 88pp.

The study site selected for the first season (winter 1974-75) was located between Canon City and Cripple Creek and covered approximately 900 km^2 (350 square miles). The second segment of the study was located on a 1950 km^2 (750 square mile) area between Canon City and Salido. Two lions were marked and released on the study area during the first season. Seventeen lions were marked and released on the expanded study area the second season and 3 were subsequently re-treed for a total of 20 captures the second season. A total of 37 sets of lion tracks were found on the study area the first season. An analysis of these tracks led to a population estimate of between 15 and 25 lions or one lion per 36-60 km^2 (14-23 square miles). A total of 135 sets of lion tracks were found on the study area the second season. An analysis of the captures and tracks from the second season resulted in an estimate of 35-65 lions or one lion per 30-56 km^2 (12-21 square miles).

Currier, M.J.P., S.L. Sheriff, and K.R. Russell. 1977. Mountain Lion Population and Harvest Near Canon City, Colorado, 1974-77. Colorado Div. Wildl. Special Rep. #42. 12pp.

The mountain lion population on tracts of 900 and 1,950 square kilometers (350 and 750 square miles) of the Arkansas River drainage from Canon City west to near Salida was evaluated during three winters beginning in December 1974 and ending in April 1977. The terrain was rough and mountainous, mostly between 2000 meters (6500 feet) and 3000 meters (9700 feet) in elevation. Twenty-nine lions were captured and marked on the study area. Six were recaptured and two were killed by hunters during the study period. Two hundred and sixty-two sets of tracks were recorded. Population density estimates of one lion per 36-60 square kilometers (14-23 square miles), 30-56 square kilometers (12-22 square miles), and 30-56 square kilometers were made after successful field seasons on the basis of track data. A density estimate of one lion per 13-55 square kilometers (5-21 square miles) was calculated by use of the Petersen Method after the third season. At least 187 lions had been killed by hunters in the management units that intersect the study area during the 10 years preceding the conclusion of this study. The principal conclusions from all available information were that the mountain lion population on the study area is relatively high and does not appear to be in danger of being overharvested.

Currier, M.J. 1978. Mountain Lion. Colorado Outdoors 27(1):1-7.

The mountain lion was an unprotected, bountied animal until 1965, when it was declared a big game animal. Based on bounty records, the first minimum estimate of the number of lions in Colorado was 124. A questionnaire survey was conducted in 1970 and these results indicated a minimum population estimate of 406 and a maximum of 769. A three year study was initiated on a 350 square mile area between Cripple Creek and Canon City during winter 1974-75. The study area was enlarged and shifted southward to a 750 square mile area between Canon City and Salida for the second and third seasons. During the three seasons, 27 lions were marked and 292 sets of tracks were recorded. A population of from 15 to 25 lions was estimated in the study area the first season (one lion/14-23 square miles), and between 35 and 65 were estimated to inhabit the enlarged study area during the second and third seasons (one lion/12-22 square miles). It was estimated that between 1100 and 1500 mountain lions inhabit Colorado.

Currier, M.J.P. 1979. An Age Estimation Technique and Some Normal Blood Values for Mountain Lions (Felis concolor). Ph.D. Thesis, Colorado State Univ., Fort Collins. 81pp.

The age-estimation formula developed for females included the following blood parameters: globulins, blood urea nitrogen, total proteins, percentage monocytes, and zinc; and morphological measurements: gumline recession from the premolars and rear tarsal length. The age-estimation formula developed for males included the following blood parameters: globulins, alkaline phosphatases, and percentage neutrophils; and morphological measurements: gumline recession from the upper canine and total body length. Both formulas had an r^2 of about 0.80. Blood, hair, and vibrissae samples, and tooth and body measurements were taken from 46 captive and 31 free-ranging mountain lions. Eight animals were sampled each year for three years, 22 for two years, and 50 only once, for a total of 52 female and 34 male captive lion samplings, and 21

female and 11 male wild lion samplings. The blood samples were evaluated for hematocrit, amount of zinc in the plasma, 18 serum parameters, and white blood cell differentials. The hair and vibrissae samples were stretched until they broke to measure elasticity. Two upper and two lower teeth were measured for gumline recession and measurements of six body characteristics were made. Normal (mean) values and 95 percent confidence intervals for all 38 parameters were determined. The entire 118 samplings were divided into several sets of subgroups and selectively tested for significant differences (P less than or equal to 0.10) in each of the 38 parameters. Three male mountain lions were raised from age 3 weeks. Eighteen summer and 17 winter blood samples were taken and tested for summer-winter differences. Ten blood and two morphological parameters were significantly different between the wild, and captive, non-kitten mountain lions. Two blood and five morphological parameters were significantly different between female, and male, non-kitten mountain lions. Eight blood and all morphological parameters were significantly different between wild kittens and wild non-kittens. Six blood parameters were significantly different between summer and winter blood collections. Twenty-six parameters (the 12 determined to be significantly different between wild and captive lions were omitted) were initially evaluated for the development of the age-estimation formulas with multiple regression analysis. Of the eight blood parameters found to be significantly different between wild kittens and wild non-kittens, two were included in the female age-estimation formula and three in the male age-estimation formula. Winter-summer significant differences were probably not seasonal differences, but for the most part due only to restraint or method of immobilization.

Currier, M.J.P., K.R. Russell. 1982. Hematology and Blood Chemistry of the Mountain Lion (Felis concolor). J. Wildl. Dis. 18:99-104

Normal values for 10 hematologic and 18 blood chemical parameters were calculated for non-kitten mountain lions, Felis concolor. A significant difference (P less than or equal to 0.10) existed between the wild and captive mountain lions sampled for 10 parameters. A significant difference (P less than or equal to 0.10) existed between the female and male mountain lions sampled for two parameters.

Currier, M.J.P. 1983. Felis concolor. Mammalian Species 200:1-7.

Eleven cougar type localities and 30 subspecies are described. Diagnosis, general characteristics, distribution, fossil record, form, function, ontogeny and reproduction, ecology, behavior, and genetics are discussed with citations from many previous authors.

Cuthill, M., D. McCarthy, T. Bartnick, D. Reed, H. Quigley and D. Craighead. 2008. Movements of a Female Cougar on the Human-Wildlands Interface. Page 247 in Toweill, D. E., S. Nadeau and D. Smith, editors. Proceedings of the Ninth Mountain Lion Workshop, May 5-8, 2008, Sun Valley, Idaho, USA.

Abstract

One of the most difficult but important aspects of large carnivore conservation will be the development of data about carnivore use of areas in and around human development. Human tolerance of large carnivores will be dependent on this understanding. Unfortunately, very little specific, empirical data are available on the use of these interface habitats. Cougars are the most widely distributed large carnivore in the Western Hemisphere. They not only occur in some of the wildest habitats, but are also well-established in human-dominated landscapes. Thus, information on cougar movements and behaviors in these situations could be key to cougar survival in these landscapes, and provide new understanding for the development of long-term carnivore conservation worldwide. The Craighead Beringia South-Teton Cougar Project has been intensively tracking cougar movements in the Jackson Hole Wyoming area since 2001. The majority of the study animals have used wild lands and wilderness landscapes. However, use of areas around human development has been well documented for several study animals. This poster presents specific movement information on one subadult female cougar. This cougar, estimated to be 3 years of age, utilized areas on the edge of the town of Jackson for approximately 10 months. We provide specific information about rates of movement, distance to human habitation, and distance to roads.

Cutler, T.J. 2002. Bilateral Eyelid Agenesis Repair in a Captive Texas Cougar. Veterinary Ophthalmology 5(3):143-148.

Abstract

Bilateral eyelid agenesis was presented with multiple ocular anomalies in a captive Texas cougar (*Felis concolor*). Corneal exposure resulted in substantial keratoconjunctivitis and blepharospasm. Bilateral inferopapillary fundic colobomas, persistent pupillary membranes, and an atypical iris coloboma OD were present. Surgical repair with a rotational pedicle flap resulted in functionally effective eyelids. Trichiasis was later treated with cryotherapy. Eyelid agenesis is reported infrequently in domestic cats and among large felids has only been reported in the snow leopard.

Dahne, B. 1958. The Truth About Black Panthers. Florida Wildlife 12(6):26.

In the strictest sense, there is no species or variety of animal anywhere in the world that can be properly called "black panther". What most people know and call "black panther" is a black color phase of the leopard. The puma has never been recorded in a black color phase (unusual coloration in a group of animals of one species). Single specimens of melanistic panthers have been found in South America, but never in North America. The best estimate of the Florida panther population was from 35-50 in the wild, and the odds are heavily against the birth of either an albino or melano, but it is not utterly impossible.

Danvir, R.E. and F.G. Lindzey. 1981. Feeding Behavior of a Captive Cougar on Mule Deer. Encyclia 58:50-56.

This study was designed to document the feeding behavior of a caged, wild cougar on mule deer under simulated natural winter conditions. A 15-month-old female cougar was utilized at the beginning of the trials and increased in weight from 25 kg (Oct. 1979) to 32 kg (March 1980). Road-killed deer were fed whole to the cougar and complete feeding on a carcass varied from four to eleven days with average quantity eaten per day highest during the first 24-hour feeding interval. The mean quantity consumed for the first day of the feeding period was 6.8 + or - 3.1 kg with a mean of 4.3 + or - 2.5 kg for days 2 through 4; mean daily consumption for the entire period was 4.0 + or - 2.3 kg. In later trials (Mar.-Apr. 1980) on a diet consisting entirely of boned muscle tissue offered ad libitum, the amount consumed was not significantly greater than amounts consumed on subsequent days. Mean daily consumption for these trials was 3.8 + or - 0.8 kg, with a maximum of 5.1 kg/day. Feeding began on the thoracic cavity of four carcasses and on the anterior abdominal cavity of the fifth carcass. The heart, lungs, liver and diaphragm were consumed initially, along with small quantities of rib bones, thoracic muscle, hair and hide. The head, femurs, humeri, and lower leg bones were unconsumed and often remained attached to the intact hide. On one occasion during a particularly cold period the cougar cracked open femurs for marrow and gnawed on the skull. The cougar consumed an average of 73.5% + or - 4.2% by weight of each carcass.

Dattilo, J.J. 1974. Introduction of Five Cougars into One Enclosure. AAZPA Reg. Conf. Proc. 248-253.

An enclosure at Opryland in Nashville, Tennessee was consisted of woven wire fencing around a ravine and measured 13 feet high with a 3 foot overhang and was buried 3 feet underground. Background information was provided on each of the five cougars. Three males were aged 6 years, 7 months and 7 months. Two females were aged 7 months and 4 months. Each cougar was turned into the ravine and brought in each night where separate quarters were provided and they were fed when the park was closed (Sept.-March). When the park was open, they were fed both in the ravine and inside their quarters at night. Observations of the interactions of these cougars are provided over a period of just over one year.

Davies, R.B. 1991. Lion Damage to Pets in Urban Colorado Springs, Colorado. Pgs. 79-80 In: Mountain Lion-Human Interaction Symposium, C.E. Braun (ed.), Col. Div. Wildl., Denver. 114pp.

During the past 20-25 years, the killing of up to 5-6 dogs per year by mountain lion was not uncommon in the Colorado Springs area. During this time, no public outcry called for the removal of mountain lions. A few of these attacks are described by the author, and in particular an incident which occurred on 24 January 1991, 10 days after 18-year-old Scott Lancaster was killed by a mountain lion near Idaho Springs, Colorado. A tied cocker spaniel was attacked and killed in a kennel in southwest Colorado Springs. The dog's owners videotaped part of the attack and subsequent attempts of the mountain lion to escape with the prey and this was aired on local television. The lion was shot and killed and found to be 5-6 years old and in prime condition. A public meeting was held and a task force was organized to determine actions and to whom to report sightings of mountain lions. An aggressive education program about mountain lions in the media and in the public schools is currently underway. The greater public seems to support actions of responding to all calls, removing lions

which kill pets or habituate to housing areas, and relocating lions. If an unprovoked attack occurs on a human, every effort is made to locate and destroy the animal. To date, no confirmed mountain lion-human contacts or aggressive acts by mountain lions have occurred in the Colorado Springs area.

Davis, G.P. 1969. Status of the Mountain Lion in Ten Western States. Defenders of Wildl. News (Oct/Nov/Dec).

Of the ten western states reviewed, only five had given the mountain lion big game status (Washington, Oregon, Nevada, Utah, and Colorado). Four of the remaining five had strong legislation pending to reclassify the lion as a game animal. Only Arizona still paid a bounty on the lion. A brief description of Hornocker's study in Idaho is presented.

Davis, J.L., C.B. Chetkiewicz, V.C. Bleich, G. Raygorodetsky, B.M. Pierce, J.W. Ostergard, and J.D. Wehausen. 1996. A Device to Safely Remove Immobilized Mountain Lions from Trees and Cliffs. Wildl. Soc. Bull. 24(3):537-539.

A simple device which safely restrains partially immobilized mountain lions from distances less than or equal to 8 meters is described. The device was constructed by attaching an angle-iron type snare-lock onto a 1 meter length of 4-mm flexible steel cable and forming a noose. Cable clamps, lightweight nylon line, "S" hooks, and ski poles were also utilized. The construction of the device is illustrated and explained in detail.

Dawn, D. 2002. Management of Cougars (*Puma concolor*) in the Western United States. M.S. Thesis. San Jose State University, Dept. Biological Sciences.

Abstract

In the U.S., cougar (*Puma concolor*) populations still exist in 13 western states. While sport hunting of cougars remains a management goal for 10 of these states, there is little information on how different hunting harvest strategies affect their biology. Both the rate of harvest and the percentage of females in the harvest affect population stability. Therefore, the purpose of this study was to examine the effect of different harvest strategies on the harvest rate and the percentage of females in the harvest. Annual hunting harvest records were requested from all 10 states and were summarized into a database for analysis. Harvest strategies that included female sub-quotas were associated with the lowest percentage of females removed, however they also had some of the highest annual rates of harvest. These results suggest that, for some states, management strategies used in regulating sport hunting may offer little protection against over-harvesting the population.

Dawn, D., M. Kutilek, R. Hopkins, S. Anand and S. Torres. 2003. Management of Cougars (*Puma concolor*) in the Western United States. Page 138 *in* S.A. Becker, D.D. Bjornlie, F.G. Lindzey, and D.S. Moody, eds. Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming.

Abstract

In the U.S., cougar (*Puma concolor*) populations still exist in 13 western states. While sport hunting of cougars remains a management goal for 10 of these states, there is little information on how different hunting harvest strategies affect their biology. Both the rate of harvest and the percentage of females in the harvest affect population stability. Therefore, the purpose of this study was to examine the effect of different harvest strategies on the harvest rate and the percentage of females in the harvest. Annual hunting harvest records were requested from all 10 states and were summarized into a database for analysis. Harvest strategies that included female sub-quotas were associated with the lowest percentage of females removed, however they also had some of the highest annual rates of harvest. These results suggest that, for some states, management strategies used in regulating sport hunting may offer little protection against over-harvesting the population.

De Angelo, C., A. Paviolo, and M. Di Bitetti. 2011. Differential Impact of Landscape Transformation on Pumas (*Puma concolor*) and Jaguars (*Panthera onca*) in the Upper Paraná Atlantic Forest. Diversity & Distribution 17(3):422-436.

Abstract

Aim

Jaguars and pumas, being similar in size and behaviour, are the largest felids of the Neotropics. However, pumas appear to be more resistant to human impacts. Our objective was to compare the response of both species with human impacts at a regional scale in a highly modified region where both species had continuous distribution in the past.

Location

The Upper Parana Atlantic Forest (UPAF).

Methods

Pumas and jaguars presence-only data were used in an Ecological Niche Factor Analysis (ENFA). From the total number of records, we resampled 95 records of each species 10 times to characterize and compare their habitat requirements, built habitat-suitability maps and examined interspecific differences in niche parameters related to present landscape characteristics.

Results

Both species showed high dependence on native forest and habitat protection, and low tolerance to anthropogenic environments. However, jaguars showed higher differences between their optimal habitat and the available landscape (mean±SD; marginality M=2.290±0.072) and lower tolerance to deviations from their optimal habitat (tolerance T=0.596±0.013) than pumas (M=1.358±0.067, $P<0.001$; T=0.742±0.022, $P<0.001$). Although their niches highly overlapped (Pianka's O=0.746±0.069), pumas' higher tolerance resulted in a larger area covered by suitable patches of habitat with higher connectivity. All jaguar-suitable areas were also suitable for pumas; however, 44±8% of puma-suitable areas were unsuitable or marginal for jaguars.

Main Conclusions

Pumas showed more tolerance than jaguars to human impacts at a regional scale in the UPAF, a pattern also observed at local and continental scales. Although the proximate factors responsible for the differential response of pumas to human-altered environments seem to be similar at all spatial scales (e.g. broader trophic niche than jaguars), the resultant spatial configuration of suitable habitat at a regional scale might be another important factor determining puma persistence and higher jaguar demands on conservation efforts.

Dear, L.S. 1955. Cougar or Mountain Lion in Northwestern Ontario. Can. Field Nat. 69:26.

A mountain lion was seen on July 23, 1953 on the side of the road on the Trans-Canada Highway near Martin, about 30 miles west of Fort William. It was estimated to be about 5 1/2 feet long and to stand about 30 inches high. On August 6, 1953, a mountain lion was seen about 25 miles west of Fort William and seen again in the same vicinity four days later. A cougar with two cubs was seen crossing a road about 5 miles east of Beardmore. The adult was between five and six feet long, had a long tail and stood at least 30 inches high. Another report was published in an issue of the Times-Journal of Fort Williams dated April 17, 1954. It describes a report of a cougar that was seen on April 13, 1954 about 43 miles west of Fort Arthur. The cougar cut across the tracks in front of the train and leaped upon a rock cut about six feet high without any trouble. The cougar was described as about five feet long and brown in color. At one point it was not more than 25 feet from the observers. The author states that although only sight records are available, the evidence appears conclusive and beyond doubt. There had been at least 21 sight records from Minnesota during the previous five years. Several of these records are from the northeastern portion of the state, bordering on Ontario, and at least three were at no great distance from Fort William. One of these was at Cascade River, about 100 miles south of Fort William on June 22, 1950. Another was at Crow Creek, about 166 miles south of Fort William on June 8, 1951. The other was at Two Harbors about 175 miles south of Fort William in the fall of 1948.

Dearborn, N. 1927. An Old Record of the Mountain Lion in New Hampshire. J. Mammal. 8:311-312.

A mountain lion was killed on November 2, 1853 by William F. Chapman in the township of Lee, Rockingham County, New Hampshire. The cat weighed 198 pounds and measured 8 feet and 4 inches from tip to tip. The badly mounted skin is located at the Woodman Institute, a public museum in Dover, New Hampshire. This was the only record of a mountain lion being killed in the state that the author could recollect.

de Azevedo, F.C.C. 2008. Food Habits and Livestock Depredation of Sympatric Jaguars and Pumas in the Iguaçu National Park Area, South Brazil. Biotropica 40(4):494-500.

Abstract

Understanding coexistence between sympatric felines with similar body sizes, such as jaguars *Panthera onca* and pumas *Puma concolor*, requires knowledge of the way these predators consume and partition food resources. Yet the importance of livestock predation on jaguar and puma coexistence is poorly known. I investigated food habits and patterns of livestock depredation of jaguar and pumas in the Iguaçu National Park (INP) in southern Brazil. From 1997 to 2001, I collected scats opportunistically on trails and roads in INP and visited ranches on the border of INP. I found that jaguars relied mostly on large and medium-sized wild prey species, while pumas concentrated on medium-sized prey species. Livestock was the fifth most frequent prey found in jaguar scats but the most important one in terms of biomass consumed. Jaguar and puma diets differed significantly when all prey items were compared and also when livestock was excluded from the jaguar diet. Jaguar predation on livestock was considerably higher than predation by pumas. However, predation was not substantial relative to availability of livestock, and cattle likely constitute an alternative source of prey for jaguars. Degree of diet overlap between jaguar and puma in INP suggests that coexistence was likely driven by exploitative competition through some degree of food partitioning. My results highlight the importance of more actions toward increasing numbers of large ungulates to preserve the population of jaguars in INP.

DeBlieu, J. 1991. The Panther Versus Florida. Pgs. 249-274 In: Meant to be Wild. Fulcrum Publ., Golden, Colorado.

The author describes the history and management of the panther in Florida.

Dedera, D. 1973. Calling Ford Bird; His Lion is Busy. Outdoor Arizona 45:13.

The author posed the question in the daily press as to whether or not the mountain lion screams. Many replies were received that claimed that the animal does and does not scream.

Dees, C.S., J.D. Clark and F. T. Van Manen. 2001. Florida Panther Habitat Use in Response to Prescribed Fire. J. Wildl. Manage. 65(1):141-147

Abstract

The Florida panther (Puma concolor coryi) is one of the most endangered mammals in the world, with only 30-50 adults surviving in and around Florida Panther National Wildlife Refuge and the adjacent Big Cypress National Preserve. Managers at these areas conduct annual prescribed burns in pine (Pinus sp.) as a cost-effective method of managing wildlife habitat. Our objectives were to determine if temporal and spatial relationships existed between prescribed fire and panther use of pine. To accomplish this, we paired fire-event data from the Refuge and the Preserve with panther radiolocations collected between 1989 and 1998, determined the time that had elapsed since burning had occurred in management units associated with the radio-locations, and generated a frequency distribution based on those times. We then generated an expected frequency distribution, based on random use relative to time since burning. This analysis revealed that panther use of burned pine habitats was greatest during the first year after a management unit was burned. Also, compositional analysis indicated that panthers were more likely to position their home ranges in areas that contained pine. We conclude that prescribed burning is important to panther ecology. We suggest that panthers were attracted to <1-year-old burns because of white-tailed deer (Odocoileus virginianus) and other prey responses to vegetation and structural changes caused by the prescribed fires. The strong selection for stands burned within 1 year is a persuasive indication that it is the burning in pine, rather than the pine per se, that most influenced habitat use. Before burning rotation lengths are reduced, however, we

suggest managers determine effects of shorter burning intervals on vegetation composition and evaluate the landscape-scale changes that would result.

Denton, B.L. and W.L. Kent. 1956. Habits of Mountain Lion. Trans. First Central Mountains and Plains Section Conf., The Wildlife Society. 3pp.

The authors hunted and trailed mountain lions for hundreds of miles and believed that the only food item that lions prefer more than deer is colt meat. The authors checked many kills and did not ever encounter a kill where the neck was not broken. It was found that the lion will eat its first meal by tearing into the heart and liver behind the shoulder. They disagreed with the notion that the lion only kills sick or wounded deer and even had their doubts as to whether a lion would even eat a sick deer. The mountain lion may travel from 20 to 25 miles in one night following ridges and crossing through the low gaps or saddles. The female lion makes a sound like a child screaming and the male makes a low grunting noise. Kittens make a noise like a screech owl. A female with kittens will make approximately three kills a week to feed her young. Traps must be set on a run and over 100 miles are usually traversed when hunting for every lion caught.

DeSimone, R. 2003. Evaluating Mountain Lion Monitoring Techniques in the Garnet Mountains of West Central Montana. Page 143 *in* S.A. Becker, D.D. Bjornlie, F.G. Lindzey, and D.S. Moody, eds. Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming.

Abstract

Research began in 1998 to document characteristics of a hunted mountain lion population and develop survey techniques to detect trends in lion abundance. Efforts to capture and radio-collar mountain lions have focused on the 850 km^2 eastern half of the Garnet Mountains where lion hunting was suspended from 2000 to 2002, allowing the lion population to increase. Lion hunting will resume, reducing the number of lions in the study area. Fluctuations in a known lion population will provide the opportunity to determine the sensitivity of population indicators to changes in lion abundance. Mountain lion population trend indicators being evaluated include lion track survey-routes and statewide telephone surveys of houndsmen and deer hunters. Eleven lion track snow-survey-routes totaling approximately 105 km were established in 2000 throughout the study area to determine the relationship between lion track density and the actual density of lions. Track densities ranged from 0 to 2 per 10 km. Preliminary results indicate that the densities of lion tracks recorded in different portions of the study area correlate with the densities of lion home ranges. A statewide telephone survey of houndsmen began in 2001 with approximately 300 houndsmen interviewed annually. Houndsmen took fewer days of hunting to tree lions (3 days) and encounter a lion family group (8 days) in northwest Montana, while in eastern Montana houndsmen took 10-35 days to tree a lion and 35-45 days to encounter a family group. Starting in 2001, the statewide telephone survey of deer hunters included asking hunters if they observed lions. The percentage of deer hunters observing lions ranged from 4% in northwest Montana to less than 1% in eastern Montana. Seventy lions have been captured and radio-collared. Eleven of 26 radioed kittens died during their first year of life. Malnutrition due to orphaning was the most common cause of death. Hunters harvested adult and subadult lions at a high rate. In portions of the study area where hunting was allowed, hunters harvested an average of 63% of the radioed lions annually from 1998 to 2001. Overall, 36 of 38 radioed lion deaths were human related.

DeSimone, R.M., B.J. Semmens and V.L. Edwards. 2005. Update: Evaluating Mountain Lion Monitoring Techniques in the Garnet Mountains of West Central Montana. Pages 83-84 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

Mountain lion populations in Montana have created public concern over human safety, depredation of livestock and pets, predation on game animals, over harvesting of lions, and possible restrictions on lion hunting. Montana Fish, Wildlife and Parks (FWP) took a proactive approach to address these concerns and began a long-term mountain lion research project in 1998. Research is being conducted in the Blackfoot Drainage (7908 km^2, specifically, an 858 km^2 portion of the Garnet Mountains designated as the Garnet Study Area (GSA). The goal of this research effort is to improve management of mountain lions by documenting the influence of hunting on population characteristics, as well as evaluating techniques designed to detect trends in lion abundance. Trend indicators being evaluated include: density of lion tracks on established

snow-track routes, statewide telephone surveys of houndsmen and deer hunters, and monitoring trends in prey populations. Similar to other lion research projects, it took approximately three years of intensive systematic searching (1998-2000) to capture and mark the resident lion population in the GSA. Furthermore, hunting of mountain lions was restricted within the GSA after the 2000 hunting season to help accomplish population goals. Since then, the number of radio-collared resident adults and subadults has ranged from 11 to 14 individuals. Over 150 miles of routes on established roads and trails are inventoried from January to March of each year to document the number and location of lion tracks. Track surveys are used to determine the relationship between lion track density and the actual density of lions. Since 1998, 93 lions have been fitted with radio-collars and more than 4,700 relocations have been recorded. From 2001 to 2004, the number of radioed adult and subadult lions and the actual number of days radioed lions spent in the study area remained relatively constant. During the same time period, the trend in the average number of lion tracks recorded remained comparatively constant as well. In the Blackfoot Drainage, legal hunting was the cause of 65% of the confirmed deaths of radioed adult and subadult lions. Overall, average annual mortality of the radioed adult and subadults was 49%. The most common cause of death of radioed lion kittens was starvation resulting from the mother being harvested by hunters. The average annual kitten mortality was approximately 40%. Statewide telephone surveys of houndsmen started after the 2000 hunting season with 300-464 houndsmen contacted each year to determine where they hunted lions, the number of days they hunted lions and how many lions they treed. From 2000 to 2002, houndsmen reported that it took more days to tree a lion in the Blackfoot Drainage (+34%) and statewide (+35%). In 2000, FWP's statewide telephone survey of deer hunters included asking hunters if they observed a mountain lion while deer hunting. From 2000 to 2002, deer hunters reported observing fewer lions in the Blackfoot Drainage (-38%) and statewide (-29%). Trends in both the statewide telephone surveys of houndsmen and deer hunters appear to be consistent with radio-collared lion mortality, pointing to a decline in the lion population in the Blackfoot Drainage. Preliminary data from January 2005 indicates an increase in the radioed-lion population. A continued increase in the lion population over several years will allow an evaluation of the accuracy of lion trend indicators to detect changes in actual lion populations.

DeSimone, R.M., M.K. Schwartz, K.L. Pilgrim and K.S. McKelvey. 2008. Estimating Lion Population Abundance Using DNA Samples in the Blackfoot Drainage of West-Central Montana. Page 162 in Toweill, D. E., S. Nadeau and D. Smith, editors. Proceedings of the Ninth Mountain Lion Workshop, May 5-8, 2008, Sun Valley, Idaho, USA.

Abstract

Mountain lion (*Puma concolor*) DNA was collected from late November 2005 through February 2006 from a 1,377-km^2 area in the Blackfoot Drainage of westcentral Montana to evaluate to the use of DNA sampling to estimate lion abundance. Three houndsmen spent 80 days systematically hunting, treeing lions and collecting tissue samples using biopsy darts fired from a CO2-powered rifle. They drove 920 km, snowmobiled 5800 km and hiked 65 km. Thirty four tissue samples were collected representing 20 individual lions (estimated to weigh over 34 kg). All tissue samples were successfully genotyped using 12 variable, microsatellite loci, which allowed ample power to discern individuals. In addition, 60 lion tracks were backtracked, 158 hair samples were collected and 133 analyzed. Twenty percent of backtracks and 13% of the hair samples resulted in quality DNA for individual and sex identification. During the first sampling period (late November–January), 20 individual lions were genotyped from 17 tissue and 3 hair samples. During the second sampling period during February, 12 individual lions were genotyped from 10 tissue and 2 hair samples. Eight of the 12 lions during the second sampling period were recaptures. Overall, a total of 24 individual lions were identified (14 females, 9 males, and 1 unknown). A simple Lincoln-Petersen index produces an abundance estimate of 29 lions with a 95% CI that ranged between 25 and 33, resulting in an estimated density of between 1.8 and 2.4 lions per 100 km^2. These preliminary results suggest that DNA sampling may be a valuable monitoring technique to estimate lion abundance.

Desmarchelier, M., S. Lair, A. Defarges, M. Lécuyer and I. Langlois, 2009. Esophageal Stricture in a Cougar (Puma concolor). J.Zoo and Wildlife Medicine 40(2):328-331.

Abstract

A 7-mo-old female cougar (Puma concolor) was presented with a 2-wk history of anorexia and a 1-wk history of regurgitation. Barium contrast esophagogram and gastroesophagoscopy revealed the presence of a segmental intraluminal esophageal stricture in the middle third of the esophagus. The stricture was potentially secondary to a previous anesthetic episode. Three endoscopic balloon dilations allowed increasing the luminal diameter to a size that enabled the cougar to eat food softened with water without any signs of discomfort or regurgitation. Two months after being discharged, the cougar was doing well, had gained weight and was eating horsemeat softened with water.

Dewar, P., and P. Dewar. 1977. The Status and Management of the Puma in British Columbia. The World's Cats 3:4-19.

Three subspecies of cougar are found in British Columbia: F. c. vancouverensis, F. c. oregonensis, and F. c. missoulensis. Bounty records indicate that a relatively high concentration of cougars were found on Vancouver Island and the Interior South, with lower concentrations on the Mainland Coast and the Kootenays. Relatively few appeared to be in the Interior North and northern British Columbia. To date there had been 15 verified cases of cougars attacking humans in British Columbia and may possibly be attributed to the more aggressive nature of the subspecies rather than a higher concentration of cougars in the area. The bounty was removed in 1957 and in 1970 a tag system was introduced for hunting cougars. In 1966, the cougar was given big game status. In 1970, it became mandatory for a nonresident to hire a resident guide before hunting cougars.

Dewdney, K. 2007. A Probabilistic Approach to the Estimation of Puma Populations. Pages 9-10 in Abstracts of Presentations of the 3rd Midwestern-Eastern Puma Conference, Trent University, Peterborough, Ontario.

Abstract

The observation of a wild animal such as a Puma is a chance affair that depends on the presence of two entities, the observer and the observed. There are therefore two populations that influence the probability of an observation: pumas and humans. Using population densities in two contrasting areas (southern and northern Ontario), as well as road densities, habitat area and other factors, we develop an approximate formula that can be applied to sighting data to obtain an estimate of puma populations in both areas – and elsewhere.

Dickson, B.G. and P. Beier. 2002. Home-Range and Habitat Selection by Adult Cougars in Southern California. J. Wildlife Manage. 66(4):1235-1245.

Abstract

Understanding the impact of habitat fragmentation, roads, and other anthropogenic influences on cougars (Puma concolor) requires quantitative assessment of habitat selection at multiple scales. We calculated annual and multiyear home ranges using a fixed-kernel (FK) estimator of home range for 13 adult female and 2 adult male radiotagged cougars that were monitored October 1986 through December 1992 in the Santa Ana Mountain Range of southern California, USA. Using compositional analysis, we assessed diurnal use of vegetation types and areas near roads at 2 orders of selection (second- and third-order; Johnson 1980). Mean annual and multiyear 85% FK home ranges for males were larger than those reported by previous studies in California. Mean wet-season 85% FK home ranges were significantly larger than those of the dry season. At both scales of selection and across seasons, cougars preferred riparian habitats and avoided human-dominated habitats. Grasslands were the most avoided natural vegetation type at both scales of selection. Although cougar home ranges tended to be located away from high- and low-speed 2-lane paved roads (second-order avoidance), cougars did not avoid roads within their home range, especially when roads were in preferred riparian areas. Protection of habitat mosaics that include unroaded riparian areas is critical to the conservation of this cougar population.

Dickson, B.G. and P. Beier. 2003. Two Sample Methods of Handling Radio-location Error for Wide-Ranging Animals in Large Complex Study Areas. Pages 57-58 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

The study of second-order habitat selection (how an animal selects a home range within a larger area of potential habitat) analyzes the differences between habitats used by an animal versus habitats available on the study area. Most studies of cougar (Puma concolor) habitat use assigned each radio-location to a single vegetation polygon, ignoring the fact that radiolocations are imprecise estimates of the animal's true location (we refer to this as "naive estimator" of habitat use). Herein, we describe 2 simpler alternative procedures to accommodate location error, readily implemented in a GIS. One alternative ("circular error estimator") is to treat each point as the center of a circle with radius equal to the estimated average error, and assign each location to habitat types with probability proportional to area of that habitat type within the circle. Another alternative ("nonpoint estimator") is to use estimated locations solely to construct a home range contour and compare the habitat composition of the home range (rather than of individual points) to available habitat. We compared both of these simple estimators of habitat use to the naïve estimator, and compared all 3 estimators to available habitat, for 10 radio-tagged adult cougars monitored in southern California. All 3 estimators showed similar patterns of habitat use, and all showed selection for riparian and scrub habitats and against grassland habitats. Although neither procedure has a precise analytic estimate of precision, the procedures are simple to understand and the results are consistent with expected patterns of use and selection. These procedures take a middle ground between pretending errors don't exist (naive estimator) and pretending that statistical headstands have reduced such errors to negligible levels.

Dickson, B.G., J.S. Jenness and P. Beier. 2005. Influence of Vegetation, Topography, and Roads on Cougar Movement in Southern California. J. Wildl. Manage. 69(1):264-276.

Abstract

Models of individual movement can help conserve wide-ranging carnivores on increasingly human-altered landscapes, and cannot be constructed solely by analyzing the daytime resting locations typically collected in carnivore studies. We examined the movements of 10 female and 7 male cougars (*Puma concolor*) at 15-min intervals during 44 nocturnal or diel periods of hunting or traveling in the Santa Ana Mountain Range of southern California, USA, between 1988 and 1992. Cougars tended to move in a meandering path (mean turning angle ~54°), and distance moved (mean and mode ~300 m) was not correlated with turning angle. Cougars used a broader range of habitats for nocturnal or diel movements than for previously described daybed locations for this same population. Riparian vegetation ranked highest in a compositional analysis of vegetation types selected during movement; grassland, woodland and urbanized sites were least selected. During periods of stasis (we presume many of these were stalking locations), patterns of selection were less marked. Cougars spent a disproportionate amount of time in highly ranked vegetation types, and traveled slowest through riparian habitats and fastest through human-dominated areas. Our results suggest that travel speed may provide an efficient index of habitat selection in concert with other types of analysis. Hunting or traveling individuals consistently used travel paths that were less rugged than their general surroundings. Traveling cougars avoided 2-lane paved roads, but dirt roads may have facilitated movement. Maintenance and restoration of corridors between large wildlands is essential to conserving cougars in southern California. Our results indicate that riparian vegetation, and other vegetation types that provide horizontal cover, are desirable features in such corridors, that dirt roads should not impede cougar use of corridors, and that corridors should lie along routes with relatively gentle topography. Our results suggest that cougars do not key in on highway-crossing structures in a way that creates a prey trap. Our empirical frequency distributions of distances and turning angles, along with cougar responses to vegetation, topography, and roads can help parameterize an individually-based movement model for cougars in human-altered landscapes.

Dickson, B.G.and P. Beier. 2007. Quantifying the Influence of Topographic Position on Cougar (*Puma concolor*) Movement in Southern California, USA. Journal of Zoology 271(3): 270-277.

Abstract

Large carnivores are frequently used as focal species for landscape-level planning and conservation purposes. Information on cougars *Puma concolor*, for example, is being used to predict movement corridors and linkage areas in habitats influenced by rapid urbanization. However, animal movement through habitat terrain is a function of multiple factors, including complex topographic features. To assess the use of topographic position during movements by cougars in the Santa Ana Mountain Range of southern California, we analyzed the travel paths of 10–17 radio-tagged individuals monitored during 44 overnight sessions. We examined selection for canyon bottom, gentle slope, steep slope and ridgeline topography at the scale of the movement session and at the scale of the home range. At both scales of selection, our results suggest

that traveling or hunting cougars discriminated in their use of topographic position, that canyon bottoms and gentle slopes (<6°) ranked highest in compositional analyses of selection, and that these patterns were not highly confounded by the presence of preferred vegetation types. Ridgelines were used significantly less often than other positions. Our novel method of quantifying availability and use of topographic positions permits the assessment of terrain features, such as canyon bottoms, in facilitating cougar movements. For complex landscapes, models of animal movement should consider the topographic context that motivates patterns of habitat use, and should be developed using data obtained and analyzed at the appropriate spatial and temporal scales.

Dies, K.H., and J.R. Gunson. 1984. Prevalence and Distribution of Larvae of Trichinella sp. in Cougars, Felis concolor L., and Grizzly Bears, Ursus arctos L., in Alberta. J. Wildl. Dis. 20(3):242-244.

Most of the 57 cougars examined were taken by hunters during January of the years 1979-1982 in the Rocky Mountains or adjacent foothills. Larvae of Trichinella sp. were recovered from 32 of 57 cougars. Twenty-five of 50 cougars collected from Banff National Park south to the Alberta-Montana border were positive. All 7 cougars from north and east of Jasper National Park were infected. The lone cougar from a zoo was negative. Previous authors had reported that in these areas where grizzly bears and cougars inhabit the same immediate area, grizzly bears were more commonly infected than cougars. However, 56% of the cougars examined from the Rocky Mountain regions were positive whereas all of the grizzly bears collected from the same area were negative.

Dixon, J. 1925. Food Predilections of Predatory and Fur Bearing Mammals. J. Mammal. 6:34-46.

An examination of 43 mountain lion stomachs from various parts of California has shown that domestic stock constitutes, on the average, less than 10 percent of all food eaten. Thirty-four of the stomachs contained remains of deer. Statements to the effect that each mountain lion in the western states kill on the average $1000 worth of domestic stock each year appears to need considerable reduction. Bounty has been paid on over 4000 mountain lions killed in California since October 1907 by the California State Fish and Game Commission.

Dixon, K.R. and R.J. Boyd. 1967. Evaluation of the Effects of Mountain Lion Predation. Colorado Div. Wildl., Proj. No. W-38-R-2l, Wk. Pl. 4, Job 4. 24pp.

Bounties were paid on mountain lions by the Denver Post newspaper from 1900-1939, a total of 890 lions being bountied at $50 each. The state of Colorado initiated a bounty system on lions in 1929, paying $50 for 1,457 lions of any age until 1965. Five counties in Colorado provided nearly 3/4 of the total lion kill from July 1956 to June, 1965; three of these counties: Fremont, Garfield and Rio Blanco provided 53% of the total kill. Of 8 actual lion kills of mule deer examined, all were bucks with antlers averaging 4 points to a side and an age of 7-9 years. Domestic sheep kills by mountain lions in 1965 totaled 139 head out of a total predator loss of 15,815 head, or 0.8%.

Dixon, K.R. 1982. Mountain Lion. Pgs. 711-727 In: J.A. Chapman and G.A. Feldhamer (eds.), Wild Mammals of North America: Biology, Management and Economics. John Hopkins Univ. Press, Baltimore. 1147pp.

The mountain lion is described and many previous authors are cited. Mountain lion distribution, physiology, reproduction, ecology, food habits, behavior, mortality, age determination, census techniques, economic status, and research and management needs are discussed.

Dobie, J.F. 1943. Tales of the Panther. Sat. Eve Post. Dec. 11:23.

Many folklore stories of the panther are presented.

Donadio, E., A.J. Novaro, S.W. Buskirk, A. Wurstten, M.S. Vitali and M.J. Monteverde. 2010. Evaluating a Potentially Strong Trophic Interaction: Pumas and Wild Camelids in Protected Areas of Argentina. J. Zoology 280(1):33-40.

Abstract

Predatory interactions involving large carnivores and their ungulate prey are increasingly recognized as important in structuring terrestrial communities, but such interactions have seldom been studied in the temperate Neotropics. Here, the large carnivore guild is limited to a single species, the puma *Puma concolor*, native prey populations have been drastically reduced and lagomorphs and ungulates have been introduced. We examined puma dietary patterns under varying abundances of native camelid prey - guanacos and vicuñas - in protected areas of northwestern Argentina. We collected puma feces from seven protected areas, and sampled each area for the relative abundance of camelids using on-foot strip and vehicle transects. In one area, where longitudinal studies have been conducted, we examined the remains of vicuñas and guanacos for evidence of puma predation in 2004-2006. We compared our results with a study conducted in 1978-1983, and contrasted the frequency of carcasses showing signs of puma predation with estimates of camelid abundance. Across sites, we observed a positive and significant relationship between camelid consumption by pumas and camelid abundance, with pumas about nine times more likely to consume camelids where the latter were most abundant. The temporal variation in predation rates on camelids differed by species. Guanacos, which did not change in abundance between periods, showed a slight decrease (1.5 times) in the relative frequencies of individuals killed by pumas. Conversely, vicuñas increased in abundance by a factor of 7 between periods, coinciding with an *c*. 3.4 times increase in individuals showing evidence of puma predation. Some protected areas of northwestern Argentina are conserving the trophic interaction between pumas and native camelid prey. This interaction may be the basis of the far-reaching community effects described for analogous systems on other continents. It also has implications for the possible recovery of or reintroduction of camelids to areas with high puma densities, where predation losses can be expected to be high, and possibly prohibitive.

Donaldson, B. 1974. Mountain Lion Research. Perf. Rep., Proj. No. W-93-l6, Wk. Pl. 15, Job 1. New Mexico Game and Fish Department. 11pp.

Six wildlife management units were surveyed from August 10, 1973 through March 21, 1974. A portion of another unit was surveyed from April 6, 1974 through June 21, 1974. This area included the eastern portion of the Gila Wilderness and was used to compile a better foundation for estimating lion population numbers. The number of individual animals bayed in each unit ranged from 1 to 4 and averaged 2.4 lions per unit. The known sex and age classes of lions bayed included 3 adult males, 3 immature males, 5 adult females, 1 subadult female, 3 immature females, and 2 immature animals sex unclassified. Twenty-four kills judged to have been made by lions were observed: 16 mule deer, 1 whitetailed deer, 1 elk, 1 javelina, 1 beaver, 3 domestic cattle, and 1 mountain lion. The number of kills in each unit ranged from 0-6, and averaged 3.4 per unit. The 16 mule deer kills comprised 67% of the total and included 2 adult bucks, 2 yearling bucks, 3 adult does, 4 unclassified fawns, 2 unclassified adults, and 3 unclassified as to sex and age. The lion that was killed was found approximately 40 feet from the remains of a Hereford cow. The investigators assumed that the lion was killed in a fight concerning the cow or killed by the cow in the process of the kill. It was reported that 132 lion licenses were sold and harvest results projected from a questionnaire survey indicated that 118 hunters took 56 lions for an implied hunter success of 47.75%. The statewide projected harvest included 40 males and 16 females.

Donaldson, B.R. 1974. Mountain Lion Research (1973-74). Final Report. Proj. No. W-93-R-16, Job 1, Wk. Pl. 15. New Mexico Dept. of Game and Fish. 6pp.

A total of 191 days were spent hunting with dogs in eight management units: 129 days were spent in seven selected units and 62 days were spent in a special unit (Unit 11). Tracks of 301 lions were observed and 166 lions were trailed. After eliminating duplicate tracks there were 268. The minimum population estimate was 115 lions. The projected total population estimate was 2060. Twenty nine lions; 5 adult males, 4 kitten males, 13 adult females, 5 kitten females, and 2 unclassified kittens, were treed. Three were killed, 18 were tagged and released and 8 were only bayed. Thirty one kills of prey were found; 21 mule deer, 3 white-tailed deer, 3 cows, 1 elk, 1 javelina, 1 beaver, and one unclassified species. A total of 1839 scrape sites were observed. The average number of scrapes per site was 2.1. Scrapes were observed more frequently in the pinyon-juniper-ponderosa vegetative type (41.1 percent), and on ridge tops (53.8 percent).

Donaldson, B.R. 1975. Mountain Lion Research (1971-75). Final Report. Proj. No. W-93-R-17, Job 1, Wk. Pl. 15. New Mexico Dept. of Game and Fish. 18pp.

This preliminary study was conducted from 1972-1974 to estimate population numbers and harvest and to observe some physical and behavioral characteristics of mountain lions in southwest New Mexico. An investigating team equipped with horses and lion dogs surveyed eight randomly selected areas for lion and lion sign. These investigators captured or treed 29

lions of which 18 were tagged and released. During the surveys the observers found 268 nonduplicated sets of lion tracks of which 55 percent were adult animals. They also found 864 scrape stations. The 40 lion kills observed indicated mule deer (68%) was the most important large herbivore in the diet. Acceptably reliable minimum population estimates indicated there were at least 493 mountain lions in southwest New Mexico. Annual recruitment into the breeding population was estimated to be about 15 percent while the reported harvest was at most only 13 percent of the breeding population. The sex ratio of the adult population was in favor of females, but was approximately equal in the kitten-yearling age class.

Douglass, E.M. 1980. Oxylate Nephrosis in Captive Pumas. Modern Vet. Practice 61:758-760.

The pumas described developed signs of severe oxylate poisoning after consuming feed which was accidentally contaminated with pure oxalic acid. The major lesions observed at necropsy were in the kidneys and intestinal tract. Potential sources of oxylates and treatments are discussed.

Doutt, J.K. 1969. Mountain Lions in Pennsylvania? Am. Midl. Nat. 82(l):281-285.

A mountain lion was killed in Pennsylvania on 28 October 1967. Although considered extinct here since the 1890's, numerous reports of mountain lions during the past 68 years have caused some people to doubt this. This article reviews some of the reports of their occurrence in northeastern North America since 1900. The evidence seems to indicate that there may be some individuals living in the wilder parts of Pennsylvania at the present time.

Downey, P.J., E.C. Hellgren, A. Caso, S. Carvajal and K. Frangioso. 2007. Hair Snares for Noninvasive Sampling of Felids in North America: Do Gray Foxes Affect Success? J. Wildl. Manage. 71(6):2090-2094.

Abstract

Hair-snare sampling has become a popular technique to assess distribution and abundance of felids. Using standard hair-snaring protocols, we sampled for margays (Leopardus wiedii) in Mexico and mountain lions (Puma concolor) in California, USA, without success. However, we noted a preponderance of gray fox (Urocyon cinereoargenteus) hair at sampling stations. Our review of recent literature suggests a pattern of failure to detect target felids in hair-snare surveys conducted within the range of the gray fox. We propose, among several alternative explanations, that marking by gray foxes interferes with the tendency of felids to face-rub at sampling stations.

Downing, R.L., and V.L. Fifield. 1978. Differences Between Tracks of Dogs and Cougars. Worcester Science Center, Worcester, MA. 2pp.

Parameters used to correctly identify cougar tracks and differentiate the tracks of dogs and cougars are described.

Downing, R.L. 1979. Eastern Cougar Newsletter. USDI, U.S. Fish and Wildlife Service, Dept. Forestry, Clemson Univ., Clemson, SC. 6pp. May.

The author located a track that was almost certainly that of a cougar in the southern Appalachians. Also encouraging was the fact that the track was within 10 miles of where a female was seen with 3 kittens in 1975 and again with 2 kittens in 1977. Techniques for obtaining track casts in snow are provided.

Downing, R.L. 1979. Status of the Eastern Cougar in the Southern Appalachians. Pg. 3 In: Eastern Cougar Newsletter, R.L. Downing (ed.), USDI, Fish and Wildl. Service, Dept. Forestry, Clemson Univ., Clemson, SC. January.

A cooperative effort had been worked out where the author would spend half-time for the following five years looking for cougars and cougar sign in the mountains of Georgia, South Carolina, North Carolina, Tennessee and Virginia. The primary approach was to search for cougar tracks in the snow. Considerable progress had been made by Dr. Mark Johnson and associates at Mississippi State University in identifying predator scats using thin layer and gas chromatography analysis of the different bile acids that the scats contain and this may prove useful for confirming the presence of cougars. Each state in

the southern Appalachians had a clearinghouse where reports were evaluated and filed.

Downing, R.L. 1981. The Current Status of the Cougar in the Southern Appalachian. Proc. of Nongame and Endangered Wildlife Symposium, Athens, GA. Pgs. 142-151.

This paper summarizes historical evidence of cougars in the southern Appalachians and elsewhere in the East and presents evidence of their continued existence. Wide-reaching searches for sign have produced one track and one scat suspected to be cougar. Hundreds of reports of sightings, screams, and tracks have been received as the result of publicity generated by the study, but in only three cases has there been accompanying substantial evidence of cougars. Future efforts will be expended where the two most promising bits of evidence were collected to establish beyond doubt that viable populations of cougars are present there. Research will also be directed toward describing the normal frequency and variability of observing positive cougar sign, based on intensive surveys in several areas in Florida, the West, and elsewhere known to contain cougars. Such information is needed to plan large-scale searches of potential habitat in the future.

Downing, R.L. 1982. Eastern Cougar Newsletter. USDI, USFWS, Dept. Forestry, Clemson Univ., Clemson, SC. 6pp.

The author presents 4 case histories of deer killed within 200 miles of Clemson, South Carolina which could probably not be attributed to any other native animal other than the cougar.

Dratch, P.A., J.S. Martenson and S.J. O'Brien. 1991. The Mexican Onza: What Cat is That? Animal Genetics 22(Supplement 1):66.

Mitochondrial DNA was used in 1986 to identify the carcass of a Mexican onza that was brought to authorities in the Sierra Madre. The rare onza had been known for over 100 years and it was speculated to be a subspecies of the cougar or jaguar, or a hybrid and some claim it to be a descendent of the extinct North American cheetah. The analysis showed 18% bands shared with the jaguar, 28% between the cheetah and 100% of 122 bands in common with the cougar which provided stong evidence that this onza was a cougar.

Dubost, G. and J. Royere. 1993. Hybridization Between Ocelot (Felis pardalis) and Puma(Felis concolor). Zoo Biology 12:277-283.

A captive living male Felis pardalis and female Felis concolor produced four litters between 1990 and 1992. Both the body size and spot pattern of the offspring showed characteristics intermediate between those of the parents, but, in general, there was greater phenotypic similarity to the sire. Contrary to previous cases of felid hybridization, neither equal body size of the partners nor male physical dominance was necessary for copulation in these felids. This successful interbreeding confirms the position of the puma in the genus Felis, but also raises questions about phylogenetic relationships within the genus.

Duckler, G.L. and B. Valkenburgh. 1998. Osteological Corroboration of Pathological Stress in a Population of Endangered Florida Pumas (*Puma concolor coryi*). Animal Conservation 1(1):39-46.

Abstract

The Florida panther, *Puma concolor coryi*, is a subspecies on the verge of extinction. Recent field studies have shown the dwindling population to be suffering from numerous physical problems manifest in their soft tissues. Here we explore the skulls and skeletons of more than 50 *P. concolor coryi* for corroborative evidence of poor condition such as tooth fracture, arthritis, infection, trauma, and lines of arrested growth (Harris lines). Results are compared with those for an osteological collection of presumed healthy pumas from outside Florida. Although the two samples did not differ significantly in the relative prevalence of most of the pathologies, the Florida cats fractured their teeth more often and exhibited significantly more lines of arrested growth in their long bones. The greater number of teeth broken in life is associated with heavier tooth wear among Florida panthers and a diet depauperate in large prey. The elevated incidence of Harris lines is probably a result of more regular episodes of poor nutrition in the Florida population. Our results demonstrate that the study of osteopathologies is a new tool for the conservation biologist and highlight the value of preserving entire skeletons, as has

been done for *P. concolor coryi*.

Dunbar, M.R. 1984. Florida Panther Biomedical Investigations. Final Perf. Rep., Study No. 7506. Florida Game and Fresh Water Fish Commission, Gainesville. 53pp.

Veterinary medical management to reduce capture-associated mortality, provide medical care to promote health and increase survival, and to conduct biomedical research to further the understanding of disease, nutrition, and reproductive physiology continued as an integral part of the Florida panther (Felis concolor coryi) recovery. Since veterinary involvement began in 1983, 159 immobilizations involving 58 individuals have been accomplished with one mortality (0.63%) in 1983, possibly capture-related. This fiscal year resulted in re-collaring 9 panthers and the capture and radio-instrumentation of 2 newly captured panthers. In addition, 8 kittens were hand-caught, examined, and released at 3 den sites. A total of 22 kittens have been hand-caught during this 4-year period. A range of 18 to 23 individual panthers have been monitored by telemetry during this 4-year period. Presently, 18 panthers (8 males, 10 females) are being monitored. The panther population estimate is 30 to 50 adults. Serologic evidence indicates that they were exposed to or were infected with several potentially pathogenic agents: feline calicivirus, feline panleukopenia virus, feline rhinotracheitis virus, feline enteric coronavirus/feline infectious peritonitis, feline immunodeficiency virus/puma lentivirus. However, panthers were serologically negative for Brucella sp., Toxoplasma gondii, feline leukemia virus, and pseudorabies virus. Twenty-one deaths were documented during this 4-year period. In fiscal year 93/94, 71% of the 7 deaths were due to road kills, 14% to intraspecific mortality, and 14% to bacterial infection. Panthers were positive for 2 trematodes, 2 cestodes, 6 nematodes, 1 acanthocephalan, and 1 protozoan. No major changes in endoparasite loads were found compared to previous studies of the Florida panther (Forrester et al. 1985). Two studies were initiated this fiscal year, one on vitamin A and one on estradiol levels in panthers. No vitamin A deficiency was found, although, vitamin A levels were correlated with several variables, including age and prey base. Apparently high estrogen levels in male panthers were suggestive of exposure to environmental estrogenic chemicals. There were no attempts to breed panthers in captivity during this period. One captive adult (#200) was euthanized this year due to a severe neurological disorder, leaving a total of 9 panthers currently in captivity.

Dunbar, M.R., M.W. Cunningham and C.F. Facemire. 1994. An Evaluation of Vitamin A and Possible Exposure to Estrogenic Chemicals as Causes of Congenital Abnormalities in the Florida Panther. Pgs. 73-74 In: Program and Abstracts of Papers Presented at the 43rd Annual Conf. of the Wildl. Dis. Assoc. July 17-22, Monterey, CA.

We evaluated the possibility that vitamin A deficiency and/or exposre to estrogenic chemicals (i.e., some pesticides and PCB's, etc.) are causing congenital abnormalities (cardiac atrial septal defects and cryptorchidism, respectively) in Florida panthers (Felis concolor coryi) in lieu of the present hypothesis of inbreeding and genetic depression. We examined liver samples from necropsies of 22 free-ranging panthers and multiple serum samples from 51 free-ranging panthers for levels of vitamin A (total retinol and retinyl esters) and compared these values to those of other felids to assess possible vitamin A deficiencies. We also examined sera from 24 Florida panthers for estradiol and testosterone levels and compared these values to those of normal and cryptorchid panthers. We found that vitamin A levels in panther sera (x=1589.6 pmol/ml, SD=929.3) and liver (x=26055.2 nmol/g dry wt., SD=18973.4) were apparently normal, based on comparisons to limited data from apparently normal felids. However, we did find both abnormally high vitamin A levels (5391.5 pmol/ml and 3985.5 pmol/ml) in sera from two panthers and abnormally low vitamin A levels, i.e., 2930.9 nmol/gm, dry wt., in liver from some panthers. We found no significant difference (F2, 21=1.13) between mean estradiol levels (228 pg/ml, SE=48) of normal male panthers (n=5) and levels 267 pg/ml, SE=32) from cryptorchid males (n=14). However, we did find unusually high estrogen levels (545-670 pg/ml) in three males and skewed estrogen/testosterone ratios in some males and females indicating a possible exposure to estrogenic chemicals. However, we could not demonstrate that vitamin A or possible exposure to estrogenic chemicals were factors contributing to the development of congenital abnormalities. In conclusion, we could not dispute the hypothesis that inbreeding and genetic depression is the primary cause of congenital abnormalities in the Florida panther.

Dunbar, M. R., G. S. McLaughin, D. M. Murphy, and M. W. Cunningham. 1994. Pathogenicity of the Hookworm, A*ncylostoma pluridentatum*, in a Florida Panther (*Felis concolor coryi*) Kitten. J. Wildl. Dis. 30:548–551.

Abstract

We evaluated clinical signs and administered anthelmintic treatment to a wild-caught, captive Florida panther (*Felis concolor*

coryi) kitten from Big Cypress National Preserve, Florida (USA) infected with the hookworm *Ancylostoma pluridentatum*. Clinical signs observed included poor body condition, lethargy, and below normal red blood cell numbers, hemoglobin concentration, and packed cell volume, and elevated eosinophil numbers. In addition, a maximum of 936 *Ancylostoma* sp. eggs/g of feces were found on Day 11 of captivity. Following oral administration of 20 mg/kg pyrantel pamoate on Day 11, 26 *A. pluridentatum* were collected from the feces. Based on the resolution of clinical signs, cessation of egg shedding, and a return to normal hematologic values following anthelmintic treatment, we believe that infection with *A. pluridentatum* was the primary cause of the stressed conditions in the panther kitten.

Dunbar, M. R., P. Nol, and S. B. Linda. 1997. Hematologic and Serum Biochemical Reference Intervals for Florida Panthers. J. Wildl. Dis. 33:783–789.

Abstract

Ninety-four blood samples were collected from 48 (29 males and 19 females) free-ranging Florida panthers (*Felis concolor coryi*) captured in southern Florida (USA) from 1983 to 1994 for routine hematological and serum biochemical analysis. Florida panthers in the northern portion of their range had significantly higher red blood cell (mean ± SD = 7.923 X 106 ± 0.854 X 106/µl), hemoglobin (12.53 ± 1.66 g/dl), and packed cell volume (36.97 ± 4.27%) values compared to those of panthers localized in more southern parts of Florida (7.148 X 106 ± 1.045 X 106/µl, 11.60 ± 1.62 g/dl, and 34.82 ± 5.99%, respectively). Adults had significantly higher mean serum total protein (7.50 ± 0.59 g/dl) and packed cell volume (36.90 ± 4.97%) values than juveniles (6.88 ± 0.49 g/dl and 34.54 ± 5.30%). However, mean serum albumin concentrations were significantly higher in juveniles (3.80 ± 0.26 g/dl) when compared to adult values (3.58 ± 0.26 g/dl). Mean serum calcium concentrations were significantly higher in juveniles (10.33 ± 0.39 mg/dl) than in adults (9.66 ± 0.45 mg/dl). Additionally, mean serum iron concentrations were significantly higher in those panthers of intergrade genetic stock compared to values in those of authentic genetic stock (105.6 ± 72.1 µg/dl versus 59.3 ± 19.7 µg/dl, respectively).

Dunbar, M.R., M.W. Cunningham, and S.B. Linda. 1999. Vitamin A Concentrations in Serum and Liver from Florida Panthers. J. Wildl. Dis. 35(2):171-177.

Abstract

Many of the anomalies and clinical signs afflicting the Florida panther (Felis concolor coryi) are suggestive of vitamin A deficiency. Our objectives in this study were to determine if a vitamin A deficiency exists in the free-ranging panther population and to determine if there are differences in vitamin A levels among various subgroups of free-ranging panthers. Retinol concentrations were used as an index to Vitamin A concentrations and were determined in serum and liver from free-ranging (serum, n = 45; liver, n = 22) and captive (serum, n = 9; liver, n = 2) juvenile and adult Florida panthers from southern peninsular Florida (USA), and in liver from free-ranging cougars (F. concolor subspp.) from Washington (USA) and Texas (USA) between November 1984 and March 1994. Combined juvenile (6- to 24-mo-old) and adult (> 24-mo-old) free-ranging Florida panthers had mean +/- SD serum retinol concentrations of 772.5 +/- 229 pmol/ml. Adult free-ranging Florida panthers had mean liver retinol concentrations of 4794.5 +/- 3747 nmol/g. Free-ranging nursing Florida panther kittens (age < 1 mo) had mean serum retinol concentrations of 397.9 +/- 69 pmol/ml. Among subgroups of free-ranging Florida panthers, females had higher corrected mean serum retinol concentrations than males and adult free-ranging Florida panthers had higher mean liver retinol concentrations than juveniles. Retinol concentrations in free-ranging Florida panthers did not differ significantly from those in captive panthers (liver and serum) or other free-ranging cougars (liver). Based on limited published values and our controls, a vitamin A deficiency could not be demonstrated in the Florida panther population nor were any subgroups or individuals considered deficient.

Durden, L.A., M.W. Cunningham, R. McBride and B. Ferree. 2006. Ectoparasites of Free-Ranging Pumas and Jaguars in the Paraguayan Chaco. Vet. Parasitol. 137(1-2):189-193.

Abstract

Ectoparasites were collected from seven puma (Puma concolor) and seven jaguar (Panthera onca) live-captures (each representing six different animals) in the Paraguayan Chaco from 2002 to 2004. The same five species of ectoparasites were recovered from both host species: the flea, Pulex simulans (total on both hosts combined=30 male, 49 female), and the ticks, Amblyomma cajennense (1 male, 4 female, 46 nymphs, 241 larvae), Amblyomma parvum (42 male, 25 female),

Amblyomma tigrinum (1 male, 7 female, 34 larvae) and Amblyomma triste (4 male). There were no statistical differences between the prevalences (percent of hosts infested) for any of these ectoparasite species between the two host species, and only P. simulans showed a significantly higher mean intensity (mean no. of each ectoparasite species per infested host) on one of the host species (jaguar). Clearly, these two large carnivores share similar ectoparasite faunas in the Paraguayan Chaco. However, both carnivores occupy large geographical distributions in the New World and this study, combined with the few previous studies, suggests that their ectoparasite faunas differ slightly in different parts of their respective ranges.